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Malheur National Forest Site-Specific Invasive Plants Treatment Project

Final Environmental Impact Statement

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

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

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

Abstract

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

We propose to treat invasive plants using integrated treatment methods in cooperation with our neighbors, and in accordance with the Pacific Northwest Region Invasive Plant Program Preventing and Managing Invasive Plants Record of Decision for Invasive Plant Program Management (USDA Forest Service 2005b, herein referred to as R6 2005 ROD)and other relevant management direction, to reduce the extent and impact of invasive plants. The underlying purpose of treating invasive plant infestations is to maintain or improve the diversity, function, and sustainability of desired native plant communities and other natural resources that can be adversely impacted by invasive plant species.

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

Invasive plant spread is unpredictable and actual locations of target species may change abruptly over time. Accordingly, we need the flexibility to adapt to changing conditions, and rapidly respond to invasive plant threats that may currently be unknown. Timeliness of action is an important factor because the cost, difficulty, and potential adverse effects of controlling invasive plants increases with the size and extent of the population. The smaller the population when treated, the more likely the treatment will be effective. The proposed action includes a decision process and design features to ensure that treatments used for rapid response to new detections are within the scope of this analysis. This FEIS includes detailed consideration of four alternatives:

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

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

- Alternative C was developed in response to some public concerns about herbicide use on the Malheur National Forest. Alternative C would impose strict limitations on our ability to use herbicides to treat invasive plants. Compared to alternative B, alternative C responds to public issues about herbicide impacts to human health, non-target vegetation, soils, water, aquatic organisms, and wildlife, while still allowing for some limited herbicide use. Under alternative C, all of the alternative components for alternative B would be followed (including a Malheur National Forest LRMP amendment to allow use of aminopyralid), except that broadcasting/boom spraying would not be allowed; herbicide use would not be allowed within the boundaries of any mapped infested area that at any point is within 100 feet of creeks, lakes, ponds and wetlands; and no picloram would be used on the Malheur as a part of this project. Components of alternative B that apply to broadcast spraying, herbicide use buffers within 100 feet of water bodies, and picloram would not apply to alternative C.
- Alternative D - no use of aminopyralid was developed to evaluate the tradeoffs involved with using aminopyralid for invasive plant management, thereby effecting a Forest Plan amendment. Alternative D would be similar to alternative B, except aminopyralid would not be approved for use on the project and a Forest Land and Resource Management Plan amendment would not be completed. Aminopyralid would not be used to treat known sites or new detections. All of the components of alternative B would apply, except those that refer to aminopyralid would not be included.

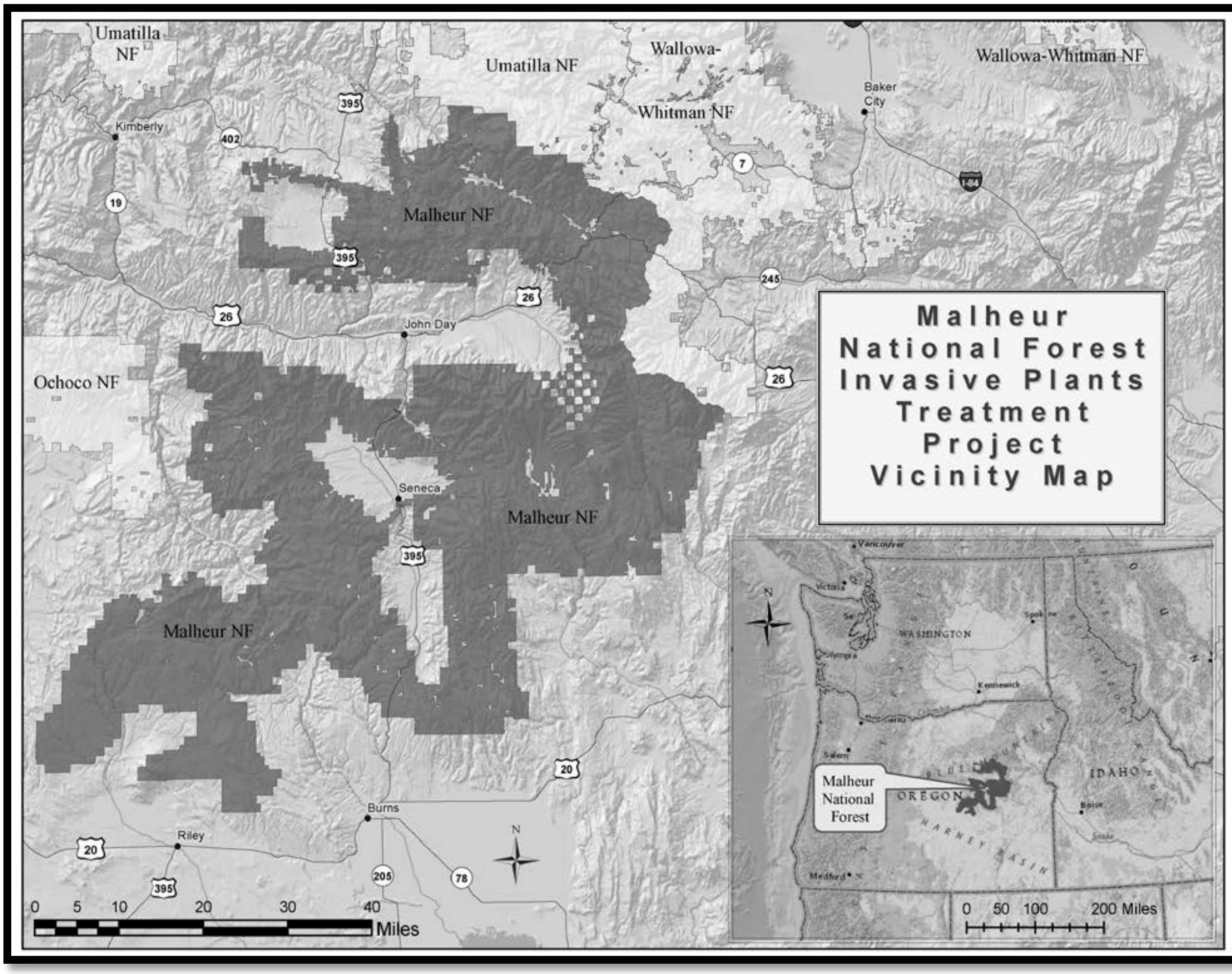

Figure 1. Vicinity Map

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APHIS	Animal and Plant Health Inspection Service
ATV	All-terrain vehicle
AUM	Animal Unit Month
BA	Biological Assessment
BCC	Birds of Conservation Concern
BCR	Bird Conservation Region
BE	Biological Evaluation
BLM	Bureau of Land Management
BMP	Best Management Practices
BO	Biological Opinion
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CWA	Clean Water Act
DBH	Diameter Breast Height
DEIS	Draft Environmental Impact Statement
DOG	Dedicated Old Growth
DN	Decision Notice
DPS	Distinct Population Segments
DWD	Down Woody Debris
EA	Environmental Assessment
EDRR	Early detection/rapid response
EFH	Essential fish habitat
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FACTS	Forest Service Activity Tracking System
FEIS	Final Environmental Impact Statement
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FOSS	Federal OSHA Safety Standard
FP	Forest Plan
FS	Forest Service
FSH	Forest Service Handbook
FSM	Forest Service Manual
FWS	Fish and Wildlife Service
GIS	Geographical information system
GLEAMS	Groundwater Loading Effects of Agricultural Management Systems
GPS	Global positioning system
HEI	Habitat Effectiveness Index
HCB	hexachlorobenzene
HQ	Hazard quotient
HUC	Hydrologic Unit Codes
IDT	Interdisciplinary Team
INFISH	Inland Native Fish Strategy
IRA	Inventoried Roadless Areas
IWM	Integrated weed management
LAU	Lynx analysis units
LCAS	Lynx Conservation Assessment and Strategy
LOAEL	Lowest observed adverse effect level
LRMP	Land and Resources Management Plan
LWD	Large Woody Debris
MCR	Middle Colombia River
MIS	Management Indicator Species
MNF	Malheur National Forest
MPG	Major Population Group
MPI	Matrix of Pathways and Indicators
MSA	Magnuson Stevens Act
NEPA	National Environmental Policy Act
NF	National Forest
NFMA	National Forest Management Act
NFS	National Forest System
NMFS	National Marine Fisheries Service
NOA	Notice of Availability

NOAEL	No observed adverse effect level
NOI	Notice of Intent
NPE	Nonylphenol Polyethoxylate
NSA	National Scenic Areas
NST	National Scenic Trails
NVUM	National Visitors Use Monitoring
ODFW	Oregon Department of Fish and Wildlife
OHV	Off-highway vehicles
ONF	Ochoco National Forest
OR	Oregon
ORV	Outstanding Remarkable Values
OSU	Oregon State University
PA	Proposed Action
PACFISH	Pacific Native Fish Strategy
PCE	Primary Constituent Elements
PDF	Project design feature
PIF	Partner in Flight
PFA	Post Fledgling Area
PNW	Pacific Northwest
POEA	Polyoxyethylene alkylamine
PPE	Personal Protective Equipment
R6	Forest Service Pacific Northwest Region Six
RHCA	Riparian Habitat Conservation Area
RMO	Riparian Management Objectives
RNA	Research Natural Areas
ROD	Record of Decision
ROG	Replacement Old Growth
ROS	Recreation Opportunity Spectrum
ROW	Right of Way
SERA	Syracuse Environmental Research Associates, Inc.
SHPO	State Historic Preservation Office
SMU	Species Management Units
SOLI	Species of local interest
TES	Threatened, Endangered and Sensitive
TMDL	Total maximum daily load
TNC	The Nature Conservancy
USDA	United States Department of Agriculture
USDI	United States Department of Interior
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WA	Washington
WEPP	Water Erosion Prediction Project
WSR	Wild and Scenic River

Summary

Introduction

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

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

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

Extent of the Primary Target Species and Management Objectives

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

We assigned preliminary treatment objectives to each of the primary target species depending on its potential negative impacts, the size of the infestation, and the values or sensitivity of the infested sites (or adjacent lands). These objectives are subject to change as site conditions change over time. Table S- 1 displays our current treatment objectives for the 18 primary invasive species mapped on the Malheur National Forest. “Eradication” is our highest priority; all other values being equal, we would treat highest priorities first. However, many variables factor into our annual program of work, including funding mechanisms and location and timing of neighboring projects. Below are definitions of our invasive plant

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

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

treatment objectives. R6 2005 Standards 12 and 13 require that we identify the desired future condition and objectives before implementing integrated treatments.

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

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

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

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

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

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

Target Species Category	Common Name	Spatial Extent (November 2012)		Treatment Objective
		Sites	Acres	
Knapweeds	Spotted knapweed	171	82	Eradicate small isolated sites in ecologically-sensitive areas Control large open sites and linear roadside populations
	Diffuse knapweed	213	74	Eradicate small isolated sites in ecologically-sensitive areas Control large open sites and linear roadside populations
	Russian knapweed	43	4	Eradicate
	Squarrose knapweed	3	<1	Eradicate small isolated sites in ecologically-sensitive areas Control large open sites and linear roadside populations

Target Species Category	Common Name	Spatial Extent (November 2012)		Treatment Objective
		Sites	Acres	
	Meadow knapweed	2	<1	Eradicate small isolated sites in ecologically-sensitive areas Control large open sites and linear roadside populations
Starthistle	Yellow star-thistle	3	1	Eradicate
Thistles	Canada thistle	1,277	1,021	Control
	Bull thistle*	0	0	Eradicate small infestations in ecologically-sensitive areas Control roadside infestations, large open sites and forested sites
	Scotch thistle	61	23	Eradicate small isolated sites in ecologically-sensitive areas Control large open sites and linear roadside populations
	Musk thistle	13	11	Eradicate small infestations in ecologically-sensitive areas Control roadside infestations, large open sites and forested sites
Roadside Species	Common St. Johnswort	185	120	Contain
	Houndstongue	171	340	Control
	Sulphur cinquefoil	61	186	Control
Toadflax	Dalmatian toadflax	666	155	Suppress
	Yellow toadflax	27	9	Suppress
Mustards	Whitetop	148	85	Control
	Perennial pepperweed	12	2	Control
Spurge	Leafy spurge	14	10	Control
Total		3,070	1,963	

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

The underlying purpose of treating invasive plant infestations is to maintain or improve the diversity, function, and sustainability of desired native plant communities and other natural resources that can be adversely impacted by invasive plant species.

Integrated Control Measures

Table S- 2 lists the integrated control measures effective for the 18 primary target species currently mapped on the Malheur National Forest. The first-choice herbicide is the one that is considered most effective for each target species. Other effective herbicides and integrated treatment methods may also be used, depending on the location of the infestation and the design of each action alternative. Not all herbicides are approved in all alternatives; picloram would not be used in alternative C and aminopyralid would not be used in alternative D.

Table S- 2. Common control measures.

Primary Target Species	First-Choice Followed by Other Effective Herbicides[3]	Integrated Treatment Notes
Yellow star-thistle *Centaurea solstitialis* (CESO3) Annual	**aminopyralid** clopyralid glyphosate picloram	Early detection and treatment increase the chances of control. Treatment of small infestations in otherwise healthy sites should be a priority. Biological control agents are available. Hand pull when soil is moist and remove all roots and flower and seed heads.
Common St. Johnswort *Hypericum perforatum* (HYPE) Perennial with stolons and rhizomes	**aminopyralid** glyphosate metsulfuron methyl picloram	Biological agents are available. Small infestations may be controlled by pulling or digging. Repeated treatments will be necessary because lateral roots can give rise to new plants. Bag and remove all plant parts from site.
Russian knapweed *Acroptilon repens* (ACRE3) Long-lived creeping perennial	**aminopyralid** chlorsulfuron clopyralid glyphosate imazapyr metsulfuron methyl picloram	Hand pulling is effective only in the establishment year. Reproduces mainly by vegetative propagation from buds on creeping roots. Biocontrol agents being developed. Cutting or mowing several times per year will control top growth and seed production; re-emerging plants will have less vigor. Lasting control requires an integrated approach; using mechanical or cultural measures with herbicide application, especially in late fall, is most effective. Small, isolated infestations should be eradicated first. Then larger infestations should be controlled from the perimeter and eradicated when possible.
Spotted knapweed *Centaurea stoebe* ssp. *micranthos* (CESTM) Taprooted perennial Diffuse knapweed *Centaurea diffusa* (CEDI3) Short-lived perennial, biennial or annual. Often with a long, stout taproot	**aminopyralid** clopyralid glyphosate triclopyr picloram	Treatment would focus on reducing seed production and preventing germination. Biological agents are available. Repeated manual pulling and digging may eliminate small infestations (2-4 times per year for multiple years). Pull prior to seed set. Bag and remove flower and seed heads.

[3] Species order does not reflect priority. First choice herbicide is listed in bold followed by other effective herbicides in alphabetical order.

Primary Target Species	First-Choice Followed by Other Effective Herbicides[3]	Integrated Treatment Notes
Squarrose knapweed *Centaurea virgata* ssp. *squarrosa* (CEVIS2) Taprooted perennial		
Meadow knapweed *Centaurea jacea* sensu lato (CEJA) Taprooted perennial		
Canada thistle *Cirsium arvense* (CIAR4) Rhizomatous perennial	**aminopyralid** chlorsulfuron clopyralid picloram	Combining mechanical, cultural, biological, and chemical methods is best for effective control. Biological agents are available, but use may affect native thistles. Mowing, cutting or pulling can be an effective control if repeated at about 1-month intervals throughout the growing season for several years. Combining mowing/cutting with herbicides (in the fall) will further enhance control of Canada thistle. Covering with plastic tarp (solarization) may be effective for small infestations.
Bull thistle* *Cirsium vulgare* (CIVU) Taprooted biennial	**aminopyralid** chlorsulfuron clopyralid glyphosate picloram triclopyr	Prioritize small infestations in otherwise healthy sites. Prioritize prevention of establishment and eliminating plants as soon as they are found. Manually pulling rosettes or cutting stems 2"-4" below the soil surface before flower heads develop kills plants and prevents seed development. Roots may be left on site to dry; all flower and seed heads should be removed. Covering disturbed sites, particularly small burn areas, with fine to medium sized organic matter may prevent or reduce the size of infestations. Please note, this was described as the "Canada thistle strategy" in the DEIS.
Scotch Thistle *Onopordum acanthium* (ONAC) Taprooted biennial or short-lived perennial		
Musk thistle *Carduus nutans* (CANU4) Taprooted biennial or occasional annual		

Primary Target Species	First-Choice Followed by Other Effective Herbicides[3]	Integrated Treatment Notes
Leafy spurge *Euphorbia esula* (EUES) Rhizomatous perennial	**aminopyralid** glyphosate imazapic picloram	Early detection and rapid eradication is important since plant spreads rapidly by seeds and rhizomes. Continuous aggressive management is necessary to keep infestations under control (5 – 10 years). Prioritizing treatment of small infestations, then treating large infestations from the outside edges is most effective. Biological control agents may reduce aboveground stems but do not kill root systems. Mechanical, cultural, or herbicide methods alone are rarely effective. Combinations of several herbicide treatments and planting grass seed may provide the best chance of controlling the species. Hand pulling and grubbing are not effective because of the extensive root system. Cutting and mowing reduce seed production and the plant's competitive ability. Covering with weed cloth, plastic, or thick mulch may kill plants. Site can then be planted with native seed. If manual methods are used all plant parts should be bagged and removed since new plants may form from roots and rhizomes as well as from seeds. Plant's milky sap may be irritating to skin, eyes, and digestive tract of humans and other animals.
Houndstongue *Cynoglossum officinale* (CYOF) Taprooted biennial or short-lived perennial	**chlorsulfuron** imazapic metsulfuron methyl	Mowing/cutting second year plants during flowering, but before seed maturation reduces seed production and may kill the plant. Pulling plants or cutting 1-2" below the soil surface have the best chance of eliminating plants. Cutting produces less ground disturbance than pulling. Bag and remove all flower and seed heads.
Dalmatian toadflax *Linaria dalmatica* (LIDA) Perennial with taproot and extensive system of lateral roots Yellow toadflax *Linaria vulgare* (LIVU2) Perennial with taproot and extensive system of vertical and creeping lateral roots	**chlorsulfuron** imazapic metsulfuron methyl picloram	Dalmatian toadflax reproduces primarily by seed and partly by adventitious root buds. Yellow toadflax reproduces primarily by adventitious root buds on lateral roots. Biological agents are available and may be very effective. If biocontrol agents continue to be effective, herbicide application may not be needed. Manual pulling and digging may not be effective because of the deep (4-10 feet) and laterally extensive root systems (to 10 feet from plant). If manually removed, all roots and flower and seed heads should be bagged and removed. Cutting stems in spring or early summer would eliminate seed production, but not the root system.
Whitetop *Cardaria draba* (CADR) Rhizomatous perennial	**chlorsulfuron** imazapic imazapyr glyphosate	These species are difficult to control because of their deep taproots (9 ft.) and ability to sprout from root fragments. Early detection and proactive management is most effective since established infestations are difficult to control. Frequent monitoring for new sites and prioritizing small infestations in otherwise healthy sites is important. Next priority would be for corridors, such as waterways

Primary Target Species	First-Choice Followed by Other Effective Herbicides[3]	Integrated Treatment Notes
Perennial pepperweed *Lepidium latifolium* (LELA2) Perennial with rhizome like creeping roots	metsulfuron methyl	and irrigations structures that have a high likelihood of spread. Biological controls are not available. Repeated pulling may control small, young infestations. Established plants are likely to resprout from deep roots. All roots and flower and seed heads should be removed. Mowing does not eliminate plants but removes thatch.
Sulphur cinquefoil *Potentilla recta* (PORE5) Taprooted perennial that may have several shallow, spreading branch roots but not rhizomes	**metsulfuron methyl** glyphosate picloram triclopyr	Cultural treatments, such as seeding of native plants may be effective. There are no approved biocontrols. Small infestations may be controlled by hand digging if the entire root crown is removed. For large infestations, selective herbicides are likely the only method of effective control (TNC 2004). Repeated treatments are needed for the first couple of years to ensure re-establishment does not occur.

Alternatives

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

Four alternatives are considered:

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

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

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

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

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

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

We propose to apply aminopyralid to about 64 percent of the infested acreage for the first treatment entry (about 1,350 acres). We would use aminopyralid initially because it is considered the most effective of the 11 available herbicides for 12 of the 18 primary target species (all except houndstongue, both toadflaxes, pepperweed, and whitetop, which have chlorsulfuron as the first-choice herbicide and sulphur cinquefoil, that has metsulfuron methyl as the first-choice herbicide) (Table S- 2). Aminopyralid has low toxicity to aquatic organisms and is labeled for use up to the edge of surface waters. Alternative B would allow broadcasting (boom spraying) of this herbicide to the edge of streams and other water bodies.

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

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

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

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

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

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

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

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

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

Alternative Comparison

The project design features (pdfs) (table 10) minimize the potential impacts of invasive plant treatment. These pdfs provide sideboards for treatment of known sites, along with new detections. The pdfs were developed to respond to the site-specific resource conditions within the infested areas, including (but not limited to) botanical areas; habitat and presence of botanical, wildlife and/or fish species of conservation concern; the potential for herbicide delivery to water, and proximity other areas of interest (roads and trails, recreation sites, Wilderness/Wild and Scenic Rivers, wildland fire areas). The analysis assumes pdfs are properly implemented. Herbicide-use buffers (table 11 and table 12 restrict the method of application for most of the proposed herbicides depending on their persistence, mobility, and toxicity to aquatic organisms and label advisories.

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

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

The following table displays the primary differences between the alternatives.

Table S- 3. Alternative comparison by activity

Activity	Alt A (No Action)	Alt B (Proposed Action)	Alt C (More Restrictive Herbicide Use)	Alt D (No LRMP Amendment)
Authorizes EDRR	No	Yes	Yes	Yes
Non-herbicide treatments	None[4]	Non-herbicide treatments would be integrated with herbicide treatments	Same as Alternative B except only non-herbicide treatments would be approved within 100 feet of water bodies	Same as Alternative B
Maximum acres of proposed herbicide treatments during any year of implementation	0	2,124	735	Same as Alternative B
Number of herbicides available for use	0	11	10 (no picloram)	10 (no aminopyralid)
Forest LRMP amendment to include aminopyralid	No	Yes	Yes	No
Herbicide Application Rate and Method	None	Lowest effective rate, broadcast sprayers may be used where needed according to pdfs	Application rate would not exceed 70% of typical broadcast rate, no boom or broadcast sprayers	Same as Alternative B, no aminopyralid
Biological control agents	Biological control agents may be released or redistributed	No biological agents would be released within the Forest boundaries	Same as Alternative B	Same as Alternative B
Prevention measures	Measures applied to all land uses to prevent the introduction and spread of invasive plants.	Same as Alternative B	Same as Alternative B	Same as Alternative B

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

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

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

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

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

Table S- 5. Alternative comparison relative to significant issues

Issue Component	Unit of Measurement	Alt A (No Action)	Alt B (Proposed Action)	Alt C (More Restrictive Herbicide Use)	Alt D (No LRMP Amendment)
1 – Treatment Effectiveness					
Restrictions on herbicide use reduce treatment effectiveness and increase treatment costs.	Average Cost per Acre of Effective Treatment of Known sites (includes re-treatments and restoration)	0	$544	$722	$598
	Total Cost of Effective Treatment of Know Sites (includes re-treatments and restoration)	0	$1,154,000	$1,472,900	$1,270,500
	Ability to meet treatment objectives	Will not meet objectives	Tools adequate to meet treatment objectives	Tools may not be adequate to meet treatment objectives, especially near riparian areas	Tools adequate to meet treatment objectives, however opportunities to use most effective herbicide or application method may be forgone
2 – Herbicide Impacts to Human Health					
Human health may be harmed by herbicide exposure.	Type (rate, method, chemical properties) and extent of herbicide use that could result in harmful exposure scenarios to people.	None	None of the herbicides proposed for use are associated with harmful scenarios to the public. Pdfs minimize or eliminate potential for harmful exposure by limiting the herbicide ingredient, rate, or method of application. Workers need to take specific precautions to avoid herbicide exposure.	Same as Alternative B, except that far less herbicide would likely be sprayed annually. The minimal risks associated with herbicide use under Alternative B would be further reduced.	Same as Alternative B. Where necessary, pdfs minimize or eliminate potential for harmful exposure scenarios.
	Qualitative assessment about the effectiveness of herbicide-use buffers and other project design features to prevent harmful herbicide exposure scenarios	None	Risk assessments demonstrate that the type of herbicide use proposed poses relatively low risk to human health. The likelihood of harmful exposures is low, thus the design features have high	Alternative C would have less risk of herbicide exposure overall, especially to fish and water, due to restrictions on herbicide use near water. The buffers would eliminate	Same as Alternative B, except opportunities to use aminopyralid would be foregone and in some cases, higher risk herbicides would be used. However, more spot treatment and less

Issue Component	Unit of Measurement	Alt A (No Action)	Alt B (Proposed Action)	Alt C (More Restrictive Herbicide Use)	Alt D (No LRMP Amendment)
			likelihood of eliminating all potential adverse impacts from herbicide use.	all potential herbicide exposure near streams. While this alternative includes some additional design features that would comparatively reduce risk of harmful herbicide exposure, the risk is already low.	broadcasting would occur, which could result in less herbicide exposure, partly because less herbicide can be applied per day so the daily treatment extent would likely be less. For the project as a whole, the design features minimize adverse impacts to human health from herbicide use.
	Potential for Herbicides to Affect Drinking Water	None	Drinking water quality would not be adversely affected. Restrictions on herbicide use near drinking water and well intakes further minimize risk. Herbicide transportation and handling safety plan would minimize potential for an herbicide spill.	Same as Alternative B	Same as Alternative B
3 – Herbicide Impacts on Non-target Vegetation					
Proposed herbicide use may harm non-target plants, specifically sensitive and other species of conservation concern, cultural use plants, and special forest products.	Type and extent of herbicide use within 100 feet of botanical special species of conservation concern, cultural use plants, and special forest products.	None	Pdfs prohibit broadcast herbicide use within 100 feet of sensitive plant populations. Spot applications will be used within 100 feet of sensitive plant populations. The pdf for use of blue dye will alert special forest product gatherers of herbicide spray areas.	Same as Alternative B, less overall herbicide use	Same as Alternative B
4 - Herbicide Delivery to Water and Potential Impacts to Fish					
Proposed herbicide use may result in chemicals	Type and extent of herbicide use within 100	None	Aminopyralid could be broadcast up to water's	Same as Alternative B, except no herbicides	Same as Alternative B, except comparatively

Issue Component	Unit of Measurement	Alt A (No Action)	Alt B (Proposed Action)	Alt C (More Restrictive Herbicide Use)	Alt D (No LRMP Amendment)
reaching streams and other water bodies (through drift, leaching and/or run off) and may adversely fish and their habitat.	feet of streams and other water bodies.		edge; however, no adverse impacts on fish are expected because the amount of herbicide that may reach streams is below a level that could harm fish. Herbicide-use buffers and other pdfs reduce the rate, extent, or frequency of herbicide use that pose potential risks to fish.	would be used within 100 feet of streams and other water bodies. There potentially could be more sediment from non-herbicide methods required near streams.	more use of higher-risk herbicides relative to fish. pdfs minimize risks and differences between alternatives.
	Qualitative assessment about whether or not, and how fisheries might be affected	No impacts	Water concentrations from site-specific model runs at highest risk sites demonstrate that levels of herbicide that could reach streams and aquatic organisms are at least 3 orders of magnitude less than levels of concern for fish and habitat. Treatment methods may result in minor amounts of sediment reaching streams.	Same as Alternative B	Same as Alternative B
5- Herbicide Impacts on Wildlife and Pollinators					
Proposed herbicide use may result in harmful exposure to terrestrial wildlife (specifically species of conservation concern).	Type and extent of herbicide use within specific wildlife habitats for wildlife of conservation concern	None	This alternative has the most broadcasting, but the first-choice herbicides that would be used pose low risk to wildlife.	Spot application of herbicides would occur on 735 acres and the first-choice herbicides pose low risk to wildlife.	First-choice herbicides that pose a low risk to wildlife would be applied on 1,337 acres whereas moderate to risk first-choice herbicides would be used on 787 acres. Less broadcasting than Alternative B, which reduces risk of drift.
	Risk of HCB (hexachlorobenzene) contamination and effects	None	No HCBs in first-choice herbicides. Pdfs minimize risk to raptors to extremely	Same as alternative B. No use of picloram reduces risk.	Picloram is the first-choice herbicide on 63 acres, posing low risk of

Issue Component	Unit of Measurement	Alt A (No Action)	Alt B (Proposed Action)	Alt C (More Restrictive Herbicide Use)	Alt D (No LRMP Amendment)
	on raptor eggs		low level.		HCB's; pdfs minimize risk to raptors to extremely low level.
	Narrative assessment about whether or not, and how species of conservation concern and amphibians might be affected	None	All first-choice herbicides pose a low risk to wildlife. Pdfs that restrict timing and application of herbicides in sensitive habitats will minimize or eliminate the likelihood for any species to receive a harmful exposure to herbicides or disturbance.	Same as Alternative B, except greater risk of disturbance from non-herbicide treatments.	Same as Alternative B, except less broadcasting and more use of herbicides that pose a comparatively greater risk to wildlife.

Chapter 1. Purpose and Need for Action

1.1 Introduction

Land managers for the Malheur National Forest (Forest) propose to suppress, contain, control, and eradicate invasive plants using an integrated approach to treatment methods that includes herbicides, mechanical, manual, cultural, and biological agents.[5] Currently, we estimate that invasive plants occupy approximately 2,124 acres on the Forest. The infestations are broadly distributed, often occurring in areas of high spread-potential (e.g., along roads). Additional invasive plant sites exist that have not yet been identified, and new invasive plants are likely to be introduced over time.

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

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

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

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

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

- *Chapter 4: Consultation and Coordination:* This chapter provides a list of preparers and agencies and people consulted during the development of the environmental impact statement. Chapter four also includes list of references cited in the document, a glossary, a list of definitions for technical terms and acronyms, and an index.
- *Appendices:* The appendices provide more detailed information to support the analyses presented in the environmental impact statement.

Site-specific reports addressing botany, soils, hydrology, wildlife, fisheries, range, recreation, and archeology; and detailed maps for the project may be found in the project record located at the Malheur National Forest Headquarters located in John Day, Oregon.

1.2 Background

On June 26, 2000, the Forest prepared an Environmental Assessment (EA), a Decision Notice (DN) and a Finding of No Significant Impact (FONSI) for the Noxious Weed Control Project on the Malheur National Forest. The project intended to treat weeds using herbicides and other methods according to regional direction developed during the 1980s. However, later that year, the project was litigated.

In December 2002, U.S. District Court (*Blue Mountains Biodiversity Project v. US Forest Service*, CV 01-703-HA) concluded that the noxious weed control environmental assessment was insufficient under NEPA because it was tiered to earlier documents that the court deemed to be outdated. Thus, we were "…enjoined from implementing … the use or application of herbicides and biological controls until and unless it considers, evaluates and discloses in an environmental impact statement or supplemental environmental impact statement the individual and cumulative impacts of herbicide use..." (ibid.). Although that court decision applied exclusively to the Malheur National Forest, in 2005 the Pacific Northwest Region 6 Regional Forester decided to amend all of the Forest Plans (LRMPs) in the Region based on new herbicide risk assessments and information about preventing invasive plant introduction, establishment and spread, and restoring treated sites. The R6 2005 FEIS satisfied the intent of the 2002 court order but did not approve invasive plant treatments on the ground; site-specific NEPA is required to implement treatment projects.

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

On March 31, 2006, the Malheur National Forest published a Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS) for an invasive plant treatment project (Federal Register Vol. 72, No. 62, pp. 16281 -1628). The Forest Service considered public scoping input and initiated an analysis. However, there was a delay in completing the NEPA process, so the proposed action was updated and a new NOI was published in the Federal Register on April 5, 2011, (Federal Register Vol. 76, No.65, pp. 18713-18715) initiating new scoping input. Scoping input from both 2006 and 2011 was used to develop issues and alternatives analyzed for this EIS.

We have continued to collect, update, and analyze site-specific information during the time since the court injunction.

In accordance with the injunction, we have been treating invasive plants exclusively using manual or mechanical methods on the Malheur National Forest.[6] Manual and mechanical treatments are labor intensive and tend to be costly, and in some cases are not effective (see common control measures table 9 in chapter 2 for more information).

1.3 Project Area

The project area encompasses the entire 1,459,422-acre Malheur National Forest and 240,000 acres of the Ochoco National Forest that are managed by the Malheur Forest (previously known as the Snow Mountain Ranger District, now managed as part of the Emigrant Creek Ranger District.) for a total of nearly 1.7 million acres located in eastern Oregon (figure 2). These 1.7 million acres is the acreage considered as the Malheur National Forest for purposes of this analysis. The counties included in the analysis area are Grant, Baker and Harney. Small portions of Crook and Malheur Counties are also included in the analysis. The Malheur National Forest shares boundaries with the Umatilla, Wallowa-Whitman and Ochoco National Forests, Bureau of Land Management (BLM), state, county, and private lands.[7]

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

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

[7] Approximately 13,080 acres of private lands have been acquired by the Malheur National Forest in the headwaters of the John Day River. These acquired lands automatically become part of the management areas within which they are located (36 CFR 254.3 (f)) which includes portions of general forest (MA 1); rangeland (MA 2); riparian areas (MA 3); big game winter range (MA 4A); semi-primitive motorized recreation (MA 11); visual corridor (MA (14); and wildlife emphasis area (MA 15). Invasive plants could be treated on these lands according to the management direction herein.

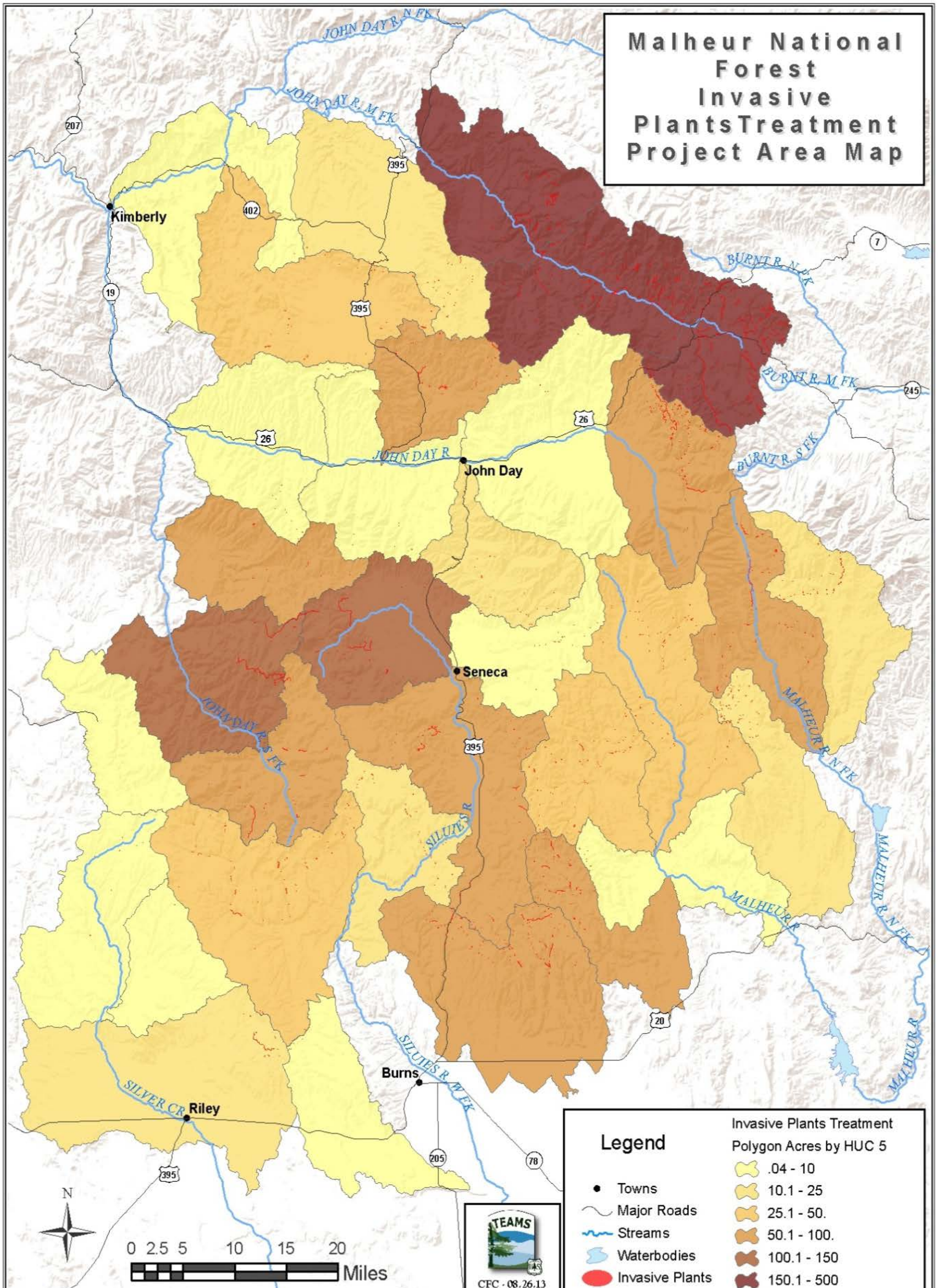

Figure 2. Malheur National Forest project area map with infestations

1.4 Desired Future Conditions

The R6 2005 ROD added the following desired future condition statement to the Malheur National Forest Land and Resource Management Plan (LRMP):

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

1.5 Purpose and Need

The most recent Forest invasive plant inventory data includes 2,124 acres of mapped target species that need to be suppressed, contained, controlled or eradicated. The underlying purpose of treating invasive plant infestations is to maintain or improve the diversity, function, and sustainability of desired native plant communities and other natural resources that can be adversely impacted by invasive plant species. As they become established and spread, invasive plants may affect the recovery trajectory for desired plant and soil communities in disturbed areas.

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

The lack of sufficient methods in the toolbox for treating invasive plants is hampering the agency’s ability to meet the desired condition described previously. For example, of 65 knapweed sites analyzed, 46 sites had a record of previous manual or mechanical treatment. Of these, 70 percent of the previous treatments were not effective (Rausch 2013). This suggests that the majority of knapweed infestations on the Forest are not effectively treated with manual and mechanical treatment alone.

Aminopyralid is thought to be one of the lowest risk and most effective herbicides for treating knapweeds and several other target species on the Forest. A Malheur National Forest Land and Resource Management Plan Amendment is needed to add aminopyralid to the list of herbicides available for use on the Forest.

Invasive plants are estimated to be spreading at an average rate of 8-12 percent per year; the emphasis on prevention may be reducing this rate (potentially to as low as 4 percent per year), but new infestations are inevitable (R6 2005 FEIS and ROD). Invasive plant spread is unpredictable and actual locations of target species may change abruptly over time. Accordingly, the Forest needs the flexibility to adapt to changing conditions, and rapidly respond to invasive plant threats that may currently be unknown. Timeliness of action is an important factor because the cost, difficulty, and potential adverse effects of controlling invasive plants increases with the size and extent of the population. The smaller the population when treated, the more likely the treatment will be effective. The Forest needs a way to treat invasive plants effectively as soon as possible after they are detected.

1.6 Proposed Action

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

1.7 Management Direction

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

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

In 2011, the Chief of the Forest Service authorized Forest Service Manual 2900 (FSM 2900) for invasive species management. This project is consistent with this manual direction, which emphasizes integrated weed management (IWM) concepts and early detection/rapid response (EDRR).

1.7.1 Land and Resource Management Plan

Management direction for the treatment of invasive plants on the Malheur National Forest is specifically provided by the Malheur National Forest Land and Resource Management Plan (LRMP) (1990), and the Ochoco National Forest LRMP (1989). Both plans were amended by the R6 2005 ROD. The R6 2005 ROD provided management direction for 1) public education and coordination, 2) prevention of the spread of invasive plants during land uses and activities, 3) treatment of target species, 4) reducing reliance on herbicides over time, and 5) site restoration.

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

- Timber sale and other contracts require washing heavy equipment
- Weed-free feed requirements in wilderness, later throughout national forests
- Weed-free rock source requirements
- Coordination between road maintenance and invasive plant staff to ensure prevention practices are incorporated into road work

- All project plans require invasive plant prevention measures to be included
- Invasive plant prevention measures are included in special use permits and grazing allotment management plans

Table 1. R6 2005 standards and project compliance

Standard #	R6 2005 Standard (LRMP)	Project Implementation Notes
11	Prioritize infestations of invasive plants for treatment at the landscape, watershed or larger multiple forest/multiple owner scale.	The highest priority infestations are those we can eradicate. Treatments to contain larger, well established populations are lowest priority. Areas where we can reduce the density of invasive plant populations but not entirely eradicate them have medium priority.
12	Develop a long-term site strategy for restoring/revegetating invasive plant sites prior to treatment.	The long-term strategy for restoration depends on the type of site infested, the target species, and location.
13	Native plant materials are the first choice in revegetation for restoration and rehabilitation where timely natural regeneration of the native plant community is not likely to occur. Non-native, non-invasive plant species may be used in any of the following situations: 1) when needed in emergency conditions to protect basic resource values (e.g., soil stability, water quality and to help prevent the establishment of invasive species), 2) as an interim, non-persistent measure designed to aid in the re-establishment of native plants, 3) if native plant materials are not available, or 4) in permanently altered plant communities. Under no circumstances will non-native invasive plant species be used for revegetation.	Revegetation (competitive seeding and planting) would occur as needed to replace invasive plants with native plant communities. Non-native, non-persistent species may be used infrequently as an interim measure to control erosion or prevent target species from returning on treated sites. Restoration of native plant communities through mulching, seeding, or planting would be considered as a follow up to invasive plant treatment.
14	Use only USDA Animal and Plant Health Inspection Service (APHIS) and state-approved biological control agents. Agents demonstrated to have direct negative impacts on non-target organisms would not be released.	Agents found to have negative impacts may not be distributed on the Forest. The R6 Regional Office updates the list regularly.
15	Application of any herbicides to treat invasive plants will be performed or directly supervised by a state or federally licensed applicator. All treatment projects that involve the use of herbicides will develop and implement herbicide transportation and handling safety plans.	The elements of herbicide transportation and handling safety plans discussed in the project design feature section of chapter 2.

Standard #	R6 2005 Standard (LRMP)	Project Implementation Notes
16	Select from herbicide formulations containing one or more of the following 10 active ingredients: chlorsulfuron, clopyralid, glyphosate, imazapic, imazapyr, metsulfuron methyl, picloram, sethoxydim, sulfometuron methyl, and triclopyr. Mixtures of herbicide formulations containing 3 or less of these active ingredients may be applied where the sum of all individual Hazard Quotients for the relevant application scenarios is less than 1.0. All herbicide application methods are allowed including wicking, wiping, injection, spot, broadcast, and aerial, as permitted by the product label. Chlorsulfuron, metsulfuron methyl, and sulfometuron methyl will not be applied aerially. The use of triclopyr is limited to selective application techniques only (e.g., spot spraying, wiping, basal bark, cut stump, injection). Additional herbicides and herbicide mixtures may be added in the future at either the LRMP or project level through appropriate risk analysis and NEPA/ESA procedures.	No aerial treatment is proposed in any alternative. A LRMP amendment would accompany a decision to add aminopyralid to the list of available herbicides.
18	Use only adjuvants (e.g. surfactants, dyes) and inert ingredients reviewed in Forest Service hazard and risk assessment documents such as SERA, 1997a, 1997b; Bakke, 2002.	Adjuvants and inert ingredients would be from approved lists (see chapter 3.1 for more information on adjuvants).
19	To minimize or eliminate direct or indirect negative effects to non-target plants, terrestrial animals, water quality and aquatic biota (including amphibians) from the application of herbicide, use site-specific soil characteristics, proximity to surface water and local water table depth to determine herbicide formulation, size of buffers needed, if any, and application method and timing. Consider herbicides registered for aquatic use where herbicide is likely to be delivered to surface waters.	Chapter 3 discusses how risks from herbicide use are abated by project design features, including buffers and restrictions on herbicide use and method of application near botanical species of local interest, certain wildlife habitats, streams, and other water bodies.
20	Design invasive plant treatments to minimize or eliminate adverse effects to species and critical habitats proposed and/or listed under the Endangered Species Act. This may involve surveying for listed or proposed plants prior to implementing actions within unsurveyed habitat if the action has a reasonable potential to adversely affect the plant species. Use site-specific project design (e.g. application rate and method, timing, wind speed and direction, nozzle type and size, buffers, etc.) to mitigate the potential for adverse disturbance and/or contaminant exposure.	Chapter 3 discusses how potential adverse effects to Endangered Species and critical habitats from herbicide use are minimized.
21	Provide a minimum buffer of 300 feet for aerial application of herbicides near developed campgrounds, recreation residences, and private land (unless otherwise authorized by adjacent private landowners).	No aerial application is proposed.

Standard #	R6 2005 Standard (LRMP)	Project Implementation Notes
22	Prohibit aerial application of herbicides within legally designated municipal watersheds.	No aerial application is proposed.
23	Prior to implementation of herbicide treatment projects, National Forest staff will ensure timely public notification. Treatment areas will be posted to inform the public and forest workers of herbicide application dates and herbicides used. If requested, individuals may be notified in advance of spray dates.	Chapter 2 lists project design features, including public notification requirements.

The Malheur National Forest LRMP outlines various management areas across the Forest and specific environmental standards and guidelines for each area. Table 2 displays the infested acreage within each management area. In some cases, the management direction is specifically related to invasive plant treatments.

Table 2. Infested acres

LRMP Management Area (MA)	Infested Acres	MA Guidance Related to This Project/How Project Complies
Big Game Winter Range Maintenance	172.3	No specific MA guidance related to invasive plants. See Forestwide Standards in table 1.
General Forest	6.4	No specific MA guidance related to invasive plants. See Forestwide Standards in table 1.
General Forest-Rangeland	720.3	No specific MA guidance related to invasive plants. See Forestwide Standards in table 1.
Long Creek Municipal Supply Watershed	0.1	R6 2005 ROD (Forest LRMP) standards do not allow aerial spraying in municipal watersheds (see table 1) The low level of current infestation likely does not require any use of herbicides.
Monument Rock Wilderness	1.1	No motorized equipment or mechanical/motorized access allowed.
Old Growth	342.1	No specific MA guidance related to invasive plants. See Forestwide Standards in table 1.
Old Growth-District 4-18	0.0	No specific MA guidance related to invasive plants. See Forestwide Standards in table 1.
Research Natural Area	0.1	The Forest Supervisor is responsible to “protect research natural areas” (FSM 4063.04b). FSM 4063.3 requires removal of exotic plants or animals to the extent practicable.” Treatments within RNAs will be coordinated with the Pacific Northwest Research Station.
Riparian Areas (Anadromous and Non-Anadromous Fish Bearing Streams)	239.9	PACFISH-INFISH: Treatments in riparian habitats designed to follow riparian management objectives. See Chapter 3.6.3.
Scenic Area	0.5	No specific MA guidance related to invasive plants. See Forestwide Standards in table 1.
Semi-Primitive Non-Motorized Recreation Areas	4.1	No specific MA guidance related to invasive plants. See Forestwide Standards in table 1.
Strawberry Mountain Wilderness	420.0	No mechanical motorized equipment or mechanical/motorized access allowed.
Visual Corridors (Foreground)	194.4	No specific MA guidance related to invasive plants. See Forestwide Standards in table 1.

LRMP Management Area (MA)	Infested Acres	MA Guidance Related to This Project/How Project Complies
Visual Corridors (Middleground)	1.5	No specific MA guidance related to invasive plants. See Forestwide Standards in table 1.
Visual Corridors (Partial Retention)	2.7	No specific MA guidance related to invasive plants. See Forestwide Standards in table 1.
Visual Corridors (Retention)	1.0	No specific MA guidance related to invasive plants. See Forestwide Standards in table 1.
Wild and Scenic River	1.1	No specific MA guidance related to invasive plants. See Forestwide Standards in table 1.
Wildlife Emphasis Area (With Non-Scheduled Timber Harvest)	0.3	No specific MA guidance related to invasive plants. See Forestwide Standards in table 1.
Wildlife Emphasis Area (With Scheduled Timber Harvest)	16.0	No specific MA guidance related to invasive plants. See Forestwide Standards in table 1.
Winter Range	172.3	No specific MA guidance related to invasive plants. See Forestwide Standards in table 1.

1.7.2 Additional Guidance

Ochoco LRMP

The Ochoco National Forest LRMP contains some specific invasive plant guidance from a 1995 Forest Plan amendment (Amendment #15). This section has been added between DEIS and FEIS to clarify that the Ochoco LRMP applies to the portion of the project within the 240,000 acres of the Ochoco National Forest that are managed by the Malheur Forest previously known as the Snow Mountain Ranger District, now managed as part of the Emigrant Creek Ranger District.

Forest-Wide Standard: Districts will coordinate closely with the respective county weed board to ensure sharing of information regarding infestations, treatments, etc.

How Project Complies: There has been, and will continue to be, coordination with counties on the treatment methods and priorities. Local invasive plant management information was obtained from Oregon State Department of Agriculture and local county invasive plant management staff. See Chapter 4.

Forest-Wide Standard: Provide for ongoing public participation and information, and other agency coordination during all noxious weed management activities. Coordinate with county officials and others to prevent and control noxious weeds. Identify species and infestation of most concern, and opportunities for joint prevention and control activities.

How Project Complies: Public participation has occurred through the planning process and will occur during implementation (see Implementation Planning Process Chapter 2.3.2).The public will be informed about herbicide treatments that occur over time. There has been, and will continue to be, coordination with counties about noxious weed prevention and treatment.

Forest-Wide Standard: Implement integrated noxious weed treatments, including manual, chemical, biological, cultural, and mechanical methods, based on site-specific analysis. Maintain documentation of annual noxious weed treatments.

How Project Complies: Action alternatives meet this standard. See implementation planning process (Chapter 2.3.2).

Forest-Wide Standard: Inform the public of planned herbicide use locations prior to initiating control projects.

How Project Complies: PDFs include public notification (see table 10, Group K)

Forest-Wide Standard: Record annually the quantity of herbicides used; document reduced reliance on herbicide use over time

How Project Complies: Action alternatives meet this standard. Recording quantities of herbicides used annually is required by Forest Service policy. Reducing reliance on herbicides over time is an objective in the R6 2005 ROD.

Wilderness Act

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

Endangered Species Act

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

Clean Water Act

A Clean Water Act (National Pollution Discharge Elimination System - NPDES) permit is required for herbicide use that may directly enter streams. The permit is needed for herbicide treatments within 3 feet of streams, wetlands, and other seasonally wet areas when water is present, including conveyances with a hydrologic surface connection to a water body (e.g., near a road culvert that runs water to a creek). Treatments on small portions of infestations (currently mapped or detected in the future) may meet the criteria; however, the type of infestations currently found on the Malheur National Forest are not riparian dependent. The current mapping is not refined enough to determine whether a permit will ultimately be needed; however, NPDES Pesticide General Permits would be obtained prior to implementing any treatments in which herbicide could be directly introduced into surface waters. This generally includes treatment within stream banks or for target plants that emerge from or overhang water bodies. Pollution control requirements would be satisfied by the project design features in this project.

Clean Water Act compliance includes use of best management practices (BMPs). The project design features in chapter 2 include BMPs to protect water quality as described in the National Best Management Practices Technical Guide (USDA Forest Service 2012). Core objectives for applying BMPs to chemical uses on National Forests include:

- Use the planning process to develop measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from chemical use on NFS lands.
- Avoid or minimize the risk of soil and surface water or groundwater contamination by complying with all label instructions and restrictions required for legal use.
- Avoid or minimize the risk of chemical delivery to surface water or groundwater when treating areas near waterbodies.

1.8 Decision to be Made

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

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

1.9 Public Involvement and Scoping

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

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

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

The Forest Service reviewed scoping responses and identified issues—points of discussion, debate or dispute about environmental effects—related to the proposed action. The significant public issues relate to the cost-effectiveness of the treatments proposed and the potential adverse effects of herbicide use.

1.10 Issues

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

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

1.10.1 Treatment Cost-Effectiveness

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

Background: Integrated invasive plant treatments need to be timely and cost-effective to be able to result in suppression, containment, control, or eradication of invasive plants. Restrictions on herbicide type, timing, extent, rate, and application method (beyond label restrictions and R6 2005 ROD standards) limit our ability to effectively treat known and new sites. Treatment costs and need for re-treatment are directly affected by the range of effective treatments available in the toolbox for any given site. Increased costs and reduced effectiveness decrease the acreage that can be effectively treated with limited funding. This issue is directly addressed in chapter 3.1.4.

Issue Measures:

- Average cost per acre of effective treatment (includes re-treatments and restoration)
- Total cost assuming treatments are fully funded
- Ability to meet treatment objectives

1.10.2 Herbicide Impacts to Human Health

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

Background: This issue speaks to general concern about herbicides and the risks to workers and the public from proposed herbicide use. For the most part, by following the management direction for herbicide use from the R6 2005 ROD, which amended the Malheur National Forest LRMP, herbicide use would not result in exposures above conservative thresholds of concern for human health. The risk assessment for aminopyralid demonstrates that this herbicide does not pose additional risks to human health. At the project level, risks are further minimized through project design features (table 10) and herbicide-use buffers (table 11 and table 12) that avoid certain types of exposures. This issue is addressed in chapter 3.2. Additional information about drinking water sources is in chapter 3.5.

Issue Measures:

- Type (rate, method, chemical properties) and extent of herbicide use that could result in toxic herbicide exposure to people
- Qualitative assessment about the effectiveness of herbicide-use buffers[8] and other project design features to prevent toxic herbicide exposure to people
- Potential for herbicides to affect drinking water

1.10.3 Herbicide Impacts on Non-target Vegetation

Issue Statement: Proposed herbicide use may harm non-target plants, specifically sensitive and other special status species, cultural use plants, and special forest products.

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

Issue Measures:

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

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

1.10.4 Delivery to Water and Potential Herbicide Impacts on Fish

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

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

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

1.10.5 Herbicide Impacts on Wildlife

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

Background: Most of the herbicides proposed for use pose no risk to terrestrial wildlife and amphibians. The focus of this issue is on the herbicides that pose a small risk, meaning that there are some plausible exposure scenarios that exceed the no-effect level. There is limited information about effects on amphibians, so pdfs are in place to add an extra layer of caution to protect these species (table 10). Hexachlorobenzene (HCB), an industrial contaminant within picloram, and to a lesser extent, clopyralid, poses potential risks to raptor eggs. This is one reason aminopyralid is the first-choice herbicide between the three, as no HCBs are present in aminopyralid. This issue is addressed in chapter 3.7.

Issue Measures:

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

1.10.6 Other Issues

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

Issues Addressed by Compliance with Management Direction

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

The proposed action will be designed to follow relevant management direction (an LRMP amendment is proposed to allow use of aminopyralid, which is intended to meet other standards requiring that impacts be minimized through site-specific selection of chemicals and other measures). In addition, we are working with tribal governments and others to ensure environmental justice and protection of heritage resources and treaty rights. An issue regarding "the spiritual and cultural need to have a source of food and medicine available that has not been contaminated with toxins, and the joy and solace in gathering plants in their natural setting" was raised in comments to the Draft EIS. This issue is addressed by the design of the project which would 1) minimize potential for impact to non-target plants; 2) mark treated areas with dye to allow people to see where herbicide has been sprayed; and 3) allow the public to identify areas they use for food or medicine gathering to determine whether these areas may be sprayed and to ensure these areas are prominently marked or posted.

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

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

Issues Addressed by Tiering to the R6 2005 FEIS

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

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

Issues Addressed by Best Available Science

This analysis incorporates peer-reviewed herbicide risk assessments and site-specific risk models, which constitute the best available science regarding herbicide toxicity. Some information used in the risk assessments may be based on studies conducted by chemical manufacturers. Some people express concern about the validity of information supplied by chemical manufacturers; these concerns cannot be resolved in this project. Established scientific protocols are followed in studies related to herbicide toxicity supplied by manufacturers as part of the herbicide registration process. This information is incorporated in the Forest Service risk assessments, with a focus on Forest Service herbicide applications. Herbicide exposure worksheets and models quantify degree of risk associated with herbicide exposure scenarios that are plausible for the proposed action and alternatives. This methodology provides a way to make best available scientific information applicable at the project level.

1.11 What this Proposal Does Not Include

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

Chapter 2. Alternatives, Including the Proposed Action

2.1 Introduction

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

Under alternative A-no action, invasive plant treatments would not be authorized as part of a decision on this project-level EIS. Projects similar to the current program would likely be authorized under *categorical exclusions* or *connected actions* associated with other project decisions. Please see the glossary for a definition of categorical exclusions and connected actions. Biological agents would likely continue to find their way onto the Malheur National Forest, but none would be deliberately released by Forest personnel. [9] More information about the no-action alternative can be found later in this chapter.

Alternative B-proposed action provides for effective invasive plant treatments. Project design features minimize the possible adverse effects of treatment in accordance with the LRMP for the Malheur National Forest (chapter 1, management direction).

2.2 Extent of the Primary Target Species and Management Objectives

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

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

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

Control: Reduce the size of the infestation over time; some level of infestation may be acceptable. This objective applies to most of the target species (houndstongue, leafy spurge, perennial pepperweed, sulfur

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

cinquefoil, whitetop) and large infestations of thistles and knapweeds. This is generally the second priority for treatment.

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

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

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

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

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

Target Species Category	Common Name	Spatial Extent (November 2012)		Treatment Objective
		Sites	Acres	
	Musk thistle	13	11	Eradicate small infestations in ecologically-sensitive areas Control roadside infestations, large open sites and forested sites
Roadside Species	Common St. Johnswort	185	120	Contain
	Houndstongue	171	340	Control
	Sulphur cinquefoil	61	186	Control
Toadflax	Dalmatian toadflax	666	155	Suppress
	Yellow toadflax	27	9	Suppress
Mustards	Whitetop	148	85	Control
	Perennial pepperweed	12	2	Control
Spurge	Leafy spurge	14	10	Control
Total		1358	941	

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

2.3 Alternatives Considered in Detail

2.3.1 Alternative A – No Action

The no-action alternative is a requirement of NEPA (36 CFR 220) to provide a baseline for comparison of effects of action alternatives. If the no-action alternative is selected for this project, no invasive plant treatments would be authorized. The Malheur National Forest invasive plants treatment program would not follow current regional and national invasive plant management direction that allows the application of selected herbicides (see alternative 2 description).

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

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

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

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

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

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

Table 4. Biological agents released on neighboring lands

Target Species	Agent	Mode of Action
Bull Thistle	*Urophora stylata*	Larvae form a hard multi-chambered gall in the flower receptacle that interferes with seed production.
Canada Thistle	*Ceutorhunchus litura*	Larvae mine pith in stems of flowering plants, increasing susceptibility to pathogens. Adults feed on leaves.
Canada Thistle	*Urophora cardui*	Larvae cause galls on the stems that act as nutrient sinks, stressing plants and reducing seed production and growth.
Dalmatian Toadflax	*Mecinus janthinus*	Larvae are stem miners; adults can cause damage to flowers and young leaves.
Diffuse Knapweed Spotted Knapweed Meadow Knapweed	*Urophora affinis* *Urophora quadrifasciata*	Larvae overwinter in the seed heads. Developing larvae cause the plant to form a gall around the reproductive parts and create a metabolic sink, drawing nutrients from the plant that extend beyond the attacked seed head.
Field Bindweed	*Aceria malherbae*	Adult and nymphal mites suck plant juices that deforms leaves and developing buds, which interferes with flowering, seed production, and reduces plant biomass.
Leafy Spurge	*Aphthona cyparissiae,* *Aphthona flava,* *Apthona nigriscutis* *Aphthona czwalinae,* *Apthona lacertosa*	Adults feed on foliage reducing the plant's production of sugars; larvae feed on root hairs and young roots reducing the plant's ability to take up water and nutrients.
Leafy Spurge	*Oberea erythrocephala*	Larvae bore in the stems and roots of larger plants. Adults girdle the top of the stalk before laying eggs in the stem.
Mediterranean Sage	*Phrydiuchus tau*	Adults feed on the leaves, and larvae feed in the root crown and petioles of large leaves.
Musk Thistle	*Rhinocyllus conicus*[1]	Larvae eat seeds in primary heads, lateral heads still produce seed.
Musk Thistle	*Trichosirocalus horridus*	Larvae feed on the root crown, damaging the primary shoot, and adults feed on the leaves. Large numbers of larvae can kill rosettes.

Target Species	Agent	Mode of Action
Musk Thistle	*Urophora solstitialis*	Larvae cause galls in the seed heads that interfere with seed production and dissemination.
Spotted Knapweed	*Cyphocleonus achates*	Larvae are root borers and adults feed on the leaves
Spotted Knapweed	*Metzneria paucipunctella*	Larvae consume seeds in infested heads.
Spotted Knapweed, Diffuse Knapweed	*Bangasternus fausti*	Attacks early buds, and appears to contribute to the impacts of *Larinus minutus*. Larvae consume most of the seeds in infested heads.
Spotted Knapweed, Diffuse Knapweed	*Larinus minutus*	Larvae feed in the flower head destroying most of the seeds. Heavy attack by adults can stunt or kill plants and delay flowering.
Spotted Knapweed Meadow Knapweed Diffuse Knapweed	*Larinus obtusus*	Larvae consume the seeds and adults can defoliate plants when in large numbers.
St Johnswort	*Chrysolina quadrigemina* *Chrysolina hyperici*	Adults and larvae are foliage feeders.
Tansy Ragwort	*Longitarsus jacobaeae*	The larvae feed on the roots of the target plant.
Yellow Starthistle	*Bangasternus orientalis*	Larvae feed on seeds and seed heads, reducing the number of seeds by 40-60%
Yellow Starthistle	*Chaetorellia australis*	Larvae tunnel into the center of the head, where they feed on the ovaries and developing seeds.
Yellow Starthistle	*Chaetorellia succinia*[1]	Larvae tunnel into the center of the head, where they feed on the ovaries and developing seeds.
Yellow Starthistle	*Eustenopus villosus*	Adults feed on developing buds, causing the buds to die. Larvae feed on the seed head and developing seeds.
Yellow Starthistle	*Larinus curtus*	Adults feed on the flowers and larvae feed on the seed head, reducing seed production.
Yellow Starthistle	*Urophora sirunaseva*	Larvae feed on flowers and seed heads and cause formation of galls.

[1]These agents are no longer approved for use in Oregon or Region Six. They do not meet Standard 14. Remnant populations may be found on host species in the region.

2.3.2 Alternative B – Proposed Action

Introduction

Alternative B – proposed action, is our proposal as the most cost-effective approach to invasive plant treatment while minimizing the potential adverse effects of treatment according to the Malheur National Forest LRMP as amended by the R6 2005 ROD. The Responsible Official has identified alternative B as the preferred alternative.

We inventoried the invasive plants across the Malheur National Forest and identified common control measures for the 18 primary target species found. The common control measures include a range of integrated treatment/restoration methods that could be implemented across a range of infested sites. We will identify the specific manual, mechanical, biological, herbicide and cultural/restoration treatments to be implemented at the time of treatment (see common control measures table below).

In addition to the common control measures (table 9), we developed project design features (table 10) and herbicide-use buffers (table 11and table 12) for alternative B. The project design features and herbicide-use buffers are intended to minimize adverse effects of treatment and follow National Best Management Practice Guidelines for Chemical Uses on National Forests (USDA Forest Service 2012).

To develop the common control measures, project design features, and herbicide-use buffers, we considered the best available scientific information about invasive plant management. The literature cited section of chapter 4 documents our commitment to using best available science and high quality data.

Alternative B responds to the purpose and need for action by authorizing several herbicide and other integrated treatment methods to be implemented on the Malheur National Forest. Alternative B is designed to effectively reduce the size and density of invasive sites and abate the adverse effects of invasive plants.

Aminopyralid would be used initially for about 1,350 acres (64 percent of the total infested acreage). This herbicide is likely to be the most effective of the 11 available herbicides for 12 of the 18 primary target species (all except houndstongue, both toadflaxes, pepperweed, and whitetop, which have chlorsulfuron as the first-choice herbicide; and sulphur cinquefoil, which has metsulfuron methyl as the first-choice herbicide).

Other effective herbicides from the approved list could be used as needed over time. The selection of herbicide would be informed by many factors including field experience and new scientific information, juxtaposition of target species, detection of new target species that require one of the other approved herbicides, potential for herbicide resistance over time, and cost.

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

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

Changes Made to Alternative B For the Final EIS

Some changes were made to alternative B since release of the Draft EIS. These changes are generally intended to help respond to public comments.

- Pdf B1: Explicit mention of coordination to ensure that treatments within municipal watersheds are supported by water managers.
- Pdf F1: No use of POEA or NPE-based surfactants to further reduce risks to people and the environment.
- Pdf E3: Included to reduce potential for sediments to enter aquatic areas, based on consultation with the National Marine Fisheries Service and US Fish and Wildlife Service.
- Pdf F2: Drop reference to NPE. Limit spot spray of triclopyr to typical rates per acre. Clarify that herbicide rates are measured on a per-acre basis. These changes are intended to further reduce risks to people and the environment.
- Pdf F4: Apply measures to reduce drift to all application methods (not just broadcast) to further minimize the low potential for drift from spot applications.
- Pdf F7: Included to confirm that herbicide use meets local, state, regional, and national requirements that may change over time. Added in response to consultation with the National Marine Fisheries Service and US Fish and Wildlife Service.
- Pdf G1: Clarified to ensure that the quantity of herbicides to be transported to treatment sites are limited to the amount needed for a given day.

- Pdf H4: This pdf was modified to decrease the frequency of use for aminopyralid, imazapyr, metsulfuron methyl and picloram. Picloram, imazapyr and metsulfuron methyl would only be used once every other year on any given treatment site (except to fill in skipped areas during the initial treatment). This was changed from once per year. Aminopyralid would be used only once per year (except to fill in skipped areas during the initial treatment, as long as the total use in a given year does not exceed the maximum label rate shown in table 8). Pdf H4 was modified to address concerns about potential persistence of these herbicides under some soil/climate conditions.
- Pdf H7: Minor clarification.
- Pdf H10: Minor clarification.
- Pdf H11: Was removed and combined with a similar pdf (F3).
- Pdf HI4: Minor clarification. Previously it had a redundancy with the H group regarding run off of some herbicides.
- Pdf J6-a: Clarify that triclopyr BEE is the only ester formulation proposed for use in this project.
- Pdf J13 was added to provide protection measures for the yellow-billed cuckoo.
- Pdf I4: Minor clarification.
- Pdf K1: Minor clarification.
- Pdfs L2-L4: Forest product gathering areas are not mapped so there was concern that these pdfs would not be implementable as written in the draft. The changes to these pdfs ensure that areas identified by the public will be prominently posted so that they may avoid medicinal/edible plant gathering in areas where herbicide has been used.
- Pdfs L2 and L3 were combined into one pdf (L2) and reference to the spiritual dimension related to herbicide use and plant collection was added.

Other changes:

- The statement has been added that passive restoration may include keeping cattle away from treated areas until the area has recovered and contains desirable vegetation.
- An acreage treatment cap for all treatment methods (except biological controls) has been added to ensure that no more than 50 acres per year would be treated within 100 feet of a water body in any 6^{th} field watershed. Of these, herbicide use would be limited to 10 acres.
- Herbicide use buffers have been modified to include roadside ditches that are hydrologically connected to streams, when surface water is present in the ditch.
- The biological control agents table has been updated to 1) explain that a previously released thistle agent is not approved for R6, and 2) omit agents that have not been effective in eastern Oregon.
- The risk assessment year and reference has been updated to include 2011 assessments for imazapyr, picloram, and triclopyr.
- The 30,000 acre life of the project cap was removed because it did not provide any analytical or other value. The analysis assumes no more than 2,124 acres would be treated using herbicide annually. The 5-15 year duration of the project was clarified to remove any implication that this is a project cap; the duration provides for analytical consistency however this project may be implemented over a longer period of time.

This section has been reorganized for clarity and additional information about treatment methods has been included.

Land and Resource Management Plan Amendment

We are proposing a Land and Resource Management Plan amendment to add aminopyralid to the list of acceptable herbicides for use as part of the integrated treatment toolbox for invasive plants on the Malheur National Forest. This amendment would also apply to the former Snow Mountain Ranger District of the Ochoco National Forest that is currently managed by the Malheur National Forest.

Aminopyralid (also known by the trade name: Milestone ™) was not available during the analysis process for the R6 2005 FEIS. The risk assessment completed in 2007 (table 8) indicates that this herbicide will increase treatment effectiveness and decrease risk of adverse effects as compared to other herbicides authorized in the R6 2005 ROD. Thus, we propose to add aminopyralid to the list of approved ingredients in invasive plant standard 16 for the Forest (LRMP amendment). All other standards and guidelines for invasive plant management would remain the same (see chapter 1).

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

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

Currently Standard 16 reads:

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

We propose to amend Standard 16 to read:

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

Invasive Plant Treatment Methods Authorized Under Alternative B

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

Table 5. Proposed treatment methods descriptions

Treatment Method	Description
Manual	Includes hand pulling or using hand tools (e.g., grubbing), to remove plants or cut off seed heads. Other manual methods could include hot water steaming and solarization techniques, such as using black plastic to cover invasive plants to shade out and kill pieces of roots (i.e., rhizomes). These techniques could be used where minimizing herbicide use is desirable, such as streambanks or near sensitive plant populations.
Mechanical	Mechanical methods use power tools and include such actions as mowing, weed whipping, road brushing, and root tilling. These activities would typically occur along roadsides, rock sources, or other confined disturbed areas and dispersed use areas.
Biological Agents	Biological agents are parasitic insects, mites, nematodes, and pathogens that feed on specific parts of invasive plants and inhibit their growth and spread. In some situations, a suite of biological control agents is needed to reduce weed density to a desirable level. For instance, a mixture of five or more biological control agents may be needed to attack flower or seed heads, foliage, stems, crowns and roots all at the same time or during the plant's life cycle. Typically, 15 to 20 years are needed to suppress or contain an established population of invasive plants. Agents approved by the Animal and Plant Health Inspection Service (APHIS) that are proven natural control agents of specific invasive species but do not harm other species may be released.
Cultural Methods/ Restoration[11]	Cultural controls are defined in the R6 2005 FEIS as: "The establishment or maintenance of competitive vegetation, use of fertilizing, mulching, prescribed burning, or grazing animals to control or eliminate invasive plants" (page 10). In this project, the following cultural treatments are not included: livestock grazing, burning, tilling, plowing, and mechanical seed drilling. Mulching, seeding, planting would be used to encourage native plant survival and re-establishment, speed reoccupation of a site by native vegetation, and provide erosion protection. Restoration of native plant communities through mulching, seeding or planting would be likely to occur as a follow up to invasive plant treatment in areas where passive restoration is not sufficient. This will be determined as a part of each treatment prescription. The 1,281 acres that are of a size and configuration to potentially warrant broadcast spraying are assumed to need some sort of restoration in this analysis. Please note that passive restoration could be sufficient in many of these areas, or restoration could be needed elsewhere.
Herbicide Application: General	Herbicides would be used to contain, control, and eradicate invasive plants that are not cost-effectively treated by other methods. When herbicide use is proposed to occur in or near sensitive areas, specific design features would be used to insure that vegetation treatments do not have an adverse impact on non- target plants or animals. Herbicide treatments, chemical mixing, spill prevention, and clean up would be done in accordance with Forest Service policies, plans, and product label requirements.
Herbicide Application: Broadcast Spraying	Broadcast application means that herbicide is applied to a continuous population of invasive plants. This method is used when the weed is dense enough that it is difficult to discern individual plants and the area to be treated makes spot spraying impractical. Larger and denser infestations may require a broadcast spray. In cases where the invasive plant covers more than 70 percent of an area that is bigger than 0.1 acre, broadcasting may be the most cost-efficient method. The analysis assumes all currently infested areas become 100 percent covered with invasive plants, which would require the full amount of herbicide to be broadcast on each acre at a typical rate. Using this assumption for this analysis, about 1,281 acres would meet the criteria for broadcast spraying under alternative B. Many project design features are proposed to avoid drift and other risks sometimes associated with broadcast spraying. Broadcast spraying using most of the 11 herbicides is not allowed near streams (with the exception of aminopyralid which poses little to no risk to the aquatic environment).

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

Treatment Method	Description
Herbicide Application: Spot and Selective Spraying	Selective application targets individual plants. Herbicide is usually applied by hand. Spot spraying targets clumps of plants. Herbicide is usually applied with a backpack sprayer or other hand pump system. Spot spraying is also done using a hose off a truck-mounted or ATV-mounted tank. The analysis assumes that all currently infested areas become 100 percent covered with invasive plants; however, the size of these infestations would not require broadcast treatment. Therefore, under this scenario about 843 acres would be treated using selective or spot application methods.

Manual and Mechanical Treatments

Manual methods include hand pulling or using hand tools (e.g., grubbing) to remove invasive plants or cut off seed heads. Handsaws, axes, shovel, rakes, machetes, grubbing hoes, mattocks, brush hooks, and hand clippers may all be used to manually remove invasive plants. Other manual methods could include hot water steaming or solarization techniques, such as using black plastic to cover invasive plants to shade out and kill pieces of roots (i.e., rhizomes). Manual methods could be used in combination with herbicide methods or alone in areas where herbicide use is restricted, such as near sensitive plant populations or surface waters.

Mechanical methods use power tools and include such actions as mowing, weed whipping, road brushing, and root tilling. These activities would typically occur along roadsides, rock sources, or other confined disturbed areas and dispersed use areas. Mowing and cutting would be used to reduce or remove above ground biomass. Seed heads and cut fragments of species capable of re-sprouting from stem, leaf, or root segments would be collected and properly discarded to prevent spreading into non-infested areas.

Cultural Methods/Restoration

Cultural controls are defined in the R6 2005 FEIS as: “The establishment or maintenance of competitive vegetation, use of fertilizing, mulching, prescribed burning, or grazing animals to control or eliminate invasive plants” (p.10). In this project, the following cultural treatments are not included: livestock grazing, burning, tilling, plowing, and mechanical seed drilling.

Restoration and competitive plantings of native flora are essential to long-term control of invasive plants. Passive restoration can be accomplished in some areas by removing competition from invasive plants and allowing native flora to occupy a site. Other areas would require active restoration, which would include mulching, competitive seeding, or planting desirable vegetation. Meadows and forested areas are most likely to respond favorably to passive restoration, while roadsides and other highly disturbed areas may require active restoration. Passive restoration may include keeping cattle away from treated areas until the area has recovered and contains desirable vegetation.

Active restoration (mulching, seeding, and planting) would be used to encourage native plant survival and re-establishment, speed reoccupation of a site by native vegetation, and provide erosion protection. Active restoration of native plant communities would likely occur as a follow-up to invasive plant treatment in areas where passive restoration is not sufficient. This will be determined as a part of each treatment prescription. The intent is to re-establish desirable native vegetation post-treatment to promote resilient habitat conditions that are less susceptible to invasive plants.

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

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

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

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

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

The degree of disturbance, as indicated by the proportion of the existing plant cover that consists of desirable native species, will also affect revegetation outcome. Ten to 20 percent native cover is considered a minimum required to facilitate natural recovery of a site (James 1992, Sheley et al. 1996, Goodwin and Sheley 2003). The diversity, abundance, and viability of plant propagules of desirable species in the seed bank or within the immediate vicinity are additional important determinants in natural recruitment and recovery.

The *Guidelines for Revegetation of Invasive Plant Sites and Other Disturbed Areas on National Forests and Grasslands in the Pacific Northwest* (Erickson et al. 2003) provides methods and guidelines for revegetation of invasive plant sites and disturbed areas. Steps are outlined for assessing existing and potential site conditions, and for developing long-term revegetation strategies that are effective, affordable, and consistent with the ecological context and land management objectives of the site and surrounding landscape. This document promotes the use of local native plant materials to establish competitive plant cover and meet the long-term objective to restore ecosystem functions.

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

Biocontrol Agents

The following table lists biological control agents that would be redistributed as needed to suppress or contain larger infestations on the Forest. These agents may be used in combination with other treatment methods.

These agents meet Standard 14 of the R6 2005 ROD (Malheur National Forest LRMP), which requires that biological agents be approved by USDA Animal and Plant Health Inspection Service (APHIS) and the state of Oregon. Agents demonstrated to have direct negative impacts on non-target organisms would not be released. The R6 Regional Office updates the list, which may allow new agents to be used in the future.

Table 6. Biological Control Agents Proposed for Redistribution

Target Species	Agent	Mode of Action
Bull Thistle	*Urophora stylata*	Larvae form a hard multi-chambered gall in the flower receptacle that interferes with seed production.
Canada Thistle	*Ceutorhunchus litura*	Larvae mine pith in stems of flowering plants, increasing susceptibility to pathogens. Adults feed on leaves.
Canada Thistle	*Urophora cardui*	Larvae cause galls on the stems that act as nutrient sinks, stressing plants and reducing seed production and growth.
Dalmatian Toadflax	*Mecinus janthinus*	Larvae are stem miners; adults can cause damage to flowers and young leaves.
Dalmatian Toadflax	*Gymnetron linariae*	Larvae cause galls in the roots, which may act as nutrient sinks and reduce plant vigor. Adults may cause minor damage by feeding on flowers.
Diffuse Knapweed Spotted Knapweed Meadow Knapweed	*Urophora affinis* *Urophora quadrifasciata*	Larvae overwinter in the seed heads. Developing larvae cause the plant to form a gall around the reproductive parts and create a metabolic sink, drawing nutrients from the plant that extend beyond the attacked seed head.
Leafy Spurge	*Aphthona cyparissiae,* *Aphthona flava,* *Apthona nigriscutis,* *Aphthona czwalinae,* *Apthona lacertosa*	Adults feed on foliage reducing the plant's production of sugars; larvae feed on root hairs and young roots reducing the plant's ability to take up water and nutrients.
Leafy Spurge	*Oberea erythrocephala*	Larvae bore in the stems and roots of larger plants. Adults girdle the top of the stalk before laying eggs in the stem.
Mediterranean Sage	*Phrydiuchus tau*	Adults feed on the leaves, and larvae feed in the root crown and petioles of large leaves.
Musk Thistle	*Urophora solstitialis*	Larvae cause galls in the seed heads that interfere with seed production and dissemination.
Spotted Knapweed Diffuse Knapweed	*Cyphocleonus achates*	Larvae are root borers and adults feed on the leaves
Spotted Knapweed Diffuse Knapweed	*Terellia virens*	The larvae feed on seeds in the flower head.
Spotted Knapweed Meadow Knapweed Diffuse Knapweed	*Larinus obtusus*	Larvae consume the seeds and adults can defoliate plants when in large numbers.
Spotted Knapweed, Diffuse Knapweed	*Larinus minutus*	Larvae feed in the flower head destroying most of the seeds. Heavy attack by adults can stunt or kill plants and delay flowering.
St Johnswort	*Chrysolina quadrigemina* *Chrysolina hyperici*	Adults and larvae are foliage feeders.
Yellow Starthistle	*Chaetorellia australis*	Larvae tunnel into the center of the head, where they feed on the ovaries and developing seeds.
Yellow Starthistle	*Eustenopus villosus*	Adults feed on developing buds, causing the buds to die. Larvae feed on the seed head and developing seeds.
Yellow Starthistle	*Larinus curtus*	Adults feed on the flowers and larvae feed on the seed head, reducing seed production.
Yellow Toadflax	*Gymnetron antirrhini*	Adult weevils emerge in late spring or early summer and feed primarily on young toadflax shoots and buds. Larvae hatch from eggs and feed on seeds.

Herbicide Use

Of the eleven herbicides considered for use, the first choice herbicides are most likely to be used. The herbicides picloram, sethoxydim, sulfometuron methyl and triclopyr are the least likely to be used. Table 7 shows the currently mapped acres that could be effectively treated using the first choice herbicides.

Broadcast is assumed to be needed on larger infestations, however. Many of the infested areas are sparsely covered with invasive plants and where effective, spot or hand treatments would be used.

Table 7. Summary of herbicide use under alternative B

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

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

Adjuvants are compounds added to the formulation to improve performance. They can either enhance the activity of an herbicide's active ingredient (activator adjuvant) or offset any problems associated with its application (special purpose or utility modifiers). Surfactants are one type of adjuvant that makes the herbicide more effective by increasing absorption into the plant. Many of the inert ingredients are proprietary in nature and have not been tested on laboratory species. However, confidential business information (i.e., the identity of proprietary ingredients) was considered in the preparation of the herbicide risk assessments completed prior to 2004. Additional information about surfactants is in appendix C.

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

The following table describes the herbicides authorized for use on the Forest. Most of these herbicides are not proposed for use during the first year of treatment for target species currently mapped on the Forest, but could be used depending on ongoing field experience and new scientific information, juxtaposition of target species, potential for herbicide resistance, and cost. Additional information on herbicide toxicity is in chapter 3.

Table 8. Herbicide descriptions, risk assessment reference, and application rates#

Active Ingredient	Risk Assessment Year and Reference	Risk Assessment Typical Application Rate (lb. per ac)*	Highest Application Rate (lb. per ac)	Remarks
Aminopyralid	2007 – SERA TR-052-04-04a	0.078	0.11	This herbicide poses a very low risk to the aquatic environments. We will avoid ground water contamination as per label instructions. Aquatic formulations are not currently available, but we can use this herbicide up to the water's edge in most situations. Milestone ™ does not contain any inert ingredients or additives other than water. It is the first-choice herbicide for about 64% of the currently infested acres (about 1,346 acres).
Chlorsulfuron	2004 – SERA TR 04-43-18-01c	0.056	Oregon label 0.13	This herbicide poses a moderate risk to the aquatic environments and there are no aquatic formulations. We will not use this herbicide next to streams or on certain soils or near certain non-target plants as per project design features. It is the first-choice herbicide for about 28% of the currently infested acreage (about 591 acres).
Clopyralid	2004 – SERA TR 04 43-17-03c	0.35	0.5	This herbicide poses a low risk to aquatic environments. We will implement some soil restrictions due to its increased mobility in some soil types, and we will avoid ground water contamination as per label instructions. It is one of the most target-species selective herbicides proposed for use.
Glyphosate	2011 – SERA_TR-052-22-03b	2	8+	This is one of the most common herbicides used in Oregon and has the advantage of being effective on a very wide range of target species. Formulations of glyphosate have ingredients that may pose higher risk to aquatic environments would not be used. It is non-selective and quickly taken up by target plants. Some people have expressed concern about "Roundup®" or ""Roundup Ready® GMO crops" and the effect on human health. However, the studies that underpin the concerns are not applicable to the proposed project 1) they are based on formulations that are not available in the United States, 2) rates are often much larger than proposed for this project, and 3) the use of glyphosate in this project would be limited to direct application to scattered invasive plants that are not used as crops.
Imazapic	2004 – SERA TR 04-43-17-04b	0.13	0.19	This herbicide poses a low risk to aquatic environments and there is no aquatic formulation. This herbicide is associated with a concern for non-target plants, and we will protect botanical species of conservation concern.
Imazapyr	2004 – SERA TR 04-43-17-05b 2011 – SERA TR-052-29-03a	0.45	0.7 (on this project as per pdfs)	This herbicide poses a moderate risk to aquatic environments. An aquatic formulation is available. This herbicide is also associated with a concern for non-target plants, and we will buffer botanical species of conservation concern.

Active Ingredient	Risk Assessment Year and Reference	Risk Assessment Typical Application Rate (lb. per ac)*	Highest Application Rate (lb. per ac)	Remarks
Metsulfuron Methyl	2003 – SERA TR 04-43-17-01b	0.03	0.075	This herbicide poses a moderate risk to aquatic environments, and no aquatic formulations are available. We will buffer streams when using this herbicide. This herbicide is also associated with a concern for non-target plants and we will protect botanical species of conservation concern. It is the first-choice herbicide for about 8% of the currently infested acreage (about 186 acres).
Picloram	2003 – SERA TR 03-43-16-01b 2011 – SERA TR-052-27-03a	0.35	1.0	This herbicide poses higher risk to aquatic environments, and there is no aquatic label. We will not use this herbicide near streams, especially because it is toxic to certain aquatic species and it can be very mobile. It is valued for its persistence in the soil; we will not use it on certain soils, and we will use it infrequently to protect soil biology.
Sethoxydim	2001 – SERA TR 01-43-01-01c	0.3	0.47	This herbicide poses a moderate risk to aquatic environments, and there is no aquatic label. We will not use it near streams. It is very selective (only kills grasses).
Sulfometuron Methyl	2004 – SERA TR 03-43-17-02c	0.045	0.38	This herbicide poses a low risk to aquatic environments, and no aquatic formulations are available. We will buffer streams when using this herbicide. This herbicide is also associated with a concern for non-target plants, and we will protect botanical species of conservation concern.
Triclopyr	2003 – SERA TR 02-43-13-03b 2011- SERA TR 052-25-03a	1.0	6 (Oregon label)	This herbicide poses higher risk to aquatic environments; however, there is an aquatic label that reduces (but does not eliminate) the risk. We will not use this herbicide near streams. This herbicide poses some risk to herbicide applicators and will not be broadcast as per R6 2005 ROD Standard 16. It may only be spot or selectively applied and only in limited cases.

[#]Application rates vary by site and target plant – these application rates are for analysis purposes.

* Pounds of active ingredient per acre; if weak acid, numbers are in acid equivalents/acre

+ Limited to maximum of 3.75 lb. per application in the PNW for Aquamaster®, and less than 8 lbs./year

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

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

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

Table 9. Common control measures for alternative B

Primary Target Species	First-Choice Followed by Other Effective Herbicides[12]	Integrated Treatment Notes
Yellow star-thistle *Centaurea solstitialis* (CESO3) Annual	**aminopyralid** clopyralid glyphosate picloram	Early detection and treatment increase the chances of control. Treatment of small infestations in otherwise healthy sites should be a priority. Biological control agents are available. Hand pull when soil is moist and remove all roots and flower and seed heads.
Common St. Johnswort *Hypericum perforatum* (HYPE) Perennial with stolons and rhizomes	**aminopyralid** glyphosate metsulfuron methyl picloram	Biological agents are available. Small infestations may be controlled by pulling or digging. Repeated treatments will be necessary because lateral roots can give rise to new plants. Bag and remove all plant parts from site.
Russian knapweed *Acroptilon repens* (ACRE3) Long-lived creeping perennial	**aminopyralid** chlorsulfuron clopyralid glyphosate imazapyr metsulfuron methyl picloram	Hand pulling is effective only in the establishment year. Reproduces mainly by vegetative propagation from buds on creeping roots. Biocontrol agents being developed. Cutting or mowing several times per year will control top growth and seed production; re-emerging plants will have less vigor. Lasting control requires an integrated approach; using mechanical or cultural measures with herbicide application, especially in late fall, is most effective. Small, isolated infestations should be eradicated first. Then larger infestations should be controlled from the perimeter and eradicated when possible.

[12] Targe species order does not reflect treatment priority. First choice herbicide is listed in bold followed by other effective herbicides in alphabetical order.

Primary Target Species	First-Choice Followed by Other Effective Herbicides[12]	Integrated Treatment Notes
Spotted knapweed *Centaurea stoebe* ssp. *Micranthos* (CESTM) Taprooted perennial Diffuse knapweed *Centaurea diffusa* (CEDI3) Short-lived perennial, biennial or annual. Often with a long, stout taproot Squarrose knapweed *Centaurea virgate* ssp. *Squarrosa* (CEVIS2) Taprooted perennial Meadow knapweed *Centaurea jacea* sensu lato (CEJA) Taprooted perennial	**aminopyralid** clopyralid glyphosate triclopyr picloram	Treatment would focus on reducing seed production and preventing germination. Biological agents are available. Repeated manual pulling and digging may eliminate small infestations (2-4 times per year for multiple years). Pull prior to seed set. Bag and remove flower and seed heads.
Canada thistle *Cirsium arvense* (CIAR4) Rhizomatous perennial	**aminopyralid** chlorsulfuron clopyralid picloram	Combining mechanical, cultural, biological, and chemical methods is best for effective control. Biological agents are available, but use may affect native thistles. Mowing, cutting or pulling can be an effective control if repeated at about 1-month intervals throughout the growing season for several years. Combining mowing/cutting with herbicides (in the fall) will further enhance control of Canada thistle. Covering with plastic tarp (solarization) may be effective for small infestations.
Bull thistle* *Cirsium vulgare* (CIVU) Taprooted biennial Scotch Thistle *Onopordum acanthium* (ONAC) Taprooted biennial or short-lived perennial	**aminopyralid** chlorsulfuron clopyralid glyphosate picloram triclopyr	Prioritize small infestations in otherwise healthy sites. Prioritize prevention of establishment and eliminating plants as soon as they are found. Manually pulling rosettes or cutting stems 2"-4" below the soil surface before flower heads develop kills plants and prevents seed development. Roots may be left on site to dry; all flower and seed heads should be removed. Covering disturbed sites, particularly small burn areas, with fine to medium sized organic matter may prevent or reduce the size of infestations. Please note, this was described as the "Canada thistle strategy" in the DEIS.

Primary Target Species	First-Choice Followed by Other Effective Herbicides[12]	Integrated Treatment Notes
Musk thistle *Carduus nutans* (CANU4) Taprooted biennial or occasional annual		
Leafy spurge *Euphorbia esula* (EUES) Rhizomatous perennial	**aminopyralid** glyphosate imazapic picloram	Early detection and rapid eradication is important since plant spreads rapidly by seeds and rhizomes. Continuous aggressive management is necessary to keep infestations under control (5 – 10 years). Prioritizing treatment of small infestations, then treating large infestations from the outside edges is most effective. Biological control agents may reduce aboveground stems but do not kill root systems. Mechanical, cultural, or herbicide methods alone are rarely effective. Combinations of several herbicide treatments and planting grass seed may provide the best chance of controlling the species. Hand pulling and grubbing are not effective because of the extensive root system. Cutting and mowing reduce seed production and the plant's competitive ability. Covering with weed cloth, plastic, or thick mulch may kill plants. Site can then be planted with native seed. If manual methods are used all plant parts should be bagged and removed since new plants may form from roots and rhizomes as well as from seeds. Plant's milky sap may be irritating to skin, eyes, and digestive tract of humans and other animals.
Houndstongue *Cynoglossum officinale* (CYOF) Taprooted biennial or short-lived perennial	**chlorsulfuron** imazapic metsulfuron methyl	Mowing/cutting second year plants during flowering, but before seed maturation reduces seed production and may kill the plant. Pulling plants or cutting 1-2" below the soil surface have the best chance of eliminating plants. Cutting produces less ground disturbance than pulling. Bag and remove all flower and seed heads.
Dalmatian toadflax *Linaria dalmatica* (LIDA) Perennial with taproot and extensive system of lateral roots Yellow toadflax *Linaria vulgare* (LIVU2) Perennial with taproot and extensive system of vertical and creeping lateral roots	**chlorsulfuron** imazapic metsulfuron methyl picloram	Dalmatian toadflax reproduces primarily by seed and partly by adventitious root buds. Yellow toadflax reproduces primarily by adventitious root buds on lateral roots. Biological agents are available and may be very effective. If biocontrol agents continue to be effective, herbicide application may not be needed. Manual pulling and digging may not be effective because of the deep (4-10 feet) and laterally extensive root systems (to 10 feet from plant). If manually removed, all roots and flower and seed heads should be bagged and removed. Cutting stems in spring or early summer would eliminate seed production, but not the root system.

Primary Target Species	First-Choice Followed by Other Effective Herbicides[12]	Integrated Treatment Notes
Whitetop *Cardaria draba* (CADR) Rhizomatous perennial Perennial pepperweed *Lepidium latifolium* (LELA2) Perennial with rhizome like creeping roots	**chlorsulfuron** imazapic imazapyr glyphosate metsulfuron methyl	These species are difficult to control because of their deep taproots (9 ft.) and ability to sprout from root fragments. Early detection and proactive management is most effective since established infestations are difficult to control. Frequent monitoring for new sites and prioritizing small infestations in otherwise healthy sites is important. Next priority would be for corridors, such as waterways and irrigations structures that have a high likelihood of spread. Biological controls are not available. Repeated pulling may control small, young infestations. Established plants are likely to resprout from deep roots. All roots and flower and seed heads should be removed. Mowing does not eliminate plants but removes thatch.
Sulphur cinquefoil *Potentilla recta* (PORE5) Taprooted perennial that may have several shallow, spreading branch roots but not rhizomes	**metsulfuron methyl** glyphosate picloram triclopyr	Cultural treatments, such as seeding of native plants may be effective. There are no approved biocontrols. Small infestations may be controlled by hand digging if the entire root crown is removed. For large infestations, selective herbicides are likely the only method of effective control (TNC 2004). Repeated treatments are needed for the first couple of years to ensure re-establishment does not occur.

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

Project Design Features

The following project design features (pdfs) minimize the potential negative effects of invasive plant treatment. These pdfs provide sideboards for treatment of known sites and species and new detections. The pdfs were developed to respond to the site-specific resource conditions within the infested areas, including (but not limited to) botanical areas; habitat and presence of botanical, wildlife, and/or fish species of conservation concern; the potential for herbicide delivery to water; and proximity to other areas of interest (roads and trails, recreation sites, Wilderness/Wild and Scenic Rivers, wildland fire areas). Implementation of the pdfs would be mandatory. The analysis assumes pdfs are properly implemented. The herbicide-use buffers apply horizontal (map) distances. The pdfs and herbicide-use buffers address Best Management Practices Guidelines for Chemical Uses on National Forests (USDA Forest Service 2012). The project design features associated with alternative B are summarized in the following table.

Table 10. Project Design Features

PDF Reference	Design Features	Purpose of PDF	Source of PDF
B – Coordination with Other Landowners/Agencies			
B1	Coordinate treatments on neighboring lands and within municipal watersheds. For neighboring lands, base distances on invasive species reproductive characteristics, and current use.	To ensure that neighbors are fully informed about nearby herbicide use and to increase the effectiveness of treatments on multiple ownerships.	A variable distance based on site and species specific characteristics was chosen because it adjusts for various conditions that exist in these areas. All pdfs

PDF Reference	Design Features	Purpose of PDF	Source of PDF
			related to riparian areas and buffer distances will be followed.
C – To Prevent the Spread of Invasive Plants During Treatment Activities			
C1	Ensure vehicles and equipment (including personal protective clothing) does not transport invasive plant materials.	To prevent the spread of invasive plants during treatment activities	Common measure.
D – Wilderness Areas [13]			
D1	No use of black plastic for solarization, no use of motor vehicles or other mechanical transport for access, and no motorized equipment will be used in wilderness areas. Manual treatments or those using non-motorized tools may occur. Herbicide use would be approved by the Regional Forester via a pesticide use proposal.	To maintain wilderness values, e.g., solitude, unimpeded natural processes—and comply with environmental laws and policies.	Wilderness Act, 1990 Malheur National LRMP
E – Non-herbicide Treatment Methods			
E1	Treatments implemented below the ordinary high water mark will be applied from the bank and workers will not walk in flowing streams regardless of treatment method.	To reduce the likelihood of causing negative impacts to fish and fish habitat.	Memorandum of Understanding between WDFW and USDA Forest Service, January 2005.
E2	Fueling of gas-powered equipment with tanks larger than 5 gallons would generally not occur within 150 feet of surface waters. Fueling of gas-powered machines with tanks smaller than 5 gallons may occur up to 25 feet of surface waters.	To protect riparian and aquatic habitats.	Common measure
E3	Within 15 feet of waterbodies, disturbed soils will be tamped down and covered with litter/mulch where available.	To reduce sediment entering aquatic habitats.	ESA Consultation with NMFS and FWS
F – Herbicide Applications			
F1	Alkylphenol ethoxylate-based non-ionic (NPE) and ethoxylated fatty amine (POEA) surfactants would not be used. Vegetable oils/silicone blends that contain alkylphenol ethoxylate ingredients may be used.	To reduce risks associated with surfactants	SERA and Bakke risk assessments
F2	The least amount of a given herbicide would be applied as necessary to meet control objectives. In no case will imazapyr use exceed 0.70 lbs. a.i./ac. Broadcast application of clopyralid, glyphosate, picloram, sethoxydim, or sulfometuron methyl will not exceed typical rates across any acre. Spot spray of triclopyr would not exceed typical rates across any acre.	To minimize herbicide exposures of concern to human health.	SERA and Bakke risk assessments
F3	Do not apply herbicides when local weather forecast calls for a ≥ 50% chance of rain, or when wind speed at the site is less than 2 mph or in excess of 8 mph. During application,	To reduce potential for drift and run off.	These restrictions are typical so that herbicide use is avoided during

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

PDF Reference	Design Features	Purpose of PDF	Source of PDF
	weather conditions would be monitored periodically by trained personnel. Herbicide application would cease during periods of unexpected rain.		inversions or windy conditions.
F4	To minimize herbicide drift, use low nozzle pressure; apply as a coarse spray, and use nozzles that minimize fine droplet spray, e.g., nozzle diameter to produce a median droplet diameter of 500-800 microns.	To reduce potential for drift.	These are typical measures to reduce drift. The minimum droplet size of 500 microns was selected because this size is modeled to eliminate adverse effects to non-target vegetation 100 feet or further from broadcast sites (see chapter 3 for details).
F5	No use of sulfonylurea herbicides (chlorsulfuron, sulfometuron methyl and metsulfuron methyl) on dust-laden bare soils. Avoid bare areas >100 sq. ft. with powdery, ashy dry soil, or light sandy soil.	To avoid potential for herbicide drift to affect non-target plants.	Label advisory
F6	When herbicides are applied, a non-toxic blue dye will be used to mark treated areas.	To ensure treated areas are obvious to people and prevent accidental ingestion by plant collectors.	Common measure
F7	Annually review any changes to herbicide regulations nationally, regionally, and locally, based on labels and tools such as Salmon Mapper (http://www2.epa.gov/endangered-species/salmon-mapper).	To ensure herbicide use is in accordance with all future limitations.	ESA Consultation with NMFS and FWS
G – Herbicide Transportation and Handling Safety/Spill Prevention and Containment			
An *Herbicide Transportation and Handling Safety/Spill Response Plan* would be the responsibility of the herbicide applicator. At a minimum the plan would: ▪ Address spill prevention and containment. ▪ Limit the quantity of herbicides transported to treatment sites to the amounts estimated to be needed for any given day. ▪ Require that impervious material be placed beneath mixing areas in such a manner as to contain small spills associated with mixing/refilling. ▪ Require a spill cleanup kit be readily available for herbicide transportation, storage, and application (minimum FOSS Spill Tote Universal or equivalent). ▪ Outline reporting procedures, including reporting spills to the appropriate regulatory agency. ▪ Ensure applicators are trained in safe handling and transportation procedures and spill cleanup. ▪ Require that equipment used in herbicide storage, transportation, and handling are maintained in a leak proof condition. ▪ Address transportation routes so that traffic, domestic water sources, and blind curves are avoided to the extent possible. ▪ Specify conditions under which guide vehicles would be		To reduce likelihood of spills and contain any spills.	FSH 2109.14

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

PDF Reference	Design Features	Purpose of PDF	Source of PDF
H6	For soils with seasonally high water tables, do not use picloram or triclopyr BEE and limit glyphosate use to aquatic label only.	Reduce the risk for contamination of groundwater and offsite runoff to aquatic habitat and fish.	Label advisory
H7	Do not remove more than 50 percent of the vegetative cover or apply herbicides to more than half the area within 100 feet of a lake or pond in a 30-day period.	Limit the area treated within riparian areas to maintain refugia habitat for reptiles and amphibians.	SERA Risk Assessments. Based on quantitative estimate of risk from maximum herbicide exposure scenario and uncertainty regarding effects to reptiles and amphibians.
H8	Wetlands would be treated when soils are driest. If herbicide treatment is necessary when soils are wet, use aquatic labeled herbicides. Favor hand/selective treatment methods where effective and practical. No more than 10 contiguous acres or fifty percent individual wetland areas would be treated in any 30-day period.	To reduce exposure to herbicides by providing some untreated areas for some organisms to use.	SERA Risk Assessments. Based on quantitative estimate of risk from maximum herbicide exposure scenario and uncertainty in effects to some organisms, and label advisories.
H9	Herbicide use would not occur within 100 feet of wells or 200 feet of spring developments. For stock tanks located outside of riparian areas, use wicking, wiping or spot treatments within 100 feet of the watering source.	To reduce the potential for herbicide delivery to wells and springs that provide drinking water, and to protect watering systems used for grazing animals.	Label advisories and state drinking water regulations http://www.deq.state.or.us/wq/WhpGuide/ch2.htm.
H10	Use of Triclopyr BEE is only allowed in dry upland areas that are not hydrologically connected to water bodies.	Reduce the risk for contamination of groundwater and offsite runoff to aquatic habitat and fish.	Label and quantitative assessment for risk to aquatic organisms.
I – Vascular and Non-Vascular Plant and Fungi Species of Concern			
I1	A USDA Forest Service botanist would use monitoring results/adaptive management to refine herbicide-use buffers to adequately protect botanical species on the Regional Forester's Sensitive List.	Minimizes repeated effects to sensitive botanical populations, thereby mitigating any long-term effects. Uncertainty about effects on nonvascular plants would be addressed through monitoring.	Herbicide-use buffer sizes for broadcast of most herbicides are based on Marrs 1989 based on tests on vascular plants. Spot and hand/select buffer distances are based on reports from experienced applicators.
I2	Botanical surveys will be conducted to document locations of sensitive plants if suitable habitat is within 100 feet of planned herbicide treatments	To ensure sensitive botanical species are protected and botanical surveys are conducted when appropriate	Forest Service Manual 2670 and applicable federally listed recovery plans
I3	Sensitive plants located within 100 feet of planned ground-based broadcast applications would be covered by protective barrier, or broadcast application would be avoided in	To ensure sensitive botanical species are protected	Forest Service Manual 2670 and applicable federally listed recovery plans

PDF Reference	Design Features	Purpose of PDF	Source of PDF
	these areas (spot or hand herbicide treatment, or non-herbicide methods may be used without covering sensitive plants).		
I4	hand/selective methods to treat invasive plants on wet soils within 10 feet of sensitive plant. This design feature does not apply to seasonally wet soils that are dry at the time of treatment.	To ensure sensitive botanical species are protected	Forest Service Manual 2670 and applicable federally listed recovery plans
I6	Monitoring prework review would occur before implementation to ensure that prescriptions, contracts, and agreements integrate appropriate project design features.	To ensure sensitive botanical species are protected	Forest Service Manual 2670 and applicable federally listed recovery plans
I7	Implementation monitoring would occur during implementation to ensure project design features are implemented as planned. An implementation monitoring form will be used to document daily field conditions, activities, accomplishments, and/or difficulties. Contract administration mechanisms would be used to correct deficiencies. Herbicide use will be reported as required by the Forest Service Health Pesticide Use Handbook.	To ensure sensitive botanical species are protected	Forest Service Manual 2670 and applicable federally listed recovery plans
I8	Effectiveness monitoring would occur during and after treatment to determine whether invasive plants are being effectively controlled and to ensure non-target vegetation, especially sensitive species are adequately protected.	To ensure sensitive botanical species are protected	Forest Service Manual 2670 and applicable federally listed recovery plans
I9	The impacts of herbicide use on some sensitive botanical species are uncertain, especially non-vascular species. To manage this uncertainty, representative samples of herbicide treatment sites adjacent to sensitive botanical species would be monitored. Non-target vegetation within 100 feet of herbicide broadcast treatment sites and 20 feet of herbicide spot and hand treatment sites would be evaluated before treatment, immediately after treatment, and two to three months later as appropriate. Herbicide-use buffers would be expanded if damage is found as indicated by: •Decrease in the population of the species of conservation concern •Leaf discoloration or chlorophyll change •Mortality Monitoring would continue until three post-treatment visits (at one or more sites near each sensitive botanical species) confirm a lack of adverse effects.	To ensure species of listed interest (SOLI) are protected and survey are conducted when appropriate	Forest Service Manual 2670 and applicable federally listed recovery plans
J – Wildlife Species of Local Interest			
J1 Gray Wolf			
J1-a	Treatments within 1 mile of active wolf dens or rendezvous sites would only occur outside the season of occupancy (April 1 through June 30).	Reduce impacts to active dens or rendezvous sites	Federal Register (USDI FWS 2003)

PDF Reference	Design Features	Purpose of PDF	Source of PDF
J2 Bald eagle			
J2-a	Noise-producing activity above ambient levels would not occur near known winter roosts and concentrated foraging areas between October 31 and March 31 during the early morning or late afternoon. Disturbance to daytime winter foraging areas would be avoided.	Minimize disturbance and energy demands during the winter.	Bald Eagle Management Guidelines for OR-WA (Dillon 1981); USDI FWS 2007, No, 62 4(d)
J2-b	Treatment of areas within 0.25 mile, or 0.50 mile line-of-sight, of bald eagle nests would be timed to occur outside the nesting/fledging season of January 1 to August 31, unless treatment activity is within ambient levels of noise and human presence (as determined by a local specialist). Occupancy of nest sites (i.e., whether it is active or not) would be determined each year prior to treatments.	Reduce impacts to eagle nests and reproduction.	Bald Eagle Management Guidelines for OR-WA (Dillon 1981) and, USDA Forest Service 2005a
J3 Peregrine Falcon			
J3-a	Seasonal restrictions shall apply to all known peregrine falcon nest sites for the periods and elevations listed below: a. Low elevation sites (1000-2000 ft.) – Jan 1st to July 1st b. Medium elevation sites (2001-4000 ft.) – Jan 15th to July 31st c. Upper elevation sites (greater than 4000 ft.) – Feb 1st to Aug 15th These restrictions may be waived if the site is unoccupied or if nesting efforts fail and monitoring indicates no further nesting behavior. Seasonal restrictions shall be extended if monitoring indicates late season nesting, asynchronous hatching leading to late fledging, or recycle behavior which indicates that late nesting and fledging will occur. Protection would be provided until at least two weeks after all young have fledged.	Reduce disturbance to nesting birds and protect eggs and nestlings.	Pagel 2006 Peregrine falcon nest site data, 1983-2006.
J3-b	All invasive plant treatments would be restricted within 0.5 miles of peregrine falcon nests (primary nest zone) during the nesting season (described above).	Reduce disturbance to nesting birds and young.	Pagel 2006 Peregrine falcon nest site data, 1983-2006.
J3-c	Invasive plant treatments involving motorized equipment and/or vehicles would be seasonally prohibited within the secondary nest zone (0.5 miles to 1.5 miles of known nest sites) during the nesting season. This may include activities such as mulching, chainsaws, vehicles (with or without boom spray equipment) or other mechanically-based invasive plant treatment.	Reduce disturbance to nesting birds and young.	Pagel 2006 Peregrine falcon nest site data, 1983-2006.
J3-d	Non-mechanized or low disturbance invasive plant activities (such as spot spray, hand pull, etc.) may occur within the secondary nest zone (0.5 miles to 1.5 miles of known nests) during the nesting season, but would be coordinated with the wildlife biologist on a case-by-case basis to determine potential	Reduce disturbance to nesting birds and young.	Pagel 2006 Peregrine falcon nest site data, 1983-2006.

PDF Reference	Design Features	Purpose of PDF	Source of PDF
	disturbance to nesting falcons and identify mitigating measures, if necessary.		
J3-e	Picloram and clopyralid would not be used within 1.5 miles of a peregrine nest more than once per year.	Minimize peregrine exposure to HCB	Pagel 2006 Peregrine falcon nest site data, 1983-2006.
J4 Greater Sage Grouse			
J4-a	Glyphosate use would be limited to the typical application rate (within greater sage grouse habitat).	Minimize exposure to herbicides and surfactants that could pose a risk.	Malheur Invasive Plant Biological Evaluation.
J4-b	Human activities within 0.3 mile of leks will be prohibited from the period of one hour before sunrise until four hours after sunrise and one hour before sunset until one hour after sunset from February 15 - May 15.	Minimize disturbance to breeding grouse	Connelly et al. 2000, USDI FWS 2003.
J4-c	Do not conduct any vegetation treatments or improvement projects in breeding habitats from February 15 – June 30.	Minimize disturbance to breeding grouse	Connelly et al. 2000
J5 Columbia Spotted Frog			
J5-a	Avoid broadcast spraying of herbicides, or spot spraying of sulfometuron methyl within 100 feet of occupied or suitable spotted frog habitat. Follow herbicide-use buffers in wetlands. Treatment methods, timing and location will be coordinated with a local biologist prior to implementation.	Reduce impacts to the Columbia spotted frog.	Appendix P of the R6 2005 FEIS; SERA 2003, 2004; Bakke 2003
J6 Silver-bordered fritillary			
J6-a	Within occupied sites, apply sensitive plant design features to host/nectar plant species.	Reduce the likelihood host/nectar plants would be affected.	Malheur Invasive Plant Biological Evaluation.
J6-b	Do not use ester (BEE) formulations of triclopyr ester within occupied silver-bordered fritillary habitat	Minimize exposure of herbicides and surfactants that could pose a risk to the silver-bordered fritillary.	Malheur Invasive Plant Biological Evaluation.
J7 Pygmy Rabbit			
J7-a	Within suspected burrow areas, activities will be restricted to manual techniques. Treatment methods, timing, and location will be coordinated with a local biologist.	Minimize chances a burrow would collapse.	Malheur Invasive Plant Biological Evaluation.
J8 Upland Sandpiper			
J8-a	In order to avoid disturbance or potential trampling of nesting upland sandpipers, no treatment would occur on sites that have historic or recent documentation of upland sandpipers during the nesting season (April 1st to August 1st), unless the site has been surveyed and no nesting is occurring.	Minimize likelihood that nests would be disturbed during treatment.	Malheur Invasive Plant Biological Evaluation.
J9 Grasshopper Sparrow			
J9-a	In order to avoid disturbance or potential trampling of nesting birds during the nesting season (May 1st to August 1st), no treatment would occur on sites where grasshopper	Minimize likelihood that nests would be disturbed during treatment.	Malheur Invasive Plant Biological Evaluation.

PDF Reference	Design Features	Purpose of PDF	Source of PDF
	sparrows have been documented.		
J10 Harney Basin Duskysnail			
J10-a	If an occupied site is proposed for treatment, a local biologist would be consulted to determine protection measures, if necessary. These measures may include limitations on vehicle entry, modifications to treatment type or timing, or implementation of buffers.	Minimize likelihood that snails would be harmed from treatment	Malheur Invasive Plant Biological Evaluation
J11 Featured Species: Raptors and Osprey			
J11-a	Active raptor nest sites will be protected during implementation. If a raptor nest is found within 0.50 mile of a site proposed for treatment, a wildlife biologist will be consulted to determine appropriate seasonal restriction dates and buffer distances, if necessary.	Reduce impacts to raptor nesting and reproduction.	Malheur and Ochoco LRMP
J12 Big game			
J12-a	Restrict off-highway vehicle use within MA 41 (big game winter range) between December 1 and April 1.	Reduce disturbance to wintering elk and deer.	Malheur LRMP
J12-b	To prevent harassment in designated calving areas, restrict off-highway vehicles and other motorized traffic use to designated roads and trails from May 1 to June 31.	Reduce impacts during elk calving.	Malheur LRMP
J13 Yellow-billed Cuckoo			
J13-a	If a known breeding site is proposed for treatment, a biologist will be contacted to determine protection measures. These measures may include limitations on vehicle entry, modifications to treatment type or timing, or implementation of buffers. Protection measures would be coordinated with the USFWS.	Minimize likelihood that nests would be affected by treatment	Professional judgment
K – Public Notification			
K1	High use areas, including administrative sites, developed campgrounds, visitor centers, and trailheads would be posted in advance of herbicide application. These areas may remain open, or could be closed during and immediately after herbicide application. Postings would indicate the date of treatments, the herbicide used, and when the areas are expected to be clear of herbicide residue. See also L2 for special products and M1 for cultural plants.	To ensure that no inadvertent public contact with herbicide occurs.	These are common measures to reduce conflicts.
K2	The public would be notified about upcoming herbicide treatments via the local newspaper or individual notification, fliers, and posting signs. Forest Service and other websites may also be used for public notification.	To ensure the public is informed about upcoming herbicide treatments.	R6 2005 ROD Standard 23 (see table 1).
L – Special Forest Products			
L2	Specific edible/medicinal plant collection areas, along with specific areas of cultural or	To minimize potential for public exposure to	R6 2005 ROD

PDF Reference	Design Features	Purpose of PDF	Source of PDF
	spiritual value, may be identified by the public. These areas would be specifically posted prior to spraying. Postings would indicate the date of treatments, the herbicide used, and when the areas are expected to be clear of herbicide residue.	herbicides and acknowledge the public's need to know whether herbicide may be used in specific areas where they harvest medicinal or edible plants.	Standard 23
L4	Flyers indicating upcoming herbicide treatments and explaining the use of blue dye may be included with mushroom and special forest product collection permits, in multi-lingual formats if necessary. See section K.	To minimize potential for public exposure to herbicides	R6 2005 ROD Standard 23
M – American Indian Tribal and Treaty Rights and Archaeology			
M1	American Indian tribes would be notified annually as treatments are scheduled so that tribal members may provide input and/or be notified prior to gathering cultural plants. Cultural plants in areas identified by tribes would be buffered as above for botanical species of concern; (see section I2, I3, and I4).	To ensure that no inadvertent public contact with herbicide occurs and that cultural plants are fully protected.	Government to government agreements between American Indian tribes and the Malheur National Forest.
N – Range Resources			
N2	Permittees will be notified of annual treatment actions at the annual permittee operating plan meeting, and/or notified within 2 weeks of planned treatments of infestations > 1 acre in size.	To ensure permittee has knowledge of activities occurring within the allotment	Common practice
N3	Follow most current EPA herbicide label for grazing restrictions.	To ensure grazing animals are not exposed to chemicals	EPA labeling requirements

Herbicide-use buffers

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

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

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

Table 11 and table 12 display the herbicide-use buffers for each herbicide and application method.

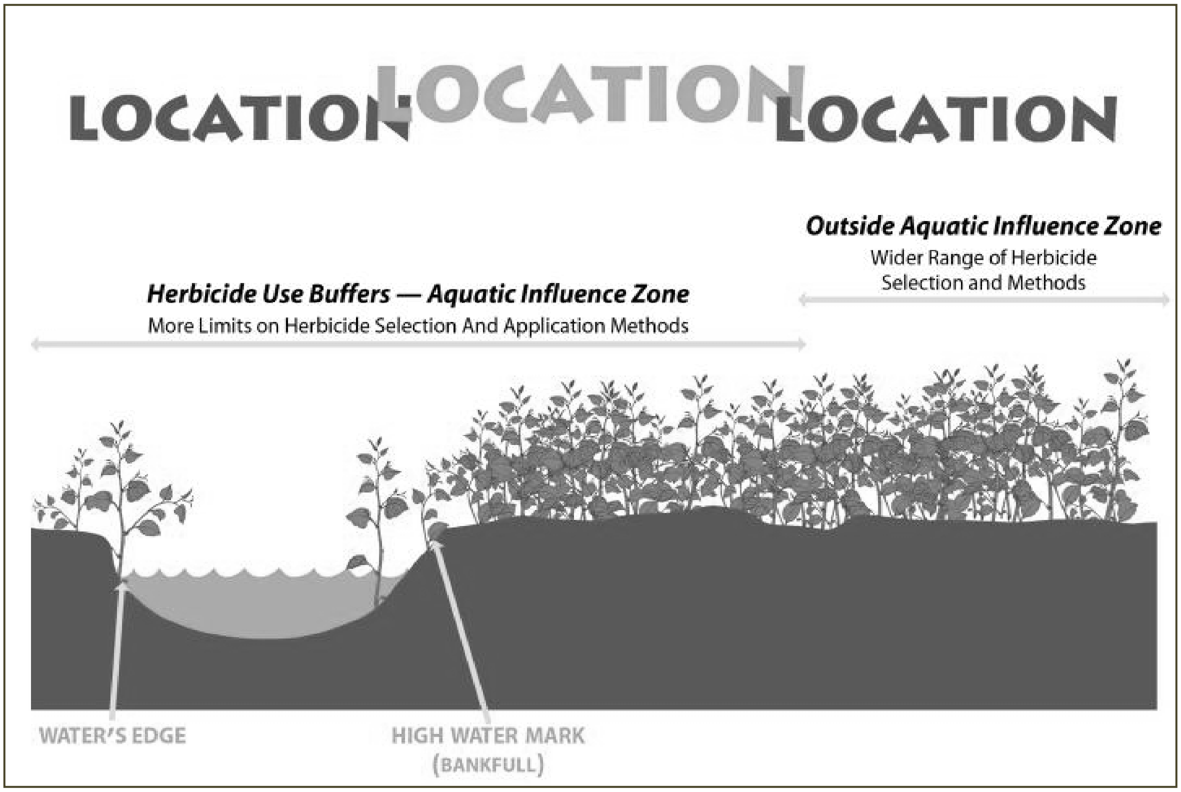

Figure 3. Herbicide-use buffers

Table 11. Herbicide-use buffers (in feet) for streams, wetlands, lakes, ponds and roadside ditches with water present at the time of treatment. Measured in feet from the edge of surface water. Herbicides in bold are those most likely to be used.

Herbicide	Streams, wetlands, lakes and ponds and hydrologically connected roadside ditches with surface water present	
	Broadcast	**Spot/Hand/Select**
Aquatic Glyphosate	50	Water's edge
Aquatic Imazapyr	50	Water's edge
Aquatic Triclopyr-TEA	Not Allowed	15
Aminopyralid	**Water's edge**	**Water's edge**
Clopyralid	100	15
Imazapic	100	15
Metsulfuron Methyl	**100**	**15**
Imazapyr	100	50
Sulfometuron Methyl	100	50
Chlorsulfuron	**100**	**50**
Picloram	100	50
Sethoxydim	100	50
Glyphosate	100	50
Triclopyr-Bee	Not Allowed	150

Table 12. Herbicide-use buffers (in feet) for stream channels that are dry at the time of treatment. Measured in feet from the edge of the channel as defined by the high water (bankfull) mark. Herbicides in bold are those most likely to be used.

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

Treatment Flexibility and Early Detection/Rapid Response

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

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

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

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

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

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

New species not currently found on the Forest may be treated as long as effective treatment methods that follow project design features and herbicide-use buffers are discussed in this EIS.

Project “Caps”

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

- In no case would more than 2,124 acres be treated using herbicides in a single year (based on our existing, site-specific inventory).[14]
- No more than 10 percent of the total acres of any 6th field watershed would be treated in a single year.
- No more than 50 acres within 100 feet of any water body in a 6th field watershed would be treated in a single year, and of these, no more than 10 acres would consist of herbicide use.[15]
- The project would continue until no more treatments were needed or until conditions otherwise changed sufficiently to warrant this EIS outdated.

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

[14] All caps and limitations on herbicide use would be based on the amount of herbicide actually applied, rather than the gross acres in any infested area.
[15] Currently, a total of 470 acres of invasive plants lie within 100 feet of a water body. This acreage is scattered mainly along roads within several 6th field watersheds. When the entire infested site acreage is included if any part of the infested area is within 100 feet of a water body, this acreage rises to 1,389.

Table 13. Management objectives under early detection/rapid response

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

Implementation Planning

This section outlines the process that would be used to ensure that the selected alternative is properly implemented. The methodology follows integrated weed management principles (R6 2005 FEIS, 3-3) and satisfies pesticide use planning requirements atFSM 2150 and FSH 2109.14. It applies to currently known infestations and new sites found within or outside currently mapped treatment areas during ongoing inventory. Appropriate Forest Service staff would develop annual treatment prescriptions to ensure that project design features are appropriately incorporated. This process applies to invasive plant treatments planned as a part of other projects (such as a mitigation measure associated with a thinning or road decommissioning) or on a stand-alone basis. The priority, strategy, and timing of treatment are influenced by the potential for disturbance, especially where seed beds are in the soil and invasive plant growth may be triggered by the disturbance. See chapter 3.1.5 for more information about the spread of invasive plants along identified vectors. The range of treatment methods considered herein are based on effective treatments (common control measures, see table 9) needed for the current inventory of 18 primary target species across the Malheur National Forest. New situations could lead to the need for additional integrated treatment methods within the scope of the selected alternative.

1. Characterize invasive plant infestations to be treated

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

2. Develop site-specific prescriptions

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

Once the treatment prescription has been refined, we will:

- Complete Form FS-2100-2 Pesticide Use Proposal. This form lists treatment objectives, specific herbicide(s) that would be used, the rate and method of application, and pdfs that apply.
- Determine need for pre-project surveys for species of local interest and/or their habitats.
- Coordinate with adjacent landowners, water users, agencies, partners, and tribal governments.
- Initiate public notification

3. Accomplishment and Compliance Monitoring

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

4. Post-treatment Monitoring and Recurring Treatments

- Monitoring would occur during implementation to ensure project design features are implemented as planned. Post-treatment reviews would occur to determine whether treatments are effective and whether or not passive/active restoration is occurring as expected.

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

The Decision to Use Herbicides

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

The Decision to Use Herbicides

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

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

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

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

Process for Prescribing Broadcast Herbicide Application Method

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

No: Use application methods other than broadcasting

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

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

Figure 4. Questions that facilitate the decision for using herbicides

Monitoring

Under alternative B, we would continue to monitor invasive plants and treatments according to national and regional Forest Service policy. Our monitoring approach is described in the bullets below:

- We would continue to inventory (catalog and map) invasive plant presence using established Forest Service protocols (NRM 2013);
- We would ensure that treatments of higher-risk[16] sites with potential to impact species of conservation concern are properly implemented, and that adverse effects are minimized according to the R6 2005 invasive plant monitoring framework and subsequent monitoring plans (a copy of the current R6 Invasive Plant Monitoring Plan is in the project record);
- We would assess the potential for chemicals and sediment to reach streams and impact water quality according to the R6 2005 Monitoring Framework and subsequent monitoring plans along with monitoring associated with National Water Quality Best Management Practice (BMPs). We would follow established monitoring protocols for chemical use and other projects that may impact streams, water, or riparian habitats. We would increase herbicide-use buffers, reduce herbicide application rate, or change treatment method should we find unexpected adverse effects.
- We would monitor treatment effectiveness as part of our annual accomplishment reporting. In accordance with national policy, at least 50 percent of all invasive plant treatments are monitored on the ground to determine treatment effectiveness. We would likely revisit most if not all treatment sites to determine need for follow up until the site is fully restored to its desired condition (depending on the capability of the site, the surrounding land uses, the nature of the infestation, and other factors – please see our implementation planning process outlined previously in this chapter).
- We would ensure that herbicide-use buffers and design features are being properly implemented. If not, we would immediately adjust treatments to ensure proper implementation. In addition, if we find unexpected adverse effects despite proper implementation, we would adjust the herbicide-use buffers and design features until the effects are no longer occurring.
- We would follow the "Invasive Species Monitoring Plan; Southern Blues Restoration Coalition" (appendix B) to address the question: "What are the trends in the occurrence and distribution of invasive plants/noxious weeds at the project and landscape scales?"

2.3.3 Alternative C – Strict Limitations on Herbicide Use

Changes between Draft and Final EIS: Clarification on integrated treatments methods, project design features, and buffers for this alternative.

Introduction

We developed alternative C in response to some public concerns about herbicide use on the Malheur National Forest. Alternative C would impose strict limitations on our ability to use herbicides to treat invasive plants. Compared to alternative B, alternative C would address public concerns about herbicide impacts to human health, non-target vegetation, potential water contamination, and herbicide effects on

[16] Higher-risk sites are defined in the Monitoring Plan and for this project would involve any broadcasting of herbicides within 100 feet of a stream.

fish, wildlife, and pollinators while still allowing for some herbicide use. About 735 acres would be approved for spot/selective herbicide use and on the remaining 1,389 acres, no herbicide would be used.[17]

Land and Resource Management Plan Amendment

Alternative C would include the same LRMP amendment as alternative B.

Integrated Treatment Methods (Common Control Measures) and Prescriptions

Alternative C would include all of the integrated treatment methods listed for alternative B except broadcast treatment would not be authorized and no picloram would be used. Biological controls that meet Standard 14 would be released as described under alternative B. Of the ten herbicides considered for use, the first choice herbicides are most likely to be used. The herbicides sethoxydim, sulfometuron methyl and triclopyr are the least likely to be used, either because they are effective on fewer target species found on the Forest than other herbicides or because of the restrictions associated with their use.

Table 14. Common control measures for alternative C. Species order does not reflect priority. First choice herbicide is listed in bold followed by other effective herbicides in alphabetical order.

Primary Target Species	First-Choice Followed by Other Effective Herbicides	Integrated Treatment Notes
Yellow star-thistle *Centaurea solstitialis* (CESO3) Annual	**aminopyralid** clopyralid glyphosate	Early detection and treatment increases the chances of control. Treatment of small infestations in otherwise healthy sites should be a priority. Biological control agents are available. Hand pull when soil is moist and remove all roots and flower and seed heads.
Common St. Johnswort *Hypericum perforatum* (HYPE) Perennial with stolons and rhizomes	**aminopyralid** glyphosate metsulfuron methyl	Biological agents are available. Small infestations may be controlled by pulling or digging. Repeated treatments will be necessary because lateral roots can give rise to new plants. Bag and remove all plant parts from site.
Russian knapweed *Acroptilon repens* (ACRE3) Long-lived creeping perennial	**aminopyralid** chlorsulfuron clopyralid glyphosate imazapyr metsulfuron methyl	Hand pulling is effective only in the establishment year. Reproduces mainly by vegetative propagation from buds on creeping roots. Cutting or mowing several times per year will control top growth and seed production; re-emerging plants will have less vigor. Biocontrol agents being developed. Lasting control requires an integrated approach; using mechanical or cultural measures with herbicide application, especially in late fall, is most effective. Small, isolated infestations should be eradicated first. Then larger infestations should be controlled from the perimeter and eradicated when possible.

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

Primary Target Species	First-Choice Followed by Other Effective Herbicides	Integrated Treatment Notes
Spotted knapweed *Centaurea stoebe* ssp. *Micranthos* (CESTM) Taprooted perennial	**aminopyralid** clopyralid glyphosate triclopyr	Treatment would focus on reducing seed production and preventing germination. Biological agents are available. Repeated manual pulling and digging may eliminate small infestations (2-4 times per year for multiple years). Pull prior to seed set. Bag and remove flower and seed heads.
Diffuse knapweed *Centaurea diffusa* (CEDI) Short-lived perennial, biennial or annual. Often with a long, stout taproot		
Squarrose knapweed *Centaurea ulfome* ssp. *Squarrosa* (CEVIS2) Taprooted perennial		
Meadow knapweed *Centaurea jacea* sensu lato (CEJA) Taprooted perennial		
Canada thistle *Cirsium arvense* (CIAR4) Rhizomatous perennial	**aminopyralid** chlorsulfuron clopyralid	Combining mechanical, cultural, biological, and chemical methods is best for effective control. Biological agents are available. Mowing, cutting or pulling can be an effective control if repeated at about 1-month intervals throughout the growing season for several years. Combining mowing/cutting with herbicides (in the fall) will further enhance control of Canada thistle. Covering with plastic tarp (solarization) may be effective for small infestations.
Bull thistle* *Cirsium vulgare* (CIVU) Taprooted biennial	**aminopyralid** chlorsulfuron clopyralid glyphosate triclopyr	Prioritize small infestations in otherwise healthy sites. Prioritize prevention of establishment and eliminating plants as soon as they are found. Manually pulling rosettes or cutting stems 2”-4” below the soil surface before flower heads develop kills plants and prevents seed development. Roots may be left on site to dry; all flower and seed heads should be removed. Covering disturbed sites, particularly small burn areas, with fine to medium sized organic matter may prevent or reduce the size of infestations.
Scotch Thistle *Onopordum acanthium* (ONAC) Taprooted biennial or short-lived perennial		

Primary Target Species	First-Choice Followed by Other Effective Herbicides	Integrated Treatment Notes
Musk thistle *Carduus nutans* (CANU4) Taprooted biennial or occasional annual		
Leafy spurge *Euphorbia esula* (EUES) Rhizomatous perennial	**aminopyralid** glyphosate imazapic	Early detection and rapid eradication is important since plant spreads rapidly by seeds and rhizomes. Continuous aggressive management is necessary to keep infestations under control (5 – 10 years).Prioritizing treatment of small infestations, then treating large infestations from the outside edges is most effective. Biological control agents may reduce aboveground stems but do not kill root systems. Mechanical, cultural, or herbicide methods alone are rarely effective. Combinations of several herbicide treatments and planting grass seed may provide the best chance of controlling the species. Hand pulling and grubbing are not effective because of the extensive root system. Cutting and mowing reduce seed production and the plant's competitive ability. Covering with weed cloth, plastic, or thick mulch may kill plants. Site can then be planted with native seed. If manual methods are used, all plant parts should be bagged and removed since new plants may form from roots and rhizomes as well as from seeds. Plant's milky sap may be irritating to skin, eyes, and digestive tract of humans and other animals.
Houndstongue *Cynoglossum officinale* (CYOF) Taprooted biennial or short-lived perennial	**chlorsulfuron** imazapic metsulfuron methyl	Mowing/cutting second year plants during flowering, but before seed maturation reduces seed production and may kill the plant. Pulling plants or cutting 1-2" below the soil surface have the best chance of eliminating plants. Cutting produces less ground disturbance than pulling. Bag and remove all flower and seed heads.
Dalmatian toadflax *Linaria dalmatica* (LIDA) Perennial with taproot and extensive system of lateral roots	**chlorsulfuron** imazapic metsulfuron methyl picloram	Dalmatian toadflax reproduces primarily by seed and partly by adventitious root buds. Yellow toadflax reproduces primarily by adventitious root buds on lateral roots. Biological agents are available and may be very effective. If biocontrol agents continue to be effective, herbicide application may not be needed. Manual pulling and digging may not be effective because of the deep (4-10 feet) and laterally extensive root systems (to 10 feet from plant). If manually removed, all roots and flower and seed heads should be bagged and removed. Cutting stems in spring or early summer would eliminate seed production, but not the root system.
Yellow toadflax *Linaria vulgare* (LIVU2) Perennial with taproot and extensive system of vertical and creeping lateral roots		

Primary Target Species	First-Choice Followed by Other Effective Herbicides	Integrated Treatment Notes
Whitetop *Cardaria draba* (CADR) Rhizomatous perennial Perennial pepperweed *Lepidium latifolium* (LELA2) Perennial with rhizome like creeping roots	**chlorsulfuron** glyphosate imazapic imazapyr metsulfuron methyl	These species are difficult to control because of its deep taproots (9 ft.) and ability to sprout from root fragments. Early detection and proactive management is most effective since established infestations are difficult to control. Frequent monitoring for new sites and prioritizing small infestations in otherwise healthy sites is important. Next priority would be for corridors, such as waterways and irrigations structures that have a high likelihood of spread. Biological controls are not available. Repeated pulling may control small, young infestations. Established plants are likely to resprout from deep roots. All roots and flower and seed heads should be removed. Mowing does not eliminate plants but removes thatch.
Sulphur cinquefoil *Potentilla recta* (PORE5) Taprooted perennial that may have several shallow, spreading branch roots but not rhizomes	**metsulfuron methyl** glyphosate triclopyr	Cultural treatments such as seeding of native plants may be effective. There are no approved biocontrols. Small infestations may be controlled by hand digging if the entire root crown is removed. For large infestations, selective herbicides are likely the only method of effective control (TNC 2004). Repeated treatments are needed for the first couple of years to ensure re-establishment does not occur.

Project Design Features

Under alternative C, all of the alternative components project design features for alternative B would be followed, except that pdfs related to broadcast spraying, use of picloram, and herbicide use within 100 feet of streams or other water bodies would not be applicable.

Herbicide-Use Buffers

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

Passive and Active Restoration

Restoration would be the same as described for alternative B.

Treatment Flexibility and Early Detection/Rapid Response

Alternative C would provide for treatment flexibility through the life of the project. Newly detected infestations could be treated according to the pdfs associated with this alternative. No broadcast treatments, use of herbicides within 100 feet of streams, or use of picloram would be authorized for future year treatments. Selective and spot treatment of herbicide would be limited to no more than 735 acres per year. No more than 50 acres of non-herbicide treatment (except biological controls) would occur annually within 100 feet of a stream or water body with any given 6^{th} field watershed.

These restrictions would apply to known sites as they change over time, as well as new detections. The implementation planning process would be similar to alternative B; however, the range of treatments that would be allowed and the places, types, and amounts of herbicide that may be used would be more restrictive. Table 15 summarizes the herbicides ingredients that are likely most effective in alternative C, based on the target species within the mapped infested areas and the restrictions on herbicide use in this alternative.

Implementation Planning and Monitoring

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

Table 15. Summary of herbicide and non-herbicide use under alternative C

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

2.3.4 Alternative D – No LRMP Amendment, No Aminopyralid

Introduction

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

LRMP Amendment

No LRMP amendment is proposed for this alternative.

Integrated Treatment Methods

All treatment methods listed for alternative D would be approved. Biological controls that meet Standard 14 would be released as described under alternative B.

Integrated Treatment Prescriptions (Common Control Measures) and Methods

Integrated treatment prescriptions for alternative D would be similar to those listed for alternative B except that no aminopyralid would be used to treat known sites or new detections. Compared to alternative B, more chlorsulfuron, glyphosate, metsulfuron methyl, and picloram would be used in lieu of aminopyralid. In some cases, the first choice herbicide would not be approved for use near streams (e.g., picloram) and another herbicide (e.g., glyphosate) would become the first choice.

Table 16. Common Control measures for alternative D. Species order does not reflect priority. First choice herbicide is listed in bold followed by other effective herbicides in alphabetical order.

Primary Target Species	First-Choice Followed by Other Effective Herbicides	Integrated Treatment Notes

Primary Target Species	First-Choice Followed by Other Effective Herbicides	Integrated Treatment Notes
Yellow star-thistle *Centaurea solstitialis* (CESO3) Annual	**picloram** clopyralid glyphosate	Early detection and treatment increase the chances of control. Treatment of small infestations in otherwise healthy sites should be a priority. Biological control agents are available. Hand pull when soil is moist and remove all roots and flower and seed heads.
Common St. Johnswort *Hypericum perforatum* (HYPE) Perennial with stolons and rhizomes	**metsulfuron methyl** glyphosate picloram	Biological agents are available. Small infestations may be controlled by pulling or digging. Repeated treatments will be necessary because lateral roots can give rise to new plants. Bag and remove all plant parts from site.
Russian knapweed *Acroptilon repens* (ACRE3) Long-lived creeping perennial	**chlorsulfuron** clopyralid glyphosate imazapyr metsulfuron methyl picloram	Hand pulling is effective only in the establishment year. Reproduces mainly by vegetative propagation from buds on creeping roots. Biocontrol agents being developed. Cutting or mowing several times per year will control top growth and seed production; re-emerging plants will have less vigor. Lasting control requires an integrated approach; using mechanical or cultural measures with herbicide application, especially in late fall, is most effective. Small, isolated infestations should be eradicated first. Then larger infestations should be controlled from the perimeter and eradicated when possible.
Spotted knapweed *Centaurea stoebe* ssp. *micranthos* (CESTM) Taprooted perennial	**picloram** clopyralid glyphosate triclopyr	Treatment would focus on reducing seed production and preventing germination. Biological agents are available. Repeated manual pulling and digging may eliminate small infestations (2-4 times per year for multiple years). Pull prior to seed set. Bag and remove flower and seed heads.
Diffuse knapweed *Centaurea diffusa* (CEDI) Short-lived perennial, biennial or annual. Often with a long, stout taproot		
Squarrose knapweed *Centaurea ulfome* ssp. *squarrosa* (CEVIS2) Taprooted perennial		

Primary Target Species	First-Choice Followed by Other Effective Herbicides	Integrated Treatment Notes
Meadow knapweed *Centaurea jacea* sensu lato (CEJA) Taprooted perennial		
Canada thistle *Cirsium arvense* (CIAR4) Rhizomatous perennial	**picloram** chlorsulfuron clopyralid glyphosate	Combining mechanical, cultural, biological, and chemical methods is best for effective control. Biological agents are available, Mowing, cutting or pulling can be an effective control if repeated at about 1-month intervals throughout the growing season for several years. Combining mowing/cutting with herbicides (in the fall) will further enhance control of Canada thistle. Covering with plastic tarp (solarization) may be effective for small infestations.
Bull thistle* *Cirsium vulgare* (CIVU) Taprooted biennial	**chlorsulfuron** clopyralid glyphosate picloram triclopyr	Prioritize small infestations in otherwise healthy sites. Prioritize prevention of establishment and eliminating plants as soon as they are found. Biological agents are available Manually pulling rosettes or cutting stems 2”-4” below the soil surface before flower heads develop kills plants and prevents seed development. Roots may be left on site to dry; all flower and seed heads should be removed. Covering disturbed sites, particularly small burn areas, with fine to medium sized organic matter may prevent or reduce the size of infestations.
Scotch Thistle *Onopordum acanthium* (ONAC) Taprooted biennial or short-lived perennial	**glyphosate** chlorsulfuron clopyralid picloram triclopyr	
Musk thistle *Carduus nutans* (CANU4) Taprooted biennial or occasional annual		

Primary Target Species	First-Choice Followed by Other Effective Herbicides	Integrated Treatment Notes
Leafy spurge *Euphorbia esula* (EUES) Rhizomatous perennial	**picloram** glyphosate imazapic	Early detection and rapid eradication is important since plant spreads rapidly by seeds and rhizomes. Continuous aggressive management is necessary to keep infestations under control (5-10 years). Prioritizing treatment of small infestations, then treating large infestations from the outside edges is most effective. Biological control agents may reduce aboveground stems but do not kill root systems. Mechanical, cultural, or herbicide methods alone are rarely effective. Combinations of several herbicide treatments and planting grass seed may provide the best chance of controlling the species. Hand pulling and grubbing are not effective because of the extensive root system. Cutting and mowing reduce seed production and the plant's competitive ability. Covering with weed cloth, plastic, or thick mulch may kill plants. Site can then be planted with native seed. If manual methods are used all plant parts should be bagged and removed since new plants may form from roots and rhizomes as well as from seeds. Plant's milky sap may be irritating to skin, eyes, and digestive tract of humans and other animals.
Houndstongue *Cynoglossum officinale* (CYOF) Taprooted biennial or short-lived perennial	**chlorsulfuron** imazapic metsulfuron methyl	Mowing/cutting second year plants during flowering, but before seed maturation reduces seed production and may kill the plant. Pulling plants or cutting 1-2" below the soil surface have the best chance of eliminating plants. Cutting produces less ground disturbance than pulling. Bag and remove all flower and seed heads.
Dalmatian toadflax *Linaria dalmatica* (LIDA) Perennial with taproot and extensive system of lateral roots Yellow toadflax *Linaria vulgare* (LIVU2) Perennial with taproot and extensive system of vertical and creeping lateral roots	**chlorsulfuron** imazapic metsulfuron methyl picloram	Dalmatian toadflax reproduces primarily by seed and partly by adventitious root buds. Yellow toadflax reproduces primarily by adventitious root buds on lateral roots. Biological agents are available and may be very effective. If biocontrol agents continue to be effective, herbicide application may not be needed. Manual pulling and digging may not be effective because of the deep (4-10 feet) and laterally extensive root systems (to 10 feet from plant). If manually removed, all roots and flower and seed heads should be bagged and removed. Cutting stems in spring or early summer would eliminate seed production, but not the root system.
Whitetop *Cardaria draba* (CADR) Rhizomatous perennial	**chlorsulfuron** glyphosate imazapic	These species are difficult to control because of their deep taproots (9 ft.) and ability to sprout from root fragments. Early detection and proactive management is most effective since established infestations are difficult to control. Frequent monitoring for new sites and prioritizing small infestations in otherwise healthy

Primary Target Species	First-Choice Followed by Other Effective Herbicides	Integrated Treatment Notes
Perennial pepperweed *Lepidium latifolium* (LELA2) Perennial with rhizome like creeping roots	imazapyr metsulfuron methyl	sites is important. Next priority would be for corridors such as waterways and irrigations structures that have a high likelihood of spread. Biological controls are not available. Repeated pulling may control small, young infestations. Established plants are likely to resprout from deep roots. All roots and flower and seed heads should be removed. Mowing does not eliminate plants but removes thatch.
Sulphur cinquefoil *Potentilla recta* (PORE5) Taprooted perennial that may have several shallow, spreading branch roots but not rhizomes	**metsulfuron methyl** glyphosate picloram triclopyr	Cultural treatments, such as seeding of native plants may be effective. There are no approved biocontrols. Small infestations may be controlled by hand digging if the entire root crown is removed. For large infestations, selective herbicides are likely the only method of effective control (TNC 2004). Repeated treatments are needed for the first couple of years to ensure re-establishment does not occur.

Project Design Features

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

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

Of the 10 herbicides considered for use under alternative D, the first choice herbicides are most likely to be used. The herbicides sethoxydim, sulfometuron methyl, and triclopyr are the least likely to be used.

Table 17. Summary of herbicide use under alternative D

First Year/First Choice Activity	Acres
Broadcast Herbicide	
Chlorsulfuron	435
Glyphosate	3
Metsulfuron methyl	69
Picloram	36
Total Broadcast	543
Selective/Spot by First-choice Herbicide	
Chlorsulfuron	595
Glyphosate	721
Metsulfuron methyl	238

First Year/First Choice Activity	Acres
Picloram	27
Total Selective/Spot	**1581**

Passive and Active Restoration

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

Treatment Flexibility and EDRR

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

Implementation Planning and Monitoring

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

2.4 Alternatives Considered but Eliminated from Detailed Study

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

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

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

2.4.2 Limitations on Herbicide-use Rates for All Herbicides

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

2.4.3 Mandatory Decline on Herbicide Use Over Time

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

2.4.4 Use of Herbicides as a Last Resort

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

The Pacific Northwest Regional Forester decided to include use of herbicides as part of an integrated weed management approach to allow for the most effective possible treatment outcome. The common control measures (table 9) display the integrated treatment methods most likely to be effective on the target invasive species currently found on the Forest. Use of non-herbicide methods have not resulted in eradication, control, or containment of the current infestations.

2.4.5 Use of Herbicides for Only the Highest Priority Target Species

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

2.4.6 No Herbicide Use in a Variety of Areas

Some comments included a number of suggestions about prohibiting herbicide use in a variety of areas including:

- PACFISH/INFISH Riparian Habitat Conservation Areas (RHCA), including wetlands, lakes, ponds, bogs, springs, fens, wet meadows, marshes, and in roadside ditches that funnel water to these areas;
- Municipal watersheds; within rock surfaces and late-successional forests; within 100 feet of stock tanks;
- Anywhere near sensitive plants; including non-vascular plants
- Habitats for silver-bordered fritillary; sage grouse; Harney Basin duskysnail; Columbia clubtail; lynx; wolverine; Columbia spotted frog, upland sandpiper, greater sage grouse, and pygmy rabbit; wolf; and goshawk;
- Within 500 feet of developed recreation sites;
- Campgrounds, visitor centers, at trailheads or along trails;
- Special forest product, cultural plant, medicinal plant gathering areas, other popular plant gathering areas (similar areas mentioned are: key areas of human plant consumption, such as where there are edible berries, flushes of medicinal herbs, indigenous people’s cultural plant gathering sites, and mushroom gathering areas, areas with plants frequently foraged for by humans);
- Wilderness and potential wilderness areas, wild and scenic river corridors, and inventoried roadless areas.

In addition, comments mention that herbicide should not be used on certain invasive species, including St. Johnswort, Canada thistle, and bull thistle. When all of the areas are added together, this becomes an alternative very similar to eliminating herbicides from the treatment toolbox and would not meet the purpose and need for timely and effective treatment.

2.4.7 No Early Detection/Rapid Response (EDRR)

Some comments suggested that new detections should be subject to additional NEPA analysis. A variation on this alternative is not using herbicide for EDRR, but allowing other treatment methods without additional NEPA analysis. An integrated treatment toolbox is necessary for EDRR to be effective. Additional NEPA analysis would not meet the need for timely treatments. Thus, this alternative was not developed for detailed study. The limitations on treatments, implementation planning process, pdfs, and herbicide use buffers proposed in the alternatives provide sufficient protections to ensure that treatments under EDRR would have effects within the scope disclosed in the EIS.

2.4.8 Increase Size of Herbicide Use Buffers

Some comments suggested that the size of herbicide use buffers along streams be increased to take in the entire riparian habitat conservation area or up to 300 feet from any stream or water body. The site-specific modeling done for the project indicates that buffers of this size are not necessary because the alternatives already either minimize or eliminate herbicide from reaching streams, and in no case is the amount of herbicide concentration in the streams predicted to exceed a level of concern for fish. Thus, this alternative was not developed for detailed study.

2.4.9 No Herbicide Use

Some comments suggested an alternative that would treat invasive plants using all but herbicide methods. Alternative A would not approve any treatment, but non-herbicide treatments could continue under categorical exclusions and as actions connected to other projects. Alternative C minimizes use of herbicides and would require non-herbicide methods across the majority of currently infested sites. It includes an annual cap on herbicide use that is much lower than the other action alternatives and addresses many of the suggestions expressed in the scoping and DEIS comment letters. Thus, another alternative strictly limiting herbicide use was not developed for detailed study because of its similarity to alternatives A and C.

Use of non-herbicide methods alone have not resulted in eradication, control, or containment of the current infestations. For fish and wildlife habitats, disturbance from non-herbicide methods that require more repeated entries could have greater effects than the herbicide use proposed. For instance, non-herbicide methods (e.g., pulling), especially within riparian areas, pose a greater risk of sediment delivery due to increased soil disturbance (chapter 3.6 and 3.7).

2.4.10 No Use of Certain Herbicides

Some public comments mentioned specific herbicides that should not be used on this project. These include: clopyralid, chlorsulfuron, glyphosate, the Roundup® formulation of glyphosate, imazapic, imazapyr, metsulfuron methyl, sethoxydim, sulfometuron methyl, picloram, and triclopyr. All of these herbicides were authorized for use in the R6 2005 ROD.

If these herbicides were not approved, the effectiveness of the herbicide use would be hampered and the purpose and need for treatment would not be met. Some of these herbicides are the first choice for target invasive plant species found on the Forest (e.g., chlorsulfuron). Some are not the first choice, but are effective options should the first choice be found ineffective on some target species or locations (e.g., clopyralid, glyphosate, imazapyr, picloram, triclopyr). Some are effective on species that are not among the primary target species found on the Forest but may be treated in special places (e.g., sulfometuron methyl is effective on medusahead). The more herbicide choices available, the more likely that the treatment will be effective

Picloram would not be used under alternative C. With this exception, the analysis considers the use of all of the herbicide choices in all action alternatives. The pdfs and herbicide use buffers provide guidance on where and how these herbicides may be used. Limitations on extent, rate, and method of application allow for the use of the most effective herbicide choice, while minimizing the potential adverse effect. Thus, alternatives to drop use of certain herbicides (with the exception of picloram) were not developed for detailed study.

2.5 Alternatives Compared

Table 18. Alternative comparison by activity

Activity	Alt A (No Action)	Alt B (Proposed Action)	Alt C (More Restrictive Herbicide Use)	Alt D (No LRMP Amendment)
Authorizes EDRR	No	Yes	Yes	Yes
Non-herbicide treatments	None[18]	Non-herbicide treatments would be integrated with herbicide treatments	Same as Alternative B, except only non-herbicide treatments would be approved within 100 feet of water bodies	Same as Alternative B
Maximum acres of proposed herbicide treatments during any year of implementation	0	2,124	735	Same as Alternative B
Number of herbicides available for use	0	11	10 (no picloram)	10 (no aminopyralid)
Forest LRMP amendment to include aminopyralid	No	Yes	Yes	No
Herbicide application rate and method	None	Lowest effective rate, broadcast sprayers may be used where needed according to pdfs	Application rate would not exceed 70% of typical broadcast rate, no boom or broadcast sprayers	Same as Alternative B except no aminopyralid
Biological control agents	Biological control agents may be released or redistributed	No biological agents would be released within the Forest boundaries	Same as Alternative B	Same as Alternative B

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

Activity	Alt A (No Action)	Alt B (Proposed Action)	Alt C (More Restrictive Herbicide Use)	Alt D (No LRMP Amendment)
Invasive Plant Prevention Measures	Same as Alternative B	Prevention measures are included in all land use assessments and projects to prevent the introduction and spread of invasive plants.	Same as Alternative B	Same as Alternative B

Table 19 displays a comparison of the first year/first choice herbicide for each alternative. All action alternatives (B-D) would approve a range of treatments on all 2,124 currently infested acres. Alternative C is the only action alternative that would disallow herbicide use in specific areas to the degree that non-herbicide treatments would be the only methods allowed for these sites. Under alternative A (no action), no treatments would be approved. However, biocontrol agents released on neighboring lands would continue to help suppress toadflax, St Johnswort, and other invasive plants on the Forest.

Table 19. Comparison of first year/first choice herbicide by alternative

First Year/First Choice Treatment	Alt A (No Action) Acres	Alt B (Proposed Action) Acres	Alt C (More Restrictive Herbicide Use) Acres	Alt D (No LRMP Amendment) Acres
Total for All Broadcast Applications	0	1,281	0	0
Aminopyralid	0	1,179	0	0
Chlorsulfuron	0	71	0	435
Glyphosate	0	0	0	3
Metsulfuron methyl	0	30	0	69
Picloram	0	0	0	36
Total for All Spot/Selective Applications	0	843	735	1,581
Aminopyralid	0	168	560	0
Chlorsulfuron	0	519	142	595
Glyphosate	0	0	0	722
Metsulfuron methyl	0	156	33	238
Picloram	0	0	0	27
No Herbicide Application	0	0	1,389	0

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

Table 20 provides a comparison of the alternatives relative to the issue measures described in chapter 1.

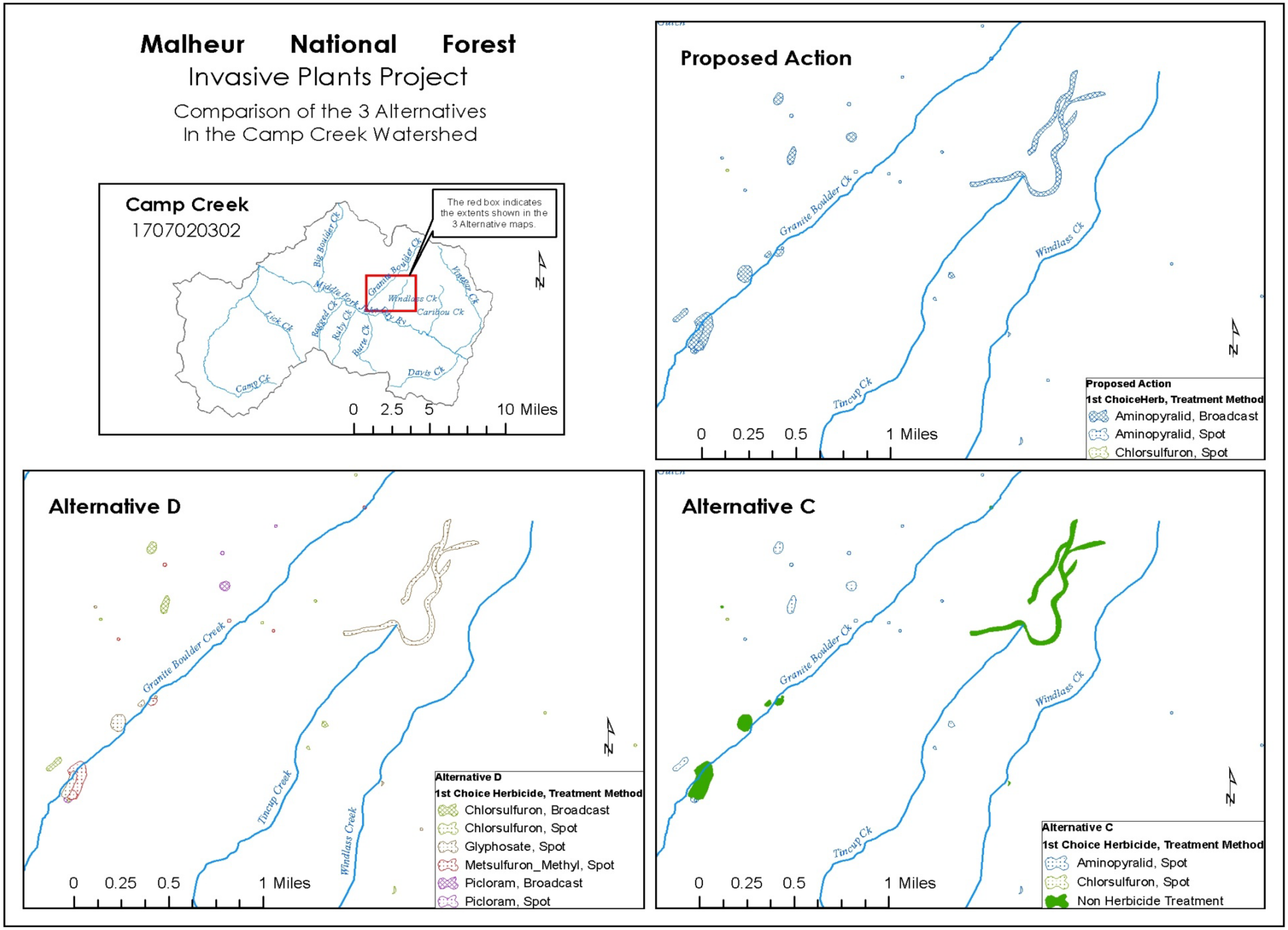

Figure 5. One area of the Forest showing treatment distribution

Table 20. Alternative comparison relative to significant issues

Issue Component	Unit of Measurement	Alt A (No Action)	Alt B (Proposed Action)	Alt C (More Restrictive Herbicide Use)	Alt D (No LRMP Amendment)
1 – Treatment Effectiveness					
Restrictions on herbicide use reduce treatment effectiveness and increase treatment costs.	Average Cost per Acre of Effective Treatment of Known sites (includes re-treatments and restoration)	0	$544	$722	$598
	Total Cost of Effective Treatment of Know Sites (includes re-treatments and restoration)	0	$1,154,000	$1,472,900	$1,270,500
	Ability to meet treatment objectives	Will not meet objectives	Tools adequate to meet treatment objectives	Tools may not be adequate to meet treatment objectives, especially near riparian areas	Tools adequate to meet treatment objectives, however opportunities to use most effective herbicide or application method may be forgone
2 – Herbicide Impacts to Human Health					
Human health may be harmed by herbicide exposure.	Type (rate, method, chemical properties) and extent of herbicide use that could result in harmful exposure scenarios to people.	None	None of the herbicides proposed for use are associated with harmful scenarios to the public. Pdfs minimize or eliminate potential for harmful exposure by limiting the herbicide ingredient, rate, or method of application. Workers need to take specific precautions to avoid herbicide exposure.	Same as Alternative B, except that far less herbicide would likely be sprayed annually. The minimal risks associated with herbicide use under Alternative B would be further reduced.	Same as Alternative B. Where necessary, pdfs minimize or eliminate potential for harmful exposure scenarios.
	Qualitative assessment about the effectiveness of herbicide-use buffers and other project design features to prevent harmful herbicide exposure scenarios	None	Risk assessments demonstrate that the type of herbicide use proposed poses relatively low risk to human health. The likelihood of harmful exposures is low, thus the design features have high likelihood of eliminating all potential adverse impacts	Alternative C would have less risk of herbicide exposure overall, especially to fish and water, due to restrictions on herbicide use near water. The buffers would eliminate all potential herbicide exposure near streams.	Same as Alternative B, except opportunities to use aminopyralid would be foregone and in some cases, higher risk herbicides would be used. However, more spot treatment and less broadcasting would occur, which could result

Issue Component	Unit of Measurement	Alt A (No Action)	Alt B (Proposed Action)	Alt C (More Restrictive Herbicide Use)	Alt D (No LRMP Amendment)
			from herbicide use.	While this alternative includes some additional design features that would comparatively reduce risk of harmful herbicide exposure, the risk is already low.	in less herbicide exposure, partly because less herbicide can be applied per day so the daily treatment extent would likely be less. For the project as a whole, the design features minimize adverse impacts to human health from herbicide use.
	Potential for Herbicides to Affect Drinking Water	None	Drinking water quality would not be adversely affected. Restrictions on herbicide use near drinking water and well intakes further minimize risk. Herbicide transportation and handling safety plan would minimize potential for an herbicide spill.	Same as Alternative B	Same as Alternative B
3 – Herbicide Impacts on Non-target Vegetation					
Proposed herbicide use may harm non-target plants, specifically sensitive and other species of conservation concern, cultural use plants, and special forest products.	Type and extent of herbicide use within 100 feet of botanical special species of conservation concern, cultural use plants, and special forest products.	None	Pdfs prohibit broadcast herbicide use within 100 feet of sensitive plant populations. Spot applications will be used within 100 feet of sensitive plant populations. The pdf for use of blue dye will alert special forest product gatherers of herbicide spray areas.	Same as Alternative B, less overall herbicide use	Same as Alternative B
4 - Herbicide Delivery to Water and Potential Impacts to Fish					
Proposed herbicide use may result in chemicals reaching streams and other water bodies (through drift, leaching and/or run off) and may	Type and extent of herbicide use within 100 feet of streams and other water bodies.	None	Aminopyralid could be broadcast up to water's edge; however, no adverse impacts on fish are expected because the amount of herbicide that	Same as Alternative B, except no herbicides would be used within 100 feet of streams and other water bodies. There potentially could	Same as Alternative B, except comparatively more use of higher-risk herbicides relative to fish. pdfs minimize risks and differences between

Issue Component	Unit of Measurement	Alt A (No Action)	Alt B (Proposed Action)	Alt C (More Restrictive Herbicide Use)	Alt D (No LRMP Amendment)
adversely fish and their habitat.			may reach streams is below a level that could harm fish. Herbicide-use buffers and other pdfs reduce the rate, extent, or frequency of herbicide use that pose potential risks to fish.	be more sediment from non-herbicide methods required near streams.	alternatives.
	Qualitative assessment about whether or not, and how fisheries might be affected	No impacts	Water concentrations from site-specific model runs at highest risk sites demonstrate that levels of herbicide that could reach streams and aquatic organisms are at least 3 orders of magnitude less than levels of concern for fish and habitat. Treatment methods may result in minor amounts of sediment reaching streams.	Same as Alternative B	Same as Alternative B
5- Herbicide Impacts on Wildlife and Pollinators					
Proposed herbicide use may result in harmful exposure to terrestrial wildlife (specifically species of conservation concern).	Type and extent of herbicide use within specific wildlife habitats for wildlife of conservation concern	None	This alternative has the most broadcasting, but the first-choice herbicides that would be used pose low risk to wildlife.	Spot application of herbicides would occur on 735 acres and the first-choice herbicides pose low risk to wildlife.	First-choice herbicides that pose a low risk to wildlife would be applied on 1,337 acres whereas moderate to risk first-choice herbicides would be used on 787 acres. Less broadcasting than Alternative B, which reduces risk of drift.
	Risk of HCB (hexachlorobenzene) contamination and effects on raptor eggs	None	No HCBs in first-choice herbicides. Pdfs minimize risk to raptors to extremely low level.	Same as alternative B. No use of picloram reduces risk.	Picloram is the first-choice herbicide on 63 acres, posing low risk of HCB's; pdfs minimize risk to raptors to extremely low level.
	Narrative assessment about whether or not, and	None	All first-choice herbicides pose a low risk to wildlife.	Same as Alternative B, except greater risk of	Same as Alternative B, except less broadcasting

Issue Component	Unit of Measurement	Alt A (No Action)	Alt B (Proposed Action)	Alt C (More Restrictive Herbicide Use)	Alt D (No LRMP Amendment)
	how species of conservation concern and amphibians might be affected		Pdfs that restrict timing and application of herbicides in sensitive habitats will minimize or eliminate the likelihood for any species to receive a harmful exposure to herbicides or disturbance.	disturbance from non-herbicide treatments.	and more use of herbicides that pose a comparatively greater risk to wildlife.

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Chapter 3. Affected Environment and Environmental Consequences

3.1. Introduction

3.1.1 The Effects Analysis

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

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

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

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

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

Chapter 3 discloses the effects of a range of treatment options applied to a range of site conditions to accommodate the uncertainty associated with project implementation. The analysis assumes that all 2,124 acres of currently mapped infestations are treated for a period of 4-6 years until control objectives are met. However, given funding constraints, we are likely to treat fewer acres each year, and treatments are likely to be needed over a longer period of time.

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

The common control measures (table 9), project design features (table 10) and herbicide-use buffers (table 11 and table 12), and the implementation planning process (figure 4) provide sideboards that minimize and bound the potential for effects even though the suite of integrated treatments would vary each year.

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

3.1.2 Herbicide Risk Assessments

The effects from the use of any herbicide depend on the toxic properties (hazards) of that herbicide, the level of exposure to that herbicide at any given time, and the duration of that exposure. Herbicide risk assessments were the basis for analysis in the R6 2005 FEIS, disclosing the potential for effects on non-target plants, wildlife, human health, soils, and aquatic organisms. Risk assessments were done by Syracuse Environmental Research Associates, Inc. (SERA) using peer-reviewed articles from the open scientific literature and current Environmental Protection Agency (EPA) documents, including Confidential Business Information. Information from laboratory and field studies of herbicide toxicity, exposure, and environmental fate was used to estimate the risk of adverse effects to non-target organisms. See table 8 in chapter 2 for the list of current SERA risk assessments.

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

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

The risk assessments considered maximum exposure scenarios including accidental exposures and application at maximum label rates. The project design features described in chapter 2 (table 10) abate hazards indicated by the assessments. Although the risk assessments have limitations (see R6 2005 FEIS pages 3-95 through 3-97), they represent the best science available. The National Academy of Science (NAS) stated:

> After 30 years of use and refinement, this risk-assessment paradigm has become scientifically credible, transparent, and consistent; can be reliably anticipated by all parties involved in decisions regarding pesticide use; and clearly articulates where scientific judgment is required and the bounds within which such judgment can be applied. The process is used for human-health and ecological risk assessments and is used broadly throughout the federal government. Thus, the committee concludes that the … risk assessment … process is singularly appropriate for evaluating risks posed to ecological receptors, such as listed species, by chemical stressors, such as pesticides" (NAS 2103).

The risk assessments specifically address forest product consumption; given the project design features, limited public exposure would be expected and even if inadvertent consumption occurred, the amount of herbicide a person may be exposed to would be below the threshold of concern.

The risk assessment methodologies and detailed analysis is incorporated into references of conclusions about herbicide toxicology in this document.

Herbicide Toxicity Terminology

The following terminology is used throughout this chapter to describe relative toxicity of herbicides proposed for use in the alternatives. Additional terminology has been added to this section since the DEIS was published.

Hazard Quotient (HQ)

The hazard quotient is the ratio of the estimated level of exposure to a substance from a specific pesticide application, to the level of the acceptable exposure or toxicity. A HQ less than or equal to 1.0 is presumed to indicate an acceptably low level of risk for that specific application.

Exposure Scenario

Exposure scenarios consider both the toxicity of a given chemical and the mechanism by which an organism may encounter it. The application rate and method influences whether a person, animal, or non-target plant could be adversely affected by exposure to a particular herbicide.

Plausible Effects

The analysis in chapter 3 focuses on whether effects that are possible based on risk assessments are plausible, given site conditions, life history of organisms in an area, herbicide application methods, and other project design features. Project design features (table 10) are often used to minimize or eliminate the plausibility of effects indicated as possible in the risk assessments.

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.

No Observable Adverse Effect Level (NOAEL)

Exposure level at which there are no statistically or biologically significant differences in the frequency or severity of any adverse effect in the exposed or control populations.

No Observed Effect Level (NOEL)

Exposure level at which there are no statistically or biologically significant differences in the frequency or severity of any effect in the exposed or control populations. The "No Observed Effect Concentration (NOEC)" is synonymous with NOEL.

Reference Dose (RfD)

The RfD is a numerical estimate of a daily exposure to the human population, including sensitive subgroups, such as children, that is not likely to cause harmful effects during a lifetime. Referenced doses are generally used for human health effects that are thought to have a threshold or minimum dose for producing effects. The reference dose is also referred to as the level of concern, threshold of concern, and toxicity index. All of these terms refer to the exposure level or "dose" below which adverse effects are unlikely to occur.

Risk Assessment Worksheet

Risk assessment worksheets are excel spreadsheets that calculate lower, central and upper bound estimates of hazard quotients for public and worker health, different types of wildlife, and aquatic organisms for project-specific herbicides and application rates and methods.

Aquatic Label

Some herbicides are labeled by EPA for direct application in water. This project relies on the use of aquatic labeled herbicides for most applications within 15 feet of wet streams and other water bodies (aminopyralid is labeled for use to the water's edge). Aquatic labeled herbicides are not necessarily less hazardous to aquatic organisms than other herbicides, but have been more extensively tested. Aquatic labeled herbicides are generally less hazardous to aquatic organisms than terrestrial formulations of the same herbicide. Aquatic labeled herbicides would not be favored over effective non-aquatic labeled herbicides that pose lower risk to aquatic organisms, assuming compliance with label requirements.

Bioconcentration (Bioaccumulation)

The increase in concentration of a substance in living organisms as they take in contaminated air, water, or food because the substance is very slowly metabolized or excreted (often concentrating in the body fat).

Herbicide Comparison Table

Table 21 was prepared by Bautista and Bulkin in 2008 and was updated between the DEIS and FEIS based on the project-level assessment using updated risk assessments. Please note that the risk comparison table indicates the *relative* risk of using any of the 11 herbicides proposed. These herbicides [the 10 analyzed in the R6 2005 FEIS], used in accordance with the R6 2005 standards, pose relatively low risks to people and non-target organisms (R6 2005 ROD p. 8). First choice herbicides are in **bold**.

The table shows that aminopyralid compares favorably with the other herbicides considered for use on this project. It provides a simplified display of the relative risk to people and the environment that does not incorporate the project design features, herbicide use buffers and other measures taken in the alternatives to reduce risk of herbicide exposure. Many variables influence site-specific degree of risk, including extent and location of treatment, application rate, and proximity to habitats of concern.

Table 21. Herbicide risk comparison

Comparative Risk Level	Public Health	Worker Health	Non Target Plants	Aquatic Organisms	Wildlife
Low	• aminopyralid • imazapyr[2] • **metsulfuron methyl**	• **aminopyralid** • **chlorsulfuron** • clopyralid • **glyphosate** • imazapic • imazapyr • **metsulfuron methyl** • **picloram**[5] • sethoxydim • sulfometuron methyl	• clopyralid • **picloram** • sethoxydim • triclopyr	• clopyralid • imazapic • **metsulfuron methyl** • **aminopyralid**	• **chlorsulfuron** • clopyralid • imazapic • imazapyr • **metsulfuron methyl** • **aminopyralid**
Moderate	• clopyralid • **chlorsulfuron**[3] • **glyphosate** • imazapic • **picloram** • sethoxydim • sulfometuron methyl[3]	• triclopyr	• **aminopyralid** • **chlorsulfuron** • imazapic • imazapyr (somewhat selective) • **metsulfuron methyl** • sulfometuron methyl	• **chlorsulfuron** • imazapyr • sulfometuron methyl	• **glyphosate**
Higher	• triclopyr[4]		• **glyphosate**	• sethoxydim • **glyphosate** • **picloram** • triclopyr	• triclopyr • **picloram**[1]

[1] Picloram was moved from moderate to higher risk in the FEIS, because the updated risk assessment showed that acute and chronic effects occurred at the typical and highest application rates.

[2] Imazapyr was moved from moderate to lower risk for public health in the FEIS based on updated risk assessment and analysis

[3] Chlorsulfuron and metsulfuron methyl were moved from lower to moderate risk for public health in the FEIS based on updated risk assessment and analysis.

[4] Triclopyr was moved from moderate to higher risk for public health in the FEIS based on updated risk assessment and analysis

[5] Picloram was moved from moderate to lower risk for worker health in the FEIS based on updated risk assessment and analysis.

Incomplete and Unavailable Information

This section was added to the EIS to articulate incomplete and unavailable information related to herbicide use. Any project involving herbicide use in a natural setting will contain many sources of uncertainty. The range of invasive plant species to be managed is large and compounded by the number of non-target species and diversity of ecological conditions in areas where treatment may occur. Data on herbicide toxicity and environmental fate is limited to those conditions and species tested for registration purposes and investigated by independent researchers. Available data on surfactants, inerts, and dyes is even more limited. It is not possible to obtain all the data necessary to significantly reduce this incomplete and unavailable information. For example, the sheer number of species and single herbicide test combinations is overwhelming.

Each rigorous laboratory test conducted to determine the toxicity of a chemical to an animal is extremely expensive. If we add to this data required to more adequately address synergistic, additive, or antagonistic effects from chemical combinations, it is not possible to obtain all data that would be relevant to making a decision. There is no way to assess all sources of chemical exposure and more precisely determine the potential risk of a cumulative effect.

In addition, invasive and native plants, wildlife, soil, and water bodies are dynamic resources that change locations and characteristics depending upon time, season, weather patterns, land use activities, random events, and other influences. This limits our ability to precisely predict effects (e.g., amount and duration of herbicide exposures, spread, and impact of invasive plants, and nature or amount of background contamination) even if more toxicity information was available.

In response to this uncertainty, adverse effects to people and the environment are assumed to occur at doses well below lethal levels, using the best available models for predicting herbicide concentrations in water using worst-case scenarios, relying on widely used and accepted risk assessment methodology. The project design features, herbicide use buffers, and implementation planning process provide additional levels of caution in response to uncertainty.

Treatment Effectiveness

Each invasive plant treatment circumstance could respond differently to the integrated treatments proposed. The prescription for each site would vary depending on the pdfs, buffers, first choice, and other effective herbicides authorized for use, as well as other factors, such as treatment history and objective. The differences in treatment effectiveness described in chapter 3.1.4 are based on assumptions about the range of treatments available. In addition, treatment costs vary depending on the integrated treatment methods, specific chemicals used and their application method, and the size and distribution of the various treatment sites.

Human Health

Toxicity data is not obtained on humans directly, but rather extrapolated from laboratory animals using standardized tests required by EPA. Human susceptibility to toxic substances can vary substantially. In response to this uncertainty, standard risk assessment methodology assigns uncertainty factors to toxicity data to account for extrapolation from laboratory animals and for sensitive individuals. However, some individuals may be unusually sensitive so individual susceptibility to the herbicides proposed in this EIS cannot be predicted specifically. Factors affecting individual susceptibility include diet, age, heredity, pre-existing diseases, and lifestyle. In response to this uncertainty, project design features are proposed to reduce the likelihood or amount of exposure.

Plants

Data on the susceptibility of different non-target plant species and families to particular herbicides is conducted with agricultural crop species and not those that may better represent non-target plants in the natural environment. Specific locations of rare plants, as well as invasive plants, change from year to year, making it impossible to precisely predict risk from treatments.

The current analysis uses the best available science on susceptibility, herbicide drift, and risk assessments to determine likely effects. Required project design features, monitoring, and practical information and expert opinion are utilized in response to uncertainty.

Soil and Water Resources

Herbicide toxicity and fate varies with environmental variables, such as pH, temperature, and presence or absence of organic matter. These variables fluctuate widely depending upon season, weather, disturbance, adjacent land uses, and other factors, making precise predictions of existing conditions and effects impossible. Data on effects to soil organisms is limited and may not reflect the actual community of organisms present at any given treatment site.

In response to this uncertainty, the current analysis uses the best available scientific information on soil mapping, watershed analysis, water monitoring, and the best available predictive models for potential contamination and drift. In addition, project design features are applied to action alternatives to restrict herbicide ingredients, application method, and rate on certain soils and in proximity to water.

Terrestrial and Aquatic Organisms (Fish and Wildlife)

Research has not been conducted on the effects of these herbicides to most free-ranging wildlife species, so the relevant data to specifically evaluate effects to different wildlife species is incomplete or unavailable. Specifically,

- Information about herbicide effects to reptiles, amphibians, and butterflies found in Region 6 is limited.
- Analysis of effects for any project involving herbicide use relies upon extrapolations from laboratory animals to free-ranging wildlife and controlled conditions to the natural environment.
- There are more data available for mammals than for birds, which require the use of mammal toxicity values in bird exposure scenarios for some of the herbicides considered in this FEIS.
- Very few studies are available on sublethal effects to fish from acute exposures. Of studies that are available, some indicate temporary effects at low herbicide concentrations (e.g., Tierney et al. 2006).

Better estimates of risk could be calculated if laboratory data on the toxicity of the herbicides considered in this FEIS were available for more groups of animals and more individual species. We would have more information on the comparative sensitivities of different wildlife groups and the types of adverse effects that may occur in different species.

However, because of the dynamic nature of wildlife and their habitat (e.g., behavior, weather, nutrient availability, contaminant presence), significant uncertainties would remain for predicting short- and long-term reactions to herbicide presence in natural settings even if more laboratory data were available. The threshold of concern for wildlife and fish is set particularly low (a no effect or no adverse effect level, or a fraction of the lethal dose). This accounts for uncertainties about how herbicides affect wildlife and fish given multiple stressors. Risks are further minimized by the low extent of treatment, the herbicide use buffers and the project design features.

Limitations notwithstanding, there is substantial scientific data on the toxicity of these herbicides to birds and mammals, as well as fish, amphibians and some invertebrates. The data is generated by manufacturers to meet EPA regulations before an herbicide may be registered for use, and by independent researchers that have published findings in peer-reviewed literature. This data is analyzed according to standard risk assessment methodology to reach a characterization of risk for each herbicide.

3.1.3 Site Types

We stratified the existing invasive plant sites into “site types” to help characterize the pattern of infestation and make predictions about future spread (see section 3.1.5 for a discussion about vectors of invasive plant spread in the context of cumulative effects analysis). The majority of mapped invasive plant sites are within 50 feet of roads. This is due to two primary factors: 1) we often look for invasive plants along roads; funding for surveys off roads is limited, and 2) roads are a major vector for the spread of invasive plants. In the following table, if any part of an invasive plant site (polygon) meets the criteria, then that site falls within the given site type. The table also shows the number of actual acres that meet the criteria (portions of invasive plant sites that do not meet the criteria are excluded). Most of the infestations near streams are also along roads. About 25 acres of infestations do not occur within any defined site-type.

Table 22. Site type criteria and acres

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

3.1.4 Treatment Costs and Effectiveness

This section addresses the cost and effectiveness of treatment and active site restoration under the action alternatives. The analysis assumes all infested acres are treated year 1, then re-treated annually until the infestation level across all treatment areas is very low. This would result in treatment and restoration of current infestations within a 4 to 6 year period. The project is likely to be implemented over a much longer time frame due to funding constraints.   Changes between the draft and final EIS include clarifying assumptions for differences in the cost of the different alternatives and including information about the pattern of herbicide use expected at treatment sites.

The design of each alternative influences the cost of eradicating, controlling, and containing invasive plants on the Malheur National Forest. The effectiveness of each treatment is influenced by the tools available for use; the more tools available, the greater the potential effectiveness of the treatment. If the toolbox is restricted and some situations cannot be effectively treated, the percentage of target population killed each year can be dramatically decreased.

On page 4-18, the R6 2005 FEIS notes, "In general, alternatives that have the widest variety of herbicides and herbicide families available for use have the greatest potential to result in effective treatments." In contrast, when herbicide use is more restricted, "…fewer acres would likely be achieved at a constant budget, and the years to control increases proportionally" (ibid. page 4-21). Thus, a loss of effectiveness is likely if the most effective choice is not available for a given site.

Herbicide resistance may occur if one herbicide is used repeatedly in an area over a series of years (R6 2005 FEIS, p. 3-94). More than one herbicide active ingredient may be needed to ensure that herbicide resistance does not occur. The repeated use of one herbicide could allow naturally resistant plants to survive and reproduce. As the number of resistant plants increases, the efficacy of the herbicide diminishes until the herbicide no longer effectively controls the invasive plant populations. To develop resistance avoidance strategies, long-term site plans should recognize which of the various herbicide families have available and effective herbicides if multiple applications are expected to be necessary. Integrated chemical and non-chemical controls are highly effective where feasible, because any surviving herbicide-resistant plants can be removed from the site.

A loss of effectiveness and efficiency would be expected where the first-choice herbicide or application method are not allowed due to a particular design feature (such as no broadcasting in alternative C and no aminopyralid use in alternative D). This would increase costs and could compromise our ability to control or eradicate populations of certain aggressive target species, such as thistles and knapweeds. The range of treatment options varies between the alternatives most widely in streamside treatment areas.

Each treatment entry would reduce the size or density of treated populations. Invasive species specialists across the region have estimated that in each treatment entry, 80 percent of the existing target plants would be removed, assuming fully effective integrated weed management methods including herbicides are available. This has been validated by experts outside the agency; reduction of around 80 percent of the target species is generally expected from forestland herbicide treatments; however, actual results can vary widely (Desser 2007, Miller 2014, Peterson 2014).

Results at any treatment site vary depending on factors such as treatment objective, the target species, the size of the infestation, and the seed bank in the soil. The estimate of 80 percent reduction each treatment entry is intended to provide a cost estimate assuming that on average, four treatment entries would be required, and that only a fraction of the existing target population would remain after each treatment entry. Remnant target plants and seed banks can remain for several years but after multiple entries, invasive plants at any given site would be substantially reduced. For instance, a 100-acre infestation effectively treated in year 1 would result in 20 acres needing treatment in year 2. These 20 acres treated in year 2 would result in 4 acres still needing treatment in year 3, and so on until the area needing retreatment becomes minimal.

The model is intended to show how limitations on the available tools influences our ability to effectively treat invasive plants, and how this limitation results in an increase in time and cost to achieve treatment objectives. In some cases, treatment objectives may never be met depending on the degree of limitation applied to particular site.

For this analysis, we assume all infested sites are covered with 100 percent invasive plants, because density is a variable that changes rapidly and is unpredictable. The 80 percent estimate is not precise and the range of results varies widely depending on the target, how long the invasive population has been established, the objectives of treatment, and other conditions (monitoring results, funding, topography, soils, weather during time of treatment, and many other variables). No data exists to determine the precise monetary impact on the project due to various limitations on the treatment toolbox. Based on the available information, the estimates for the Malheur National Forest are intended to highlight the differences between alternatives relative to their cost-effectiveness.

Alternative B is by definition the most cost-effective alternative because it allows for the widest range of treatment tools. A consistent cost of $200 per acre was used regardless of treatment method. The site-specific combination of methods and their juxtaposition vary depending on many factors and a more specific estimate is not available. Many treatments are integrated, and the Malheur National Forest does not have recent data on which to compare costs of different methods. In general, herbicide spot treatment would tend to be more expensive than broadcast; this cost difference would be magnified in larger areas with dense populations of invasive plants. Manual treatments tend to be more costly than herbicide treatments; this would be magnified in areas where invasive plants are dense and well-established.

Biological and mechanical treatments are the least costly; however, these treatments are often not adequate in themselves to meet the treatment objective.

For this analysis, the difference in cost of the project for each action alternative is a function of the effectiveness of each alternative (and the likelihood of repeated treatments needed), rather than the base cost per acre of a given treatment method. For those areas in alternative C where herbicide use would not be approved, more treatment entries are likely, and the effectiveness (number of acres meeting objectives) would be reduced. Alternative C also would not allow broadcast treatment. This would increase the cost and number of entries needed to achieve treatment objectives for larger, denser populations of invasive plants. Alternative D would not allow for the most effective herbicide (aminopyralid) to be used in some areas, which would influence our ability to meet the treatment objectives, especially near streams where herbicide use buffers would limit the herbicides that could be used in lieu of aminopyralid. This would also amount to an increase in cost/number of treatment entries for some infested areas under alternative D.

Alternative Comparison

The alternatives vary as to the first year/first choice herbicides, and these differences influence cost and effectiveness over time. The more effective the first year/first choice herbicide, the less retreatment would be needed. The estimates of the impact of restrictions on herbicide use are based on professional judgment; no information is available to allow for a precise comparison.

The design of alternatives C and D require that non-herbicide, spot or hand treatments may be required for areas that would more efficiently be broadcast, which would increase the cost of treatment in that alternative.[19] The primary differences between the alternatives and the influence on cost-effectiveness are:

1) *Whether or not aminopyralid may be used as the first-choice herbicide*. Aminopyralid is the first-choice herbicide to treat 1,350 acres (64 percent) of the primary target species found on the Forest. In alternative B, we could broadcast this herbicide almost everywhere needed on the Forest, including to the water's edge. In alternative C, we would spot apply this herbicide to 560 acres; however, no herbicide would be used within 100 feet of streams and other water bodies.

   We would not use this herbicide in alternative D. This increases the amount of spot or hand treatment required in alternative D due to the herbicide-use buffers associated with herbicides other than aminopyralid. The requirement to spot or hand treat, rather than have the broadcast tool, is estimated to decrease the effectiveness of each year's entry from 80 percent to 40 percent. Broadcast methods accomplish many more acres a day than spot or hand methods. Spot and hand treatments tend to require more labor as applicators must walk from spot to spot and then return to accommodate skips and gaps that are common with this type of treatment. On neighboring Forests, the estimates for cost differences between spot and broadcast treatment costs range from spot treatments being 25 percent more costly to more than double the cost (examples from other Forests are in the project record). This difference is magnified for places where broadcast is needed but prohibited.

2) *Restrictions on herbicide use and method.* The herbicide application rates and methods approved influence our ability to effectively treat invasive plants. Alternatives B and D approve broadcast spraying and some use of herbicide near streams. Alternative C does not approve any broadcast spraying and does not allow more than 70 percent of the maximum herbicide label rate to be sprayed on a given acre. It also excludes herbicide use within 100 feet of a stream or water body.

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

This is estimated to reduce effectiveness to 40 percent from 80 percent, in effect doubling the time and cost for this alternative. This is because 1) non-herbicide methods tend to be more costly and require more treatment entries to meet treatment objectives, particularly for species that are well established, more extensive, or more dense, and 2) spot and selective herbicide methods tend to be more costly than broadcast and would require more treatment entries to meet treatment objectives. On neighboring Forests, the difference in cost for non-herbicide treatments varied, with manual treatment being the most costly ($340 per acre in the R6 2005 FEIS). This is more than triple the cost of an average herbicide broadcast operation.

The effectiveness would decrease by half on the portion of alternative D that requires spot or hand treatment rather than allowing broadcast, due to the elimination of aminopyralid.

3) *Whether or not picloram may be used.* Alternatives B and D allow picloram and alternative C does not. Alternative D includes the use of picloram as the first-choice herbicide on 63 acres (or about 3 percent of the total infested acreage). Because alternative C does not approve the use of picloram, there will be an unquantifiable loss of effectiveness for those acres where picloram is one of the effective herbicides. About 1,697 (80%) of the existing infested acres are occupied by target species where picloram is listed as an effective choice (table 9, chapter 2); however, picloram would likely be the “second choice” herbicide on some of these acres.

Alternative A

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

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

Alternative B

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

The analysis assumes all 2,124 acres within a year of this decision being signed (2015 or year 1). The majority of acres would be treated using herbicide; however, non-herbicide treatments would be used in combination with herbicide methods or alone, for larger infestations where containment is the treatment objective or for very small infestations. The following year 20 percent of the acreage would need to be retreated (425 acres in 2016 or year 2). These remaining acres would be subject to spread, so a rate of 10 percent spread per year was applied on the remaining acres. Thus, about 468 acres would be treated and given the 80 percent effectiveness on these acres; about 94 acres would need to be treated in 2017 (year 3). Thus, about 103 acres would be treated in year 3 once 10 percent spread rate is applied. the analysis assumes these 103 acres would be reduced to about 21 acres by 2018 (year 4). Active restoration would occur where necessary. Under this treatment assumption, the remaining infestation level would be very low after five years.

Passive restoration would be adequate on most of the treated sites; however, some areas will need to be seeded, mulched, or planted once invasive species are removed. that the analysis assumes that cost of active restoration (mulching, seeding, planting) would be applied to areas where target species are dense and large enough to require broadcast herbicide application. This is a high estimate and passive restoration would likely suffice for many of these areas. However, this estimate accurately characterizes the potential for high costs of repeat treatments and restoration of invasive species over time. The surrounding vector of spread and propagule pressure would influence the need and extent of active restoration. Perpetual disturbance associated with recreation, livestock grazing, and roads could complicate restoration.

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

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

Table 23 shows the costs per year, total cost over a 4-year period, and average cost per acre to be applied to unpredictable new infestations that could be discovered and treated over the life of the project according to common control measures, pdfs, and subject to treatment caps.

Table 23. Estimated treatment costs for alternative B

	Acres Treated	Acres Remaining to Be Treated	Add 10% spread rate	Cost Year 1
Year 1	2,124	425	468	$424,800
Year 2	468	94	103	$93,600
Year 3	103	21	23	$20,600
Year 4 – restoration	1,231	Maintenance level	NA	$615,500
Total				**$1,154,500.00**
Average Cost per Acre with all activities included				$544

Alternative C

Alternative C restricts available treatment methods for both the existing infestations and future detections and thus reduces its effectiveness. The loss of the ability to use herbicides/broadcast spray in this alternative is estimated to reduce the effectiveness of treating all existing infestations to half of alternative B based on these restrictions. This is based on the difference in cost between broadcast spray and other treatment methods (25 percent to 300 percent increase in comparative costs based on estimates from neighboring Forests) and the likelihood that more treatment entries would be required to meet treatment objectives (see discussion above). In addition, the potential effectiveness would be reduced due to the lack of picloram in the toolbox. The loss of the use of picloram would reduce our ability to effectively adapt to areas that do not effectively respond to aminopyralid or another first year/first choice herbicide.

The analysis assumes that all 2,124 acres within a year of this decision being signed (2015 or year 1). The following year, half of this acreage would still need to be treated and would be subject to annual spread. Table 24 shows how this would compound over time and increase the life of the project cost. Restoration costs are the same across the action alternatives. Cooperative treatments between neighboring land owners and agencies involved with invasive plant management would increase the effectiveness of alternative C.

Table 24 below shows the costs per year, total cost over a 6-year period, and average cost per acre to be applied to unpredictable new infestations that could be discovered and treated over the life of the project according to common control measures, pdfs, and subject to treatment caps associated with alternative C.

Table 24. Estimated treatment costs for alternative C

	Acres Treated	Acres Remaining to Be Treated	Add 10% spread rate	Cost Year 1
Year 1	2,124	1,062	1,168	$424,800
Year 2	1,168	584	642	$233,600
Year 3	642	321	353	$128,400
Year 4	353	177	195	$70,600
Year 5	195	98	108	$39,000
Year 5	108	54	59	$21,600
Year 6 - restoration	1,231	Maintenance level	NA	$615,500
Total				**$1,533,500.00**
Average Cost per Acre with all activities included				$722

Alternative D

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

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

The analysis assumes all 2,124 acres are treated within a year of this decision being signed (2015 or year 1). The following year 34 percent of this acreage would still need to be treated and would be subject to annual spread. Table 25 shows how this would compound over time and increase the life of the project cost and average cost per acre. Restoration costs are the same across the action alternatives. Cooperative treatments between neighboring land owners and agencies involved with invasive plant management would increase the effectiveness of alternative D to ensure weed spread between land ownerships is properly abated.

Table 25 below shows the costs per year, total cost over a 5-year period, and average cost per acre to be applied to unpredictable new infestations that could be discovered and treated over the life of the project according to common control measures, pdfs and subject to treatment caps associated with alternative D.

Table 25. Estimated treatment costs for alternative D

	Acres Treated	Acres Remaining to Be Treated	Add 10% spread rate	Cost Year 1
Year 1	2124	701	771	$424,800
Year 2	771	254	279	$154,200
Year 3	279	92	101	$55,800
Year 4	101	34	37	$20,200
Year 5 – restoration	1,231	Maintenance level	NA	$615,500
Total				**$1,270,500.00**
Average Cost per Acre with all activities included				$598

Alternative Comparison

Table 26. Results of the cost-effectiveness analysis for alternatives

Issue Indicator	Alternative A	Alternative B	Alternative C	Alternative D
Average Cost per Acre of Fully Effective Treatment (includes 4-6 years of re-treatments and restoration)	0	$544	$722	$598
Estimated Cost For Treatment and Restoration of 2,1,24 infested acres	0	$1,154,000	$1,472,900	$1,270,500
Ability to Meet Treatment Objectives	Will not meet	Tools adequate to meet treatment objectives	Tools may not be adequate to meet treatment objectives, especially near riparian areas	Tools adequate to meet treatment objectives, however opportunities to use most effective herbicide or application method may be forgone

It is unlikely that the Malheur National Forest will be funded to treat all currently infested acres in a single year. Only a portion of the 2,124 acres currently needing treatment will likely be treated in year 1 regardless of action alternative selected. The economic analysis allows a consistent basis to see the impact of differences in alternatives and provides an estimate of the cost of fully treating and restoring an acre, based on the metrics of existing infestations. The sooner effective treatment of existing infestations occurs; the less likely large numbers of acres will need to be treated in the future. Funding and workforce capacity will dictate how many acres are treated under the auspices of this project.

In the action alternatives, herbicide use is expected to be greatest during the initial entry, and would decrease over time as the size and density of invasive plant populations decline. The majority of infested areas would be treated using herbicide the first year of implementation. However, over time, the proportion of non-herbicide to herbicide treatment would increase. This pattern would be most evident under alternatives B and D, especially if most or all of the existing invasive plant populations early in the life of the project. Under alternative C, less herbicide use would occur in the early years of implementation; however, the decline in herbicide use would likely be less pronounced over time because more visits would likely be necessary to meet treatment objectives.

3.1.5 Introduction to the Cumulative Effects Analysis

Introduction

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

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

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

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

The issues for this project center on the effects of herbicide use or restrictions of herbicide use in the alternatives. Some people have expressed concern that herbicide use from this project could combine with herbicide use elsewhere and have an additive, synergistic, or other cumulative effect; specifically the effects on wildlife, fish, or people exposed to repeated doses of herbicides. The focus of the following section is on herbicide use; however, potential cumulative effects of non-herbicide treatment methods and other projects and land uses across and adjacent to the Malheur National Forest are discussed throughout chapter 3.

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

The various sections of chapter 3 address cumulative effects arising from treatment of invasive plant over the life of the project. Applications of herbicides and other integrated treatments would occur throughout the life of the project in all action alternatives. Chapter 3 discusses how the use of herbicides through the life of the project could further affect National Forest System lands on the Forest that are being impacted by ground disturbance.

Counties are responsible for controlling noxious weeds along county roads and other county property outside of and within the Malheur National Forest. They also work with conservation districts, weed management areas, and watershed councils to control noxious weeds on private property. Three Bureau of Land Management (BLM) districts border the Malheur National Forest (Prineville, Burns and Vale). Invasive plant management, including herbicide use, occurs annually on the Burns and Vale units. The BLM contribution to cumulative effects from herbicide use is relatively low compared to other herbicide use in Oregon (USDI Bureau of Land Management 2010).

Additive herbicide exposures are possible if herbicide is used on neighboring lands during the same day as planned on the Forest. Treatments occurring on National Forest System land, lands of other federal agencies, states, and counties would be coordinated so treatment overlaps are unlikely. Any molecules of herbicide that leave a treatment site will have time to dilute and degrade before mixing with another contaminant. The R6 2005 FEIS (p. 4-10) estimated 3 percent of the herbicide use within Oregon and Washington is on National Forest System land.

The R6 2005 FEIS (pages 4-1 to 4-3) and SERA Risk Assessments discussed effects of chronic exposure to low levels of herbicides used to treat invasive plants on National Forest System land. Chronic exposures do not result in cumulative effects because the herbicides are more rapidly excreted from organisms (people, animals, and fish) than would be absorbed from predicted levels of exposure. Thus, an animal could encounter herbicide in more than one location over time; however, herbicide exposures are unlikely to accumulate in the body of animals.

Statewide Herbicide Use

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

- Metam-sodium (42%) [soil fumigant]
- Glyphosate (9%) [herbicide]
- Copper naphthenate (7%) [wood preservative][20]
- 1,3-dichloropropene (5%) [soil fumigant]
- Aliphatic petroleum hydrocarbons (4%) [insecticide]

Of these, glyphosate is the only herbicide. It was the second most-used active ingredient and accounted for 9 percent of all pesticide use reported statewide. The vast majority was agricultural use. Statewide

[20] The statewide pesticide use report for 2008 indicated that this value was overreported; this was the amount of diluted product, not the amount of active ingredient used.

reported glyphosate use was over 3.5 million pounds. In the John Day Basins alone, nearly 153,000 pounds of glyphosate were reportedly applied. Glyphosate is quickly taken up by plants or bound up with soils so that it is not mobile in the environment soon after application. Effects of glyphosate from invasive plant treatments are very limited in time and space to the immediate area of the treatment. If vegetation adjacent to or emergent from flowing water is treated, glyphosate may be detected downstream from the treatment. However, it is very likely bound to organic matter and not biologically active and very unlikely to cause any effect. Therefore, glyphosate use from other lands in the water basins is not likely to cause cumulative effects when added to the direct and indirect effects of this project. Many of the proposed herbicides have limited mobility in the environment, so effects would be limited to areas immediately adjacent to the treatment sites; others, though mobile to some extent, have properties that bind them to soil particles or ensure rapid degradation, so do not pose a level of concern. Herbicide toxicity, mobility, and persistence are managed through the project design features and herbicide-use buffers.

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

A pesticide use report was also published in 2009 based on statewide use in 2008. In the John Day basins, glyphosate was also the second most used pesticide, and again the only herbicide within the top five. Glyphosate accounted for 10 percent of the total pesticide use in the state in 2008, with 1,914,144 total pounds reported. In the John Day basins, glyphosate was the top pesticide used with a 105,040 total pounds reported, comprising about 44 percent of all pesticide use there. Another herbicide, 2,4-D was the second most used pesticide (67,572 pounds total).

We are proposing a very low level of herbicide use compared to river basin or statewide use. The Forest Service contribution to cumulative herbicide use would remain low in all alternatives. No water quality issues related to pesticides have been identified in the waters in the project area (none of the streams in the area are 303d listed for chemical contamination). The site-specific modeling shown in Chapter 3.5.3 indicates very small amounts of herbicide potentially reaching the stream. Any herbicide reaching the stream would be quickly diluted and as the herbicide moved downstream, it would become less and less likely to cause impacts.

NWQAP Pesticide Study

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

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

> Pesticides are transported to streams and ground water primarily by runoff and recharge. Nonpoint sources of pesticides originating from areas where they were applied—rather than point sources such as wastewater discharges—are the most widespread causes of pesticide occurrence in streams and ground water (Modified from Majewski and Capel 1995.) The atmosphere is often overlooked

> as a source of pesticides, which return to earth with precipitation and dry deposition and can reach streams and ground water. Streams are particularly vulnerable to pesticide contamination because runoff from agricultural and urban areas flows directly into streams along with both dissolved and particle-associated pesticides. Ground water is most susceptible to contamination in areas where soils and the underlying unsaturated zone are most permeable and drainage practices do not divert recharge to surface waters.

The study also stated:

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

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

Clackamas River Pesticide Study

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

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

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

The study stated that pesticides were most prevalent in the Clackamas River during storms and were present in all storm-runoff samples — averaging 10 individual pesticides per sample from these streams. Two tributaries contained 17-18 different pesticides each during a storm in May 2005. These medium-sized streams drain a mix of agricultural land (row crops and nurseries), pastureland, and rural residential areas. Two small streams that drain the highly urban and industrial northwestern part of the lower basin had the greatest pesticide loads. Streams draining predominantly forested basins contained fewer pesticide detections (2-5 pesticides). The study stated that pesticide use on the Mount Hood National Forest, which comprises most of the Federal land in the upper Clackamas River Basin, was a relatively insignificant contribution.

Invasive Plant Spread and Cumulative Effects

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

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

Cumulative Disturbance and Invasive Plant Spread

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

Ground disturbance associated with natural processes, such as wildland fire, and human activities, such as road use, may favor the spread of invasive plants and discourage the reestablishment of native species. Seastedt et al. 2008 notes that human-caused disturbance can change soil conditions to which native species have adapted, resulting in conditions that favor invasive plants. Repeated road clearing and graveling, an open gravel pit, or a cleared compacted recreation area create environments that favor colonist species or vegetation that can optimize a large volume of soil with a taproot or species that germinate quickly, grow, and set seed during the limited growing conditions of the site. Roadside environments have coarser texture growing substrate with higher rock content and thus represent growing environments that favor invasive plants (Gelbard and Belnap 2003).Generally; disturbed environments have greater available resources for invasive plants because of exposed soil, open light, and higher nutrient and water availability. Shade under forest canopies substantially limits weed growth. Most of the primary target species on the Forest do not invade shaded environments.

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

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

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

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

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

Grazing lands experience annual disturbance from livestock along with intermittent vehicle use that can bare soils in livestock congregation areas near troughs, salt licks, fences, and waterways. Plant parts may stick to animals and be transported into rangelands. The grazing activities on the Forest result in overall moderate level of disturbance and occur within a timeframe of less than 6 months per year. The moderate level corresponds to the small and distributed amount of disturbance across the allotment. However, some portions of allotments, including riparian areas, have been more seriously degraded. Disturbance from cattle can increase susceptibility to invasive plants.

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

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

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

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

Table 27 displays potential disturbance frequency and intensity, and invasive plant propagule pressure associated with ongoing activities that are vectors for invasive plant spread. Disturbance frequency and intensity and propagule pressure strongly influences the rate that invasive plants are likely to spread along vectors. The most applicable R6 2005 ROD Standard dealing with preventing the spread of invasive plants via each vector is also shown. Prevention is an important aspect of our invasive plant management program. National policies and regional and local plans are in place to reduce the potential for invasive plants to become introduced, established, or to spread as a result of our activities. See chapter 3.1.4 Treatment Effectiveness for more information about how the location of infestations and surrounding vectors influence our treatment and restoration methods.

Table 27. Potential disturbance frequency for invasive plants spread

Vector	Disturbance Frequency/ Potential Maximum Intensity	Potential Propagule Pressure	Most Applicable R6 Management Direction/ Prevention Considerations
Recreation sites management, dispersed and developed sites; campgrounds, hunter camps, trailheads	Perpetual/Low	High	R6 Goal 1, Objectives 1.2; 2.4, 2.5; Standards 1, 4 outreach and education, travel management, recreation management

Vector	Disturbance Frequency/ Potential Maximum Intensity	Potential Propagule Pressure	Most Applicable R6 Management Direction/ Prevention Considerations
Livestock grazing; Dry open grassland steppe, shrub lands, dry forestlands	Seasonal/Moderate to High	Moderate to High	R6 Goals 1, 2; Objectives 1.2, 2.1, 2.2; Objective 5.3; Standards 4,6 AMPs and annual operating plans
Vegetation management (thinning and brushing, logging, burning)	Periodic/High (especially yarding corridors and landings, pile burning)	High	R6 Goals 1,2; Objectives 1.1, 2.1, 2.2, Standards 1, 2, 3, 13 Covering disturbed sites, particularly small burn areas, with fine to medium sized organic matter may prevent or reduce the size of some infestations, such as Canada thistle (see table 8)
Wildland fire and incident response	Periodic/Low to High	Moderate	R6 Goals 1, 2; Objectives 1.1, 1.3, 1.5 2.3; Standards 1, 2*, 3, 13 *although emergencies like wildland fire are explicitly exempt from this equipment cleaning standard, Forests report that it happens routinely.
Roads (road maintenance, construction, reconstruction, and use)	Perpetual/High	High	R6 Goals 1,2; Objectives 1.1, 2.4, 2.5; Standards 1, 2, 7, 8, 13 Forests report excellent coordination with engineering staff , quarries are inspected and road materials are weed free
Closing roads	Periodic/Low	Moderate	R6 Goal 2; Objective 2.4; Standards 1, 2, 3, 13
Restoring roads and landings	One time/ Low to High	Moderate	R6 Goals 1, 2; Objective 1.1; 2.1, 2.4; Standards 1, 2, 3, 13
Adjacent agriculture	Perpetual/Low	Low	R6 Goal 5; objectives 5.1-5.3
Stream restoration (i.e., fish passage and habitat projects, riparian vegetation restoration), Stream flow	Seasonal/High	Low	R6 Goals 1, 2; Objectives 1.1, 1.3, 1.5, 2.1, 2.2; standards 1, 2 Keep equipment working near streams clean
Mining, Minerals Exploration	Low to High	Low	R6 Goals 1, 2; Objectives 1.1, 1.2, 2.1, 2.2, Standards 1, 3, 13

How Prevention Measures Integrated into Land Uses and Activities Influence Invasive Plant Spread

Prevention measures are intended to reduce the rate of spread of invasive plants from several vectors, including foreseeable future projects and ongoing types of activities described above. Rate of spread would be unlikely reach zero because some infestations are too large to be contained and some vectors are outside Forest Service control and some infestations. However, the action alternatives can reduce the seed sources within the Forest that are subject to invasive plant spread along with prevention measures applied to possible vectors of spread would work together to reduce the impact of invasive plants on and off the Forest.

The treatment cost-effectiveness estimates in chapter 3.1.4 used a spread rate of 10 percent (R6 2005 FEIS) as an average rate. If prevention measures reduce the rate of spread, the cost of each action alternative would be reduced because less acreage would need to be treated over time.

Species and site-specific models do not exist to more precisely predict the rate of spread and the influence of prevention measures or the cumulative influence of prevention plus effective treatment. However, the R6 2005 FEIS (Chapter 4.2.3) discusses how adherence to the prevention standards along with effective treatments would reduce the future extent and impacts of invasive plants.

Climate Change and Invasive Plant Spread

Global climate change may add stress to the ecosystems within the Malheur National Forest and increase susceptibility to invasives. Climate change is predicted to alter precipitation and seasonal temperature patterns, as a result of increased levels of atmospheric carbon dioxide (CO_2) and other factors (Mote 2004). Most recent studies on the interaction between climate change and invasive plants conclude that climate change is likely to favor invasive plant species to the detriment of native plant species for individual ecosystems (Chornesky et al. 2005, Climate Change Science Program 2008, Dukes and Mooney 1999, Hellmann et al. 2008, Pyke et al. 2008). In some studies, invasive plant species have demonstrated increased growth rates, size, seed production, and carbon content in the presence of elevated CO_2 levels (Rogers et al. 2008, Rogers et al. 2005, Smith et al. 2000, Ziska 2003). Warming climates may remove elevational barriers to invasive plant distribution that currently exist. For instance, cheatgrass is becoming established in dry forests in the Intermountain West, particularly after wildfires and fuels reduction projects. After these events, native perennial grasses are lost, leaving potential cheatgrass habitat, which can increase fire frequency (Tausch 2008).

Many invasive plants are species that can thrive in the presence of disturbance and other environmental stressors, have broad climatic tolerances, large geographic ranges, and possess other characteristics that facilitate rapid range shifts. In a simulation experiment, Kremer et al. (1996) found that a less productive, invasive grass community would tolerate climate change, whereas a native sagebrush community would not survive the increased temperatures. The predicted changes in climate are thought to contribute additional stressors on ecosystems, including those on National Forests, making them more susceptible to invasion and establishment of invasive plant species (Joyce et al. 2008).

Climate change may affect invasive species differently. Bradley et al. (2009) found that rather than simply enhancing invasion risk, climate change may also reduce invasive plant competitiveness if conditions become climatically unsuitable. Climate change could result in both range expansion and contraction for some invasive plants in the western United States (potentially introducing invasive species that thrive in warmer conditions). Likely future conditions may also make management of invasive species more difficult. Treatments used on invasive plants may be less effective under various climate change scenarios and/or elevated CO_2 (Hellmann et al. 2008, Pyke et al. 2008, Ziska, Faulkner, and Lydon 2004).

Predicting how climate change will affect invasive plants, and invasive plant management, at the local or even regional scale is more difficult to deduce than are these general indications. Anticipated changes in the climate for the Pacific Northwest (e.g. more rain, less snow, warmer temperatures) (Mote 2004, Mote et al. 1999, National Assessment Synthesis Team 2000) or elevated CO_2 may not be realized at a local area, particularly within the time frame of this analysis. Growth of invasive plants under elevated CO_2 conditions will also be influenced by environmental conditions such as soil moisture, nutrient availability, and the plant community in which the invasive species occurs (Cipollini, Drake and Whigham 1993; Curtis, Drake, and Whigham 1989; Dukes and Mooney 1999; Johnson et al. 1993; Taylor and Potvin 1997). The complex interaction of multiple and uncertain variables make site-specific predictions speculative.

Most of the important elements of global change are likely to increase the prevalence of biological invaders (Dukes and Mooney 1999, Bradley et al. 2010). The Forest will likely become more vulnerable to the establishment of invasive plant infestations, however actual acreage affected by invasive plants could increase, and control strategies may become more difficult. Recommended management responses to these predictions are early detection (resulting from regularly scheduled monitoring) followed by a rapid response to eradicate initial infestations (Hellmann et al. 2008, Joyce et al. 2008, Tausch 2008).

Insufficient information exists to discern any meaningful differences between alternatives regarding the cumulative effects of the alternatives with respect to climate change. The action alternatives provide for early detection and rapid response to new invasives, which would help the Forest Service respond to the introduction or spread of invasive plants for the foreseeable future.

Reasonably Foreseeable Projects on the Malheur National Forest

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

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

Table 28. Foreseeable future projects on the Forest with project details, vectors for invasive plant spread, watershed(s) affected, and implementation schedule

Project name	Project Details	Potential Vector	Watershed(s)	Implementation Schedule
Bald Butte LO Decommission	Remove Lookout with explosives	Recreation Site Management	Middle Silver Creek	2013
Bear Creek Riparian Juniper Thinning	Thin 47 acres of juniper	Vegetation Management	Upper South Fork John Day River	2014
Blue Mountain Snow Park	Clearing trees and leveling 7 acres and paving parking area; construction of warming hut, restrooms, and grooming shed; construction of pad for fuel tank	Recreation Site Management	Summit Creek (170702030102)	2013
Buck and Rock Springs Campground Hazard Tree Removal Project	Remove hazard trees	Recreation Site management	Upper Silver Creek and Wolf Creek	2013
Camp Creek LWD	Felling and placing entire trees ranging from 4- 20 inches in diameter within the following streams and their associated Riparian Habitat Conservation Areas (RHCAs)	Stream Restoration	Upper Camp Creek (170702030205); Lick Creek (170702030205)	2013-14

Project name	Project Details	Potential Vector	Watershed(s)	Implementation Schedule
Campground Hazard Tree Project	Remove hazard trees in D-Lake, Idlewild, Joaquin Miller, Yellowjacket, Emigrant Creek, Falls Camp	Vegetation Management	Upper Silver, Upper Silvies, North Basin, Emigrant Creek	2013
Dairy EA	Commercial harvest, road closures and decommissioning	Vegetation Management	Upper Silver Creek	2013-2014 road closures may go on for years
Damon	RX fire, commercial and non-commercial harvest, road closures and decommissioning	Vegetation Management, Closing Roads, Restoring Roads and Landings	Van Aspen-Silvies River (171200020105); Lower Scotty Creek (171200020104); Shirttail Creek (171200020301)	FY 11 to FY 13
Dragon's Head Plantation PCT	thin plantations	Vegetation Management - Ground disturbance, open canopy	Wolf Creek and Upper Silvies River	2013 and beyond
Dragon's Hump Plantation PCT	PCT and treat slash on 5000 acres of plantations	Vegetation Management	Middle Silvies and Emigrant Creek	2013 and beyond
Egley Aspen Restoration Project	thin and remove conifers up to 20.9 inches in 20 acres of aspen	Vegetation Management	Emigrant Creek	2013
Egley/Pine Springs Overlook Interpretive Display Update and Toilet Replacement project	replace toilet	Recreation Site Management	Middle Silver Creek	unknown, no funding, low priority
Elk 16	RX fire, commercial and non-commercial harvest, road closures and decommissioning, aspen restoration, aquatic restoration	Vegetation Management, Closing Roads, Restoring Roads and Landings, Stream Restoration	Elk Creek and Crane Creek Subwatershed	FY 2015
Galena Project	RX fire, commercial and non-commercial harvest, road closures and decommissioning	Vegetation Management, Closing Roads, Restoring Roads and Landings	Vinegar Creek-MFJDR (170702030201); Little Boulder Creek-MFJDR (170702030202)	FY 14 to FY 17
Green Ant Project (Formerly the Ant and Emigrant Projects)	Commercial harvest, road closures and decommissioning	Vegetation Management	Emigrant Creek	2013 and beyond
Idlewild Snowpark Relocation Project	Relocate snowpark	Recreation Site Management	North Basin	2013

Project name	Project Details	Potential Vector	Watershed(s)	Implementation Schedule
Jane Hazardous Fuel Reduction Project	RX fire, commercial and non-commercial harvest, road closures and decommissioning	Vegetation Management, Closing Roads, Restoring Roads and Landings	Wolf Creek	2013 and beyond
JB Spring Development and Trough	Develop spring, thin 5 acres of juniper	Livestock Grazing, Vegetation Management	Griffin Creek/Upper Malheur River	2013
Keeney Meadows Aspen	Non-commercial thinning and fencing 10 aspen stands	Vegetation Management	Bridge Creek (170702030105); Headwaters Long Creek (170702030401); East Fork Beech Creek (170702010802); Upper Camp Creek (170702030205); Headwaters Long Creek (170702030401);	July - Aug 2014
Logan Valley Grazing Authorization	Grazing authorization on the Summit Prairie, Logan Valley, McCoy Creek, and Lake Creek Grazing Allotment	Livestock Grazing	Lake Creek, Bosenberg Creek, Upper Big Creek, Summit Creek Subwatershed	FY 2014
Malheur River Range Aquatics Projects	Extension of the Malheur River Drift Fence. Cross Springs water source reconstruction and extension to a second trough. Development of Dollar Basin Spring	Livestock Grazing	Lake Creek and Bosenberg Creek Subwatershed	FY 2013
Marshall/Devine Hazardous Fuel Reduction Project	RX fire, commercial and non-commercial harvest, road closures and decommissioning	Vegetation Management, Closing Roads, Restoring Roads and Landings	Upper Silvies River and North Basin	2013-2014 road closures may go on for years
Murderer's Creek Juniper Management Project	Cutting of juniper and mixed conifer, fuel treatment, aspen restoration, and watershed improvement activities.	Vegetation Management; Stream Restoration	Deardorff Creek (170702010502); Corner Creek-South Fork John Day River (170702010402); Lower Murderers Creek (170702010305); Lower Deer Creek (170702010206)	FY 2014

Project name	Project Details	Potential Vector	Watershed(s)	Implementation Schedule
Plantation Maintenance Fox/Camp Creek	Non-commercial thinning of plantations	Vegetation Management	Dixie Meadows (170702010602); Bear Creek (17070201603); Grub Creek (170702010607); Upper Beech Creek (170702010801); East Fork Beech Creek (170702010802); Lower Beech Creek (170702010803); Birch Creek (170702010905); Dry Creek-John Day River (170702010906); Belshaw Creek (170702011003); Cummings Creek (170702011005); Wiley Creek (170702020902); McHaley Creek (170702020903); Lower Fox Creek (170702020904); Upper Cottonwood Creek (170702020905); Upper Camp Creek (170702030205); Lick Creek (170702030206); Lower Camp Creek (170702030207)	FY 13 to FY 23
Plantation Maintenance Long Creek	Non-commercial thinning of plantations	Vegetation Management	Indian Creek-MFJDR (170702030303); Slide Creek (170702030304); Granite Creek-MFJDR (170702030305); Headwaters Long Creek (170702030401); Upper Long Creek (170702030402); Basin Creek (170702030404); Basin Creek (170702030406); Upper Deer Creek (170702021001); Upper Fox Creek (170702020901); McHaley Creek (170702020903)	FY 12 to FY 22

Project name	Project Details	Potential Vector	Watershed(s)	Implementation Schedule
Sawtooth and Emigrant Creek Culvert Replacement	replace culverts	Stream Restoration	Emigrant Creek	Sawtooth complete, Emigrant creek not, no funding, low priority
Sawtooth and Nicoll Checkdam Modification	modify existing structures	Stream Restoration	Emigrant Creek and Upper Silver Creek	unknown, no funding, low priority
Schurtz Creek Story-Fry Riparian Restoration Project	Fence and thin conifers less than 21 inches	Vegetation Management	Wolf Creek	2013-2014
Season of Burn Research Project	Rx burn research units	Vegetation Management	Pine Creek and Upper Silvies River	2013 and beyond
SF John Day Culverts Replacements	Replace 3 culverts	Stream Restoration	Upper South Fork John Day River	2013 and beyond
Soda Bear	RX fire, commercial and non-commercial harvest, road closures and decommissioning	Vegetation Management, Closing Roads, Restoring Roads and Landings	Middle Bear Creek (171200020202); Lower Bear Creek (171200020204)	FY 13 to FY 15
South Fork John Day Riparian Juniper Thinning	Thin 90 acres of juniper	Vegetation Management	Upper South Fork John Day River	unknown, no funding, low priority
Starr Aspen	Commercial and Non-commercial thinning, Rx fire, fencing, wood in streams, road closures	Vegetation Management, Closing Roads, Restoring Roads and Landings, Stream Restoration	Starr Creek-Silvies River (171200020102)	FY 15
Starr HFRA	RX fire, commercial and non-commercial harvest, road closures	Vegetation Management, Closing Roads, Restoring Roads and Landings	Starr Creek-Silvies River (171200020102)	FY 12 to FY 15
Summit	RX fire, commercial and non-commercial harvest, road closures and decommissioning, aspen restoration, aquatic restoration	Vegetation Management, Closing Roads, Restoring Roads and Landings, Stream Restoration	Summit Creek and Tureman Creek Subwatersheds	FY 2016
Thompson Butte SUP Passive Reflector Removal	remove reflector	Recreation Site Management	Pine Creek	2013

Project name	Project Details	Potential Vector	Watershed(s)	Implementation Schedule
UMF Culvert Replacement	Replacement of 15 culverts located on twelve tributaries in two watersheds of the Middle Fork John Day River subbasin.	Stream Restoration	Summit Creek (170702030102); Bridge Creek (170702030105); Vinegar Creek-MFJDR (170702030205); Little Boulder Creek-MFJDR (170702030202); Granite Boulder-MFJDR (170702030203); Balance Creek (170702030208)	July - Aug 2014
Upper Pine Hazardous fuel Reduction Project	RX fire, commercial and non-commercial harvest, road closures and decommissioning	Vegetation Management, Closing Roads, Restoring Roads and Landings	Pine Creek	2014-2015 road closures may go on for years
Voigt Ditch Headgate Replacement	Replacing current head gate with a new one including a measuring device and extending pipe down existing easement.	Adjacent Agriculture	Mill Creek (170702030106)	July - Aug 2013
Whistle Prescribed Burn	Prescribed Burn 3450 acres	Ground Disturbance, open canopy	Upper Silver Creek	unknown, low priority
Access and Travel Management	Designating roads available for use	Road Use	All	On Hold

Under all action alternatives, some level of invasive plant control would occur on 2,124 acres, and of this, 1,067 acres occur within watersheds where some future management activity is anticipated. Watersheds that contain mapped invasive plants and future management activities are displayed in table 29. However, through the life of the project, newly detected infestations in any watershed could be treated according to the alternative selected.

Table 29. Watersheds containing planned future activities and invasive plant treatments

Watershed	Future Activity[1]	Invasive Plant Acreage[2]
Birch Creek	P	1
Bosenberg Creek	G	4
Bridge Creek	T, R,G	26
Crane Creek	T,B,	12
Deardorff Creek	T	11
Dry Cr. John Day River	P	<1
Elk Creek	T,B	24
Emigrant Creek	T,R	44
Granite Boulder Creek	R,P	120
Long Creek	P	1

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

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

The various resource sections of chapter 3 address cumulative effects arising from treatment of invasive plants over the life of the project given the foreseeable future projects on the Forest. Applications of herbicides and other integrated invasive plant treatments would occur throughout the life of the project in all action alternatives. The annual treatment caps in all alternatives limit the potential for direct, indirect and cumulative effects by limiting the extent and intensity of impacts from treatment. Risks from herbicide use that may linger over time, such as persistence of herbicides in the soil, are managed through the project design features.

3.2 Human Health

3.2.1 Introduction

This section has been updated from the DEIS to reflect 1) updated risk assessment information for imazapyr, picloram and triclopyr, 2) additional analysis for herbicide application rates and methods that are specific to this project and incorporate project design features, 3) changes to project design features in response to public comments, and 4) new risk assessment technology that allows examination of additional human health exposure scenarios. The DEIS discussed risks associated with exposure to NPE surfactants. These risks have been eliminated because this class of surfactant would no longer be approved for this project in any alternative (pdf F1).

This chapter summarizes information from the R6 2005 FEIS and accompanying Appendix Q: Human Health Risk Assessment, which detailed the potential for health effects from non-herbicide treatments as well as the use of 10 of the herbicides proposed for this project, and is incorporated by reference in this EIS. Herbicide active ingredients, metabolites, inert ingredients, and adjuvants, and people with particular herbicide sensitivity were addressed. The R6 2005 ROD adopted standards to minimize herbicide exposures of concern to workers and the public based on the human health risk assessments. The herbicide risk assessments are updated on an ongoing basis; the glyphosate, imazapyr, picloram, and triclopyr risk assessments were updated in 2011.

This chapter also discusses the proposal to add a new herbicide, aminopyralid. Aminopyralid poses low risk to human health and compares favorably to the herbicides approved in the R6 2005 ROD (table 21, chapter 3.1.2). The Aminopyralid Risk Assessment (SERA 2007) is the primary source of toxicological information.

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

The use of herbicide in the action alternatives would be according to label requirements, with further direction in Malheur National Forest LRMP as amended by the R6 2005 ROD for standards and project design features associated with the project. The risk assessments and project-specific risk assessment worksheets quantify expected exposures and calculate hazard quotients (HQ). These worksheets provide a range of values (lower, central, and upper) rather than rely on a single estimate. The upper exposure estimates are based on the maximum estimate for every exposure factor that is considered, which is very unlikely to occur in our operations (e.g., maximum application volume, maximum concentration in field solution, maximum volume of a spill, maximum residue rates on food items, maximum exposure rates, maximum hours worked). The upper exposure estimates are not reflective of the way herbicides would be used in this project and the probability of maximum exposures occurring is very low. Thus, the central and lower estimates provide more realistic risk assessment results; however, even considering central or lower HQ estimates, many of the exposure scenarios for the public are implausible or extremely conservative.

Slight exceedances of hazard quotients greater than 1.0 could cause clinically detectable physiologic changes, but are unlikely to produce any human health symptoms detectable by a person. Even considering central or lower HQ estimates, many of the exposure scenarios for the public are implausible or extremely conservative.

The risk assessments and risk assessment worksheets consider potential impacts to children, women of child-bearing age, and men. In some cases, the reference dose (Rfd) varies between these groups. The Rfd is far less than the level thought to cause impacts, which provides an additional layer of caution to the human health assessment.

Regulatory Framework and Compliance

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) established the United States system of pesticide regulation to protect applicators, consumers and the environment. It is administered by the Environmental Protection Agency and the appropriate environmental agencies of the respective states. The Federal Insecticide, Fungicide, and Rodenticide Act requires registration for all herbicides, after extensive testing, to evaluate whether a pesticide has the potential to cause adverse effects on humans, wildlife, fish, and plants, including endangered species and non-target organisms, as well as possible contamination of surface water or ground water from leaching, runoff, and spray drift.

When registered, a label is created to instruct the applicator on the proper usage of the material and required personal protective equipment. The EPA also must approve the language that appears on each pesticide label and the product can only be used legally according to the directions on the labeling accompanying it at the time of sale.

The Forest Service is authorized by FIFRA and the Cooperative Forestry Assistance Act to use pesticides for multiple-use resource management and maintenance of the quality of the environment as long as the actions comply with the National Environmental Policy Act and the Council on Environmental Quality regulations. Forest Service Manual (FSM 2150) and Forest Service Handbook (FSH 2109) provide direction on safe use of pesticides, including direction on storage and transport, and development of safety plans and emergency spill plans.

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

All alternatives comply with standards, policies, and laws aimed at protecting worker safety and public health. None of the alternatives would result in disproportionate impacts to low income or minority group.

3.2.2 Affected Environment

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

A variety of mushrooms, berries, roots, and herbs, some of which have cultural importance to traditional gatherers, occur on the Forest. Cultural plants are used for food and baskets and traditional gathering is essential to the maintenance of tribal traditions and culture. Gathering is also economically important. Gatherers return to the accustomed gathering areas of their ancestors to tend and harvest plants to be used for traditional purposes.

The Forest also issues permits for special forest products, such as firewood gathering. The possibility of herbicide exposure may be greater for people gathering forest products than the public. Firewood gathering often occurs on disturbed roadsides that also contain invasive plants.

Invasive plant infested sites are scattered throughout the Malheur National Forest and occupy about 0.1 percent of the land area within the Forest. Invasive plant treatments on the Forest are implemented through Forest Service contracts or in partnership with county operations. Applicators are generally from the communities in and around the Forest, are licensed by the State of Oregon, and are well-trained in safe herbicide application and transportation practices. Licensed applicators are required to take ongoing training in order to remain certified (ODA website http://www.oregon.gov/ODA/PEST/pages/licensing_index.aspx).

The Malheur National Forest has several formal agreements for use of drinking water. Chapter 3.5 (Water Resources) lists municipal watersheds, springs, and well intakes with formal agreements and the extent of invasive plants mapped within or near these areas.

3.2.3 Environmental Consequences

Worker Herbicide Exposure Analysis

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

The herbicides considered for use on this project can cause irritation and damage to the skin and eyes if mishandled. Eye or skin irritation would likely be the only overt effect because of mishandling these herbicides. These effects can be minimized or avoided by prudent industrial hygiene practices during handling. Worker exposure can be effectively managed through ordinary prudent practices, limiting the number of hours per day that workers are exposed to herbicide, and limiting the application rates and application methods for situations that may affect worker health. Herbicide labels indicate the personal protective equipment required for applicators. “Upper bound” hazard quotients for workers are intended to represent scenarios where workers are not following typical safety practices (SERA 2011a).

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

Exposure scenarios involving chemical spills onto the skin are characterized by a spill onto the lower legs as well as a spill onto the hands. In these scenarios, it is assumed that a solution of the chemical is spilled onto a given surface area of skin and that a certain amount of the chemical adheres to the skin. The protection provided by clothing is not included in the assessment.

The herbicides proposed for use under all alternatives have little potential to harm workers. In most cases, hazard quotient (HQ) values are below the threshold of concern (HQ values are less than 1.0, even given unlikely upper bound estimates). For the rates and methods that would be approved in the action alternatives, triclopyr is the one herbicide that is associated with HQ values greater than 1.0 for worker health. Triclopyr is not among the first-choice herbicide in any alternative.

For general worker exposure, the upper bound estimates HQ values range from 1.6 (triclopyr TEA) to 6 (triclopyr BEE). Accidental exposure to triclopyr BEE can also have impacts that are more serious to the eyes. An upper bound estimated HQ of 7 was calculated for an applicator wearing gloves saturated with triclopyr BEE for one hour.

In addition, two herbicides, picloram and clopyralid, contain an industrial contaminant from the manufacturing process that is linked to cancer: hexachlorobenzene (HCB). Picloram contains a higher concentration of HCB than does clopyralid. One alternative (D) would use picloram as the first-choice herbicide for about 63 acres. A worker applying picloram at the maximum application rate, treating 112 acres in one day, and not wearing any protective clothing resulted in theoretical HCB exposure over the cancer risk threshold established by EPA. This is not plausible for this project because picloram would not be broadcast at the maximum rate (pdf F2) and personal protective equipment is required by the label. Thus, HCB exposure from this project would not increase risk of cancer to workers (SERA 2004b, 2011c).

Public Herbicide Exposure Analysis

The public is unlikely to be affected by the herbicide use proposed in this project. The risk assessments provided hazard quotient estimates for accidental, operational, and chronic exposure scenarios. The reference doses for a child, woman, or man are conservative and account for uncertainty and sensitive populations. Few plausible scenarios exist that exceed even the most conservative threshold of concern for public health and safety. The potential for the public to be exposed to HCBs from the use of clopyralid or picloram was also considered; the use of these herbicides as proposed in this project would not result in increased cancer risk to the public (SERA 2004b, 2011c).

Accidental Scenarios

Accidental exposure is unlikely to occur. The risk assessments provide hazard quotient estimates for two types of accidental scenarios: 1) direct spray, and 2) exposures from drinking water or eating fish from a pond where herbicide has been spilled. Direct spray scenarios include the exposed skin of a woman or child being directly sprayed. Spill scenarios include a child drinking out of a pond where spills have occurred, a man eating fish out of a pond where a spill has occurred, and a man from a subsistence population eating fish as a greater part of their diet from a pond where a spill has occurred. These scenarios are implausible because 1) applicators would not directly spray a person and 2) project design features limit the amount of herbicide that may be transported to daily amounts. Upper bound estimates a 200-gallon spill; this is a greater amount than would be transported on the Forest given pdf G1 that limits the amount of herbicide that may be transported each day. The central and lower bound estimates include a smaller spill (100 and 20 gallons respectively).

Accidental Direct Spray

No person is likely to be directly sprayed given the broadcast, spot, and hand/select methods proposed in the action alternatives. An HQ of 1.4 is associated with the upper bound estimate for triclopyr BEE for this scenario. No HQ values greater than 1.0 are associated with this scenario for any of the other herbicides, even considering upper bound estimates.

Accidental Spill Scenarios

Aminopyralid, chlorsulfuron, imazapyr, sulfometuron methyl, and metsulfuron methyl do not have HQ values that exceed 1.0 for any spill scenario, including a large spill of 200 gallons. HQ values are less than 1.0 for all herbicides proposed for use in the action alternatives for smaller spills (20 and 100 gallons respectively). None of the fish consumption scenarios for any herbicide have HQ values greater than 1.0 for any herbicide proposed for use in the action alternatives.

Some herbicides include upper bound HQ values greater than 1.0 are associated with a child drinking 1 liter of water out of a pond where 200 gallons of herbicide have been spilled. These include clopyralid (HQ =2), glyphosate (HQ = 4), imazapic (HQ = 1.9), picloram (HQ = 1), sethoxydim (HQ = 1.6) and triclopyr (both formulations are associated with an HQ of 2 for this scenario).

A spill of this magnitude is not plausible and would be avoided by applying the pdfs, specifically G1 that limit the amount of material allowed to be transported to treatment sites, and requires spill planning and response. The potential risk of human health effects from any herbicide spill into drinking water would be avoided or mitigated by appropriate spill response identified in the spill response plan, periodic equipment inspections, and carrying an emergency response kit in vehicles transporting herbicides.

Acute Exposure – Contact with Vegetation

A person could brush up against sprayed vegetation soon after herbicide is applied. Such contact is unlikely because spraying occurs during the work-week (not on weekends), and public exposure would be discouraged during and after herbicide application through notification or signing. Contact with sprayed vegetation would not exceed a level of concern for any herbicide proposed for use in the action alternatives, even for the upper bound exposure estimates.

Eating Contaminated Vegetation or Fruit

A person could be exposed to herbicide if they eat contaminated vegetation or fruit (including berries, mushrooms, or other plants). Upper bound estimates for acute exposure assume that a person would eat about 0.01 kg of contaminated vegetation or fruit per kg of body weight. Upper bound estimates for chronic exposure assume a person eats this amount for 90 days; however, the amount of herbicide residue on the vegetation or fruit would decline over time, so the doses received each day for the chronic scenarios are less than for the acute scenarios. A person is unlikely to consume this much vegetation collected from the Forest in a one-time or chronic basis. A person might eat this much fruit one time; however, it is less plausible that they would eat this much for 90 days.

Central estimates assume a person eats about 0.001 kg of contaminated vegetation or fruit per kg of body weight in a day (acute) or for a 90-day period (chronic). This amount of consumption is plausible; however, the likelihood a person would eat any contaminated vegetation remains low given the extent and design of the project. These acute and chronic scenarios also approximate the effects of eating other contaminated products, such as mushrooms (Durkin and Durkin 2005).

Project design features include use of dye in spray mixes, public notification, posting of treatment sites, supplying information during the special forest products permitting process, and coordination with the Native American tribes. Contaminated plants would likely show obvious signs of damage over a relatively short period of time and are therefore not likely to be consumed (SERA 2007).

Acute scenarios for eating contaminated vegetation exceed HQ = 1.0 for upper bound estimates for glyphosate (HQ = 3), sethoxydim (HQ = 1.1), and both formulations of triclopyr (HQ = 4 for fruit, 27 for vegetation). HQ values for a person eating this much vegetation for 90 days (chronic) exceed 1.0 for upper bound estimates for chlorsulfuron (HQ = 4), clopyralid (HQ = 2), picloram (HQ = 2), and sulfometuron methyl (HQ = 4). Both the acute and chronic estimates involve a level of consumption that is implausible, especially given the design and extent of this project. These scenarios assume an adult consumes more than a pound of contaminated vegetation.

Aminopyralid, imazapic, imazapyr, and metsulfuron methyl are not associated with HQ values greater than 1.0 for any acute or chronic vegetation or fruit consumption.

With the exception of triclopyr, hazard quotients greater than 1.0 for any acute or chronic exposures from eating contaminated vegetation or fruit were not found for the herbicides proposed at central estimates. The central estimate for triclopyr (TEA and BEE) for the acute scenario of a woman of child bearing age eating contaminated vegetation is HQ = 3. The amount of vegetation that would need to be eaten is plausible; however, this exposure scenario would be unlikely given the design and extent of the project.

Drinking Contaminated Water

Acute and long-term exposures from direct contact or consumption of water following herbicide application were estimated for herbicide use rates for this project using the risk assessment worksheets. Along with the accidental scenarios previously described, risks from a child drinking water from stream contaminated with herbicide residues by runoff or leaching from an adjacent herbicide application are analyzed. None of the herbicides proposed for use in the alternatives are associated with HQ values greater than 1.0 for acute or chronic non-accidental exposure scenarios involving drinking water.

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

Consuming Contaminated Fish

Acute and long-term exposure scenarios involving the consumption of contaminated fish were evaluated using the herbicide concentrations in the contaminated water scenarios described. Acute exposure was based on the assumption that an angler consumes fish taken from contaminated water after adjacent lands were sprayed. Chronic exposures are assumed to occur over a lifetime of eating contaminated fish. Subsistence groups (e.g., Native Americans) were considered to have higher consumption rates of fish (exposure rates) than recreational anglers. Hazard quotients are less than or equal to 1.0 for all herbicides and exposure scenarios evaluated, including a lifetime of subsistence fishing. Please see chapters 3.5 and 3.6 for more information about potential effects to water quality and fish.

Bioconcentration (bioaccumulation) was taken into account when determining exposures and resulting dose from eating contaminated fish. Bioconcentration at first increases with the length of exposure, but eventually reaches a constant maximum level. It is measured as the ratio of the concentration in the fish compared to the concentration in the water, referred to as the bioconcentration factor (BCF). A BCF less than or equal to 1 indicates that fish excrete a chemical faster than, or as fast as, they can absorb it and therefore no bioconcentration would occur. Of the 11 proposed herbicides, 3 slightly exceed a BCF of 1.0 (chlorsulfuron has a BCF of 1.5; sethoxydim, a BCF of 7; and sulfometuron methyl, a BCF of 7).

Hexachlorobenzene has a high BCF of 2,000, ranging from 2,000-20,000. The 2011 risk assessment for picloram (SERA 2011c) quantitatively assessed chronic risk from HCB using a BCF of 20,000 for consumption of contaminated fish by subsistence populations. The HQ for carcinogenicity was 0.4; below the level of concern; however, because it occurs at such low levels in picloram (8 parts per million) and clopyralid (less than 2.5 parts per million) the risk from bioconcentration is low. The HQ for clopyralid is below the level of concern (clopyralid has much less HCB than does picloram) (SERA 2004b).

Swimming

Another exposure scenario is for a woman swimming in a stream adjacent to a sprayed area. None of the herbicides proposed for use have an HQ value greater than 1.0 for this scenario.

Multiple Chemical Sensitivity

The following information was adapted from USDA 2012, Gypsy Moth Management in the United Sates, a Cooperative Approach, from public comment responses prepared by SERA.

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

Forest Service risk assessments incorporate an uncertainty factor of 10 to account for sensitive individuals, which may or may not eliminate risk that an individual may suffer symptoms. However, the uncertainty factor for sensitive individuals addresses variability in tolerances within a normal population. Individuals reporting MCS assert, either explicitly or implicitly, that they are atypically sensitive. There is no current consensus on the diagnosis and cause of MCS. Until the etiology and pathogenesis of MCS has been clarified, associated symptoms and symptom complexes cannot be entirely ruled out. The Forest Service has no way to resolve concerns for MCS at the project level.

Endocrine Disruption

The Environmental Protection Agency has recently worked to establish appropriate tests and benchmarks for endocrine disruption effects. In 2009, they released a list of pesticides (based on the high potential for human exposure) that will be tested for potential to cause endocrine disruption. Glyphosate was the only herbicide considered for use on the Malheur National Forest that was included in the initial EPA testing. Current status of these studies indicate that some tier-1 studies for glyphosate have been finished, some will not be finished until 2014, and some tier-2 studies have been ordered. Results are not yet available.

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

There is no evidence of direct effects to the endocrine system, nor reproductive or developmental effects from aminopyralid (SERA 2007), chlorsulfuron (SERA 2004a), imazapic (SERA 2004c), imazapyr (SERA 2011b), metsulfuron methyl (SERA 2004d), or picloram (SERA 2011c). One study found that chlorsulfuron produced a slight decrease in fertility index in rats in a 3-generation study when rats were fed 125 mg/kg/day, but other studies have not found adverse effects on reproductive systems (SERA 2004a). Clopyralid, sethoxydim, and triclopyr have not been found to cause reproductive effects at doses that do not also produce direct maternal toxicity, suggesting a direct toxic effect rather than an effect to the endocrine functions (SERA 2001, 2004b, 2011c). Additionally, for imazapyr, EPA states in their review of toxicity data that there was no evidence of estrogen, androgen, and/or thyroid agonistic or antagonistic activity (US EPA/OPP 2005). Some studies of sulfometuron methyl reported changes in rat testes, reproductive performance and in thyroid function (SERA 2004e). In specific reproductive studies with dietary exposures, there were no adverse effects to reproduction found (SERA 2004e).

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

Additionally, there is a lack of specific information on the composition of different surfactants used in different formulations of glyphosate, as this information is identified as confidential business information. This lack of information limits the hazard identification for some toxic effects (SERA 2011). Given data limitations, the current practice of risk assessment is to use very protective exposure and dose scenarios, which are used in the 2011 glyphosate risk assessment and this analysis. Until more data on surfactants becomes available, it is not certain that assessment relies on "the most toxic surfactant in the most sensitive species" for the quantitative analysis (SERA 2011).[21]

The risk for endocrine disruption would be greatly reduced by measures such as required use of proper protective equipment, public notification, use of licensed applicators, limiting application rates and other relevant pdfs. Results of herbicide risk assessments indicate that there is no evidence to suggest that these types of effects will occur from use of the proposed herbicides.

Environmental Justice and Disproportionate Effects

The R6 2005 FEIS suggested that Hispanic forest workers and American Indians may be minority groups that could be disproportionately affected by herbicide use. Hispanic and non-Hispanic herbicide applicators would be more likely to be exposed to herbicides than other people. Contractors for the Forest and/or County would likely implement herbicide treatments. County invasive plant control departments do not indicate that they employ any specific population group that could be disproportionately affected during invasive plant treatments. Regardless, effects to all County or contract employees engaged in invasive plant control would be negligible due to pdfs and compliance with occupational health and safety standards. The R6 2005 ROD (Malheur LRMP) requires that all herbicide application crews be supervised by a licensed pesticide applicator.

No environmental justice concerns have been raised during government-to-government consultation with American Indian tribes. The likelihood of herbicide exposure to anyone is low, including subsistence gatherers. Cultural plants identified by the tribes would be buffered from herbicide use (pdf M1).

On the Malheur National Forest, people of southeast Asian (Khmer, Khmer Krom, Laotian, and Vietnamese) descent are minority groups that tend to gather mushrooms. However, the season that matsutake are harvested is generally outside the timeframe that herbicides are used for treatments. Mushrooms are not invasive target species. Whenever herbicide treatment is scheduled to occur, the Forest will notify plant collectors and the public with media postings, handouts attached to permits, and on-the-ground signing. Information about invasive plant treatments may be added to the multi-lingual mushroom gathering permit material to eliminate inadvertent exposures.

Given the design and extent of the project, minority forest workers, subsistence gatherers, and mushroom pickers are not likely to be exposed to an herbicide dose that exceeds a threshold of concern on this project.

[21] The potential for NPE based surfactants to cause endocrine disruption was discussed in the DEIS. A pdf was added to the project that eliminates use of NPE based surfactants (pdf F2). Thus, no potential for endocrine disruption from exposure to NPE surfactants would be associated with this project.

Direct and Indirect Effects of Alternatives

Alternative A – No Action

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

Alternative B – Proposed Action

Workers and the public may be exposed to herbicides used to treat invasive plants under this alternative. Few exposures exceeding a threshold of concern are predicted and adverse effects to human health are unlikely for this alternative. Table 30 lists specific pdfs in alternative B that address human health concerns. None of the first choice herbicides in this alternative are associated with HQ values greater than 1.0.

Table 30. Project design features in alternative B that minimize potential worker and public exposure to herbicides

PDF Reference	Project Design Feature
B1	Coordinate treatments on neighboring lands and within municipal watersheds. For neighboring lands, base distances on invasive species reproductive characteristics, and current use.
F1	Nonylphenol ethoxylate-based non-ionic (NPE) and ethoxylated fatty amine (POEA) surfactants would not be used. Vegetable oils/silicone blends that contain alkylphenol ethoxylate ingredients may be used.
F2	The least amount of a given herbicide would be applied as necessary to meet control objectives. In no case will imazapyr use exceed 0.70 lbs. a.i./ac. Broadcast application of Clopyralid, Glyphosate, Picloram, Sethoxydim, or Sulfometuron methyl will not exceed typical rates across any acre. Spot spray of triclopyr would not exceed typical rates across any acre.
F6	When herbicides are applied, a non-toxic blue dye will be used to mark treated areas.
G	**Herbicide Transportation and Handling Safety/Spill Prevention and Containment** ▪ An Herbicide Transportation and Handling Safety/Spill Response Plan would be the responsibility of the herbicide applicator. At a minimum the plan would: ▪ Address spill prevention and containment. ▪ Estimate and limit the daily quantity of herbicides to be transported to treatment sites. ▪ Require that impervious material be placed beneath mixing areas in such a manner as to contain small spills associated with mixing/refilling. ▪ Require a spill cleanup kit be readily available for herbicide transportation, storage, and application (minimum FOSS Spill Tote Universal or equivalent). ▪ Outline reporting procedures, including reporting spills to the appropriate regulatory agency. ▪ Ensure applicators are trained in safe handling and transportation procedures and spill cleanup. ▪ Require that equipment used in herbicide storage, transportation and handling are maintained in a leak proof condition. ▪ Address transportation routes so that traffic, domestic water sources, and blind curves are avoided to the extent possible. ▪ Specify conditions under which guide vehicles would be required. ▪ Specify mixing and loading locations away from water bodies so that accidental spills do not contaminate surface waters. ▪ Require that spray tanks be mixed or washed further than 150 feet of surface water. ▪ Ensure safe disposal of herbicide containers. Identify sites that may only be reached by water travel and limit the amount of herbicide that may be transported by watercraft.
H1	Follow herbicide-use buffers. Tank mixtures would apply the largest buffer as indicated for any of the herbicides in the mixture.
K1	High use areas, including administrative sites, developed campgrounds, visitor centers, and trailheads would be posted in advance of herbicide application or closed. Postings would indicate the date of treatments, the herbicide used, and when the areas are expected to be clear of herbicide residue. See also L2 for special products and M1 for cultural plants.
K2	The public would be notified about upcoming herbicide treatments via the local newspaper or individual notification,

PDF Reference	Project Design Feature
	fliers, and posting signs. Forest Service and other websites may also be used for public notification.
L2	Members of the public, who identify specific forest product collection areas, non-target edible or medicinal species they collect, or areas of cultural or spiritual value, will be informed about upcoming use of herbicide in the area. Specific edible or medicinal plant collection areas identified by the public would be prominently posted prior to spraying.
L4	Flyers indicating upcoming herbicide treatments and explaining the use of blue dye may be included with mushroom and special forest product collection permits, in multi-lingual formats if necessary. See section K.
M1	American Indian tribes would be notified annually as treatments are scheduled so that tribal members may provide input and/or be notified prior to gathering cultural plants. Cultural plants identified by tribes would be buffered as above for botanical species of concern; (see section I2, I3, and I4).

Alternative C

Under alternative C, compared to alternative B, there would be less use of herbicides and less risk of exposure associated with alternative C. Use of spot or selective treatments (no broadcast) would reduce the potential for vegetation or fruit to become contaminated with herbicide. Not using herbicide near streams would reduce risk of consuming contaminated drinking water or eating contaminated fish. The same project design features listed for alternative B would be implemented. Picloram would not be used, so there would be no possible risk to human health (risk is low in alternative B) from exposure to this herbicide.

Alternative D

Under alternative D, there would be increased use of glyphosate and picloram instead of aminopyralid. About 63 acres would be treated with picloram as a first-choice herbicide and about 725 acres of glyphosate would be the first-choice herbicide under alternative D. Upper bound estimates for a child drinking out of a pond where 200 gallons of herbicide has spilled, and for eating contaminated vegetation exceed 1.0 for these herbicides.

Summary of Worker and Public Exposure Scenarios by Herbicide

Based on the risk assessment worksheets, use of herbicides in this project are associated with HQ values greater than 1.0 for the following exposure scenarios. In most cases, only upper bound estimates are greater than 1.0, indicating a very low level of risk.

Aminopyralid: This is a first year/first choice herbicide in all action alternatives. No worker or public exposure scenarios have HQ values greater than 1.0.

Chlorsulfuron: This is a first year/first choice herbicide in all action alternatives. Upper bound HQ = 4 for chronic consumption of contaminated vegetation, which is an implausible scenario given the extent of the project and the pdfs.

Clopyralid: This is not a first year/first choice herbicide in any alternative. Upper bound HQ = 2 for a child drinking from a pond where 200 gallons of herbicide have been spilled. Upper bound HQ = 2 for chronic consumption of contaminated vegetation. Both of these scenarios are implausible given the extent of this project and the pdfs.

Glyphosate: This is a first year/first choice herbicide in alternative D. Upper bound HQ = 4 for a child drinking from a pond where 200 gallons of herbicide have been spilled. Upper bound HQ = 3 for a woman eating contaminated vegetation. Both of these scenarios are implausible given the extent of the project and the pdfs.

Imazapic: This is not a first year/first choice herbicide in any alternative. Upper bound HQ = 1.9 for a child drinking from a pond where 200 gallons of herbicide have been spilled. This scenario is implausible given the extent of the project and the pdfs.

Imazapyr: This is not a first year/first choice herbicide in any alternative. No worker or public exposure scenarios have HQ values greater than 1.

Metsulfuron methyl: This is a first year/first choice herbicide in all action alternatives. No worker or public exposure scenarios have HQ values greater than 1.

Picloram: This is a first year/first choice herbicide in alternative D and it would not be used at all in alternative C. Upper bound HQ = 1 for a child drinking from a pond where 200 gallons of herbicide have been spilled. Upper bound HQ = 4 for chronic consumption of contaminated vegetation. Both of these scenarios are implausible given the extent of this project and the pdfs.

Sethoxydim: This is not a first year/first choice herbicide in any alternative. Upper bound HQ = 1.6 for a child drinking from a pond where 200 gallons of herbicide have been spilled. Upper bound HQ = 1.1 for consumption of contaminated vegetation. Both of these scenarios are implausible given the extent of this project and the pdfs.

Sulfometuron methyl: This is not a first year/first choice herbicide in any alternative. Upper bound HQ = 4 for chronic consumption of contaminated vegetation. This scenario is implausible given the extent of the project and the pdfs.

Triclopyr BEE: This is not a first year, first choice herbicide in any alternative. For workers, upper bound HQ = 6 for general exposure, and upper bound HQ = 7 for wearing saturated gloves for one hour. Upper bound exposures assume no protective clothing and improper safety practices, which is unlikely given the pdfs. Upper bound HQ = 1.4 for direct spray of a child, which is an implausible scenario. Upper bound HQ = 2 for a child drinking from a pond where 200 gallons of herbicide have been spilled and the upper bound HQ = 27 for consumption of contaminated vegetation, which are also implausible scenarios. The upper bound HQ = 4 for consumption of contaminated fruit, which is an unlikely scenario. The central HQ = 3 for consumption of contaminated vegetation, which is unlikely given the extent of the project and pdfs.

Triclopyr TEA: This is not a first year, first choice herbicide in any alternative. For workers, upper bound HQ = 1.6 for general exposure. Upper bound exposures assume no protective clothing and improper safety practices, which is unlikely given the pdfs. Upper bound HQ = 2 for a child drinking from a pond where 200 gallons of herbicide have been spilled and the upper bound HQ = 27 for consumption of contaminated vegetation, which are also implausible scenarios. The upper bound HQ = 4 for consumption of contaminated fruit, which is an unlikely scenario. The central HQ = 3 for consumption of contaminated vegetation, which is unlikely given the extent of the project and pdfs.

Comparative Risk Assessment

All of the herbicides proposed for use in the project pose relatively low risks to people and the environment. None of the herbicides besides triclopyr are associated with HQ values greater than 1.0 for worker health. Triclopyr has comparatively greater risk due to upper bound HQ values greater than 1.0 for general and accidental exposures.

Aminopyralid, imazapyr and metsulfuron methyl are lowest risk for public health because no HQ values are greater than 1.0 for any exposure scenarios. All other herbicides (except triclopyr) are moderate risk due to upper bound HQ values greater than 1.0 for at least one public exposure scenario. Triclopyr is in the higher risk category because one central HQ value exceeds 1.0 for a public exposure scenario.

Cumulative Effects

Alternative A would not result in any cumulative effects on human health, as there would be no direct or indirect effects from no action.

The proposed use of herbicides in all action alternatives could result in multiple doses of the same or different herbicides to workers or the public. A person could be exposed to multiple doses within the project area or elsewhere. However, there is no evidence that herbicide exposure from this project would combine with exposure elsewhere and cause a discernable effect.

The R6 2005 FEIS considered the potential for synergistic effects of exposure to two or more chemicals:

> Combinations of chemicals in low doses (less than one tenth of RfD) have rarely demonstrated synergistic effects. Review of the scientific literature on toxicological effects and toxicological interactions of agricultural chemicals indicate that exposure to a mixture of pesticides is more likely to lead to additive rather than synergistic effects (ATSDR, 2004; U.S.EPA/ORD, 2000). Based on the limited data available on chemical combinations involving the … herbicides considered in this EIS, it is possible, but unlikely, that synergistic effects could occur as a result of exposure to the herbicides considered in this analysis. Synergistic or additive effects, if any, are expected to be insignificant (R6 2005 FEIS p. 4-3).

No project-level evidence suggests that significant synergistic or additive effects might occur.

The risk assessment worksheets indicate that of the herbicides proposed for use on this project, triclopyr poses the greatest theoretical risk to workers and/or the public. However, the extent of use on the Forest would be very low. Because the potential extent of use is low, and the pdfs minimize the potential for exposures that are over a level of concern, the potential for triclopyr use on the MNF to contribute to a cumulative effect to a worker or the public is implausible.

Herbicide applicators are more likely than the public to be exposed to multiple doses of herbicide; however, there is low risk that a worker would receive multiple exposures during the time period in which the herbicide might remain in their body. This project involves the use of relatively low risk herbicides and none of the central bound estimates for general worker exposure were over a level of concern. The use of personal protective equipment would minimize the potential for exposure to the levels of herbicide analyzed in the risk assessments. In addition, the herbicides proposed for use are associated with low bioconcentration factors (see discussion above).

The potential for this project to contribute to cumulative effects on the public is very low. The risk assessment worksheet calculations indicate a risk from *chronic* exposure of some herbicides based on a woman eating contaminated vegetation for a 90-day period. HQ values exceed 1.0 for upper bound estimates for eating vegetation that has been sprayed with chlorsulfuron (HQ = 4), clopyralid (HQ = 2), picloram (HQ = 2), and sulfometuron methyl (HQ = 4). However, the likelihood of a person eating contaminated vegetation daily over a 90-day period is implausible.

Theoretically, a person could be exposed to herbicides by more than one scenario; for instance, a person could handle, and then consume sprayed berries. The cumulative impact of such cases may be quantitatively characterized by adding the HQs for each exposure scenario. An example using the herbicide glyphosate was provided in the R6 2005 FEIS Appendix Q. Glyphosate is the most used herbicide in Oregon based on Statewide Pesticide Use Reports from 2007 and 2008 (most recent data available, see Chapter 3.1.5). The R6 2005 FEIS used central exposure estimates for a woman being directly sprayed on the lower legs, staying in contact with contaminated vegetation, eating contaminated fruit, and consuming contaminated fish. This resulted in a combined (acute) HQ of 0.012. Using the updated risk assessment (2011) worksheet for the maximum application rate in Oregon, a similar calculation resulted in an HQ of 0.322 for a woman contacting then eating contaminated fruit and vegetation, still below a threshold of concern for glyphosate exposure.

Triclopyr is associated with the largest HQ values of the herbicides proposed for use in the alternatives. However, the extent of use would be too low to result in multiple exposure (triclopyr is not a first choice herbicide in any alternative) and LRMP standards restrict application methods so that multiple routes of exposure for the public are implausible.

Even if a person was exposed to triclopyr in multiple ways, the herbicides are rapidly excreted or metabolized in the human body. The time between dermal exposure caused by harvesting of contaminated vegetation and the subsequent eating (oral exposure) would allow the body to metabolize some of the initial dose before receiving another exposure, thus reducing the potential for a cumulative dose.

Additional information about herbicide use on other land ownerships in Oregon and potential for cumulative effects is in chapter 3.1.5. The ongoing and foreseeable projects and activities within the project area would not combine with this project and cause cumulative effects because even under worst case exposure estimates, the doses potentially received would not remain in the body long enough to combine and cause a cumulative effect.

3.3 Botany

3.3.1 Introduction

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

Endangered Species Act (Federally Listed Species)

The United States Fish and Wildlife Service (USFWS) website indicates that whitebark pine (*Pinus albicaulis*) occurs in Baker and Grant County. This species is currently a candidate for federal listing. Whitebark pine is found throughout western North America in subalpine habitats, usually near the timberline (above 6,500 feet altitude). The plant association group where it occurs is cold upland coniferous forest. Sites are usually fairly dry with thin, rocky, cold soils. It is found from Canada south to central California, and east to Wyoming and Colorado. It occurs on all Blue Mountain Forests, including at scattered sites on the Malheur NF. Very few documented invasive plant sites occur in high elevation dry sites. Therefore, it is unlikely that any invasive plant treatments will occur in areas where whitebark pine is found.

The USFWS website indicates that Malheur wire lettuce (*Stephanomeria malheurensis*) occurs in Harney County. This species is federally listed as endangered. It is found in a very limited area 35 miles south of the southern boundary of the Malheur National Forest. It grows only on volcanic tuffaceous soils. It is highly unlikely that there is any potential habitat for this species on the Malheur National Forest.

The USFWS website indicates that Howell’s spectacular thelypody (*Thelypodium howellii* ssp. *spectabilis*) occurs in Baker County. This species is federally listed as threatened. It is found in a very limited area of the Baker Valley. The closest known population is over 35 miles northeast of the Malheur National Forest. This species grows only at relatively low elevations on moist alkaline plains, and in alkaline river valleys. It is usually found with black greasewood (*Sarcobatus vermiculatus*). All National Forest System land located on the Malheur National Forest in Baker County is in relatively high elevation in forested or open sub-alpine habitat types; therefore, potential habitat for this species is unlikely to be found. The USFWS website does not list any plants for Crook or Malheur Counties.

For these reasons, consultation with the United States Fish and Wildlife Service regarding federally listed plants is not necessary.

Forest Service Designated Sensitive Species

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

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

Regulatory Framework and Compliance

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

3.3.2 Affected Environment

Native Vegetation

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

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

Plant communities can be classified by a variety of factors such as vegetation structure, site moisture, overstory, and understory. The 2005 FEIS used broad potential vegetation groups (PVGs) to rate the susceptibility of vegetation to invasive plant establishment. Table 31 lists potential vegetation groups (PVG) found on the Malheur National Forest, their susceptibility to damage from invasive plants, the local plant community types that correspond to these broad PVG types, and mapped acres of invasive plants within the plant community types. The groups are aggregations of plant associations and represent a combination of temperature and moisture regimes for this Forest. Overall, most plant community types found on the Malheur National Forest are moderately to highly susceptible to invasion.

Table 31. Potential Vegetation Groups on the Malheur National Forest's 1.7 million acres and their susceptibility to invasive plants

Potential Vegetation Group	Percent of Forest	Susceptibility to Invasion[1]	Infested acres (all species)[2]
Cold forest	2	Moderate	5
Cold herbland	0.1	Moderate	0.1
Cold shrubland	0.2	Moderate	0.3
Cool-cold riparian forest	0.000007	Moderate-high	0
Cool-cold riparian herbland	0.0002	Moderate-high	0.06
Dry Douglas-fir forest	16	Moderate-high	290
Dry grand-fir forest	24	Moderate-high	503
Dry ponderosa pine forest	21	Moderate-high	457
Hot-dry pine forest	10	Moderate-high	136
Dry herbland	2	High	29
Dry shrubland	6	High	43
Juniper woodland	3	Moderate-high	28
Moist forest	13	Moderate-high	456
Moist herbland	0.55	Moderate-high	18
Moist shrubland	0.8	Moderate	29
Warm-hot riparian herbland	1	High	74
Warm-hot riparian forest	0.00003	Moderate-high	0.3
Warm-hot riparian shrubland	0.0009	High	26
Whitebark pine forest	0.4	Moderate-high	0.4
Total	**100.0**		

1 Susceptibility ratings (derived from R6 2005 FEIS): High = high susceptibility to invasion. Invasive plant species invade the cover type successfully and becomes dominant or co-dominant even in the absence of intense or frequent disturbance; Moderate = moderate susceptibility to invasion. Invasive plant species is a "colonizer" that invades the cover type successfully following high intensity or frequent disturbance that impacts the soil surface or removes the normal canopy; Low = low susceptibility to invasion. Invasive weed species does not establish because the cover type does not provide suitable habitat.

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

Sensitive Plants

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

- The Regional Forester's Sensitive Species List (USDA Forest Service 2011)[22]
- The Forest Service's Natural Resource Manager Database (NRM) – Threatened, endangered, and sensitive species geographic information system (GIS) database, and other pertinent GIS mapping layers (potential natural vegetation, streams, and wetlands, aerial imagery).
- Project GIS layer showing proposed treatment areas.

Table 32. Sensitive plant populations within 100 feet of proposed invasive treatment areas

5th Field Watershed	Sensitive Plant Species	Invasive Species	Distance Between Species
Bridge Creek 1707020301	Blandow's feather moss (*Helodium blandowii*)	Hound's tongue (*Cynoglossum officinale*)	30 feet – 1 site
Fields Creek John Day River 1707020110	Colonial luina (*Luina serpentina*)	Dalmatian toadflax (*Linaria dalmatica*)	57 feet – 1 site
		Spotted knapweed (*Centaurea stoebe* ssp. *micranthos)*	51 feet – 1 site
Headwaters Silvies River 1712000201	Crenulate moonwort (*Botrychium crenulatum*)	Canada thistle (*Cirsium arvense*)	54 feet – 1 site
Upper Silvies River 1712000203	Idaho sedge (*Carex idahoa*)	Canada thistle (*Cirsium arvense*)	0 feet – 1 site
		Hound's tongue (*Cynoglossum officinale*)	0 feet – 1 site
	Deschutes milk vetch (*Astragalus tegetarioides*)	Dalmatian toadflax (*Linaria dalmatica*)	0 feet – 3 sites
Middle Silvies River 1712000204	Deschutes milk vetch (*Astragalus tegetarioides*)	Spotted knapweed (*Centaurea stoebe* ssp. *micranthos)*	0 feet – 1 site
		White-top (*Cardaria draba*)	79 feet – 1 site
Emigrant Creek 1712000205	Peck's long-bearded sego lily (*Calochortus longebarbatus* var. *peckii*)	Yellow toadflax or Butter-and-eggs (*Linaria vulgaris*)	0 feet – 3 sites
North Basin 1712000101	Deschutes milk vetch (*Astragalus tegetarioides*)	Dalmatian toadflax (*Linaria dalmatica*)	0 feet – 1 site

Table 33 that follows lists all Region 6 sensitive plant species that are documented or suspected to occur on the Malheur National Forest.

[22] Forest Service Manual 2670.5 defines sensitive species as those plant and animal species identified by a Regional Forester for which population viability is a concern, as evidenced by significant current or predicted downward trends in population numbers, density, or habitat capability that would reduce a species existing distribution.

Table 33. Sensitive plant species documented (D), suspected (S), or having a historical record (H) on the Malheur National Forest

Malheur National Forest Sensitive Plant Species			
Taxa Type	**Scientific Name**	**Common Name**	**Occurrence on the Forest[1]**
Fungus	*Pseudorhizina californica*	umbrella false morel	S
Lichen	*Texosporium sancti-jacobi*	woven spore lichen	S
Liverwort	*Anastrophyllum minutum*	tiny notchwort	S
Liverwort	*Anthelia julacea*	alpine silverwort	D
Liverwort	*Barbilophozia lycopodioides*	giant fourpoint, maple liverwort, greater pawwort	S
Liverwort	*Harpanthus flotovianus*	great mountain flapwort	S
Liverwort	*Jungermannia polaris*	Arctic flapwort	S
Liverwort	*Lophozia gillmanii*	Gillman's pawwort	S
Liverwort	*Peltolepis quadrata*	shieldscale liverwort	S
Liverwort	*Preissia quadrata*	blister ribbon, narrow mushroom-headed liverwort	D
Liverwort	*Ptilidium pulcherrimum*	lovely fuzzwort, naugahyde liverwort	S
Moss	*Encalypta brevipes*	candle snuffer moss, stubby extinguisher moss	S
Moss	*Entosthodon fascicularis*	banded cord-moss, Hasselquist's hyssop	S
Moss	*Helodium blandowii*	Blandow's feather moss, wet plume moss	D
Moss	*Meesia uliginosa*	Meesia moss	D
Moss	*Pseudocalliergon trifarium*	blunt water moss, worm moss	S
Moss	*Schistidium cinclidodonteum*	schistidium moss	S
Moss	*Schistostega pennata*	schistostega moss	S
Moss	*Splachnum ampullaceum*	purple-vased stink moss, small capsule dung moss	S
Moss	*Tetraphis geniculata*	tetraphis moss	S
Moss	*Tomentypnum nitens*	tomentypnum moss	D
Moss	*Tortula mucronifolia*	mucron-leaf tortula moss	S
Vascular	*Achnatherum hendersonii*	Henderson's ricegrass	S
Vascular	*Achnetherum wallowaense*	Wallowa ricegrass	S
Vascular	*Artemisia arbuscula* ssp. *longicaulis*	Lahontan sagebrush	S
Vascular	*Astragalus tegetarioides*	Deschutes milkvetch, bastard milkvetch	D
Vascular	*Botrychium ascendens*	upward-lobed moonwort	D
Vascular	*Botrychium crenulatum*	crenulate moonwort	D
Vascular	*Botrychium hesperium*	western moonwort	S
Vascular	*Botrychium lineare*	slender moonwort	S
Vascular	*Botrychium lunaria*	common moonwort	D
Vascular	*Botrychium montanum*	mountain moonwort	D
Vascular	*Botrychium paradoxum*	twin-spiked moonwort	S
Vascular	*Botrychium pedunculosum*	stalked moonwort	S
Vascular	*Bupleurum americanum*	American thorough-wax	S

Malheur National Forest Sensitive Plant Species			
Taxa Type	**Scientific Name**	**Common Name**	**Occurrence on the Forest[1]**
Vascular	*Calochortus longebarbatus* var. *longebarbatus*	long-bearded sego-lily	S
Vascular	*Calochortus longebarbatus* var. *peckii*	Peck's long-bearded sego-lily	D
Vascular	*Camissonia pygmaea*	dwarf evening-primrose	S
Vascular	*Carex atrosquama*	blackened or brass-fruit sedge	S
Vascular	*Carex cordillerana (Carex backii)*	cordilleran sedge	D
Vascular	*Carex diandra*	lesser panicled sedge	S
Vascular	*Carex idahoa*	Idaho sedge	D
Vascular	*Carex lasiocarpa* var. *americana*	slender wooly sedge	S
Vascular	*Carex media*	Scandinavian sedge	S
Vascular	*Carex micropoda*	timberline sedge	S
Vascular	*Carex nardina*	spikenard sedge	S
Vascular	*Carex pelocarpa*	dusky-seed or new sedge	S
Vascular	*Carex retrorsa*	retrorse sedge	S
Vascular	*Carex saxatilis*	russet sedge	S
Vascular	*Carex scirpoidea* ssp. *stenochlaena*	Alaska single-spiked sedge	D
Vascular	*Carex subnigricans*	nearly black or dark alpine sedge	S
Vascular	*Carex vernacula*	native sedge	S
Vascular	*Chaenactis xantiana*	desert chaenactis	S
Vascular	*Cheilanthes feei*	Fee's lip fern	S
Vascular	*Cistanthe rosea(Calyptridum roseum)*	rosy pussypaws	H
Vascular	*Cryptogramma stelleri*	Steller's rock-brake	S
Vascular	*Cymopterus nivalis*	snowline cymopterus	D
Vascular	*Cypripedium fasciculatum*	clustered lady's-slipper	S
Vascular	*Elatine brachysperma*	short-seeded waterwort	S
Vascular	*Eleocharis bolanderi*	Bolander's spike-rush	D
Vascular	*Eriogonum cusikii*	Cusick's buckwheat	S
Vascular	*Eriogonum salicornioides*	playa or saltwort buckwheat	S
Vascular	*Heliotropium curassavicum*	salt heliotrope	S
Vascular	*Kobresia myosuroides*	Bellard's kobresia	S
Vascular	*Listera borealis*	northern twayblade	D
Vascular	*Lomatium erythrocarpum*	red-fruited desert-parsley	S
Vascular	*Luina serpentina*	colonial luina	D
Vascular	*Lupinus cusickii* var. *cusickii*	Cusick's lupine	S
Vascular	*Lycopodium complanatum*	ground-cedar	S
Vascular	*Mimulus evanescens*	disappearing monkey-flower	H
Vascular	*Muhlenbergia minutissima*	annual or little-seed muhly grass	S
Vascular	*Ophioglossum pusillum*	adder's-tongue	S
Vascular	*Pellaea bridgesii*	Bridge's cliff-brake	S
Vascular	*Phacelia minutissima*	least or dwarf phacelia	D
Vascular	*Phlox hendersonii*	Henderson's phlox	S

Malheur National Forest Sensitive Plant Species			
Taxa Type	**Scientific Name**	**Common Name**	**Occurrence on the Forest[1]**
Vascular	*Phlox multiflora*	many-flowered phlox	S
Vascular	*Pinus albicaulis*	whitebark pine	D
Vascular	*Pleuropogon oregonus*	Oregon semaphore grass	S
Vascular	*Potamogeton diversifolius*	diverse-leaved pondweed	S
Vascular	*Rotala ramosior*	lowland toothcup	S
Vascular	*Salix farriae*	Farr's willow	S
Vascular	*Salix wolfii*	Wolf's willow	S
Vascular	*Saxifraga adscendens* ssp. *oregonensis*	wedge-leaved saxifrage	S
Vascular	*Stanleya confertiflora*	biennial stanleya	S
Vascular	*Thelypodium eucosmum*	arrow-leaf thelypody	D
Vascular	*Trifolium douglasii*	Douglas' clover	S
Vascular	*Trollius laxus* ssp. *albiflorus*	American globeflower	S
Vascular	*Utricularia minor*	lesser bladderwort	S

Botanical Surveys

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

Project design features (table 10) stipulate that site-specific surveys for sensitive plants will be conducted prior to project implementation. In areas with high potential for sensitive plant species habitat, a Forest Service botanist or otherwise qualified person will examine all areas of potential ground disturbance or herbicide application at the appropriate time of the year to identify targeted sensitive plant species before implementation.

Culturally Significant Plants

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

Special Forest Products

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

3.3.3 Environmental Consequences

Methodology

There is no potential habitat on the Malheur National Forest for any federally listed or proposed plant species. All alternatives for this project comply with standards and guidelines in the LRMP and Forest Service Manual 2670 for management of sensitive plants and special forest products. Therefore, there is no effect from any of the alternatives to federally listed threatened, endangered, or plants proposed for federal listing. Hence, consultation with the U.S. Fish and Wildlife Service is not necessary for federally listed or proposed plants.

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

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

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

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

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

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

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

Incomplete and Unavailable Information

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

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

Some sensitive plant species do not produce above-ground plants every year. These plants include some grape-ferns (*Botrychium spp.*), and many annual species which are dependent upon sufficient early spring rains, Some of the annual sensitive species include least phacelia (*Phacelia minutissima*), disappearing monkeyflower (*Mimulus evanescens*), dwarf evening-primrose (*Camissonia pygmaea*) annual muhly grass (*Muhlenbergia minutissima*), lowland tooth-cup (*Rotala ramosior*), and desert chaenactis (*Chaenactis xantiana*).

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

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

Spatial and Temporal Context for Effects Analysis

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

Effects to Sensitive Plants Common to All Action Alternatives

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

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

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

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

Manual and Mechanical Control Effects

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

Control of invasive plants using manual or mechanical methods may potentially directly affect non-target plants. Direct negative effects may include mortality of individuals, reduced vigor due to trampling or removal of above ground parts, and reduced seed production. These effects would be minor with manual control and mechanical control using string trimmers. There would be less ability to target individual plants with mowing, resulting in greater risk of potential negative effects to non-target plants in the treated area.

The project design features for sensitive plants ensure that botanical surveys occur when warranted before project implementation, which will greatly reduce the possibility of these activities negatively affecting sensitive plants. Additional protection will be provided by the pdf that provides for buffers of known sensitive plant sites (table 10).

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

Cultural Control Effects

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

Effects of Biological Control Agents

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

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

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

Herbicide Control Effects

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

All action alternatives include some herbicide control. The action alternatives allow various chemicals and levels of chemical use across the Malheur National Forest. The potential for negative effects from herbicide use increases directly in relation to how many acres are treated, and the toxicity of various chemicals. Effects on non-target plants would vary based on the herbicide properties, application rate, timing of application, application method, site conditions, and the susceptibility of the non-target plants. Use of non-selective herbicides with residual soil activity and relatively high risk for offsite effects could result in the most damage to non-target plant species. Use of selective herbicides could shift the composition of the plant community, as less tolerant species are replaced by more tolerant species. At many herbicide-treated sites, selective herbicides would result in greater impacts to native broad-leaved forbs than trees, shrubs, or grasses.

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

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

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

Offsite Movement of Herbicides

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

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

Drift could potentially affect non-target plants adjacent to treatment sites; the risk would be greatest during use of picloram and the sulfonylurea herbicides. Offsite drift is a physical process dependent on application rate, droplet size, and weather conditions. To reduce drift, herbicide labels have advisories for wind velocity and nozzle pressure/droplet size. The presence of intercepting vegetation at application sites can also limit drift. Drift is most associated with broadcast, rather than spot applications. Marrs et al. (1989) examined the distances that drift from broadcast applications affected non-target vascular plants and found observations consistent with drift deposition models. The maximum safe distance at which no lethal effects were found was 20 feet, but for most herbicides, the distance was 7 feet or less. Generally, damage symptoms were found at greater distances than lethal effects, but in most cases, there was rapid recovery by the end of the growing season. No effects were seen to non-target vascular plants further than 66 feet from the broadcast treatment zone. Damage to non-target plants outside of treated areas from drift has not been observed at sites on the Forest spot treated with glyphosate or picloram in the past.

Pdf I -4 (table 10) restricts use of herbicides to no closer than 100 feet from known sensitive plant populations, so would greatly reduce the chance of negative impacts from herbicide drift.

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

Unintended Direct Spray

Unintended direct spray would result in an exposure level equivalent to the application rate and is much more likely than wind erosion, drift, or runoff to cause impacts to non-target plants. The potential for damage to non-target plants would be greater during broadcast spraying than during spot spraying or wicking, which are much more selective application methods and generally apply less herbicide per acre. Broadcast applications would be used on dense patches of invasive plants that have few interspersed native species; therefore, it is unlikely that substantial impacts to desirable plants would occur. Spot spraying or wicking could damage plants growing immediately adjacent to or among target invasive plants. Monitoring of past spot applications on other forests has found these techniques to be highly accurate, with most of the visible damage to non-target plants occurring within less than 10 feet of treated plants (Desser 2014).

Residual Soil Activity

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

Herbicide Effects to Fungi/Soil Organisms

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

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

Herbicide Effects to Bryophytes and Lichens

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

Potential Effects to Special Forest Products

The main special forest product that is gathered on the Malheur National Forest is firewood. Posts and poles are another important non-timber product. All proposed treatments for invasive plant species should have no effect to opportunities to gather these products. Any potential negative effect would be human exposure to herbicides. The risks of human exposure to herbicides are discussed in other sections of this document (chapter 3.2.3).

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

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

Effects on Culturally Significant Plants

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

Effects of Alternatives

Alternative A

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

Since invasive plants often out-compete native plants, the risk to sensitive plants from invasive plants increases with the number of acres of invasive plant infestation. Alternative A will not achieve the goal of reducing acreage or suppressing, containing, controlling or eradicating invasive plants. This alternative would not meet the desired future condition “to retain healthy native plant communities that are diverse and resilient, and restore ecosystems that are being damaged, and to provide high quality habitat for native organisms throughout the forest, and assure that invasive plants do not jeopardize the ability of the forest to provide goods and services communities expect.” Invasive species would continue to spread and could eventually adversely affect sensitive species.

Alternative B

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

Cultural techniques that include seeding and planting native plants may change the species composition at treatment sites. Heavy seeding of native or short-lived non-native grasses could delay germination and growth of other native plants. However, in areas where competitive seeding may be used, the invasive plant infestations are generally so dense that the native plant community has already been drastically altered. Reducing the invasive plants and establishing desirable vegetation would improve the probability that a native community could reestablish over time. Impurities in seed lots could potentially introduce non-native or invasive species, but the requirement to use certified weed-free seed would reduce this risk. Project design features that include surveys and buffers for sensitive plants (table 10 pdf group I) would help to reduce the risk that cultural control methods may negatively impact sensitive plants. Therefore, cultural techniques would not have any direct negative impacts to sensitive plant species or habitat.

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

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

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

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

Early Detection/Rapid Response (EDRR)

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

Cumulative Effects

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

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

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

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

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

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

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

Alternative C

Direct and Indirect Effects

The primary difference between alternatives B and C is the amount and types of herbicides used. Alternative C would not allow the use of picloram and would not allow broad spraying. It also would prohibit the use of herbicides within 100 feet of water bodies. The maximum number of acres of herbicide treatment annually is 735 (as compared with the 2,124 acres proposed in alternative B). The same project design features will apply for sensitive plant protection with additional protection provided near streams.

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

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

Early Detection/Rapid Response

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

Cumulative Effects

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

Alternative D

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

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

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

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

Early Detection/Rapid Response (EDRR)

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

Cumulative Effects

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

Summary of Effects to Botanical Resources

Table 34. Summary of effects to sensitive plants and special forest products

Issue and Indicator	Alternative A	Alternative B	Alternative C	Alternative D
Type and extent of herbicide use within 100 feet of sensitive plants and special forest products	none	Pdf prohibits broadcast herbicide use within100 feet of sensitive plant populations. Spot applications will be used within 100 feet of sensitive plant populations. Pdf for use of blue dye will alert special forest product gatherers of herbicide spray areas.	Same as Alt B	Same as Alt B
Effectiveness of buffers and project design features to prevent impacts to non-target vegetation	NA	Buffers and pdfs would substantially reduce the chance of herbicide use within 100 feet of sensitive plant populations.	Same as Alt B	Same as Alt B
Compliance with existing management direction and disclosure of findings	Will not achieve goal of adequately treating invasive plants	Meets full compliance	Meets full compliance	Meets full compliance
Determination of short-term effects to Sensitive Plants	NA	Uncertainties due to difficulty of location and identification of all populations of sensitive plants leads to a call of **may impact individuals or habitat (MIIH).** Risk is directly correlated with number of acres treated.	Uncertainties due to difficulty of location and identification of all populations of sensitive plants leads to a call of **may impact individuals or habitat (MIIH).** Risk is directly correlated with acres treated. Slightly lower risk than alternative B due to treating fewer acres with herbicide, and not using picloram (which is more persistent in the soil).	Uncertainties due to difficulty of location and identification of all populations of sensitive plants leads to a call of **may impact individuals or habitat (MIIH).** Risk is directly correlated with acres treated. Slightly higher risk than alternative B due to lower effectiveness of chemicals other than aminopyralid.
Determination of long-term effects to sensitive plants	Spread of invasive plants would lead to a long-term negative impact to sensitive plants.	Reduction in amount and extent of invasive plants would lead to a long-term beneficial impact to sensitive plants (BI).	Reduction in amount and extent of invasive plants would lead to a long- term beneficial impact to sensitive plants (BI).	Reduction in amount and extent of invasive plants would lead to a long-term beneficial impact to sensitive plants (BI).

3.4 Soils

3.4.1 Introduction

This section describes the potential direct, indirect, and cumulative impacts on soil from proposed invasive plant treatments. Herbicides may accumulate in soils and harm soil biology, nutrient cycling, and the organisms necessary for decomposition and soil productivity. Soil properties influence the potential for herbicide treatments within riparian areas to reach streams.

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

Regulatory Framework and Compliance

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

3.4.2 Affected Environment

Geology

The geology of the Malheur National Forest is amongst the oldest and most complex in Oregon. Remnants of a shallow seafloor and sediments thereon were accreted onto the one-time edge of the North American tectonic plate (Brooks 1979). Under pressure and heat, these layers were metamorphosed into argillites, quartzite, and amphibolites that predominate in the center of the Malheur National Forest, Aldrich Mountain, and Bear Valley Basin. This process was concomitant with volcanism, and intrusion of oceanic crust, which are the frequent large bodies of serpentine common to the areas mentioned. A thick sequence of sediment, eroded from the one-time coast range, approximately where the Blue Mountains are today, deposited into the John Day geosyncline. These sediments are the mudstone, shale, greywacke, and volcanic rocks that overlay the seafloor sedimentary rocks, but now in turn, are often eroded away to expose the older rock.

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

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

Climate

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

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

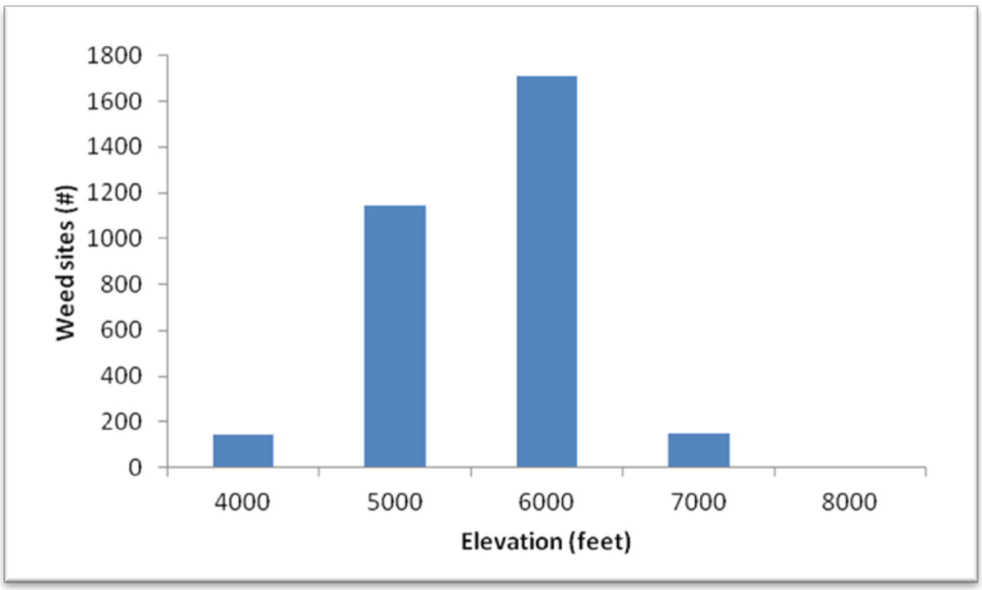

Figure 6. Target invasive plant sites by elevation

Location of Invasive Plants and Soil Conditions

The list of site types in chapter 3 (table 22) shows that most of the invasive plant sites occupy roadside settings, with natural soil conditions making up a small portion of the current invasive plant sites. Roadside areas provide more available light and less competition for moisture and nutrients, and are frequently disturbed, which favor the typical early seral stage invasive plants. Roadsides have compacted gravels formed for roadbase that may or may not have a developing litter layer where roadside vegetation grows. The soil properties for disturbed roadside environments will be moderate to poor drainage and considered to have low fertility. However, open light conditions and pooled water from roadside drainage increases water availability for grasses and forbs compared to adjacent natural soils.

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

The SSURGO mapping has an accuracy of 40 acres for the map units and thus represents a fine scale compared to prior soil surveys. This mapping covers the diverse terrain and landforms common to the rest of the Malheur National Forest. The exception would be that a higher presence of volcanic ash is found in the northern portion of the forest. Table 35 lists soil properties associated with the dominant soil types and affiliated geology derived from the northern portion of the forest.

Table 36 lists the soil properties that contrast soil capacity to hold water and provide nutrients. Soil properties for organic matter, soil depth, hydrologic conductivity, cation exchange capacity, and pH were derived from the NRCS Soil Data Viewer. Strong gradients in fertility are found between grassland and forest soils in the project area. Grassland and forb rich soils have high organic matter content along with finer textures that hold water longer into the dry season. The parent rock mineralogy affects the soil texture, degree of clay, rock content, cation exchange content, pH, and available minerals. With exception to the valley bottoms, most of the Malheur National Forest soils have high percent gravel to cobble rock fragments. The pH ranges from 6 to 7, having no indication of acidic or alkaline conditions that limit productivity.

The cation exchange capacity (CEC) serves as an indicator for fertility and adsorption of applied herbicides. The cation exchange capacity is an index of available sites for solutes/ions to attach to soil particles. A higher CEC represents increased ability to hold and release various chemical elements – a relative higher capacity for holding nutrients. The soils in the project area have CEC of 5 to 35 meq/gram of soil for mineral soil horizons (table 36). Humus, highly decomposed organic matter within the soil, has the strongest impact on overall CEC since humus itself has CEC in the range of 100 to 200 meq. The clay influenced soils have the highest CEC at 35 meq since clay minerals have high surface to volume ratios that bolster CEC. Though not listed in table 36 grasslands with deep accumulations of organic matter will have CEC in the range of 30 to 50 CEC.

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

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

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

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

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

Table 35. Most common soil types from SSURGO mapping-ordered from dry to mesic vegetation types

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

Soil Series	Area (%)	Geology	Characteristic	Vegetation	Where found
			metavolcanics		
Hondu	1.4	argillite and metavolcanics	Deep and rocky, ashy dry forest soil on argillite and metavolcanics	Grand fir, Douglas-fir, and ponderosa pine	Hillslopes
Gorham-gulch	0.5	granite rock	Ashy, forest soil on granite	Mixed conifer forest	Hillslopes

*The percent area found within invasive plant mapping.

Table 36. Soil properties of prevalent soil series

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

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

3.4.3 Environmental Consequences

Methodology

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

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

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

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

Spatial and Temporal Context for Effects Analysis

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

Effects of Alternative A – No Action

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

Effects Common to All Action Alternatives

Direct and Indirect Effects Summary

All action alternatives expand the tools for controlling invasive plants. Non-herbicide treatments would have negligible effects to soils. Soils would also not be adversely affected from the herbicide treatments due to the typical rates of application and the prevalence of sites on non-natural surfaces, such as roadsides, trailways, and at parking areas. Soil productivity would not be directly affected. Indirect effects may include a shift in the composition of plant and soil biota related to use of herbicides. However, the project design features applied to all action alternatives make this unlikely because restrictions on the rate, type, and frequency of specific herbicides (see pdf groups F and H, chapter 2, table 10) would reduce herbicide build up in the soil and effects on soil organisms or productivity.

Direct and Indirect Effects from Non-herbicide Treatments

The non-herbicide treatments would have very minor effects on soils. Some soil disturbance could occur from pulling invasive plants. Typical treatments result in less than 1 square foot loosened soil as pulling is typically used on sparse scattered infestations rather than large, densely infested areas. These disturbances do not adversely affect overall site productive capacity since they are small and distributed, and do not lead to substantial soil loss. The retained cover of target plant species curtails erosion of loosened soil. Sufficient groundcover would ensure low potential erosion on treatment sites.

On treatment sites that are part of the productive landbase, groundcover would likely average at least 40 percent (USDA 1990, p. IV-40). Groundcover would consist of non-target vegetation stems and leaves, leaf litter and residual noxious weed plant material. Ten to twenty percent native cover is considered a minimum requirement to facilitate natural recovery (Goodwin et al. 2006). Administrative areas, such as road prisms, would continue to maintain groundcover to reduce erosion. Restoration and rehabilitation using mulching, seeding, and planting would occur as needed (see chapter 2.3.2).

Direct and Indirect Effects from Herbicide Treatments

Herbicides would be sprayed directly on target species using ground-based methods (hand, spot, and broadcast) in all action alternatives; as per the pdfs, all methods, including broadcast, would be implemented in a manner that reduces potential for non-target species and bare soil to be affected. However, herbicide is likely to reach the soil surface in some places.

Herbicide application temporarily disturbs soils by altering vegetation cover and reducing the annual plant production. The duration of the impact would be less than 10 years following treatment; desired vegetation is expected to reoccupy treated sites. Treatments would not result in detrimental soil conditions or permanent reductions to soil productivity.

The primary consideration for soils is the ability to filter and degrade herbicide residue depending on surface conditions. The major pathway for herbicide degradation is metabolism by soil microbes. Half-lives for herbicides range widely depending on the growing conditions for soil microbes. Herbicide decays from toxic levels by microbial decomposition, sunlight degradation, and hydrolysis after absorption in the soil profile (Bollag and Liu 1990). Most of the recommended herbicides primarily degrade by microbes metabolizing the residue (SERA 2004b, d, e, 2007, 2011a-d). Chlorsulfuron and metsulfuron methyl also degrade strongly by hydrolysis (SERA 2004a, 2004c).

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

The GLEAMS model (see chapter 3.5 for details) was used to examine the fate of herbicides in the rooting zone of the soil and to evaluate the potential for herbicides to run off or leach through soils and reach water bodies. The modeling included a scenario for herbicide application on the most common soil type along a roadside. Figure 7 displays the results by soil depth versus magnitude of herbicide concentration. Dot size represents the level of herbicide concentration (larger dots mean more herbicide found in that soil layer). The Wonder soil series was used, having gravelly silt loam topsoil over gravelly loam subsoil and developed in andesite and basalt parent material to greater than 80 inch depth. Climate data was taken from the nearby Austin station and modeled for summer. The GLEAMS modeling shows none of the herbicides penetrating deeper than 36 inches using the highest application rates. The faint dot of aminopyralid represents small herbicide concentrations. The sharp decrease in herbicide concentration with depth illustrates the adsorption of herbicides to soil despite their high solubility. The topsoil organics and mineral matrix bind the bulk of the herbicide in the top inches as reflected in the modeling results.

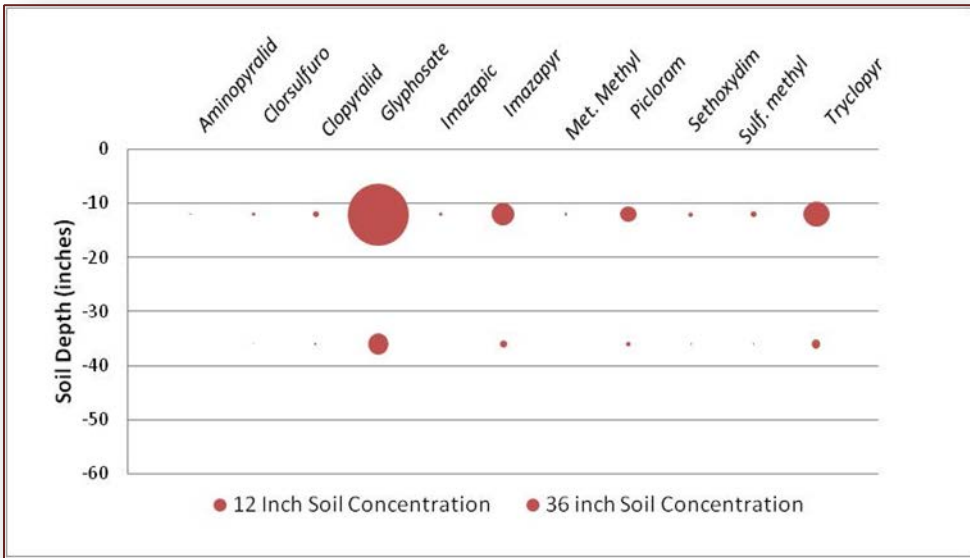

Figure 7. Concentrations (ppm) of herbicide modeled for Wonder Series soils in the Clear Creek watershed

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

Direct and Indirect Effects to Soil Organisms

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

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

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

Aminopyralid may be used in alternatives B and C. The 2007 SERA Risk Assessment does not indicate any risk to soil microbes. However, aminopyralid has a very wide-ranging half-life of 14-343 days as reported in the SERA Risk Assessment. Due to plausible persistence from slow microbial decomposition, the project has limited broadcast spray to once a year on a given site (pdf H4). Aminopyralid has no restriction from poor soils since the herbicide readily breaks down in sunlight. Aminopyralid has a half-life of 61 days when exposed to sunlight, while the half-life drops dramatically to 0.6 days when exposed to water and sunlight. Poor soils tend to have open forest conditions.

Using the SERA risk assessments, short-term impacts to soil organisms from picloram, imazapyr, metsulfuron methyl, and sulfometuron methyl could occur for high rate applications on poor soils. In laboratory assays, short-term decreases for some types of soil microbes are reported with high concentrations above the amounts expected in soils. The effect of the herbicides decreases with time as other microbes, less sensitive to herbicide, decompose the active ingredient. The project microbial decomposition of each herbicide can be compared in table 40. Persistent herbicides such as picloram have longer half-lives. Impacts to microbes would be least where soils have a high degree of productive capacity with adequate organic matter, aeration, and moisture.

For picloram, the SERA risk assessment cited a slight decrease in the N fixing bacteria Azotobactor for a two-week period at picloram concentrations of 10 ppm (see Tu 1994). In general, laboratory assays found few detectible changes in microbial activity below 50 ppm soil concentrations (SERA 2011c). Within the SERA risk assessment, GLEAMS model results show that for the clay, loam, and sandy soils the soil concentration after application would be below 10 ppm. Results for GLEAMS-Driver modeling on the Malheur National Forest sites for a typical silt loam soil would have 0.3 ppm of picloram following treatment (figure 7). The GLEAMS-Driver is a module that uses climate data specific to an area. Given picloram's persistence (half-live 80 days to 3 years), this project limits application to once every two years on a given site (pdf H4). Similarly, picloram is excluded from use on poor soils where natural plant communities are desired (pdf H3). The emphasis on natural plant community addresses uses on administrative sites and roadsides that have unique conditions that favor desired non-native species as protective groundcover.

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

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

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

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

Imazapyr has been shown to temporarily depress microbial activity for select organisms. Imazapyr soil concentrations over 20 ppm were reported to slow cellulose decomposition by microbes in the lab (SERA 2011d). For the Malheur National Forest project, predicted soil concentrations are 0.50 ppm, below the 20 ppm level that effects were found. The reported average half-life of greater than 200 days indicates imazapyr can be resistant to decomposition. As with other more persistent herbicides, the project avoids the use of imazapyr on poor soils (pdf H3) and limits the frequency of broadcast application to once every other year on a given site (pdf H4).

Triclopyr has significantly slowed growth of bacterial and fungal strains in laboratory assays where concentrations exceeded 1000 ppm (SERA 2011a). Some fungal strains had detectible changes to growth down to as little as 0.1 ppm. When testing natural soil samples, no detectible changes to microbial function or community structure was found for a rate of 1.2 lb. a.i./acre (Houston et al. 1998). The typical rate for triclopyr on the Malheur National Forest would be 1 lb./acre. Model runs using a high rate at 2 lb./acre show average soil concentrations of 0.6 ppm. At this concentration, triclopyr has very low potential for slowing fungal growth.

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

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

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

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

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

Effects from Early Detection/Rapid Response

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

None of the proposed treatment methods would create large bare areas or result in heavy disturbance to the soil surface. Thus, disturbances would not be large enough to contribute measurable levels of erosion or sediment delivery to streams. As a result, there is little potential for this project to adversely affect soils or contribute to meaningful cumulative effects when combined with past and ongoing Malheur National Forest activities.

The potential effect of repeated treatment of herbicides has been considered in the development of the pdfs. Relatively low toxicity and low application rates reduce this risk. Imazapyr, picloram and metsulfuron methyl have the longest half-lives of the eleven herbicides considered for use (SERA 2011b, 2004d and 2011c). Using these herbicides could have short-term transient effects that could slow growth of select soil microbes. Herbicides half-lives are listed in table 40 in the Hydrology section. The project limits use of these persistent herbicides to every other year on any given site to minimize soil buildup (pdf H4). Since soil conditions determine the buildup potential – a lack of soil microbes equates to lack of decomposition – the use of metsulfuron methyl and picloram would be avoided on sites with poor soil conditions (pdf H3) where restoration to native vegetation is desired. Gravel pits and parking lots would be examples of infertile areas where half-lives may be longer than on areas of productive soil; however, herbicide buildup would also not have adverse effects in these areas.

Depths of maximum concentration presented in GLEAMS results are between 8 and 12 inches (table 40). Although the application of herbicide is likely in successive years on most sites, the time between applications and the half-life of the various herbicides will minimize residue accumulations. Applying herbicides at typical and not maximum recommended rates will limit the amount of excess residue present on site each year, while the presence of soil microbes and soil temperatures conducive to degrading the herbicides will limit the amount of accumulation.

Cumulative Effects Common to All Action Alternatives

None of the alternatives would measurably affect soils or soil productivity, especially given background conditions and ground disturbance created by ongoing activities. Thus, there is no potential for effects from any alternative to contribute to additive, synergistic, or other negative long-term cumulative effects. Manual, mechanical, and cultural treatments would likely result in very small disturbances that may reduce groundcover down to 40 percent. Treatment scale would not be large enough to cause adverse cumulative effects when combined with past and ongoing Forest activities.

Treatment and monitoring of invasive populations would continue through the life of the project. Foreseeable management activities on these sites are dispersed recreation travel, prescribed burns, wildfire suppression activities, and vegetation management, including timber harvest. Although these activities could result in direct detrimental disturbance to the sites, the effects to soils from herbicide applications proposed under this project are unlikely to incrementally change soil characteristics enough to alter the productivity of any treated sites. Activities proposed under this project are not likely to be additive to the impacts of any other activities that could be cumulative to existing conditions on these sites.

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

The effects of the herbicide treatments do not harm soil organisms but do change the vegetation composition, which results in a minor level of disturbance. Ongoing management activities outlined in chapter 3.1.5 create a very large disturbance footprint compared to the effects of any action alternative. A list of forestwide projects is scheduled (2013-2015) that will be concurrent with the action alternatives (table 28). Most of the activities will involve ground disturbance.

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

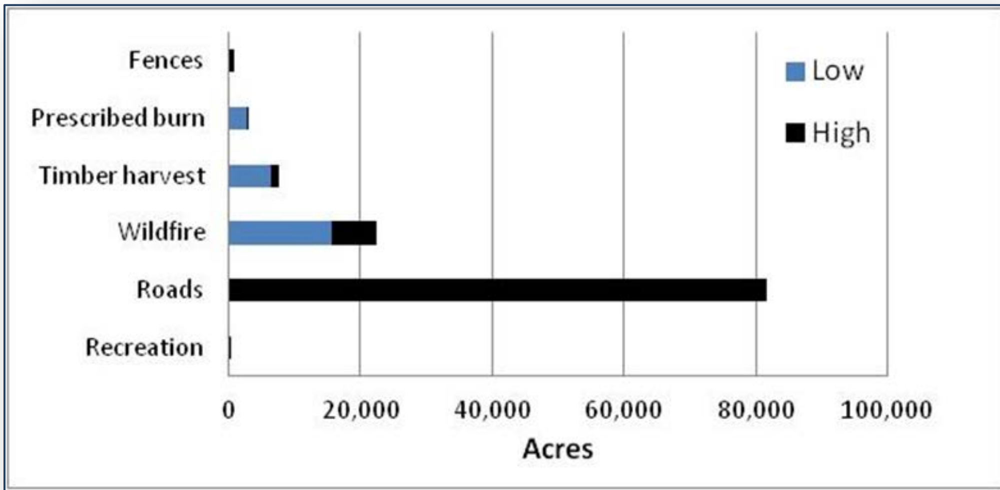

Figure 8. Disturbance from ongoing forest activities

Road related disturbance accounts for the most extensive disturbance across the forest. Most of the existing invasive plants are mapped along road templates (83 percent). The road templates are not intended as a part of the productive land base and thus minor changes to plant cover from herbicide treatment would not produce adverse effects. The planted roadsides consist primarily of grasses selected for stabilization. The grasses resist most of the first choice herbicides that select specifically for invasive forbs. However, invasive plant treatment frequency would remain high along roadsides since the engineered surface perpetually favors re-colonization by opportunistic plant species.

Continued road management activities would increase noxious weed treatment needs when ditch clearing and road blading remove or bury roadside vegetation. Current best management practices reduce this risk by promoting vegetative cover. Road maintenance best management practices reduce the bare soil along road sides by limiting the frequency (BMP Road-4, USDA 2012) and establishing plant cover after construction and re-construction activities (BMP Road 3, USDA 2012). Passive and active restoration on roadsides would help establish desired vegetation and discourage invasive plants (see Chapter 2).

The short-term reduction in vegetation growth that creates minor soil disturbance is a tradeoff. Given the large disturbance footprint and continued invasive plant presence along the roads, future additive effects from herbicide application and forest activities are reduced if treatment occurs along prominent vectors. The proposed methods reduce populations of invasive plants at rock pits and stockpiled road materials.

As per R6 2005 ROD standards, using invasive plant-free road materials (i.e., rock and gravel) also reduces the potential spread onto adjoining road prisms and within planned harvest units. Administrative sites, campgrounds, roads (areas that have unnatural surfaces and perpetual propagule pressure from traffic flow) have the highest risk of invasive plant spread. Many MNF activities (e.g., range, timber, and recreation management) depend on road access, thus the extent of the road system is an indicator of where ground disturbance is most likely.

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

Livestock grazing requires road access and creates heavy disturbance along fence lines, and around stock ponds and troughs. This disturbance has a small footprint; cattle trails typically have 2- to 4-foot width and stock troughs may have 0.25 acres of compacted, barren ground. These features are evenly distributed across thousands of acres, as opposed to confined disturbance that results from timber harvest or wildfire. The distributed nature and seasonal disturbance creates a moderate risk for cumulative effects from livestock grazing.

Multiple herbicide applications over a series of years in this project would not pose a risk to soil microbes or soil productivity. Soil microbes are the primary means of decomposing herbicide residue. The suppression of sensitive suites of soil microbes is avoided by allowing sufficient time between applications, given the half-life of the various herbicides. Pdfs included to apply herbicides at the lowest application rate for effective control would limit the amount of excess residue present on site each year. Pdf H4 lengthens the re-entry period to two years before herbicides with longer half-lives – imazapyr, metsulfuron methyl, and picloram – may be reapplied on a site. As a result, residues remaining in the soil when subsequent applications occur are expected to be minimal. Also, the treatment effectiveness of each application would reduce the extent of re-treatment needed and would limit that amount of herbicide build up that could occur (See chapter 3.1.5).

Herbicide use adjacent to the MNF could drift onto the Forest, but the amount would be far below a level of concern for soils assuming adherence to labels.

Differences between Alternatives

The differences between alternatives would not substantially change their impact on soils because manual and herbicide treatments of invasive plants are unlikely to affect soil properties or productivity. Properties of soils in the Malheur National Forest limit off-site movement of herbicides through the soil profile. Alternative B utilizes the most aminopyralid and allows the most broadcasting of the alternatives. Alternative C reduces the amount of herbicide used, and excludes use on sites that fall within 100 feet of streams, lakes, ponds, and wetlands. This alternative also excludes use of picloram. Thus, the risk for herbicide buildup is reduced in this alternative because less herbicide would be applied and because picloram is eliminated. Alternative D would use 440 more acres of chlorsulfuron, 725 more acres of glyphosate, and 63 more acres of picloram as first-choice herbicides (table 17). However, the pdfs, herbicide-use buffers, and project caps ensure there would be no measurable adverse effects to soil from these differences.

3.5 Water Resources

3.5.1 Introduction

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

Results of modeling for water and soil concentration are reported in milligrams per liter (mg/l), which is the same as parts per million (ppm). Sedimentation from manual methods will be analyzed by determining probable affected acres within the scope of major watershed area.

This section has been updated since release of the DEIS. Some sections have been edited for clarity. The GLEAMS modeling was refined to provide for more accurate estimates, and includes a ‘worst case” scenario assuming maximum treatment within 100 feet of a stream occurred in a contiguous 10-acre area without any buffers. None of the current infestations near streams are this large, and all action alternatives include limitations on herbicide use that were not included in the worst-case model. However, this example provides an estimate of the effects of the maximum treatment allowed should invasive plants spread within riparian zones. In addition, the GLEAMS model runs using size and location data from actual treatment sites was updated to improve the statistical validity of the runs by including additional years of historic weather data. This resulted in a small increase in the estimate of amount of herbicide reaching the stream.

The results of the updated modeling indicate that some herbicide may reach streams assuming maximum application scenarios, especially in the event of a storm soon after application. However, the amounts of herbicide predicted to reach streams is less than the amount that would affect beneficial uses of the stream or drinking water.

Regulatory Framework and Compliance

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

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

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

3.5.2 Affected Environment

Climate

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

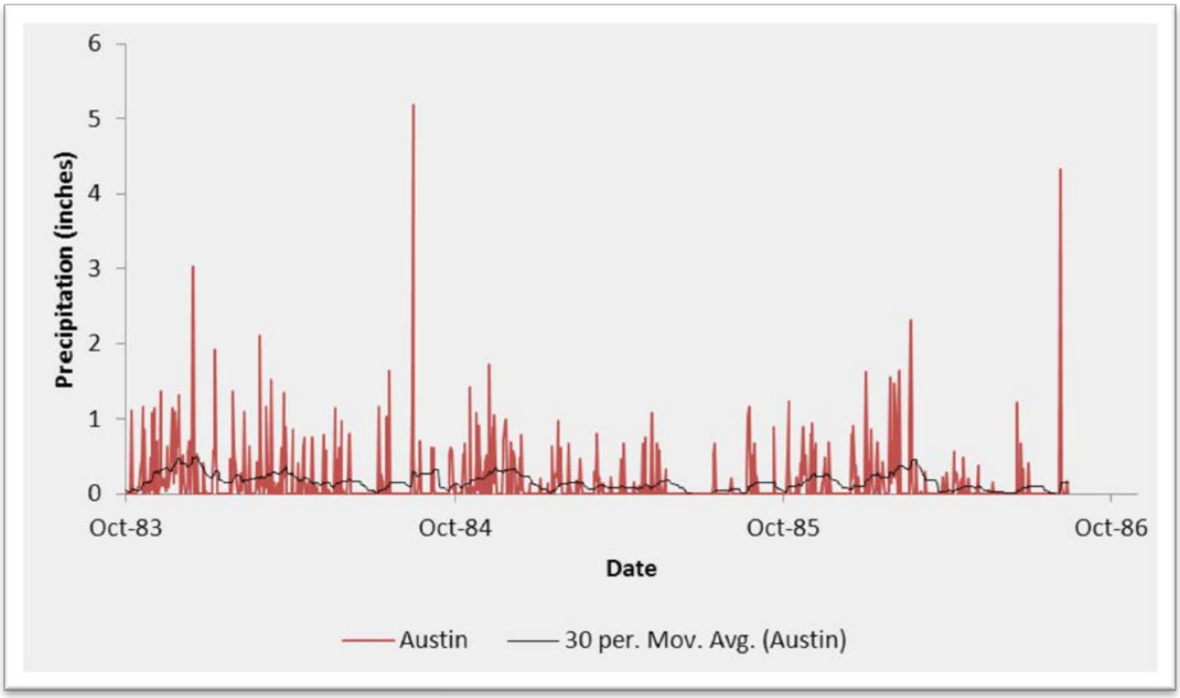

Figure 9. Precipitation pattern at Austin weather station

Stream Flow

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

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

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

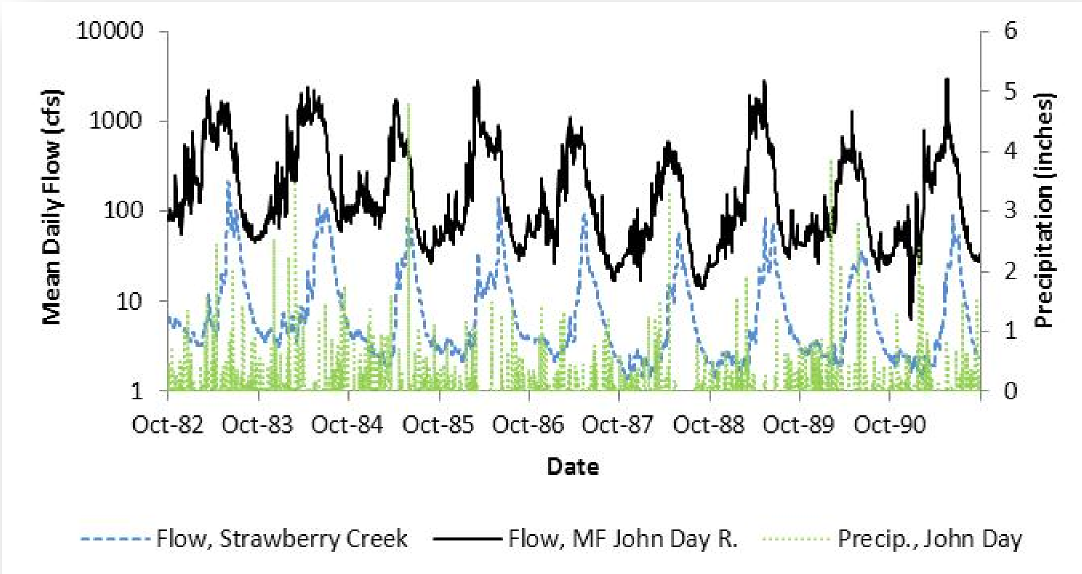

Figure 10. Stream flow at selected gages and precipitation at John Day

Water Quality

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

Use of water quality and other resource protection BMPs (USDA Forest Service 2012) in National Forests is required by the National Forest Management Act (NFMA). Pertinent practices to this project assure proper mixing, application, and clean-up as well as evaluation and monitoring of application that guards against use on unintended targets. Project design features, particularly parts F, G, and H (table 10) incorporate BMPs on the handling of chemicals (Section 5, (8-13).

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

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

Category 4A streams within the Malheur National Forest boundary are the John Day River System, including the Middle Fork and South Fork and their tributaries with approved TMDL for temperature. Issues are water temperature for life stages of red band and cutthroat trout. Category 5A streams are within the Silvies River system and include Hay, Myrtle, and Skull Creeks for water temperature; and within Silver Creek system: Nicoll, Claw, Sawmill, Salt Canyon, and Mainstem Silver for water temperature.

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

Table 37. Beneficial uses of major streams on the Malheur National Forest

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

Table 38. Drinking water sources

Site Name	Source	NFS acres in watershed	Comments
Municipal : Streams with Surface Water Intake			
Canyon City	Byram Gulch	610	Flows directly from Strawberry Mountain Wilderness
Prairie City	Dixie Creek	9,300	0.44 acres of infestation, none within 100 feet of stream
Long Creek[23]	Tributary of Long Creek	224	0.1 acres of infestation
Springs with Formal Agreement			
Canyon Creek Meadow	EF Canyon Creek	4,200	0.2 acres of infestation, none within 200 feet of stream
Dixie Campground	Trib. Of Bridge Creek	470	0.23 acres of infestation, but none upstream of campground
Idlewild Campground	Devine Canyon	350	About 0.1 acre of infestation within campground, and 1.0 acre along roads on watershed slopes
Magone Lake Campground	Lake Creek	150	0.36 acre of infestation along shore of the lake downstream of campground and none within 100 feet of stream.
Parish Cabin Campground	Bear Creek	14,000	1.5 acre of infestation along roads within watershed. 0.1 acre within 100 feet of stream about 5 miles above campground
Strawberry Campground	Strawberry Creek	2,300	No infestation in watershed.
Trout Farm Campground	Trib. of John Day R.	300	No infestation within watershed
Wells with Formal Agreement			
Big Creek Campground	Big Creek	16,400	7.2 acres of infestation along roads within watershed, about 2 acres within 100 feet of stream

[23] Long Creek was inadvertently left out of the table in the DEIS.

Site Name	Source	NFS acres in watershed	Comments
John Day	John Day River	100,000	Unknown
Mount Vernon	John Day River	200,000	
Seneca	Silvies River	123,700	
Yellowjacket Campground	Yellowjacket Creek	3,700	About 7.7 acres of infestation within watershed, and about 4.7 acres within campground area. About 2.5 acres within 100 feet of stream or reservoir.
Austin House Restaurant	Bridge Creek	11,000	About 12.5 acres of infestation, most along Highway 26

Invasive Plants Near Roads and Streams

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

About 1,491 acres of invasive plant sites are within about 100 feet (33 meters) of roads within the project area (see site type #2, chapter 3.1.3) when the portion of infested sites that meet the criteria (not the entire site) are considered. This amounts to about 70 percent of total infested acreage.

There is a strong association between forest roads and perennial stream channels. About 2,138 miles of the Malheur National Forest System roads are within about 300 feet (100 meters) of stream courses (34 percent of the total stream mileage). Roads are prone to surface runoff from precipitation events; road drainage when in close proximity may discharge directly into streams. The close association of invasive plants to roads and roads to perennial streams are important considerations in analysis of herbicide transport beyond its point of application.

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

3.5.3 Environmental Consequences

Methodology

Analysis for herbicide effects used published assessments (SERA, 2001, 2004a-d, 2005, 2007, and 2011a-d), which provided parameters of degradation in various mediums, adsorption in soil, and solubility in water. These parameters were used in the GLEAMS model (in the risk assessments) and GLEAMS-Driver utility (for site-specific analyses) to assess potential risk of off-site movement of herbicides, potential effects to water quality, and effectiveness of stream buffers. Assumptions are that herbicide application rates would be no more than the maximum rate (table 21). We conducted runs on four sites on the Malheur National Forest, using local soil, precipitation, slope, vegetative cover, and streamflow. The start date of the model runs was June 15 of any given year. Applications were modeled once a year on that date.

Spatial and Temporal Context for Effects Analysis

The project is expected to last at least 5 to 15 years. Repeated treatments, manual, mechanical, or chemical may be necessary in sequential years or the same year on the same ground. A soil disturbance or persistence of various chemical herbicides may affect soils for a period after treatment.

General Effects of Herbicide Treatment

During the droughty summers typical for the project area, the soil water content is brought down to very low levels through evaporation and osmatic pressure. Whatever water had percolated into the soil column beyond the rooting depth will tend to stay in place in the drier months because of lack of hydraulic head. In the fall, initial dry soil conditions create a sporadic and weak stream flow response. Most infiltrating rainwater is simply absorbed by the soil, filling empty pores and binding to soil particles. Even with a high volume of rainfall, stream response may be slight until soil pores fill with water and hydraulic head builds.

Herbicides that are highly water soluble or strongly adsorbed to soil particles have the potential to move off-site following application. Once into solution, herbicides may transport through the soil with groundwater flow, potentially reaching natural surface water bodies. However, as groundwater is dispersed through a soil there is also increasing chance that chemicals will adsorb to the soil.

Runoff risk is particularly high for saturated soils during snowmelt, because of low infiltration capacity. Spraying in spring when soil moisture is high and groundwater flow active may pose greater risk to transport of chemicals than in early fall when soil moisture content is very low, even under the same conditions of precipitation. Chemicals move into the soil with infiltrating precipitation; the depth of infiltration affects the ability for soil to assist in herbicide decomposition. Herbicides infiltrating into soil with high water content and active groundwater flow may quickly percolate beyond the range of most soil biota that would degrade the chemical, increasing the half-live in the soil or ground water.

To limit risk of off-site movement of herbicides, pdfs H5 and H6 limit herbicide spraying in conditions of high water table or saturated soils, and H11 provides parameters on allowable weather conditions for spraying. Roadside treatments pose the greatest risk to water contamination from herbicide spraying because roadsides are more compacted and promote more runoff, and roadside ditches may have direct connection to a stream channel. In these circumstances, ditches may effectively circumvent streamside buffers.

Table 40 gives physical and chemical characteristics of the 11 herbicides proposed for use. These characteristics are important in the following discussion of alternatives and analysis based on the GLEAMS model.

Table 39. Herbicide physical and chemical properties

Herbicide	Toxicity to Aquatic Organisms	Adsorption	Water Solubility (ppm)	Degradation Half-Life in days unless otherwise noted		
				Soil Microbes	Water and Sunlight	Ground-water
Aminopyralid	low	low	205,000	14-343	0.6	127-447
Clopyralid	low	low	1,000	12-70	8-40	261
Chlorsulfuron	low	low	27,900	120-180	?	37-168
Glyphosate	moderate	strong	12,000	3-130	4-11	50-70
Imazapic	No info	moderate	>2670	25-142	1-2	30
Imazapyr	low	low	11-13,500	210-2154[1]	500 stable in anaerobic conditions	N/A
Metsulfuron methyl	low	low	≈3,000-10,000 pH neutral	30-126	7-8	35 +

Herbicide	Toxicity to Aquatic Organisms	Adsorption	Water Solubility (ppm)	Degradation Half-Life in days unless otherwise noted		
				Soil Microbes	**Water and Sunlight**	**Ground-water**
Picloram	low	low	200-400,000	18-300 in aerobic conditions; stable in anaerobic	2.6	14 aerobic; stable in anaerobic conditions
Sethoxydim	low	low	4700 @pH7	1-60 the high end of range is anaerobic conditions	5-43	155+@ pH7
Sulfometuron methyl	low	low	300 @ pH7	10-100	20-60	44-113
Triclopyr TEA	Inhibits fungal and bacterial growth	low	8,100	14-46	2-6 **hours**	6 **hours**
Triclopyr (BEE)	high	strong	2-23	0.2-40	0.5-8.7 Depending on pH	≈6

1 Imazapyr half-life is very long in anaerobic conditions that are rare to non-existent on treatment sites on the MNF. These conditions may occur in wetlands and wet meadows.

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

Once in soil, herbicide not directly absorbed into plant roots is typically metabolized by microbes (Bollag and Liu 1990) with the exception of triclopyr, which is degraded by hydrolysis or aqueous photolysis. Hydrolysis is the process by which the water molecule breaks down a compound into at least two separate constituents. Aqueous photolysis means the aminopyralid breaks down in water in the presence of sunlight.

Half-life of herbicides in soil is affected by its rate of adsorption to soil particles or organic matter incorporated into the soil. The stronger the adsorption the more likely chemicals will be retained in top soil layers for microbial degradation. Organic matter in particular has an affinity for adsorption.

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

Surface Runoff

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

Invasive plant treatments are unlikely to remove all vegetation from a site. In some cases, dead invasive plants would provide an organic cover on the soil. Project design feature H3 (table 10) avoids spray treatment on extensive bare areas or obviously poor surface conditions. In the event of surface runoff from a treated area, winnowing of sediment laden sheet flow can be as much as 90 percent effective by a vegetative buffer of 100 feet in width, even on steep slopes (Castelle et al. 1994, Castelle and Johnson 2000, Fischer and Fischinich 2004)

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

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

Soil Water (Interstitial) Transport

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

Direct foliar application lowers offsite effects for leaching. If rainfall were to occur during application or within the first day after, the risk for leaching exists for all the herbicides. Project design feature H11 (table 10) lowers leaching risk by avoiding treatment within 24 hours of forecasted rainfall.

Runoff risk is particularly high for saturated soils during snowmelt, because of low infiltration capacity. Herbicide application of highly soluble chemicals is avoided during snowmelt when soils are likely to be saturated (table 10 pdf H5, H6).

General Effects of Non-Herbicide Treatment

Non-herbicide treatments include manual, mechanical, cultural, and biological. Manual treatment has the highest likelihood of impact to water resources. Manual methods are hand-pulling or using hand tools. Ground disturbance would occur from drawing up a plant by its roots, or digging sufficiently to leverage roots out. Other treatments, such as cutting, clipping, mowing, and mulching, do not disturb the ground. There is a short-term risk of erosion from disturbed ground, particularly in a highly infested area, if a contiguous patch of ground is disturbed sufficiently to initiate surface erosion, such as a road cut bank or fill slope. Post-treatment restoration (passive and active planting, seeding, and mulching) would be part of all treatment prescriptions and would help treatment sites recover from ground disturbance.

The Water Erosion Prediction Program (WEPP) (Elliot 2004) was used to assess, quantitatively the impact of manual removal of invasive plants on sediment delivery. This model has a disturbed forest slope, and a forest road application, so that sediment produced from manual treatment and a typical forest road may be compared for amount of sediment produced on a unit area basis of an acre.

The WEPP model was used to estimate the amount of sediment that might be produced from manual treatment near streams where about 40 percent of the natural cover is retained. Assuming that the area is otherwise not compacted or rutted, about 2 pounds of sediment per acre per year was estimated to be produced. If the maximum acreage (treatment cap) within a 6^{th} field watershed within 100 feet of a stream were manually treated (50 acres), about 100 pounds of sediment (0.05 tons) would be produced. This amount would not be detectable or measurable, and would not have significant effects on water resources or beneficial uses of water.

Effects of Alternatives

Alternative A – No Action

There would be no direct, indirect, or cumulative effects on water resources from the no-action alternative. Invasive plants are not expected to impact hydrology or water quality given the scattered types of infestations found within the project area. However, over time, invasive plants could out-compete desirable vegetation that helps maintain functional riparian areas and stream conditions (see Chapter 3.6 for more discussion about how invasive plants affect riparian management goals and objectives).

Alternative B – Proposed Action – Direct and Indirect Effects

The proposed action would allow spraying of herbicides on up to 2,124 acres per year over the life of the project. Some non-herbicide treatments would occur in combination with herbicide treatments, but the first year/first choice treatment would be aminopyralid, chlorsulfuron, and metsulfuron, with non-herbicide follow up as needed.

Non-Herbicide Treatments

Non-herbicide treatments for alternative B are unlikely to result in substantial impacts to beneficial uses of water. Use of herbicides in combination with manual treatments would minimize the potential for sediment delivery from the manual treatments.

The most ground disturbing activity that might occur is manual treatment within 100 feet of a stream. An analysis was done to compare the amount of sediment that might be produced assuming that the maximum acreage was manually treated (the treatment that might produce the most sediment) to the amount of sediment annually produced by forest roads. The following parameters were used for inputs into WEPP for the forest road application: 0.5 percent grade, 14 feet wide, insloped but not ditched with medium traffic.

Idaho Creek-Summit Creek HUC6 was used because it currently has the largest concentration of mapped invasive plants at that watershed level within 100 feet of a stream; a total of 51.29 acres. Also within the Idaho Creek-Summit Creek watershed is 10.9 miles of forest roads within 100 feet of a stream, or approximately 18.5 acres of running surface, which equals 37 tons of sediment per year versus 0.05 ton from manual treatment. The road surfaces are contributing sediment every year though rates will vary widely according to slope and drainage. The cap of 50 acres of treatment per year within 100 feet of a stream in a 6^{th} field watershed would ensure that sediment delivery to streams would be minimal.

Herbicide Treatments

The Groundwater Loading Effect of Agricultural Management Systems (GLEAMS) model (Website: http://www.tifton.uga.edu/sewrl/Gleams/gleams_y2k_update.htm), was used to examine the fate of herbicides in the rooting zone of the soil. It may be modified for site-specific parameters of climate, soils, topography, vegetation cover and size, flow rate of natural water bodies, and application rate of herbicides. All runs shown in table 41 and table 42 below used Austin 3S weather station near Austin Oregon. The GLEAMS model incorporates climate data from local stations, in this case the station at Austin was chosen because it was close to the main area of infested sites on the Forest: the upper Middle Fork John Day River. The Cligen program developed by the National Soil Erosion Research Lab uses real weather data to generate simulated yearly data (Website: http://www.ars.usda.gov/Research/docs.htm?docid=18094), and is uploaded by the GLEAMS program.

Results of GLEAMS runs are shown for four selected sites (figure 11). The size, shape, configuration and field conditions differ between the four sites. Results of GLEAMS runs are shown in table 41 and table 42 on selected sites. The location of the selected sites is displayed in figure 11. We modeled the results of using any of the 11 herbicides at these sites, however, only the first-choice herbicide and other effective herbicides described in table 8 would likely be used, unless a new target species were to occupy these sites and need treatment under our EDRR proposal. In all model runs, the maximum application rate was used to calculate concentrations in the soil and in a non-treated area below the treatment site. The GLEAMS model does not explicitly incorporate the effects of treatment distance from a stream; however, the amount of herbicide predicted to be delivered to a non-treated area below a treated area can be used to predict the amount of herbicide that could eventually reach the stream. One application of chemicals was assumed per year. For reported concentrations, 0.001 mg/l is approximately 1 ppb (part per billion) and 1mg/l is approximately 1 ppm (part per million).

Table 41 describes Site #1 (Ennis Creek). This site was modeled assuming a worst-case scenario for alternative B. The modeled run assumed 10 acres are treated to the edge of this 2 cfs stream. The infested area is approximately 3 acres; however, the acreage was increased in order to model the maximum amount of herbicide that might reach the stream given the EDRR cap of 10 riparian treatment acres within a 6th field watershed. The model run assumed that 100 percent of the 10 acres are treated using the maximum allowable herbicide use rate. Triclopyr TEA is the formulation used in the model because triclopyr BEE would only be used in upland sites far from water. Herbicide use buffers were not explicitly modeled for these runs.

Table 40. Results for GLEAMS model run site 1, alternative B

Dominant soil series/map location	Soil series/ Texture	General Surface Condition	Herbicide	App'l Rate (lbs/acre a.i.)	Conc. At 12" (Mg/l)	Conc. At 36" (Mg/l)	Water Peak Conc.' (Mg/l)
Invasive: sulphur cinquefoil First choice: metsulfuron methyl Location: T12S R31E S18, Road: maintenance Level 2 Road # 3940 HUC6: Beech Stream name: Ennis Creek Model Run	Humarel soil series Very gravelly clay loam, very cobbly clay, moderately deep, 31 inches	Native surface road in conifer forest with fair grass cover, high runoff potential, poor surface condition Treatment area: 2800 feet long, 50 feet wide centered on road, 0-100 feet from stream. Hill slope gradient 20%	Aminopyralid	0.11	0.0192	0.0	0.0000
			Chlorsulfuron	0.13	0.0432	0.0	0.0007
			Clopyralid	0.5	0.0983	0.0	0.0001
			Glyphosate	3.5	0.6283	0.0	0.0000
			Imazapic	0.19	0.0566	0.0	0.0014
			Imazapyr	0.70	0.1644	0.0	0.0019
			Metsulfuron Methyl	0.075	0.0240	0.0	0.0030
			Picloram	1.00	0.2911	0.0	0.0040
			Sethoxydim	0.47	0.0891	0.0	0.0009
			Sulfometuron methyl	0.38	0.0712	0.0	0.0002

Dominant soil series/map location	Soil series/ Texture	General Surface Condition	Herbicide	App'l Rate (lbs/acre a.i.)	Conc. At 12" (Mg/l)	Conc. At 36" (Mg/l)	Water Peak Conc.' (Mg/l)
design flow 2cfs			Triclopyr TEA	6.00	1.3363	0.0	0.0045

All values in mg/l (ppm)

The site-specific location and current size of the treatment site was modeled for sites 2 through 4 (table 42). In Site 2, the road crosses the stream so there is the possibility of runoff from the road surface and the treated area adjacent to the road surface entering directly into the stream. Road cuts may intercept groundwater flow, which are classified as seeps. Forest soils besides roads may also be areas of seasonably high water tables. .

Table 41. Results for GLEAMS model runs sites 2-4, alternative B

Dominant soil series/map location	Soil series/ Texture	General Surface Condition	Herbicide Suite	Conc. In Soil (12")	Conc. In Soil (36")	Peak Conc. In Water**
Site# 2 Invasive: Canada thistle First Choice: Aminopyralid Location: T10S R34E S35 Road: Maintenance Level 2 Road #7106 HUC6: Camp Creek Stream name: unnamed Model Run design flow 2cfs	Five Beaver soil series gravelly silt loam/extremely cobbly silt loam, shallow depth, 14 inches	Native surface road in conifer forest with fair grass cover, high runoff potential, poor surface condition Treatment area 1800 feet long 50 feet wide centered on road, 350 to 700 feet from stream. Hill slope gradient 27%	aminopyralid	0.0334	0.0000	0.0002
			chlorsulfuron	0.0311	0.0000	0.0001
			clopyralid	0.1055	0.0000	0.0002
			glyphosate	0.6486	0.0000	0.0001
			imazapic	0.0582	0.0000	0.0003
			imazapyr	0.0227	0.0000	0.0001
			metsulfuron methyl	0.0248	0.0000	0.0001
			picloram	0.3030	0.0000	0.0012
			sethoxydim	0.0919	0.0000	0.0002
			sulfometuron methyl	0.0807	0.0000	0.0003
			triclopyr TEA	1.3705	0.0000	0.0009
Site#3 Invasive: St. Johnswort First choice: aminopyralid Location: T10S R34E S32, HUC6: Camp Creek Stream name: Granite Boulder	Melloe soil series Loam/very cobbly sandy clay loam, very deep, 79 inches	Conifer forest, excellent grass, moderate runoff potential Treatment area: 350 feet X 500 feet along Granite Boulder Creek and below Road 4611 Hill slope	aminopyralid	0.0268	0.0115	0.0000
			chlorsulfuron	0.0302	0.0101	0.0000
			clopyralid	0.1000	0.0348	0.0000
			glyphosate	0.6282	0.2094	0.0000
			imazapic	0.0570	0.0190	0.0001

Dominant soil series/map location	Soil series/ Texture	General Surface Condition	Herbicide Suite	Conc. In Soil (12”)	Conc. In Soil (36”)	Peak Conc. In Water**
Creek, bull trout spawning/rearing Model Run design flow 10cfs		3%	imazapyr	0.2086	0.0697	0.0002
			metsulfuron methyl	0.2190	0.0076	0.0000
			picloram	0.2809	0.0992	0.0002
			sethoxydim	0.0892	0.0297	0.0000
			sulfometuron methyl	0.0785	0.0262	0.0001
			triclopyr TEA	1.3358	0.4453	0.0001
Site#4 Invasive: houndstongue First choice: chlorsulfuron Location: T11S R35E S34, Road: maintenance Level 2 Road # 2255 HUC6: Clear Creek Stream name: Clear Creek/bull trout spawning—rearing Model Run design flow 2cfs	Wonder soil series, Gravelly silt loam/gravelly loam, very deep, 79 inches	Native surface road in conifer forest with fair grass cover, high runoff potential, poor surface condition Treatment area 1,180 feet long and 50 feet wide centered on road, 180 to 250 feet from stream	aminopyralid	0.0216	0.0103	0.0003
			chlorsulfuron	0.0310	0.0104	0.0001
			clopyralid	0.0540	0.0356	0.0001
			glyphosate	0.6484	0.2161	0.0000
			imazapic	0.0577	0.0192	0.0003
			imazapyr	0.2117	0.0706	0.0008
			metsulfuron methyl	0.0246	0.0082	0.0001
			picloram	0.2895	0.0976	0.0001
			sethoxydim	0.0982	0.0306	0.0002
			sulfometuron methyl	0.1126	0.0269	0.0002
			triclopyr* TEA	1.3707	0.4659	0.0010

All values in mg/l (ppm)

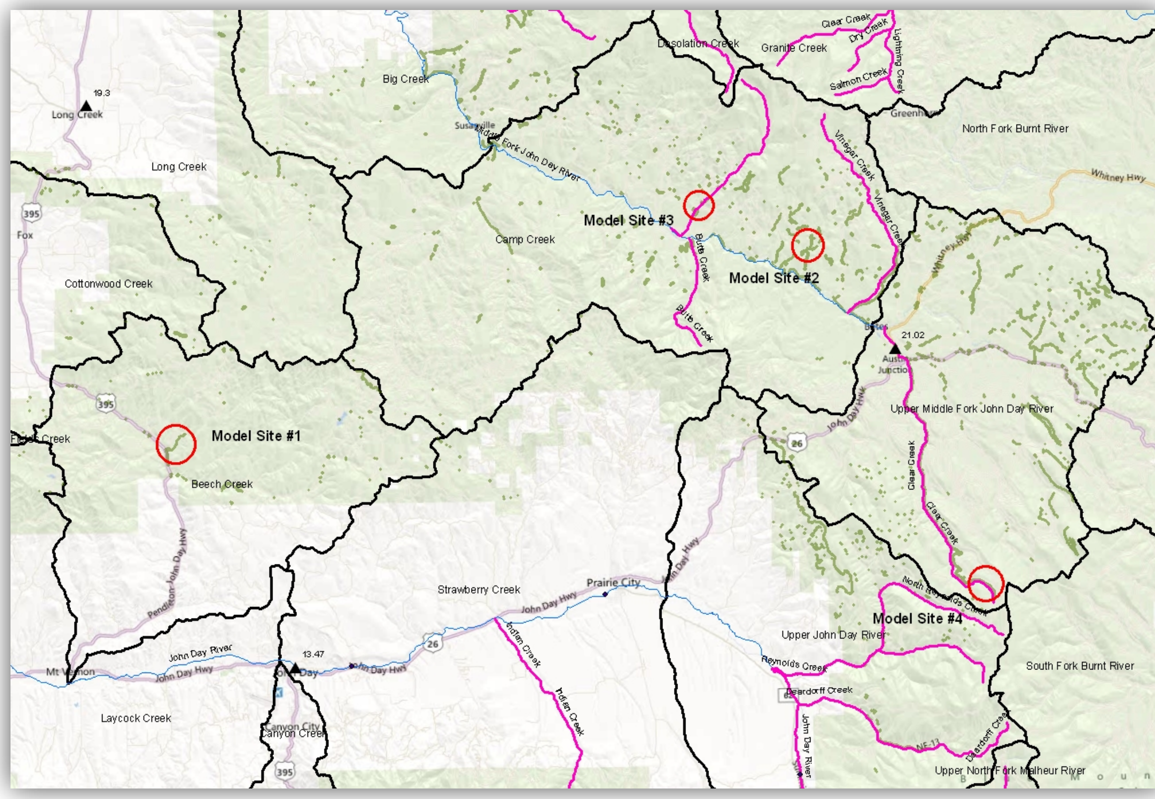

Figure 11. Location in Middle Fork John Day River of GLEAMS model sites

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

Results indicate that herbicide concentrations in the water are at least 3 orders of magnitude less than levels of concern for fish, amphibians and aquatic invertebrates. However, the threshold of concern for aquatic plants was exceeded for the sulfonylurea herbicides (chlorsulfuron, metsulfuron methyl and sulfometuron methyl). These exceedances are unlikely to affect the aquatic environment because (1) the threshold of concern is at least 10 times less than the amount that killed an aquatic plant, (2) the project design features, herbicide use buffers and project caps reduce the potential for the modeled concentration to actually reach a water body, and (3) the potential impacts would occur in a single stream reach within a 6th field watershed. The herbicide use buffers, limitations on broadcast and spot treatments within 100 feet of streams, and caps on treatments within 6th field watersheds reduce the potential for aquatic plants to be killed. Beneficial uses of water would not be adversely affected at any meaningful scale.

None of the predicted peak concentrations in water exceeds drinking water standards as defined by the State of Oregon (2004). Ninety-one different contaminants currently have concentration standards including glyphosate (0.7mg/l limit) and picloram (0.5 mg/l). In both cases, predicted water concentrations are 3 to 4 orders of magnitude lower than for the chemicals with stated thresholds. The EPA has established advisory benchmarks for drinking water for the other nine herbicides proposed for use in this project (EPA 2013). The benchmarks are the same as the acute threshold of concern used in the SERA Risk Assessments. Use of these herbicides would not exceed these thresholds (e.g., Hazard Quotients are less than 1).

Effectiveness of Buffers

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

Berg (2004) in a comprehensive review of Best Management Practices associated with herbicide spraying in region 5 and elsewhere in the United States found similar results. Detectable levels of herbicides, such as glyphosate, triclopyr, and clopyralid, were found in various locations (Washington, Oregon, New York, and Florida) mainly as a result of drift from boom broadcast spray or aerial application. An Oregon Department of Transportation study sampled runoff from road shoulders after treatment of Glyphosate, with no buffers on a stream. Under simulated rainfall of high intensity, they found 100s of ppb could be transported off site. In a similar test, under natural rainfall 0.1-1 ppb was detected leaving the road prism. The results of these studies show that the GLEAMS results for this project are reasonable, and that the greatest risk is from roads with direct hydrologic connection to stream channels.

Drinking Water Sources

Sources for public drinking water located in watersheds entirely or partially on the forest are listed in the affected environment section. The GLEAMS runs demonstrate that surface and ground sources (streams, springs, and wells) would not be contaminated and concentrations of chemicals in water would be well below thresholds of concern for human consumption.

Direct and Indirect Effects of Alternative C

Alternative C would have no herbicide use within 100 feet of a stream channel. Providing for increased buffer would reduce the amount of herbicide that could reach a stream. The Ennis Site (#1) was run in GLEAMS assuming maximum application rates for 10 acres approximately 100 feet above the stream. Picloram was not run because it would not be used in this alternative. Aminopyralid and glyphosate were not run because the result from an application directly adjacent to the stream resulted in zero concentration in water.

Table 42. Results for GLEAMS model run site 1, alternative C

Herbicide	App'l Rate (lbs/acre a.i.)	Water Peak Conc. (Mg/l)	Change from Alternative B Water Peak Conc.
Chlorsulfuron	0.13	0.0000	-0.0007
Clopyralid	0.50	0.0000	-0.0001
Imazapic	0.19	0.0001	-0.0013
Imazapyr	0.70	0.0004	-0.0015
Metsulfuron methyl	0.075	0.0000	-0.0030
Sethoxydim	0.47	0.0001	-0.0039
Sulfometuron methyl	0.38	0.0000	-0.0009
Triclopyr TEA	6.00	0.0000	-0.0002

All values in mg/l (ppm)

The result of this run demonstrates that the 100-foot buffer would reduce the amount of herbicide reaching the stream assuming maximum application rates. A 100-foot buffer would effectively eliminate chlorsulfuron, clopyralid, metsulfuron methyl, sulfometuron methyl, and triclopyr from reaching Ennis Creek. Small amounts (less than 1 ppb) of imazapic, imazapyr, and sethoxydim could reach the stream; however, all results are under a threshold of concern for aquatic organisms and other beneficial uses. The herbicide rate and method restrictions and treatment caps would further reduce the potential for water contamination.

Alternative C would increase the reliance on non-herbicide methods within 100 feet of streams and other water bodies. There is the potential for increases in sediment delivery to streams , however this level of activity is well below current delivery rates and likely not at measurable levels in streams which contain aquatic resources.

Direct and Indirect Effects of Alternative D

Effects of alternative D would be similar to alternative B, except an LRMP amendment would not be completed and aminopyralid would not be approved for use on the Malheur National Forest. Aminopyralid would not be used to treat known sites or new detections. Compared to alternative B, more picloram, clopyralid, and glyphosate would likely be used in lieu of aminopyralid. Herbicide treatment could be up to 2,124 acres per year under this alternative.

Glyphosate has high water solubility, but also has very strong adsorption qualities, and in the GLEAMS model runs never penetrated beyond 8 inches into the soil. It also has a moderately higher toxicity to aquatic organisms than the other chemicals being considered here; however, never in the model runs because of adsorption rate did it register detectable limits of concentration in water. Model runs assume high maximum application rates of 7 pounds per acre. This is greater than the typical rate of 1 pound per acre (typical FS rate in 2011 risk assessment). It is not expected that wider use of glyphosate due to selection of this alternative would lead to water concentrations higher than the model results.

Picloram has very high water solubility, low adsorption rate to soil, and is very stable under anaerobic conditions, so the chemical has a high ability to transport with groundwater. Otherwise, it has average or even low persistence in research studies. Still, its toxicity to fish and invertebrates is relatively high, and because of it transportability and persistence in sediments (where anaerobic conditions might prevail), it poses one of the greatest environmental risks of the entire suite of chemicals being proposed.

Clopyralid has moderately low solubility and soil absorption rate. Toxicity to aquatic organisms is also low with LC50 concentrations many orders of magnitude above modeled runs. Clopyralid, however, has high resistance to degradation, particularly in absence of sunlight. Nonetheless, it is not expected that increased use of clopyralid will pose greater risk than model results imply.

Cumulative Effects for All Action Alternatives

Water Temperature

No measurable increases in water temperature are expected to occur as a result of the invasive plant treatments proposed. While the high water temperature may be attributed to loss of shade from past activities, such as building roads, logging, and grazing, this project does not have the potential to result in a loss of shade. The type of plants that would be removed from streamside areas and the treatment caps would minimize potential for water temperature increases. All foreseeable future projects would be planned to retain shade and would not combine with this project to increase water temperature.

Water Chemistry

No measurable increases in pH or chlorophyll a or decrease in dissolved oxygen (DO) are expected to occur as a result of the invasive plant treatments proposed. There would not be cumulative effects to pH, DO, or chlorophyll a.

Herbicides in Water

Most of the National Forest System lands being analyzed for this FEIS are in headwater areas (upstream of other sources of herbicides). Some agricultural use, and therefore probably herbicide use, may occur upstream of National Forest System lands. The potential for accumulation downstream would be based on the potential for herbicide from agricultural use to reach the water in a measurable amount to where the

Forest Service proposes treatment, and then for there to be a measurable amount from Forest Service treatments, so the two sources could combine. Several conditions make this highly unlikely. First, herbicide use on agricultural lands would have to reach the stream in sufficient quantity to not be diluted downstream. Research by Evans and Duseja (1973), however, found picloram concentrations diluted 85 to 98 percent 100 meters (328 feet) below treatments areas and below detection levels at 1000 meters (3281 feet) following a 1.5" rainstorm within the first week of spraying. Application rates were 1 and 2 lb/ac (3 to 6 times the typical application rate) on test plots ranging from 1 to 2 acres.

The project design features, herbicide use buffers, and treatment caps are likely to prevent herbicide from reaching streams in measurable or harmful concentrations. Any herbicide reaching the stream would be quickly diluted as it moved downstream. The amount of herbicide potentially reaching a common downstream point and combining with chemicals from agricultural uses is very low and would not result in cumulative effects. Mixing and dilution of any trace amount of herbicide that may result from invasive plant treatment would occur quickly, making it highly unlikely that herbicide concentrations would be additive or synergistic with similar treatments at the watershed scale.

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

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

While no other herbicide use would be planned on the Forest, Chapter 3.1.5 describes the herbicide use that might occur in surrounding areas. However, the amount of herbicide potentially reaching a common downstream point would not be detectable. Thus, there would be no contribution to cumulative effects from herbicide delivery to streams. Expected mixing and dilution of any trace amount of herbicide that may result from invasive plant treatment would occur quickly, making it highly unlikely that herbicide concentrations would be additive or synergistic with other herbicide use at the watershed scale, especially considering that no more than 10 acres within 100 feet of any water body in a 6^{th} field watershed would be treated with herbicide in a single year.

Sediment Delivery

A list of forestwide projects are scheduled (2013-2015) that will be concurrent with the proposed action (table 28). These projects include prescribed burning, plantation thinning, replacing road culverts, road decommissioning, snow park relocation, aspen release, juniper thinning, toilet replacement, commercial timber harvest, parking lot paving, gate replacement, demolition of a structure by explosion, and fencing. Most of the activities will involve a level of ground disturbance and risk increasing sediment delivery to streams. However, since the amount of sediment that would reach streams in alternative B is very low in comparison to background levels, there would be no potential for sediment to accumulate with sources from other projects or activities in the watersheds.

Livestock grazing near streams may also result in sediment delivery. Surface erosion can result from trampling and trailing but the primary affect is to channel condition. Channel condition can be affected by hoof action (i.e., trampling, hoof shear, post holing) and the reduction and vigor of palatable woody streamside vegetation. It is not possible to quantify livestock generated sediment because of the dispersed character of the impacts, problems with distinguishing between cattle and wildlife impacts, inability to attribute or portion channel affects specifically to livestock, and inability to separate long term (decades) affects from past management or events from current management. Allotment management is expected to result in increased riparian protection and less sediment production from grazing

3.6 Fisheries

3.6.1 Introduction

Fish species of special conservation concern (e.g., federally listed, USFS sensitive, USFS management indicator species) within the aquatic environment analyzed in this report include the native bull trout, middle Columbia River steelhead, middle Columbia River Chinook salmon (including essential fish habitat), redband (rainbow) trout, and westslope cutthroat trout (table 44). In addition, one USFS sensitive aquatic macroinvertebrates and one amphibian species are addressed. All aquatic species of special conservation concern (and their habitat) will be analyzed for both effects to individuals and effects to habitat.

During public scoping, concerns were raised about the use of herbicides near streams or other surface water that may result in herbicide concentrations in water that are harmful to fish (particularly ESA listed fish and native fish) and other aquatic organisms. Manual and mechanical treatments can also affect water quality, fish, and other aquatic species by disturbing riparian structure or increasing sedimentation. This report estimates effects to aquatic species and their habitat from herbicide and non-herbicide treatment methods.

Detailed analyses of federally listed fish species are provided in the project biological assessment (for preferred alternative only). USFS sensitive aquatic species are analyzed in the project biological evaluation (for all EIS action alternatives).

PACFISH and INFISH are programmatic strategies to help maintain and restore aquatic habitats on the Malheur National Forest and other Forests east of the Cascade Mountains. Riparian Management Objectives (RMOs) are identified in these strategies and Forest projects are designed to contribute to meeting these objectives, or at least not block attainment of RMOs. Our progress toward maintaining and restoring good fish habitat is measured at the 3^{rd} to 6^{th} order streams scale, based on measurable indicators of good fish habitat.

The indicators are pool frequency, water temperature, amount of large woody debris, lower bank angle of the creek, and width to depth ratio. These indicators are addressed through the matrix of pathways and indicators discussed for fish species.

Treatments authorized under this invasive plant treatment project could be implemented as part of aquatic habitat restoration activities on the Forest. The long-term intent is to restore native plant communities to the extent possible. However, treatments near the aquatic environment have the potential for short-term adverse impacts. In general, these adverse impacts are very small in comparison to the benefits of restoration.

A biological assessment has been prepared and the effects of this action have been discussed with FWS and NMFS. Based on the assessment and discussions, including additional or revised project design features, the Forest Service has determined that this project will not adversely affect any listed fish species or their habitat (see discussion in 3.6.3). A Record of Decision for this project will not be signed until the Forest Service receives a letter of concurrence from FWS and NMFS.

Regulatory Framework

The Executive Order 12962 of 1995 (aquatic systems and recreational fisheries) requires federal agencies to conserve, restore, and enhance aquatic systems to provide for increased recreational fishing opportunities nationwide. The Order requires federal agencies to evaluate the effects of federally funded actions on aquatic systems and document those effects relative to the purpose of this order.

The two principle laws relevant to fisheries management are the National Forest Management Act of 1976 (NFMA) and the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.). Direction relative to fisheries is as follows:

- NFMA requires the Forest Service to manage fish and wildlife habitat to maintain viable populations of all native and desirable non-native wildlife species and conserve all listed threatened or endangered species populations (36CFR219.19).
- ESA requires the Forest Service to manage for the recovery of threatened and endangered species and the ecosystems upon which they depend. Forests are required to consult with the U.S. Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service (NMFS) if a proposed activity may affect the population or habitat of a listed species.

The Malheur National Forest Land and Resource Management Plan (LRMP) as amended (USDA Forest Service 1990), provides direction to protect and manage resources. The specialist report cites a detailed list of the portions of the Forest LRMP relevant to fisheries and fisheries habitat requirements. In addition, Forest standards and guidelines along with relevant laws are cited. Of special interest are Forest LRMP amendment 29 and PACFISH/INFISH (1995). Recommendations regarding fisheries habitat would adhere to this regulatory framework.

Fish-bearing streams are assigned 600-foot-wide (total width) riparian habitat conservation areas (RHCAs), as defined within PACFISH/INFISH. RHCA widths along other streams in the Project Area vary depending on whether streamflow is perennial or intermittent. Treatment within RHCAs would be designed to follow PACFISH/INFISH goals and requirements. Specific to this project is PACFISH/INFISH standard RA-3: “Apply herbicides, pesticides, and other toxicants, and other chemicals in a manner that does not retard or prevent attainment of the Riparian Management Objectives [RMOs] and avoids adverse effects on inland native fish (INFISH)/ listed anadromous fish (PACFISH).”

Key Watersheds: The intent of designating Key Watersheds is to provide a pattern of protection across the landscape where habitat for fish species of special conservation concern would receive increased attention and treatment. Priority within these watersheds would be to protect or restore habitat for listed stocks, stocks of special interest or concern, or salmonid assemblages of critical value for productivity or biodiversity. Criteria considered to designate Key Watersheds are:

1. Watersheds with stocks listed pursuant to the ESA, or stocks identified in the 1991 American Fisheries Society report as “at risk” or subsequent scientific stock status reviews; or
2. Watersheds that contain excellent habitat for mixed salmonid assemblages; or
3. Degraded watersheds with a high restoration potential

Threatened and endangered species are listed under the ESA whereas sensitive species are identified by the Forest Service Regional Forester. An endangered species is an animal or plant species that is in danger of extinction throughout all or a significant portion of its range. A threatened species is an animal or plant species that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range. A sensitive species is an animal or plant species where viability is a concern either a) because of current or predicted downward trend in population numbers or density or b) because of current or predicted downward trends in habitat capability that would reduce a species' existing distribution. LRMP Standard 62 (p. IV-32) gives direction to meet all legal and biological requirements for the conservation of threatened and endangered plants and animals.

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), requires the inclusion of Chinook salmon Essential Fish Habitat (EFH) descriptions in Federal fishery management plans. In addition, the MSA requires Federal agencies to consult with NMFS on activities that may affect EFH.

Management Indicator Species (MIS) are vertebrates and invertebrates whose population changes are believed to best indicate the effects of land management activities. Through the MIS concept, the total number of species found within the Forest is analyzed using a subset of species that collectively represent habitats, species, and associated management concerns. The MIS are used to assess the maintenance of populations (the ability of a population to sustain itself naturally) and biological diversity (which includes genetic diversity, species diversity, and habitat diversity), and to assess effects on species in public demand. LRMP Standard 61 (p. IV-32) lists species and gives direction to provide for habitat requirements of MIS species. Aquatic MIS on the Forest include rainbow/redband trout, bull trout, and steelhead trout.

3.6.2 Affected Environment

Aquatic Species of Conservation Concern

Table 44 describes aquatic species of conservation concern on the Malheur National Forest. It includes the status of each species, whether it is documented or suspected to occur on the Forest, and other specific information about the populations that could be affected by forest activities.

Table 43. Aquatic species of conservation concern

Species	Status	Occurrence	Note
Middle Columbia River steelhead (*Oncorhynchus mykiss*)	Federally threatened, designated critical habitat	Documented occurrence	Middle Columbia River distinct population segment (DPS)
Bull trout (*Salvelinus confluentus*)	Federally threatened, designated critical habitat	Documented occurrence	John Day and Malheur species management units (SMUs)
Middle Columbia River Chinook salmon (*Oncorhynchus tshawytscha*)	Essential fish habitat and USFS sensitive	Documented occurrence	Essential fish habitat (EFH)
Redband trout (*Oncorhynchus mykiss gairdneri*)	USFS sensitive*	Documented occurrence	Widespread
Westslope cutthroat trout (*Oncorhynchus clarkia lewisi*)	USFS sensitive*	Documented occurrence	Present in John Day River and tributaries
Western ridged mussel (*Gonidea angulata*)	USFS sensitive*	Documented occurrence	Only known in Middle Fork John Day River

*From 2011 Region 6 list.

Steelhead

Steelhead (Middle Columbia DPS, MCR steelhead) was listed by NMFS as threatened under the Federal Endangered Species Act (ESA) on March 25, 1999 (64 FR 15417). Middle Colombia River steelhead are also a Malheur National Forest management indicator species (MIS). Critical habitat for MCR steelhead was designated on September 2, 2005 (70 FR 52630).

Life History (NatureServe 2013): Migrates between freshwater breeding and marine nonbreeding habitats. Steelhead typically spend 2 years in fresh water, migrate to marine waters where they spend 2-3 years, then return to natal stream to spawn. Most middle Columbia River steelhead smolt at 2 years and spend 1-2 years in salt water prior to re-entering fresh water, where they remain up to a year before spawning. First-time spawners generally are 4-5 years old. Individuals are capable of spawning more than once before they die, though spawning more than twice is rare. Steelhead eggs incubate 1.5-4 months before hatching (varies with temperature). Juveniles spend 1-4 (generally 2) years in fresh water before migrating to the ocean as smolt.

Steelhead are capable of surviving in a wide range of temperature conditions. They do best where dissolved oxygen concentration is at least 7 ppm. In streams, deep low velocity pools are important wintering habitats. Freshwater habitat types utilized include big and medium rivers, creeks, low to high gradient pools, and riffles. They usually requires a gravel stream riffle for successful spawning. Eggs are laid in gravel in a depression made by the female. Salinity of 8 ppt. is the upper limit for normal development of eggs and alevins.

John Day River Status (ODFW 2009): The John Day River Major Population Group (MPG) covers Oregon's John Day River drainage. The MPG contains five extant populations (Lower Mainstem John Day, North Fork John Day, Middle Fork John Day, South Fork John Day, and Upper Mainstem John Day). Steelhead in these populations are exclusively summer steelhead. The MPG is one of the few remaining summer steelhead groups in the Interior Columbia basin that has had no intentional influence from introduced hatchery steelhead and that has recently been classified as strong or healthy. Spawning is widely distributed across tributary and mainstem habitats.

The Lower Mainstem John Day River population includes tributaries to the John Day River downstream of the South Fork John Day River. This widespread population is the most differentiated ecologically from other populations, occupying the lower, drier, Columbia Plateau ecoregion. The North Fork John Day River population occupies the highest elevation, wettest area in the John Day basin. Population boundaries include the main stem and tributaries of the North Fork John Day River. The population was defined based on habitat characteristics, basin topography, and demographic patterns. The Middle Fork John Day River population resides in the Middle Fork John Day and all its tributaries. Spawning areas in the Middle Fork John Day River are separated substantially from all other spawning areas; except for those in the North Fork John Day, that exhibit different habitat characteristics.

Table 44. Special Status Fish in John Day River Watersheds

Watershed	Population Current Risk Status
North Fork John Day	Highly viable
Upper Mainstem John Day	Moderate risk
Lower Mainstem John Day	Moderate risk
Middle Fork John Day	Moderate risk
South Fork John Day	Moderate risk

The following are major limiting factors for the John Day River MPG:

Main limiting factors and threats:

- ♦ Degraded tributary habitat
- ♦ Mainstem passage
- ♦ Hatchery related effects
- ♦ Predation/competition/disease in mainstem and estuary

Within the analysis area, there are approximately 409 miles of designated critical habitat, dispersed throughout 15 watersheds (table 44). A detailed biological assessment (BA) will be prepared for the preferred alternative and ESA Section 7 Consultation with the National Marine Fisheries Service (NMFS) is underway.

Bull Trout

Bull trout were listed by the USFWS as threatened under the Federal ESA on June 10, 1998 (63 FR 31647). In 2010, critical habitat for bull trout was revised by the U.S. Fish and Wildlife Service, with many previously excluded streams within the analysis area becoming designated by the new rule (75 FR 63898, FWS-R1-ES-2009-0085). Bull trout are also a Malheur National Forest management indicator species.

The analysis area includes portions of both the John Day and Malheur bull trout species management units (SMUs).

Life History (USDI 2002): Bull trout have more specific habitat requirements than most other salmonid. Habitat components that influence bull trout distribution and abundance include water temperature, cover, channel form and stability, substrate for spawning and rearing, and migratory corridors. Bull trout are found in colder streams and require colder water than most other salmonid for incubation, juvenile rearing, and spawning. Spawning and rearing areas are often associated with cold-water springs, groundwater infiltration, and/or the coldest streams in a watershed. Throughout their lives, bull trout require complex forms of cover, including large woody debris, undercut banks, boulders, and pools. Alterations in channel form and reductions in channel stability result in habitat degradation and reduced survival of bull trout eggs and juveniles. Channel alterations may reduce the abundance and quality of side channels, stream margins, and pools, which are areas bull trout frequently inhabit. Spawning and early rearing bull trout require loose, clean gravel relatively free of fine sediments. Because bull trout have a relatively long incubation and development period within spawning gravel (greater than 200 days), transport of bedload in unstable channels may kill young bull trout. Bull trout use migratory corridors to move from spawning and rearing habitats to foraging and overwintering habitats and back. Different habitats provide bull trout with diverse resources, and migratory corridors allow local populations to connect, which may increase the potential for gene flow and support for refounding of populations.

Declines in bull trout distribution and abundance are the results of combined effects of the following: habitat degradation and fragmentation; the blockage of migratory corridors; poor water quality; angler harvest and poaching; entrainment (process by which aquatic organisms are pulled through a diversion structure or other device) into diversion channels and dams; and introduced non-native species. Specific land and water management activities that continue to depress bull trout populations and degrade habitat include dams and other diversion structures, forest management practices, livestock grazing, agriculture, road construction and maintenance, mining, and urban and rural development. Some threats to bull trout are the continuing effects of past land management activities.

Bull trout are present within both the Malheur River and John Day River drainages. Occupied waters within the John Day River drainage include headwaters of the North Fork John Day River, Middle Fork John Day River, and upper mainstem John Day River and tributaries, with seasonal use of the mainstem river downstream to the vicinity of the town of John Day. The John Day River Recovery Unit Team has identified 12 extant local populations in the recovery unit. Within the Malheur River drainage, occupied areas include North Fork Malheur River and the Upper Malheur River sub-basins and the Mainstem Malheur River from headwaters downstream to Namorf Dam.

There are approximately 202 miles of designated critical habitat within the analysis area, dispersed throughout six watersheds within the John Day River and Malheur River drainages.

Redband Trout

Redband trout are currently on the Forest Service Region 6 sensitive species list, and considered a management indicator species on the Malheur National Forest.

Life History: This is a resident form of rainbow trout, and exhibits habitat preferences similar to those for steelhead (described above). Redband trout may migrate within river systems, but do not migrate to the ocean. Redband trout populations are widely distributed in all/most major stream drainages (and tributaries) within the Malheur National Forest, including the John Day River, Malheur River, and Silvies River (table 46).

Westslope Cutthroat Trout

Westslope cutthroat trout are currently on the Region 6 Forest Service sensitive species list and are considered a MIS species on the Malheur National Forest.

Life History (NatureServe 2013): Habitat includes small mountain streams, main rivers, and large natural lakes; requires cool, clean, well-oxygenated water; in rivers, adults prefer large pools and slow velocity areas (stream reaches with numerous pools and some form of cover generally have the highest fish densities); often occurs near shore in lakes. Juveniles of migratory populations may spend 1-4 years in their natal streams, and then move (usually in spring or early summer, and/or in fall in some systems) to a main river or lake where they remain until they spawn. Many fry disperse downstream after emergence. Juveniles tend to overwinter in interstitial spaces in the substrate. Larger individuals congregate in pools in winter.

Spawns in small tributary streams on clean gravel substrate; mean water depth is 17-20 cm and mean water velocity is 0.3-0.4 m/sec; tends to spawn in natal stream. Adfluvial populations live in large lakes in the upper Columbia drainage and spawn in lake tributaries. Fluvial populations live and grow in rivers and spawn in tributaries. Resident populations complete the entire life history in tributaries. All three life-history forms may occur in a single basin. Migrants may spawn in the lower reaches of the same streams used by resident fishes. Maturing adfluvial fishes move into the vicinity of tributaries in fall and winter and remain there until they begin to migrate upstream in spring. Of migratory spawners, some remain in tributaries during summer months, but most return to the main river or lake soon after spawning.

Westslope cutthroat trout distribution is not precisely known, but they do occur within the North Fork John Day River and upper mainstem John Day River (widely distributed).

Chinook Salmon

Spring Chinook salmon are a Region 6 sensitive species. Essential fish habitat (EFH) for spring Chinook salmon has been designated by NMFS in the analysis area.

Life History (USDA 2008a): Salmon are sensitive to changes in water quality and habitat. Juvenile Chinook salmon are generally associated with pool habitats. An increase in sediment lowers spawning success and reduces the quantity and quality of pool and interstitial habitat. Other important habitat features include healthy riparian vegetation, undercut banks, and large woody debris.

Adult spring Chinook salmon return to the main stem John Day River and Middle Fork John Day River during the spring. Spawning occurs within both drainages, with the majority in the Middle Fork John Day. Adults hold in deep pools during the summer while sexually maturing. Spawning occurs during fall, generally from August through September. Embryos incubate over the winter and emergence occurs the following spring. Juveniles generally rear for one year in freshwater. Juveniles use habitats with slower water velocities (pools, glides, and side channels). Juveniles overwinter in deep pools with abundant cover. Smoltification and emigration to the ocean occurs in the spring of their second year. The ocean rearing phase lasts from 1 to 3 years.

For this analysis, essential fish habitat (EFH) for Chinook salmon is approximated by the distribution of steelhead, which includes most perennial streams within the John Day River drainage. Consultation with the National Marine Fisheries Service (NMFS) will be conducted.

Western ridged mussel (Jepsen et al. 2010)

The western ridged mussel (*Gonidea angulata*) is widely distributed from southern British Columbia to southern California, and can be found east to Idaho and Nevada. *G. angulata* inhabits cold creeks and streams from low to mid-elevations. Hardhead, Pit sculpin, and Tule perch are documented fish hosts for *G. angulata* in northern California, although little is known about the fish species that serve as hosts for this mussel throughout other parts of its range. *G. angulata* is sedentary as an adult and probably lives for 20-30 years, and thus can be an important indicator of habitat quality. *G. angulata* is a filter feeder that consumes plankton and other suspended solids, nutrients, and contaminants from the water column. Large beds of *G. angulata* can improve water quality by reducing turbidity and controlling nutrient levels. Some Native American tribes historically harvested this animal and used it for food, tools, and adornment. Populations of *G. angulata* have likely been extirpated in central and southern California, and it has probably declined in abundance in numerous watersheds, including the Columbia and Snake River watersheds in Washington and Oregon. The western ridged mussel belongs to a monotypic genus and thus would be considered a high priority for conservation. Lack of information on the western ridged mussel's current and historical abundance and distribution, and a lack of understanding of which host fish species it uses will impede conservation efforts.

Western ridged mussels have been documented in the Middle Fork John Day River drainage.

Please note that conclusions from the analysis for fishes will be used to qualitatively estimate effects for invertebrates since the aquatic species utilize the same habitat, and detailed distribution and habitat requirements are not well known for the invertebrates.

Invasive Plants by Watershed

Table 46 displays fish species of aquatic concern within 5th field watersheds on the Malheur National Forest. The table shows the acreage infested within 100 feet of streams within each 5th field watershed and the percent of the total acreage within 100 feet of a stream that is infested within that 5th field watershed.; total infested acres is approximately 460 acres. Of these, about 117 acres are located within 25 feet of streams (Appendix A, Rausch 2012).

The watersheds are listed in descending order of the percent (on Forest System lands only) of total near-stream area (within 100 feet) with mapped infestations. This table underscores the fact that most of the 5th field watersheds have scattered infestations that occupy a very small percentage of the near-stream area. Of the 39 5th-field watersheds on the Malheur National Forest, 33 have less than one-half of 1 percent of the near-stream area occupied by invasive plants. Figure 12 displays these 5th field watersheds.

Table 45. Invasive Plants and Fish Species in 5th field watersheds

Watershed Name	HUC 5 code	Infested acres within 100' of a stream (estimated in 2012)	Percent of total acreage within 100' of a stream infested	Fish species*
Upper Middle Fork John Day River (Bridge Creek)	1707020301	94.21	**1.50**	BT, CH, ST, RT
Pine Creek	1705011603	31.01	1.45	RT

Watershed Name	HUC 5 code	Infested acres within 100' of a stream (estimated in 2012)	Percent of total acreage within 100' of a stream infested	Fish species*
Big Creek	1707020303	49.8	1.04	BT, CH, ST, RT
Middle South Fork John Day River	1707020103	27.62	0.96	CH, ST, RT, WT
Camp Creek	1707020302	94.96	0.69	BT, CH, ST, RT
North Basin	1712000101	15.97	0.51	RT
Beech Creek	1707020109	21.43	0.48	CH, ST, RT, WT
Upper Malheur River-Griffin Creek	1705011605	1.64	0.43	RT
Upper South Fork John Day River	1707020101	18.20	0.43	RT
Upper Silvies River	1712000201	19.63	0.39	RT
Wolf Creek	1705011602	13.97	0.33	RT
Little Malheur River	1705011612	4.88	0.22	RT
Trout Creek	1712000203	19.86	0.39	RT
Otis Creek	1705011606	2.15	0.22	RT
Silvies Canyon	1712000205	4.97	0.16	RT
Emigrant Creek	1712000206	9.79	0.11	RT
Bear Creek	1712000202	1.47	0.05	RT
Canyon Creek	1707020107	3.66	0.05	CH, ST, RT, WT
Fields Creek	1707020111	1.52	0.04	CH, ST, RT, WT
Cottonwood Creek	1707020209	3.84	0.13	CH, ST, RT, WT
Upper Silver Creek	1712000403	0.48	0.02	RT
Upper North Fork Malheur River	1705011611	6.55	0.10	BT, RT
Long Creek	1707020304	0.64	0.02	CH, ST, RT, WT
Upper John Day River	1707020106	4.69	0.13	BT, CH, ST, RT, WT
Laycock Creek	1707020110	0.87	0.03	CH, ST, RT, WT
Lower North Fork John Day River	1707020210	0.17	0.00	CH, ST, RT, WT
Murderers Creek	1707020104	1.30	0.02	CH, ST, RT, WT
Upper Malheur River	1705011601	6.50	0.09	BT, RT
Strawberry Creek	1707020108	0.44	0.01	BT, CH, ST, RT, WT
Buck Creek	1707030303	0.00	0.00	RT
Claw Creek	1712000402	0.00	0.00	RT
Desolation Creek	1707020204	0.00	0.00	RT
Granite Creek	1707020202	0.00	0.00	RT
Grindstone Creek	1707030306	0.00	0.00	RT
Headwaters Silver Creek	1712000401	0.17	0.00	RT
Lower South Fork John Day River	1707020105	0.00	0.00	CH, ST, RT, WT
South Fork Beaver Creek	1707030307	0.00	0.00	RT
Twelvemile Creek	1707030305	0.00	0.00	RT
Willow Creek	1712000207	0.00	0.00	RT

Watershed Name	HUC 5 code	Infested acres within 100’ of a stream (estimated in 2012)	Percent of total acreage within 100’ of a stream infested	Fish species*
		Total: 462		

* Estimate of potential presence: BT = bull trout, CH = Chinook salmon, RT – redband trout, ST = steelhead trout, WT = westslope cutthroat trout

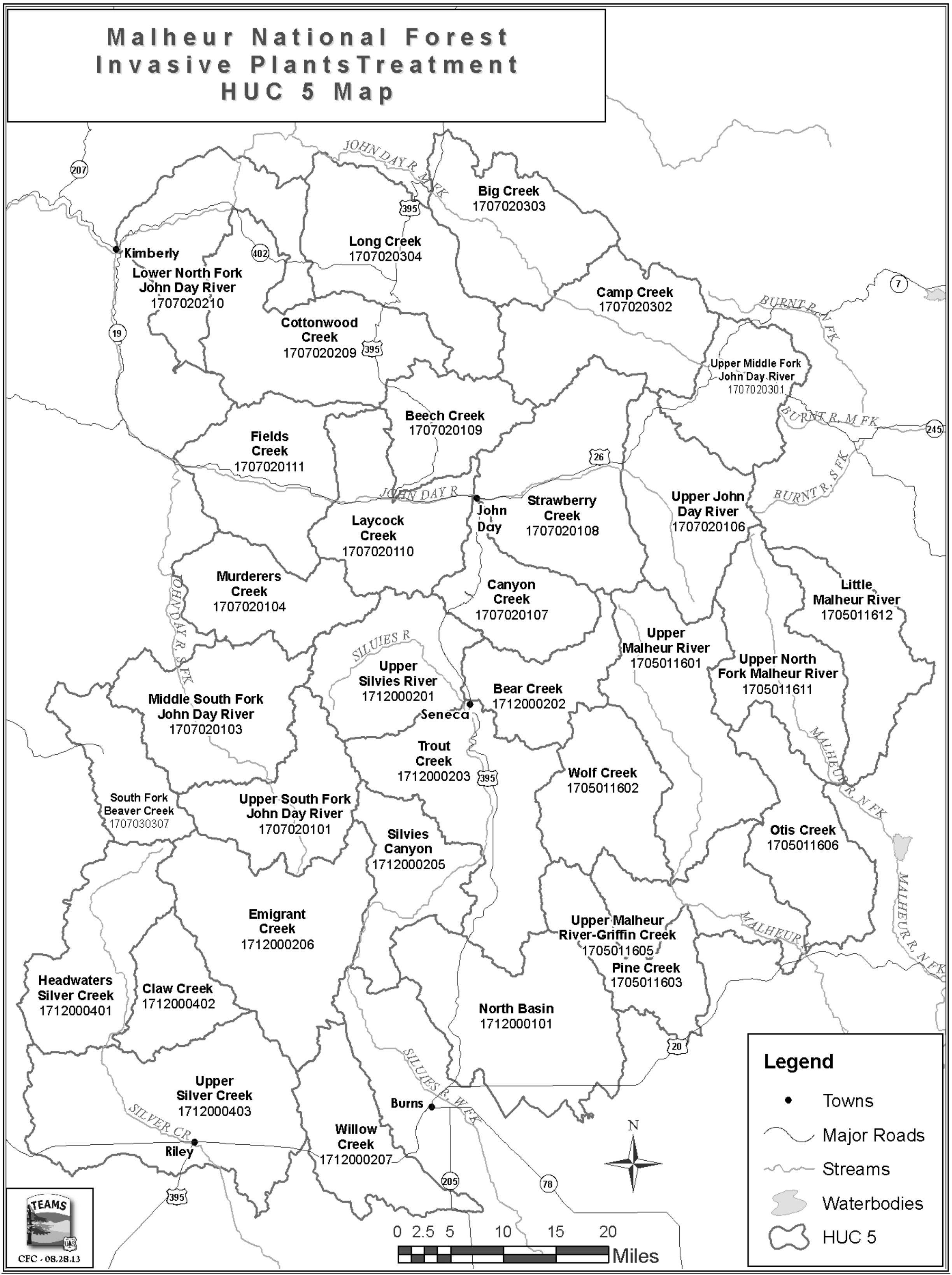

Figure 12. 5th field watersheds on the Malheur National Forest

3.6.3 Environmental Consequences

Analysis Methodology

The fisheries analysis is tiered to programmatic documents, such as PACFISH and INFISH, and the R6 2005 FEIS. At the project scale, the different treatment methods were mapped and overlaid with fish distribution to see if potentially harmful treatments might occur in proximity to habitat for aquatic species of conservation concern. The analysis on treatments is focused within infested areas that lie within 100 feet of aquatic habitat.[24]

Analyses include consideration of effects at the infested site scale as well as at various watershed scales to determine relative risk to fish from the project. The SERA Risk Assessments and GLEAMS model (see Soil and Water section above for details) were used to determine whether herbicide use could result in measurable delivery of herbicide to the stream.

The spatial analysis boundary for aquatics effects are is the administrative boundary of the Malheur National Forest. Detectable effects, such as increased turbidity resulting from sediment created by the project, are not expected to extend beyond the Malheur National Forest boundary.

“Short-term” effects refer to the time within 2 years of site-specific (e.g., within a watershed) implementation, with “long-term” extending from 2-15 years beyond the time of treatment. The spatial and temporal boundaries are identical for all effects: direct, indirect, and cumulative.

Incomplete and Unavailable Information

The distribution of aquatic organisms throughout the entire analysis area (forest administrative boundary) is not precisely known. The locations of actual treatment could change over time, as new sites of invasive plants are discovered or known sites change in size. To ensure that the analysis covers conditions subject to change over time (see early detection/rapid response discussion in chapter 2), we developed project design features, buffers, and caps. The design features, buffers and caps ensure that the effects of treatment can be analyzed despite uncertainties.

Compliance with PACFISH/INFISH

This section discusses how invasive plant treatment will help maintain or restore (or not prevent attainment of) riparian and aquatic conditions as described in the following PACFISH/INFISH goals and riparian management objectives.

Goal 1: Maintain or restore water quality, to a degree that provides for stable and productive riparian and aquatic ecosystems

Water quality would be maintained in all alternatives. The project design features, herbicide use buffers, and treatment caps would prevent herbicide from reaching streams in measurable or harmful concentrations in any alternative. Any herbicide reaching the stream would be quickly diluted as it moved downstream. The amount of herbicide potentially reaching a common downstream point and combining with chemicals from agricultural uses is very low and would not result in cumulative effects. Mixing and dilution of any trace amount of herbicide that may result from invasive plant treatment would occur quickly, making it highly unlikely that herbicide concentrations would be additive or synergistic with similar treatments at the watershed scale. The result of the GLEAMS model runs on various scenarios of sites within the project area is consistent with results of several monitoring studies reviewed by Bakke (2001) and Berg (2004). Amounts of herbicides in streams are predicted to be below levels of concern for

[24] If any part of the infested area is within 100 feet of a stream or other water body, the entire area is considered a “riparian unit” even if only a portion of the infested sites is near the water body.

aquatic health. The cap of 10 acres of herbicide treatment per year within 100 feet of a stream would prevent the amount of herbicide delivery to streams from reaching a measurable or meaningful concentration. Alternatives A and C would result in less potential herbicide exposure to streams, however the potential for invasive plants to impact water quality would be greater under these alternatives.

Goal 2: Maintain or restore stream channel integrity, channel processes, and the sediment regime (including the elements of timing, volume, and character of sediment input and transport) under which the riparian and aquatic ecosystems developed.

Invasive plants have the potential to outcompete native vegetation with which these systems developed. Treating invasive plants would improve riparian stability where invasive plants have colonized along stream channels and out-competed native species. For instance knotweed has poor bank holding capacity, which may lead to more bank erosion and sedimentation of streams in high winter flows (R6 2005 FEIS). Lacey et al. (1989) reported higher runoff and sediment yield on sites dominated by knapweed versus sites dominated by native grasses. Alternatives A and C lack effective treatment options in riparian areas (see Chapter 3.1.4).

Invasive plant treatment in all action alternatives may create some sediment, but the cap of 50 acres of treatment per year within 100 feet of a stream in a 6^{th} field watershed would ensure that sediment delivery to streams would be minimal.

Goal 3: Maintain or restore instream flows to support healthy riparian and aquatic habitats, the stability and effective function of stream channels, and the ability to route flood discharges.

Invasive plant treatments are unlikely to influence stream flow. There is no potential for increased peak flows or alteration of the timing, magnitude, duration and spatial distribution of flows as a result of treating or not treating invasive plants. This is because of the relatively small size of invasive plant infestations (especially adjacent to water), the spatial distribution, staggered timing of treatments, and low water use of invasive plants (Deschutes-Ochoco National Forest and Crooked River Grassland 2011 Invasive Plant FSEIS).

Goal 4: Maintain or restore natural timing and variability of the water table elevation in meadows and wetlands.

Invasive plant treatment is unlikely to influence water table elevation. This is because of the relatively small size of invasive plant infestations (especially adjacent to water), the spatial distribution, staggered timing of treatments, and low water use of invasive plants (Deschutes-Ochoco National Forest and Crooked River Grassland 2011 Invasive Plant FSEIS).

Goal 5: Maintain or restore diversity and productivity of native and desired non-native plant communities in riparian zones.

This purpose and need for this project revolves around maintaining and restoring native plant communities; and riparian zones are among the highest priority treatment site types. Treatment of invasive plants near streams would allow for re-establishment of native riparian plants that typically have better root structure (and bank holding capacity) than non-native invasive plants (Deschutes-Ochoco National Forest and Crooked River Grassland 2011 Invasive Plant FSEIS).

Goal 6: Maintain or restore riparian vegetation, to:

(a) provide an amount and distribution of large woody debris characteristic of natural aquatic and riparian ecosystems;

(b) provide adequate summer and winter thermal regulation within the riparian and aquatic zones; and

(c) help achieve rates of surface erosion, bank erosion, and channel migration characteristic of those under which the communities developed.

Invasive plants do not provide large woody debris to streams. They can adversely influence thermal regulation by outcompeting shade-producing vegetation. Some invasive plants have limited soil holding capacity and result in accelerated erosion. A good example is knotweed. This invasive plant chokes waterways, displaces native plants, and erodes riverbanks (USDA 2015). Knotweed creates its own monoculture, leaving stream banks susceptible to increased erosion as it loses its leaves during the rainy season (ibid). Removal of knotweed can help promote establishment of more desirable plants, especially if active restoration methods are employed (ibid).

Some minor bank erosion may occur from removing invasive plants in locations where invasive plants have taken over a stream bank, especially in smaller streams. This is a low risk in all action alternatives, especially considering that no heavy equipment work is proposed and because there is a cap on acres of treatment within 100 feet of a stream each year within 6^{th} field watersheds. These factors limit the extent and intensity of any potential bank erosion from treatment.

Goal 7: Maintain or restore riparian and aquatic habitats necessary to foster the unique genetic fish stocks that evolved within the specific geo-climatic region.

There is no indication that any of the alternatives would influence fishery genetics or the long term viability of fisheries on the Forest.

Goal 8: Maintain or restore habitat to support populations of well-distributed native and desired non-native plant, vertebrate, and invertebrate populations that contribute to the viability of riparian-dependent communities.

Invasive plant treatment would help maintain or restore riparian vegetation threatened by invasive plants. Native riparian vegetation plays a key role in forming aquatic habitat for fish and other aquatic species. Roots help stabilize stream banks, preventing accelerated bank erosion and providing for the formation of undercut banks, important cover for juvenile and adult fish. Native riparian vegetation also provides large and small wood to streams, adding to habitat complexity and providing cover and food sources for aquatic organisms.

Invasive plant treatment may have short term impacts on some elements of the riparian ecosystem (there is a potential for some common native plants to be killed); however, the impacts would be very small scale (limited to the area directly adjacent to treatment) and short term (vegetation would rebound within one season). This is based on the characteristics of the herbicides proposed for use, the PDFs that limit the application method, Long term benefits to the development of native plants and riparian dependent ecosystems are possible from removal of invasive plants.

Invasive plants degrade diversity and productivity of native plant communities within and outside riparian areas. Invasive plant treatment is needed to maintain or restore native plant communities. Without effective invasive plant treatment, undesirable non-native vegetation would continue to degrade native plant communities and adversely affect riparian and fish habitat development.

PACFISH-INFISH Riparian Management Objective (RMOs)

PACFISH-INFISH Riparian Management Objective (RMOs) were considered to determine whether there is any potential effect that could be influenced by invasive plant treatment, specifically herbicide use. RA-3 requires the Forest to “Apply herbicides, pesticides, and other toxicants, and other chemicals [within Riparian Habitat Conservation Areas] in a manner that does not retard or prevent attainment of Riparian Management Objectives and avoids adverse effects on inland native fish.

Progress toward maintaining and restoring good fish habitat is measured at the 3rd to 6th order streams scale within 6th field watersheds, based on measurable indicators of good fish habitat. The indicators are pool frequency, water temperature, amount of large woody debris, bank stability, lower bank angle of the creek, and width to depth ratio. Invasive plant treatments have low potential to affect any of these indicators and would complement other habitat restoration actions.

Indicator: Pool Frequency

Wetted Width (feet)	10	20	25	50	75	100	125	150	200
Pools per mile	96	56	47	26	23	18	14	12	9

The RMO for pool frequency are shown above; the objective for pools per mile varies by stream width. There is no possibility that treatment of invasive plants would affect pool area, quality, and frequency. The type of treatments proposed would not change stream dynamics that influence pool frequency.

Indicator: Water Temperature

The RMO is no measurable increase in maximum water temperature (7-day moving average of daily maximum temperature measured as the average of the maximum daily temperature of the warmest consecutive 7-day period). INFISH: Maximum water temperatures below 59 degrees F within adult holding habitat and below 48 degrees F within spawning and rearing habitats. PACFISH: Maximum water temperatures below 64 degrees F within migration and rearing habitats and below 60 degrees F within spawning habitats.

Invasive plant treatments would not be capable of changing solar radiation to a degree that would measurably affect stream temperature. Over time, removing invasive plants could help promote the recovery of shade-producing, native vegetation.

Indicator: Large Woody Debris

The RMO for Large Woody Debris in forested ecosystems east of the Cascade Crest: >20 pieces per mile; >12 inch diameter, > 35 foot length.

Treatment of invasive plants in RHCAs would not affect current wood debris in streams. Removal of invasive plants could help restore vegetation that produces large woody debris.

Indicator: Bank Stability

Invasive plant treatments have low potential to adversely affect bank stability, especially at a meaningful scale, because 1) native vegetation usually provides better bank stability than invasive plants and 2) the project design and project caps limit treatment within riparian areas to 50 acres per 6th field watershed (of which only ten acres may include herbicide use). Small scale, short term impacts on bank stability would not cause any stream currently above 80 percent stable (thus meeting the RMO desired condition) to drop below this value. Given these factors, there is little likelihood that invasive plant treatments would adversely affect bank stability or retard recovery efforts. Neither invasive plants, nor invasive plant treatments have the potential to affect bank angle or width to depth ratio and thus would not retard recovery of these habitat indicators.

The presence of people or crews with hand-held tools along streambanks could lead to localized, sediment/turbidity to fish habitat because of trampling, soil sloughing due to stepping on banks and removal of invasive plant roots. However, amounts of potential localized sediment/turbidity would be negligible because the invasive plant populations on the Forest are not extensive enough to result in significant sediment/turbidity and emergent vegetation will not be treated. Exposed streambanks are expected to re-vegetate during the spring/summer following treatment. In addition, site restoration and re-vegetation methods preclude erosion as a result of herbicide treatment. It is expected that most patches would be relatively small and any erosion negligible.

Small scale, short term impacts on bank stability would not cause any stream currently above 80 percent stable (thus meeting the RMO desired condition) to drop below this value. Given these factors, there is little likelihood that invasive plant treatments would adversely affect bank stability or retard recovery efforts. Restoration of native vegetation in riparian areas could improve bank stability because native vegetation usually provides better bank stability than invasive plants.

Indicator: Lower Bank Angle

The bank angle RMO requires that less than 75% of a stream have banks that are less steep than 90 degrees. This project poses no risk of negatively affecting channel condition and dynamics as a result of treating invasive plants. Thus, there are no possible adverse effects on lower bank angle.

Indicator: Width/Depth Ratio

This RMO requires that width of a stream remain less than 10 times as wide as it is deep. There is no risk of negatively affecting channel condition and dynamics as a result of treating invasive plants. Thus, there are no possible adverse effects on channel condition and dynamics.

Environmental Effects of Alternative A

Since no project activities would occur, there are no project-related direct, indirect, or cumulative effects associated with choosing the no-action alternative. Not taking action means that the need for eradication, control, containment, and suppression of invasive plants would not occur, and adverse effects on native plant communities described previously would continue. Aquatic habitats are harmed when invasive species outcompete native vegetation. Native vegetation supports the biotic (e.g., invertebrate community) and abiotic (soil stabilization) attributes necessary for high-quality aquatic habitat. Continued expansion of invasive plants, as is likely to occur with no action, (see chapter 3.1.4), would change near-stream biotic and abiotic conditions and could degrade aquatic and riparian habitats.

Direct and Indirect Effects of Alternative B

Introduction

The following analysis discusses the potential direct and indirect effects on near-stream and aquatic habitat indicators at the site and small watershed scale. Unless otherwise specified, the analysis of habitat indicators is relevant to all fish species (federally listed, USFS Sensitive, and MIS) as they share overlapping habitat and have very similar habitat requirements.

In summary, serious adverse effects on aquatic organisms, in the short or long term, are unlikely. Concentrations of herbicides potentially delivered to any water body on the Forest would remain well below levels capable of measurably affecting aquatic organisms (chapter 3.4 GLEAMS model results). Potential effects due to sediment input are discussed below; while sediment contribution from invasive plant treatments would be relatively minor, treatments in riparian areas could result in minor local changes to fish habitat.

Direct and Indirect Effects

Risk assessment worksheets produced by SERA and based on the comprehensive reports (SERA 2001, 2004a-d, 2005, 2007, and 2011a-d) list concentration levels deemed at acute or chronic toxicity for aquatic organisms potentially at risk from water contamination. Table 47 lists these thresholds. Generally, the lowest toxicity index available for the species most sensitive to effects was used. Measured chronic data (NOEC) was used when they were lower than 1/20th of an acute LC50 because they account for at least some sublethal effects, and doses that are protective in chronic exposures are more certain to be protective in acute exposures.

Table 46. Toxicity indices for fish from project herbicides based on the R6 2005 FEIS and 2007 SERA Risk Assessment for aminopyralid

Herbicide	Duration	Endpoint*	Dose**	Species	Effect Noted at LOAEL***
Aminopyralid	Acute	NOEC	50mg/l	Rainbow Trout	None available
	Chronic	NOEC	1.35 mg/l	Rainbow Trout	None available
	Chronic	NOEC[1]	3.2 mg/L	Brown trout	rainbow trout length affected at 66mg/L
Chlorsulfuron	Acute	NOEC	2 mg/L (1/20th of LC50)	Brown trout	LC50 at 40 mg/L
	Chronic	NOEC[2]	3.2 mg/L	Brown trout	rainbow trout length affected at 66mg/L
Clopyralid	Acute	NOEC	5 mg/L (1/20th of LC50)	Rainbow trout	LC50 at 103 mg/L
	Chronic				none available
Glyphosate (no surfactant)	Acute	NOEC	0.1 mg/L	Rainbow trout	Olfactory impairment (Tierney et al. 2006)
	Chronic	NOEC	2.57 mg/L[2]	Rainbow trout	Life-cycle study in minnows; LOAEL not given
Glyphosate with POEA surfactant	Acute	NOEC	0.065 mg/L (1/20th of LC50)	Rainbow trout	LC50 at 1.3 mg/L for fingerlings (surfactant formulation)
	Chronic	NOEC	0.36 mg/L	salmonid	estimated from full life-cycle study of minnows (surfactant formulation)
Imazapic	Acute	NOEC	100 mg/L	all fish	at 100 mg/L, no statistically sig. mortality
	Chronic	NOEC	100 mg/L	fathead minnow	No treatment related effects to hatch or growth
Imazapyr	Acute	NOEC	5 mg/L (1/20th LC50)	trout, catfish, bluegill	LC50 at 110-180 mg/L for North American species
	Chronic	NOEC	43.1 mg/L	Rainbow	“nearly significant” effects on early life stages at 92.4 mg/L
Metsulfuron methyl	Acute	NOEC	10 mg/L	Rainbow	lethargy, erratic swimming at 100 mg/L
	Chronic	NOEC	4.5 mg/L	Rainbow	standard length effects at 8 mg/L

Herbicide	Duration	Endpoint*	Dose**	Species	Effect Noted at LOAEL***
Picloram	Acute	NOEC	0.04 mg/L (1/20th LC50)	Cutthroat trout	LC50 at 0.80 mg/L
	Chronic	NOEC	0.55 mg/L	Rainbow trout	body weight and length of fry reduced at 0.88 mg/L
Sethoxydim	Acute	NOEC	0.06 mg/L (1/20th LC50)	Rainbow trout	LC50 of Poast® at 1.2 mg/L
	Chronic	NOEC			none available
Sulfometuron methyl	Acute	NOEC	7.3 mg/L	Fathead minnow	No signs of toxicity at highest doses tested
	Chronic	NOEC	1.17 mg/L	Fathead minnow	No effects on hatch, survival or growth at highest doses tested
Triclopyr acid	Acute	NOEC	0.26 mg/L (1/20th LC50)	Chum salmon	LC50 at 5.3 mg/L[3]
	Chronic	NOEC	104 mg/L	Fathead minnow	Reduced survival of embryo/larval stages at 140 mg/L
Triclopyr BEE	Acute		0.012 mg/L	Bluegill sunfish	LC50 at 0.25 mg/L
	Chronic[4]	NOEC	104 mg/L	Fathead minnow	Reduced survival of embryo/larval stages at 140 mg/L

*--NOEC = No Observed Effect Concentration

**--LC50, Lethal Concentration, 50% kill

***--LOAEL—Lowest Observed Adverse Effect Level

Table 47. Toxicity indices for algae from project herbicides based on the R6 2005 FEIS and 2007 SERA Risk Assessment for aminopyralid

Herbicide	Duration	Concentration	Species	Effects noted at LOAEL
Aminopyralid	acute	6 mg/L	Diatoms	Cell density
	chronic			
Chlorsulfuron	acute	0.01 mg/L	*Selanastrum capriconutum*	Mortality
	chronic			
Clopyralid	acute	6.9 mg/L	*Selanastrum capriconutum*	Growth inhibition
	chronic	Chronic study of duckweed showed EC50 >> sensitive algae (acute)		
Glyphosate (most toxic formulation)	acute	3 mg/L	Duckweed	Growth inhibition
	chronic			
Imazapic	acute	0.05 mg/L ***	Various species	Growth inhibition
	chronic			
Imazapyr	acute	0.2 mg/L *	Chlorella	Growth inhibition
	chronic			
Metsulfuron Methyl	acute	0.09 mg/L	*Selanastrum capriconutum*	Growth inhibition
	chronic			Only short-term data available
Picloram	acute	0.23 mg/L	Diatoms	Growth inhibition
	chronic			
Sethoxydim (based on toxicity of commercial formulation)	acute	0.2 mg/L*	Algae	Mortality– toxicity similar for algae and macrophytes
	chronic			

Herbicide	Duration	Concentration	Species	Effects noted at LOAEL
Sulfometuron Methyl	acute	0.0025 mg/L	*Selanastrum capriconutum*	Cell density
	chronic			
Triclopyr TEA	All exposures	5.9 mg/L *	Unspecified algae	Mortality

* NOEC is estimated from EC50
** NOEC is estimated from EC25
*** NOEC is estimated from LOEC

Table 48. Toxicity indices for aquatic plants from project herbicides based on the R6 2005 FEIS and 2007 SERA Risk Assessment for aminopyralid

Herbicide	Duration	Concentration	Species	Effects noted at LOAEL
Aminopyralid	acute	44mg/L	Duckweed	Frond Density
	chronic			
Chlorsulfuron	acute	0.00047 mg/L *	*Lemna minor*	Mortality
	chronic			
Clopyralid	See information for algae			
Glyphosate (most toxic formulation)	See information for algae			
Imazapic	acute	0.0013 mg/L	*Lemna gibba*	Growth inhibition
	chronic			
Imazapyr	acute	0.013 mg/L **	*Lemna gibba*	Growth inhibition
	chronic			
Metsulfuron Methyl	acute	0.00016 mg/L	Duckweed	Based on chronic data
	chronic			Mortality
Picloram	acute	0.1 mg/L ***	Water milfoil	Transient inhibition of flowering
	chronic			
Sethoxydim (based on toxicity of commercial formulation)	acute	0.2 mg/L *	Algae	Mortality – toxicity similar for algae and macrophytes
	chronic			
Sulfometuron Methyl	All exposures	0.00021 mg/L	*Lemna gibba*	Mortality
Triclopyr TEA	All exposures	5.9 mg/L *	Unspecified algae	Mortality

* NOEC is estimated from EC50
** NOEC is estimated from EC25
*** NOEC is estimated from LOEC

Table 49. Toxicity indices for aquatic invertebrates from project herbicides based on the R6 2005 FEIS and 2007 SERA Risk Assessment for aminopyralid

Herbicide	Duration	Concentration	Species	Effects noted at LOAEL
Aminopyralid	acute	98mg/L	*Daphnia magna*	No effects observed
	chronic	102 mg/L	*Daphnia magna*	No effects observed
Chlorsulfuron	acute	10 mg/L	daphnid	Mortality
	chronic	20 mg/L	daphnid	Mortality
Clopyralid	acute	214 mg/L	daphnid	Mortality

Herbicide	Duration	Concentration	Species	Effects noted at LOAEL
	chronic	11.8 mg/L	daphnid	Mortality
Glyphosate (most toxic formulation)	acute	11 mg/L	*Daphnia magna*	Mortality
	chronic	0.7 mg/L	*Daphnia magna*	Estimated from less toxic formulation
Imazapic	acute	100 mg/L	*Daphnia magna*	No effect at any concentration
	chronic	100 mg/L	*Daphnia magna*	No effect at any concentration
Imazapyr	acute	100 mg/L	*Daphnia magna*	No effects observed
	chronic	97.1 mg/L	*Daphnia magna*	No effects observed
Metsulfuron Methyl	acute	420 mg/L	*Daphnia magna*	Immobility
	chronic	17 mg/L	*Daphnia magna*	Growth
Picloram	acute	26.8 mg/L	Shrimp	Mortality
	chronic	3.8 mg/L	Oyster larvae	Mortality
Sethoxydim (based on toxicity of commercial formulation)	acute	2.6 mg/L	daphnid	Mortality
	chronic	2.6 mg/L	No data found, acute level used to assess risks	
Sulfometuron Methyl	acute	75 mg/L	Alonella spp. & Cypria spp.	Not given
	chronic	0.19 mg/L	Alonella spp. & Cypria spp.	Neonate survival
Triclopyr TEA	acute	133 mg/L	Not given	Mortality
	chronic	81 mg/L	daphnid	Reproduction

Chapter 3.5.3 shows the results of GLEAMS model runs using site-specific soil, slope, surface condition, and weather information from the project area. One site was run assuming 10 acres were treated adjacent to the stream. This provides an indication of the maximum impact that could occur in alternatives B and D, given the elements of the project design that could be modeled. The other three sites were run using the current configuration (size and location) of current infestations.

Results indicate that herbicide concentrations in the water are at least three orders of magnitude less than levels of concern for fish, amphibians, and aquatic invertebrates. However, the threshold of concern for aquatic plants was exceeded for the sulfonylurea herbicides (chlorsulfuron, metsulfuron methyl, and sulfometuron methyl). These exceedances are unlikely to affect the aquatic environment because 1) the threshold of concern is at least 10 times less than the amount that killed an aquatic plant, 2) the project design features, herbicide use buffers and project caps reduce the potential for the modeled concentration to actually reach a water body, and 3) the potential impacts would occur in a single stream reach within a 6th field watershed. The herbicide use buffers, limitations on broadcast and spot treatments within 100 feet of streams, and caps on treatments within 6th field watersheds reduce the potential for aquatic plants to be killed. Individual plants may be adversely affected, but the aquatic food chain is unlikely to be affected. Recovery of aquatic plants, if impacts occur, could take up to several weeks. See table 41 in chapter 3.5.3 for GLEAMS model results.

Indirect effects of chemicals used to treat invasive plants on ecosystem structure and function are important in determining overall risk to aquatic organisms (Preston 2002). Algae and aquatic plants are generally more sensitive than aquatic animals to effects from herbicides. Therefore, herbicides can affect the structure of aquatic communities at concentrations below thresholds for fish and aquatic invertebrates. Model runs indicate that thresholds for algae would not be approached in any treatment sites. For plants (*Lemna gibba*), models indicate that an exposure threshold could be approached (slightly below) for the herbicide sulfometuron methyl. Any potential effects to this aquatic plant community would be spatially isolated, representing much less than 1 percent of total aquatic habitat. Therefore, indirect effects (e.g., change to growth rates of macroinvertebrate prey organisms) to aquatic species of special conservation concern, resulting from isolated potential aquatic plant impacts, are unlikely to be detectable.

Indirect effects on the aquatic environment are possible from treatment within riparian areas if bare soil exists following treatment, due to the potential for erosion and sediment delivery to streams, primarily in the period between application and native plant regrowth, when soil may be slightly destabilized. Vegetation reduction in near-stream areas could slightly alter the food base for fish by changing habitat for terrestrial invertebrates; this potential effect would be short term and affect a small minority of total terrestrial habitat. The common control measures (table 9) describe the types of treatments proposed for the invasive plant target species currently mapped on the Malheur National Forest.

The maximum potential treatment scenario, and associated effects, would be restricted by project caps that limit treatment to 10 percent of a 6^{th} field watershed, and no more than 50 acres of total treatment within 100 feet of water bodies. Even under a maximum manual treatment scenario, ground disturbance would only be expected to produce a few pounds of sediment production per acre. For example, Idaho Creek-Summit Creek HUC6 currently has the largest concentration of mapped invasive plants within 100 feet of a stream; a total of 51.29 acres. If this entire site was manually treated using the most ground disturbing method (grubbing), approximately 0.06 tons of sediment may be delivered to a stream. This amount would not result in measurable adverse effects to fish.

Project design features and project caps would be implemented to minimize or eliminate adverse effects at any scale, even assuming the maximum possible treatment that could occur.

Watershed-based results were extrapolated to the western ridged mussel through the assumption that this sympatric species shares most habitat requirements with native fish, and results are logically transferable. Assuming that near-stream native vegetation is beneficial to aquatic habitat, the long-term result of this project for all aquatic species would be positive as invasive plants are replaced by native species. This change would presumably occur within a few years post-treatment in most cases. New infestations are expected within both currently infested and uninfested watersheds that could be treated, with a corresponding chance of measurable effects. Previously discussed project design features, herbicide use buffers, and treatment caps would minimize or eliminate adverse effects.

Effects on Habitat Indicators

Effects on various fish species were discussed previously. The proposed action would have minimal effects on habitat for aquatic organisms, including species of conservation concern. Adverse effects have been avoided to the extent practicable through pdfs, herbicide use buffers, and project caps. Effects to fish and habitat would be short term, and treatment of invasive plants would complement fish habitat restoration efforts over the long term. Further discussion about fish habitat indicators is in the sections below. Several overlapping types of analysis are done for aquatic organisms, mainly focused on species of conservation concern. The following is an analysis of the effects on *Steelhead Primary Constituent Elements* (PCE) for designated critical habitat (NMFS 2005) as determined via analysis of "*Matrix of Pathways and Indicators*" (MPI) analysis. This analysis also covers the *Essential Habitat Features* of Chinook salmon designated critical habitat.

PACFISH-INFISH Riparian Management Objective (RMOs) were considered to determine whether there is any potential effect that could be influenced by invasive plant treatment, specifically herbicide use, since RA-3 requires that herbicide not retard or prevent habitat from meeting RMOs. RA-3 also requires that adverse effects on inland and anadromous fish be avoided. Progress toward maintaining and restoring good fish habitat is measured at the 3^{rd} to 6^{th} order streams scale within 6th field watersheds, based on measurable indicators of good fish habitat.

The indicators are pool frequency, water temperature, amount of large woody debris, bank stability, lower bank angle of the creek, and width to depth ratio. Invasive plant treatments have low potential to affect any of these indicators, and would complement other habitat restoration actions. Invasive plant treatments do not have the potential to influence pool frequency or retard development of pools. Invasive plant treatments have no potential to affect recruitment of large woody debris and would complement other habitat restoration efforts by removing competition between invasive plants and native woody vegetation. Invasive plant treatments have are highly unlikely to measurably or adversely affect water temperature because invasive plants provide little or no understory shade, and no overstory shade. Invasive plant treatments could help restore native vegetation that provides shade.

Invasive plant treatments have low potential to adversely affect bank stability, especially at a meaningful scale, because 1) native vegetation usually provides better bank stability than invasive plants, and 2) the project design and project caps limit treatment within riparian areas to 50 acres per 6^{th} field watershed (of which only 10 acres may include herbicide use). Small scale, short term impacts on bank stability would not cause any stream currently above 80 percent stable (thus meeting the RMO desired condition) to drop below this value. Given these factors, there is little likelihood that invasive plant treatments would adversely affect bank stability or retard recovery efforts.

Project design features and project caps were developed to minimize or prevent a wide range of effect types. A selection of those particularly important to chemical contamination and sediment habitat indicators includes the following:

- Variable width herbicide-use buffers for all herbicides based on aquatic risk (table 11 and table 12).
- No more than 50 total acres within 100 feet of all water bodies combined within any 6^{th} field watershed would be treated in a single year, with no more than 10 of the 50 acres being treated with herbicide.
- In riparian and aquatic settings, vehicles (including all-terrain vehicles) used to access invasive plant sites or for broadcast spraying will not travel off roadways, trails, and parking areas.

For the complete list of project design features see table 10.

PCE Crosswalk – Bull Trout

A crosswalk was done between the Bull Trout Matrix of Pathways and Indicators (MPI) and Primary Constituent Elements (PCEs) of Critical Habitat. The Matrix of Pathway Indicators (MPI) for bull trout is used to evaluate and document baseline conditions and to aid in determining whether a project is likely to adversely affect or result in the incidental take of bull trout. The MPI analysis incorporates 4 population indicators and 19 physical habitat indicators. Analysis of the habitat indicators can provide a thorough evaluation of the existing baseline condition and potential project affects to the PCEs of critical habitat for bull trout. Table 51 shows the relationship between the PCEs for bull trout critical habitat and the MPI habitat indicators.

The limited ground disturbance and absence of in-stream treatment would limit potential effects to the following habitat indicators: temperature, sediment, chemical contaminants/nutrients, large woody debris, pool frequency and quality, and riparian conservation areas. The majority of these effects would be of very low magnitude, and undetectable in most areas. Treated riparian area vegetation would likely experience rapid regrowth, and the majority of near-stream vegetation would not be treated. Stream reaches where treatment is concentrated could experience measurable levels of sediment/turbidity increase post-project during storm events, but these effects would be spatially restricted, short-term, and low-magnitude. PCEs potentially affected (most undetectable) include 1, 2, 3, 4, 5, 6, 7, and 8.

Table 50. Bull trout PCEs and MPI habitat indicators

Diagnostic Pathway Indicator	PCE 1	PCE 2	PCE 3	PCE 4	PCE 5	PCE 6	PCE 7	PCE 8	PCE 9
	Springs, Seeps, Groundwater	Migratory Habitats	Abundant Food Base	Complex Habitats	Water Temperature	Substrate Features	Natural Hydrograph	Water Quality and Quantity	Predators Competition
Water Quality									
Temperature		x	x		x			x	
Sediment		x	x			x		x	
Chemical contaminants nutrients	x	x	x					x	
Habitat Access									
Physical Barriers	x	x	x						x
Habitat Elements									
Substrate Embeddedness	x		x			x			
Large Woody Debris				x		x			
Pool Frequency and Quality			x	x		x			
Large Pools				x	x				
Off-Channel Habitat				x	x				
Refugia		x			x				x
Channel Conditions and Dynamics									
Wetted Width/Maximum Depth Ratio		x		x	x				
Streambank Condition	x			x	x	x			
Floodplain Connectivity	x		x	x	x		x	x	
Flow/Hydrology									
Changes in Peak/Base Flows	x	x			x		x	x	
Drainage Network Increase	x						x	x	
Watershed Conditions									
Road Density and Location	x				x		x		
Disturbance History				x			x	x	x
Riparian Conservation Areas	x		x	x	x		x		
Disturbance Regime				x			x	x	

Pathway: Water Quality

Indicator: Temperature, PCE Crosswalk: Spawning, Rearing, Migration habitat PCEs

Stream temperature is controlled by many variables at each site. These include topographic shading, stream orientation, channel morphology, discharge, air temperature, and interactions with ground water, which would not be measurably influenced by invasive plant treatments in the vast majority of treatment locations. In a few areas, treatment of invasive plants would change understory and ground vegetation, but extent would be limited in quantity by project design features and project "caps." The majority of shade-providing vegetation is expected to be retained. Treatments would not be capable of changing solar radiation to a degree that would measurably affect stream temperature. Therefore, direct or indirect effects on the temperature indicator would not affect spawning, rearing, or migration PCEs.

Pathway: Water Quality

Indicator: Chemical Contaminants/Nutrients, PCE Crosswalk: Spawning habitat PCEs

The most likely routes for herbicide delivery to water are potential runoff from a large rain storm soon after application, especially from treated roadside ditches. Other concerns, such as drift, overspray, and spills, are addressed through project design features that would control drift and overspray. The potential risk from accidental spills in RHCAs exists; however, pdf G describes the mechanism to minimize the occurrence and restrict highly concentrated chemicals proximity to water.

GLEAMS model results (table 41 and table 42, chapter 3.5.3) indicate that the low amount of herbicide that might be delivered to a stream would not exceed levels of concern for any fish, algae, or aquatic invertebrate species. Temporary adverse effects to spatially isolated (scattered, infrequent) aquatic plants are possible. Effects from chemical contamination would be negligible in all project watersheds.

In summary, alternative B is not likely to adversely affect water quality or result in water contamination that could adversely affect fish.

Pathway: Channel Condition & Dynamics

Indicator: Floodplain Connectivity, PCE Crosswalk: Rearing habitat PCE

Some invasive plant treatments can have long-term positive effects on floodplains and streambanks when infestations of invasive plants on valley bottom areas are removed. Valley-bottom infestations often encroach on floodplains where road-related, grazing, or recreational activities have led to the establishment of invasive plant populations. Removal of such infestations is expected to benefit aquatic and terrestrial communities in the long-term by increasing floodplain area available for nutrient, sediment and large wood storage, and flood flow refugia. Potential localized, short-term, and low-magnitude sediment/turbidity increases would not be sufficient to alter channel condition and dynamics. Therefore, alternative B is unlikely to affect floodplain connectivity or fish rearing habitat.

Pathway: Habitat Access

Indicator: Physical Barriers, PCE Crosswalk: Migration habitat PCE

Invasive plant treatments would not create physical barriers or otherwise degrade access to aquatic habitat since there is no causal mechanism from proposed activities. Habitat access, physical barriers, and migration habitat would not be affected by alternative B.

Pathway: Habitat Elements

Indicator: Substrate/Sediment, PCE Crosswalk: Spawning, Rearing habitat PCEs

The alternatives are unlikely to produce measurable sediment in the majority of locations because very little ground disturbance would take place, though very minor inputs could conceivably occur during the period between plant death and regrowth. Manual labor such as hand pulling may result in localized soil disturbance, but increases of sediment to streams would likely be undetectable in most areas. In the few areas where more intense treatment could occur, disturbance areas would be limited in quantity by herbicide-use buffers, project design features, and project “caps”.

Sediment increases would be limited to short-term (e.g., a few hours/days) inputs during, and immediately following, intense precipitation events. A small increase in turbidity is the most likely effect and minor increases in surface fines could occur in some pool habitat. The substrate/sediment indicator would not be measurably affected over the long-term because treatment of invasive plants would not result in a chronic sediment source; fewer disturbances would occur during re-treatment, as the infestation density would decrease each treatment entry (see 3.1.4 for more information on treatment effectiveness). Sediment is unlikely to be large enough to affect spawning and rearing PCEs over the long term. Some minor sediment delivery could occur in the short term but it would be unlikely to adversely affect fish.

Indicator: Large Woody Debris, and Pool Area, Quality and Frequency, PCE Crosswalk: Spawning habitat PCE

Treatment of invasive plants would not affect pool area, quality, and frequency, as a causal mechanism does not exist. Near-stream treatment of invasive plants would not affect current wood debris in streams. As the vast majority of native vegetation would be retained in all treatment sites, it is highly unlikely that future woody debris recruitment would be affected. Therefore, spawning habitat would not be affected by changes to the large woody debris, and pool area, quality and frequency indicators**.**

Pathway: Flow/Hydrology

Indicator: Change in Peak/Base Flows, PCE Crosswalk: Spawning, Rearing, Migration habitat PCEs

A small percentage of each watershed (even small subwatershed) would be treated during a single year; in most cases, it would be less than one percent. Project “caps” establish an absolute maximum of 10 percent of any 6th field watershed per year, but this is highly unlikely to occur given the current level of infestation is far lower. The treatments would not affect stream flow or fish migration habitat. In addition, no more than 50 acres (10 acres herbicide) of treatment would occur per year within 100 feet of streams in any 6th field watershed.

Focus Watersheds

The focus of the effects analysis for aquatic organisms is on the eight 6th-field watersheds where more than one-half of 1 percent of the area within 100 feet of streams or other water bodies is infested. [25] These include Big Creek, Camp Creek, Middle South Fork John Day River, North Basin, Pine Creek, and Upper Middle Fork John Day River. Table 52 lists the infested acreage and percent of near-stream acres infested, as well as fish species in the focus watersheds. See figure 13 for a display of the location of these watersheds in relation to the Malheur National Forest.

[25] Treatment of less than one-half of 1 percent of the riparian area in a 6th field watershed is unlikely to have any detectable effects to fish or other aquatic organisms based on professional judgment (Mease 2013).

Table 51. Invasive plants and fish species in focus watersheds

Watershed Name (alphabetical order)	HUC 5 code	Infested acres	Percent of total near-stream area	Fish species*
Big Creek (Middle Fork John Day River)	1707020303	49.80	1.04%	BT, CH, ST, RT
Camp Creek (Middle Fork John Day River)	1707020302	94.96	0.69%	BT, CH, ST, RT
Middle South Fork John Day River	1707020103	27.62	0.96%	CH, ST, RT, WT
North Basin (Malheur River)	1712000101	15.97	0.51%	RT
Pine Creek	1705011603	31.01	1.45%	RT
Upper Middle Fork John Day River	1707020301	94.21	1.50%	BT, CH, ST, RT

Key for table use: BT = bull trout, CH = Chinook salmon, RT – redband trout, ST = steelhead trout, WT = westslope cutthroat trout

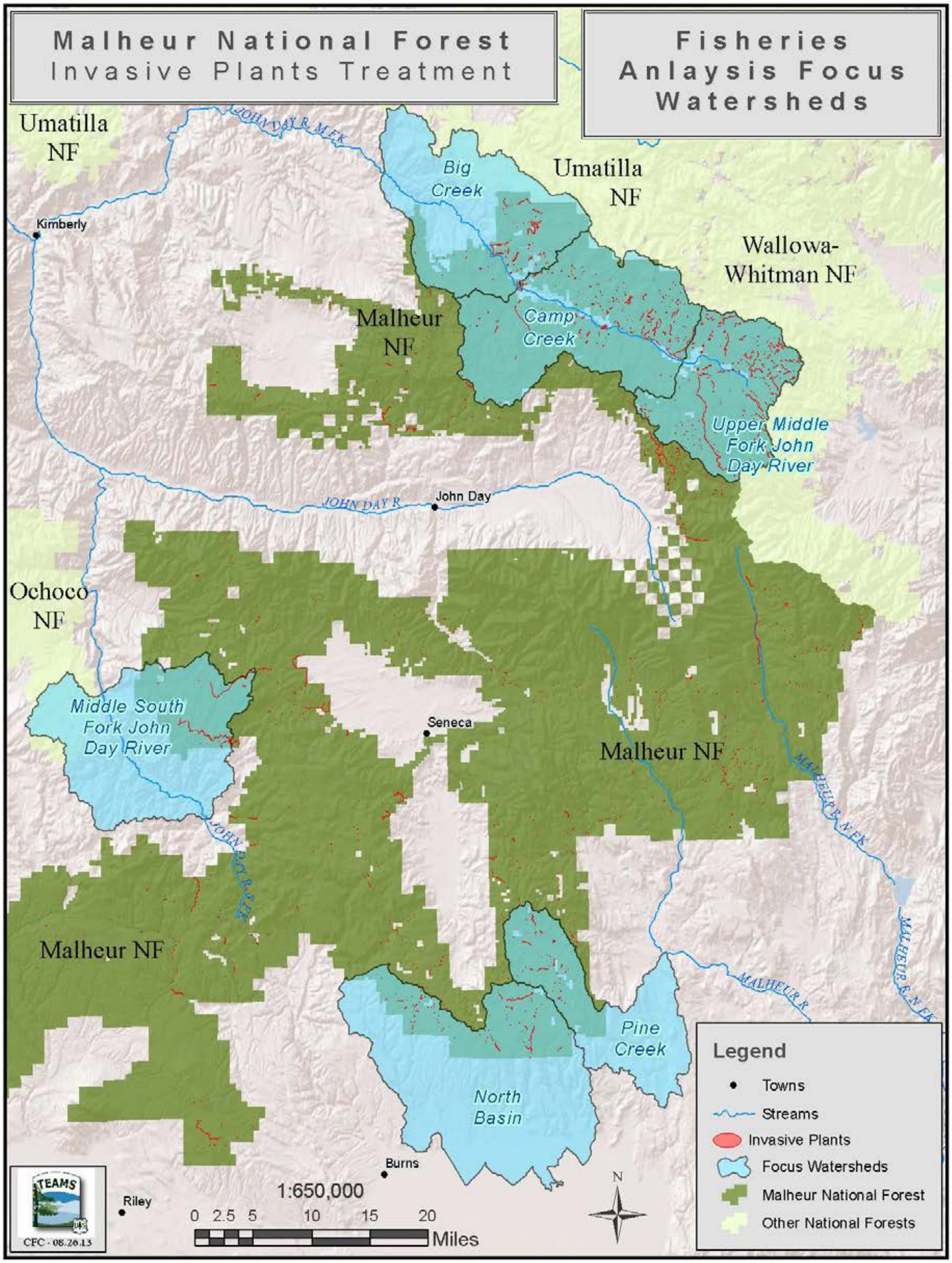

Figure 13. Focus watersheds for fisheries analysis

Big Creek Watershed

Approximately 49.80 acres (1.04%) of near-stream treatment is proposed on National Forest System land within this watershed. This watershed contains critical habitat for both steelhead and bull trout, and essential fish habitat for Chinook salmon. Habitat exists for redband trout, westslope cutthroat trout (not currently present), and western ridged mussel. This watershed is an example of “higher” relative risk since more treatment is expected and multiple aquatic species of special conservation concern exist.

Based on proximity, detectable sediment effects (e.g., turbidity) could potentially occur in spot locations within the following steelhead and/or bull trout critical habitat streams: Middle Fork John Day River, Elk Creek, Deep Creek, Mosquito Creek, Deadwood Creek, and Swamp Gulch. The areas of highest relative risk for measurable sediment effects are along Deep Creek and Mosquito Creek, where, respectively, approximately 1 mile (16 acres) and 0.50 mile (5-8 acres) of treatments are proposed. The remainder of the units are small and spatially separated. Potential sediment/turbidity effects to fish include, but are not limited to, altering behavior (e.g., feeding efficiency), gill trauma, oxygen depletion, reduction in habitat quality for multiple life stages, and reduction of food organisms. These segments represent less than 10 percent of stream length within the watershed; therefore, any effects would be low magnitude and short term. In addition, no more than 50 acres (10 acres herbicide) of treatment would occur per year within 100 feet of streams in any 6th field watershed.

Camp Creek Watershed

Approximately 94.96 acres (0.69%) of near-stream treatment is proposed on National Forest System land within this watershed. This watershed contains critical habitat for both steelhead and bull trout, and essential fish habitat for Chinook salmon. Habitat exists for redband trout, westslope cutthroat trout, Columbia spotted frog, and aquatic invertebrates. This watershed is an example of “higher” relative risk since more treatment is expected and multiple aquatic species of special conservation concern exist.

Infestations are widely distributed throughout this watershed, both along critical habitat and in tributary reaches. Based on proximity, detectable sediment effects (e.g., turbidity) could potentially occur in spot locations within the following steelhead and/or bull trout critical habitat streams: Camp Creek, Cottonwood Creek, Lick Creek, Myrtle Creek, Big Boulder Creek, Badger Creek, Dry Creek, Beaver Creek, Ragged Creek, Butte Creek, Little Boulder Creek, Windlass Creek, Tincup Creek, Granite Boulder Creek, Vincent Creek, Vinegar Creek, Davis Creek, Placer Gulch, Middle Fork John Day River, Blue Gulch, Lemon Creek. The areas of highest relative risk for measurable sediment effects are along Caribou Creek and Little Boulder Creek, where approximately ½-mile of treatment would occur along each stream. The remainder of units are small (less than ¼-mile along stream) and spatially separated. Potential sediment/turbidity effects to fish include, but are not limited to, altering behavior (e.g., feeding efficiency), gill trauma, oxygen depletion, reduction in habitat quality for multiple life stages, and reduction of food organisms. In total, segments proposed for treatment represent less than 10 percent of stream length within any watershed; therefore, any effects would be low magnitude and short term. In addition, no more than 50 acres (10 acres herbicide) of treatment would occur per year within 100 feet of streams in any 6th field watershed.

Middle South Fork John Day River

Approximately 27.62 acres (0.96%) of near-stream treatment is proposed on National Forest System land within this watershed. This watershed contains critical habitat for steelhead and essential fish habitat for Chinook salmon. Habitat exists for redband trout and westslope cutthroat trout.

Most of the treatment proposed in this watershed is along Deer Creek and North Fork Deer Creek, both of which are designated critical habitat. Potential sediment/turbidity effects to fishes include, but are not limited to, altering behavior (e.g., feeding efficiency), gill trauma, oxygen depletion, reduction in habitat quality for multiple life stages, and reduction of food organisms. More than a mile of treatment could occur along these two streams. Project "caps" would limit total annual treatment to 10% of the 6th field watershed (Corral Creek) where a relatively high concentration of sites exists. Because more treatment could be concentrated in a localized area, sediment/turbidity could be of greater magnitude than other areas; however, duration would be short term. In addition, no more than 50 acres (10 acres herbicide) of treatment would occur per year within 100 feet of streams in any 6^{th} field watershed.

North Basin

Approximately 15.97 acres (0.51%) of near-stream treatment is proposed on National Forest System land within this watershed. There is no critical habitat for federally listed species within this watershed. Redband trout may be present.

Based on proximity, detectable sediment effects (e.g., turbidity) could potentially occur in spot locations within the following streams: Polson Creek, Devine Canyon, Armstrong Canyon, Cow Creek, Rattlesnake Creek, East Fork Rattlesnake Creek, West Fork Rattlesnake Creek, and Middle Fork Rattlesnake Creek. A few sites within the Rattlesnake Creek drainage are approximately ½-mile in length; these sites pose the greatest risk of potentially measurable sediment/turbidity effects. Because less than 10 percent of this watershed would be treated, any effects that could occur would be of low magnitude and short term. In addition, no more than 50 acres (10 acres herbicide) of treatment would occur per year within 100 feet of streams in any 6^{th} field watershed.

Pine Creek

Approximately 31.01 acres (1.45%) of near-stream treatment is proposed on National Forest System land within this watershed. There is no critical habitat for federally listed species within this watershed. Redband trout may be present.

Based on proximity, detectable sediment effects (e.g., turbidity) could potentially occur in spot locations within the following streams: Pine Creek and unnamed tributaries, West Fork Pine Creek, and Alkali Creek and unnamed tributary. One site along an unnamed tributary in the headwaters of Pine Creek, and a site along West Fork Pine Creek, each exceed ½-mile in length. These areas pose the greatest risk of producing measurable sediment/turbidity effects. Potential sediment/turbidity effects to fishes include, but are not limited to, altering behavior (e.g., feeding efficiency), gill trauma, oxygen depletion, reduction in habitat quality for multiple life stages, and reduction of food organisms. Because less than 10 percent of this watershed would be treated, any effects that could occur would be of low magnitude and short term. In addition, no more than 50 acres (10 acres herbicide) of treatment would occur per year within 100 feet of streams in any 6^{th} field watershed.

Upper Middle Fork John Day River

Approximately 94.21 acres (1.50%) of near-stream treatment is proposed on National Forest System land within this watershed. This watershed contains critical habitat for steelhead and bull trout, and essential fish habitat for Chinook salmon. Habitat exists for redband trout, westslope cutthroat trout (not currently present), and western ridged mussel. This watershed is an example of "higher" relative risk since more treatment is expected and multiple aquatic species of special conservation concern exist.

Based on proximity, detectable sediment effects (e.g., turbidity) could potentially occur in spot locations within the following steelhead and/or bull trout critical habitat streams: Middle Fork John Day River, Bridge Creek, Clear Creek, Dry Fork Clear Creek, Mill Creek, Crawford Creek, Summit Creek, Idaho Creek, and Squaw Creek. The area of highest relative risk for measurable sediment effects is along Crawford Creek, where more than a mile of treatment along the stream is proposed. Project "caps" would limit total annual treatment to 10 percent of the 6th field watershed (Mill Creek) where this relatively high concentration of sites exists. Because there would be more treatment concentrated in a localized area, sediment/turbidity could be of greater magnitude than other areas (low-moderate); however, duration would be short term. In addition, no more than 50 acres (10 acres herbicide) of treatment would occur per year within 100 feet of water bodies in any 6th field watershed.

Species of Conservation Concern Determinations

Based on quantity of proposed treatment near streams, short-term detectable effects were determined to be possible in six watersheds (5th field HUC): Big Creek, Camp Creek, Middle South Fork John Day River, North Basin, Pine Creek, and Upper Middle Fork John Day River. Measurable effects in other watersheds from treatment of currently mapped infestations are not expected. More site-specific information about fisheries impacts at the watershed scale (6th field HUC) will be developed through the ongoing ESA Section 7 consultation process.

Federally Listed Fishes and their Designated Critical Habitat

For federally listed species (steelhead, bull trout) and essential fish habitat (Chinook salmon), the potential for short-term adverse effects is greatest in four watersheds within the project area: Big Creek, Camp Creek, Middle South Fork John Day River, and Upper Middle Fork John Day River. Sediment produced from treatments in riparian areas, especially manual treatments, may affect listed fish in the short term. However, these impacts are expected to be minor and discountable. The effects from sediment were further reduced with the addition of pdf E3 that provides for some erosion control in disturbed riparian areas.

Potential effects to habitat indicators are not likely to adversely affect fish and their designated critical habitat. Consultation will be completed with U.S. Fish and Wildlife Service and the National Marine Fisheries Service on the preferred alternative prior to a final agency decision.

Forest Service Sensitive Species

Forest Service Sensitive species (trout and mussel) exhibit largely overlapping ranges and similar vulnerability to effects with the federally listed fishes; therefore, the following determination applies: “May impact individuals, but a not likely to cause a trend toward federal listing or loss of viability within the planning area.”

Forest Service Management Indicator Species

Forest Service Management Indicator Species (MIS) (resident trout group – e.g., redband) overlap the distribution of federally listed fishes, and exhibit similar vulnerability to effects. In summary, there would be no reduction in quantity (miles) of stream habitat due to project actions. Habitat quality may be slightly reduced in the short-term due to post-implementation sediment input resulting from dead near-stream vegetation. This potential effect would occur within a fraction of 1 percent of available habitat; therefore, the following determination applies: “May impact individuals, but is not likely to cause a trend toward federal listing or loss of viability within the planning area.” In the long term, near-stream conditions would be improved as native vegetation re-establishes.

Table 52. Determinations for Fish Species of Conservation Concern

Species	Status	Determination[26]
Middle Columbia River steelhead DPS and designated critical habitat	Federally threatened	May affect, not likely to adversely affect.
Columbia River and Malheur River bull trout SMUs and designated critical habitat	Federally threatened	May affect, not likely to adversely affect.
Middle Columbia River Chinook salmon	Essential fish habitat and USFS sensitive	No adverse modification of essential fish habitat. May affect individuals, but is not likely to cause a trend toward federal listing or loss of viability within the planning area.
Redband trout	USFS sensitive	May impact individuals, but is not likely to cause a trend toward federal listing or loss of viability within the planning area.
Westslope cutthroat trout		
Western ridged mussel		
Resident trout group (same effects as above for same/other trout species)	USFS Management Indicator Species (MIS)	May impact individuals, but is not likely to cause a trend toward federal listing or loss of viability within the planning area.
PACFISH/INFISH	Fish and Habitat at 6th field watershed scale	Project would not prevent or retard RMO indicators associated with PACFISH/INFISH. Adverse effects are avoided to the extent practicable given the pdfs, herbicide use buffers, and project caps.

Land and Resource Management Plan Amendment

The effects of adding aminopyralid to the list of available herbicides would not adversely affect fish. The Environmental Protection Agency classified aminopyralid as a "reduced risk" herbicide and stated that the use of aminopyralid as a replacement for other herbicides will decrease risk to some non-target species [including fish] (U.S. EPA 2005 *in* SERA 2007 Risk Assessment).

Early Detection/Rapid Response

The early detection/rapid response component of the project would have similar impacts to treatment of known sites due to the implementation planning process that would ensure new detections are treated according to pdfs, treatment caps, and herbicide-use buffers. The greatest potential impact would be localized sediment/turbidity of low-moderate magnitude as discussed above for areas that currently have the highest concentration of invasive plants in a subwatershed.

The GLEAMS model run for Ennis Creek assumes that 10 acres of treatment occur adjacent to the creek because up to 10 acres may be treated using herbicide within 100 feet of a stream in a 6th field watershed in a single year. Currently, there are no sites containing 10 contiguous acres of infestation. This run does not consider the herbicide use buffers and herbicide rate restrictions associated with alternative B (model assumes maximum rates and broadcasting to the water's edge), thus the amount of herbicide that may be delivered to the stream is likely less than estimated by the model.

[26] The ESA determinations have been updated in the FEIS based on the Biological Assessment and ESA Consultation process. The project design features and other elements of the project have minimized the potential impacts on ESA listed fish and their habitat to a discountable level.

Direct and Indirect Effects of Alternative C

The conclusions from the analysis for alternative B generally apply to alternative C, with the following qualitative differences and clarifications.

- The risk of chemical contamination of aquatic habitat from herbicide application associated with alternative B would be reduced due to the absence of near-stream herbicide application. See GLEAMS model results for alternative C in chapter 3.5.3 indicating reduction in herbicide reaching streams due to the prohibition on any herbicide use within 100 feet of streams. In addition, picloram would not be used so there would be no potential for this herbicide to reach streams.
- An increase in sediment production could result from alternative C as compared to alternative B due to an increase in non-herbicide methods, many of which would produce more soil disturbance and associated mobilization into stream channels (see chapter 3.4). Treatments would be less effective and would require more treatment entries to reach desired conditions (see chapter 3.1.4) which could compound the potential effect on sediment and turbidity.
- To the extent that the greater costs and time to reach desired conditions associated with alternative C (see chapter 3.1.4), there could be less short- and long-term benefit to the aquatic environment.

Direct and Indirect Effects of Alternative D

The conclusions from the analysis for alternative B generally apply to alternative D, with the following qualitative differences and clarifications.

The risk of harm to aquatic habitat from herbicide application would increase because of increased use of picloram and glyphosate, two of the herbicides posing greatest risk to aquatic organisms. However, despite the increased use of these herbicides, GLEAMS model results show a low risk of these herbicides reaching streams. Project design features, herbicide-use buffers, and project “caps” provide substantial protection, making detectable difference in effects to aquatic organisms and their habitat unlikely, except in the case of an unexpected over-application (e.g., spill near water). Due to the greater costs and time to reach desired conditions associated with alternative D (see chapter 3.1.4), there could be less short- and long-term benefit to the aquatic environment. All other potential effects would be similar to alternative B, including sediment from all treatment methods.

Cumulative Effects of All Action Alternatives

The baseline for cumulative effects analysis is the current condition as described in the affected environment section. The differences between alternatives in terms of impacts to fisheries are so small that cumulative effects would be the same across alternatives.

Herbicide Application

Herbicides are commonly applied for a variety of agricultural, landscaping, and invasive plant management purposes. Herbicide use occurs on tribal, state, county, private forestry, range, utility corridor, road rights-of-way, and private property lands. Studies (see chapter 3.1.5) have shown that pesticides are commonly found in surface waters in Oregon and throughout the United States. However, the studies indicate that herbicide use similar to the type proposed in this project would not result in harmful concentrations of herbicide in water. Herbicide concentrations from the project are expected to be undetectable or very low in all waterways, and would therefore not contribute to herbicide cumulative effects.

The effect of higher than historic water temperature on fish sensitivity to proposed herbicides is unknown. The exposure scenarios likely overestimate the amount of herbicide that may reach streams because they do not account for all aspects of project design that minimize the potential for herbicide to reach water bodies. In addition, the thresholds of concern for fish are conservative; the exposure scenarios and thresholds of concern likely account for any potential increased sensitivity due to water temperature. Therefore, the project is not expected to add to potential temperature-related effects from other ongoing or foreseeable projects.

Sediment and Turbidity

Sediment production from project actions could add to sources derived from other actions on National Forest System lands, tribal lands, state and county lands, private forestry lands, rangelands, utility corridors, road rights-of-way, and private property. These potential additions will be analyzed qualitatively based on percentage of lands of other ownerships present within specific watersheds where effects are potentially measurable. Project caps would similarly limit potential effects in areas where new or expanding invasive plant populations are discovered and treated.

Within the six focus watersheds where project-related sediment/turbidity effects are most likely, effects would be low magnitude and short term. Streams listed (303(d)) for sediment within the Middle Fork John Day and Upper John Day watersheds (see Water Quality section) are not expected to incur any detectable long-term sediment additions from project activities; spatially isolated short-term sediment effects would be limited to low-magnitude turbidity increases and pool surface-fines.

Table 54 considers the other current and future actions that may contribute sediment to the focus watersheds for fisheries, along with manual treatment proposed in this project in both action alternatives. Manual treatment would contribute a very small percentage to the total sediment produced. Natural background seasonal fluctuation along with sediment/turbidity effects from other actions (e.g., roads, timber harvest, grazing) exceeds any potential production from invasive plant treatment by orders of magnitude.

Table 53. Cumulative effects, qualitative estimates within focus watersheds for fisheries

Watershed Name	Currently Infested acres within 100’ of water bodies	Other current/future Federal actions capable of contributing sediment	Percent of watershed private land (approximate)	Project-related sediment based on current infestations	Long-Term Total
Big Creek (Middle Fork John Day River)	50	Road maintenance, grazing, dispersed camping	60%	Low quantity, short duration (<2 years beyond the time of treatment)	Pre-project levels
Camp Creek (Middle Fork John Day River)	100	Road maintenance, prescription fire, timber harvest, road closures/decommissioning, culvert replacements, large woody debris in-stream placement, grazing, campgrounds, dispersed camping	<5%	Low quantity, short duration (<2 years beyond the time of treatment)	Pre-project levels
Middle South Fork John Day River	28	Road maintenance, juniper and mixed conifer cutting, fuel treatment, aspen restoration, watershed improvement activities, grazing, dispersed camping, Murder’s Creek Wild Horse Territory	75%	Low quantity, short duration (<2 years beyond the time of treatment)	Pre-project levels

Watershed Name	Currently Infested acres within 100' of water bodies	Other current/future Federal actions capable of contributing sediment	Percent of watershed private land (approximate)	Project-related sediment based on current infestations	Long-Term Total
North Basin	16	Road maintenance, snow park relocation, prescription fire, timber harvest, road closures/decommissioning, hazard trees, grazing, campgrounds, dispersed camping	75%	Very low quantity, short duration (<2 years beyond the time of treatment)	Pre-project levels
Pine Creek (Malheur River)	31	Road maintenance, prescription fire, grazing, dispersed camping	60%	Low quantity, short duration (<2 years beyond the time of treatment)	Pre-project levels
Upper Middle Fork John Day River	94	Road maintenance, snow park, prescription fire, timber harvest, road closures/decommissioning, aspen restoration, aquatic restoration, culvert replacements, grazing, dispersed camping	<5%	Low quantity, short duration (<2 years beyond the time of treatment)	Pre-project levels

Several other stressors on fish exist, including hydropower development, habitat degradation from human activities, direct harvest of fish, and competition from hatchery fish (USDA Forest Service 2008b). These are part of the existing condition for aquatic organisms and this project will not influence these conditions. The threshold of concern for herbicide impacts has been set deliberately low to accommodate uncertainty about how fish respond to herbicide exposure in combination with other stressors.

The analysis assumes maximum levels of treatment over the life of the project. Even given these unlikely treatment levels, project-related additions to existing cumulative effects are likely to be minor or non-existent. At any given site, direct or indirect adverse effects to aquatic organisms under all alternatives would be low magnitude, localized, and short term. The potential to affect the aquatic environment is limited to a low amount of herbicide or sediment, and minor impacts on native riparian vegetation (see previous sections of this EIS). These effects are not of a type or extent that would combine with ongoing human activities or foreseeable projects on the Forest and produce long-term, cumulative impacts, even considering the vectors of invasive plant spread described in chapter 3.1.5.

3.7 Wildlife

3.7.1 Introduction

National Forest System land on the Malheur National Forest (Forest) provides diverse habitats for wildlife including grasslands, sagebrush, and juniper; fir and pine forests; and mountain lakes and meadows. These varied habitats provide for a diversity of wildlife including 365 vertebrate species (22 fish, 9 amphibians, 14 reptiles, 235 birds, and 85 mammals) (Forest LRMP p. III-42). Invasive plants have become established and continue to spread, causing a loss of wildlife habitat and posing a risk of injury to wildlife on the Malheur National Forest. This section addresses the impacts and benefits of the proposed Malheur National Forest Site-Specific Invasive Plants Treatment Project on wildlife and wildlife habitat.

Regulatory Framework

The following is a summary of regulatory direction specifically applicable to the management of wildlife resources on the project area.

- National Environmental Policy Act (NEPA) of 1969 (as amended) - NEPA requires that effects of management actions on wildlife be disclosed and requires that management provide for a diversity of plant and animal communities (16 USC 1604((g) (3) (B))

- Endangered Species Act (ESA) of 1973 (as amended) - ESA requires the Forest Service to manage for the recovery of threatened and endangered species and the ecosystems, upon which they depend. Forests are also required to consult with the United States Fish and Wildlife Service if a proposed activity may affect the population or habitat of a listed species.

- National Forest Management Act (NMFA) of 1976 (as amended) - NFMA requires the Forest Service to manage fish and wildlife habitat to maintain viable populations of all native and desirable non-native vertebrate wildlife species and conserve all listed threatened or endangered species populations (36 CFR219.19).

- Executive Order 13186 (Migratory Bird Treaty Act) - The MBTA established an international framework for the protection and conservation of migratory birds. This Act makes it illegal, unless permitted by regulations, to “pursue, hunt, take, capture, purchase, deliver for shipment, ship, cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird.” Within the NEPA process, effects of proposed actions on migratory birds will be evaluated and actions will consider approaches to identify and minimize take (USDA Forest Service 2008).

- Forest Service Manual Direction regarding wildlife (FSM 2600) - Forest Service Manual direction provides guidance related to Threatened, Endangered, and Sensitive (TES) species. It requires that the Forest Service identify and prescribe measures to prevent adverse modifications or destruction of critical habitat and other habitats essential for the conservation of endangered, threatened, and proposed species (FSM 2670.31 (6)). It also requires the Regional Forester to identify sensitive species for each National Forest where species viability may be a concern (under FSM 2670.32) and mitigate adverse impacts of management activities (FSM 2634).

The Forest LRMP provides comprehensive guidance for wildlife management. The wildlife report details specific objectives, standards, and guidelines related to wildlife. This project has very limited impacts to wildlife species and most of the Forest LRMP wildlife management direction is not applicable to this project.

3.7.2 Affected Environment

Invasive Plants Influence Wildlife Habitat

Invasive plants are thought to generally degrade wildlife habitat, especially for species that require intact native plant ecosystems. Some wildlife species use invasive plants for food or cover. For example, American goldfinch (*Carduelis tristis*) and red-winged blackbird (*Agelaius phoeniceus*) use purple loosestrife (Kiviat 1996; and Thompson 1987), and native bighorn sheep will eat cheatgrass (Csuti et al. 2001). It has been reported that elk, deer, and rodents eat rosettes and seed heads of spotted knapweed. Doves, hummingbirds, honeybees, and the endangered southwestern willow flycatcher (*Empidonax trailii* extimus) are known to use saltcedar (Barrows 1996).

The few uses that an invasive plant may provide do not outweigh the adverse impacts to an entire ecosystem (Zavaleta 2000). Invasive plants have adversely affected habitat for native wildlife in Oregon (ODFW 2006). Species of wildlife that depend upon native vegetation for food, shelter, or breeding can be adversely affected by invasive plants. Species restricted to very specific habitats, for example pond-dwelling amphibians, are more susceptible to adverse effects.

Displacement of native plant communities by non-native plants results in alterations to the structure and function of ecosystems and constitutes a principle mechanism for loss of biodiversity at regional and global scales (Lacey and Olson 1991). Mills et al. (1989) and Germaine et al. (1998) found that native bird species diversity and density were positively correlated with the volume of native vegetation, but were negatively correlated or uncorrelated with the volume of exotic vegetation.

Invasive plants can adversely affect wildlife species by eliminating required habitat components, including surface water (Dudley 2000; Horton 1977); reducing available forage quantity or quality (Bedunah and Carpenter 1989; Rice et al. 1997; Trammell and Butler 1995); reducing preferred cover (Rawinski and Malecki 1984; Thompson et al., 1987); drastically altering habitat composition due to altered fire cycles (D’Antonio and Vitousek 1992; Mack 1981; Randall 1996; Whisenant 1990); and physical injury, such as that caused by long spines or “foxtails” (Archer 2001). In the case of common burdock (*Arctium minus*), the prickly burs can trap bats and hummingbirds and cause direct mortality to individuals (Raloff 1998). Invasive plants that grow large and densely (e.g., giant reed, Himalayan blackberry) can act as physical barriers to water sources and essential habitat.

Invasive plants can act as a population sink by attracting a species and then exposing it to increased mortality or failed reproduction (Chew 1981). Schmidt and Whelan (1999) reported that native birds increased their use of exotic *Lonicera* and *Rhamnus* shrubs over native trees, even though nests built in the exotic shrubs experienced significantly higher mortality rates.

Some invasive plants, such as knapweed, contain chemical compounds that make the plant unpalatable to grazing animals. Chemical compounds in these invasive plants disrupt microbial activity in the rumen or cause discomfort after being ingested, resulting in a reduced or avoided consumption of the invasive plant (Olson 1999).

Habitats that become dominated by invasive plants are often not used, or are used much less, by native and rare wildlife species, and species, such as yellow starthistle and knapweed reduce, wildlife habitat (USDA Forest Service 2007, Utah State University 2013), and degrade upland game bird habitat. Some hunters and wildlife managers are concerned that invasive plants are degrading the quality of remaining habitat for deer and elk, adversely affecting distribution of the animals, and hunting opportunities. Trammell and Butler (1995) found that deer, elk, and bison avoided sites infested with leafy spurge (*Euphorbia esula*). Tamarisk stands have fewer and less diverse populations of wildlife (Jakle and Gatz 1985; Olson 1999). Invasion by purple loosestrife makes habitat unsuitable for numerous birds, reptiles, and mammals (Kiviat 1996; Lor 2000; Rawinski 1984 and Malecki 1984; and Thompson et al. 1987; Weiher and Neely, 1997; Weiher et al. 1996). Reed canarygrass, implicated in the loss of Oregon spotted frog habitat, may have contributed to contractions in the range of Oregon spotted frogs in western Oregon (Hayes 1997; McAllister and Leonard 1997). Bald eagle mortality in other parts of the U.S. has been linked to a toxin produced by cyanobacteria that grow on the invasive aquatic plant, *Hydrilla verticillata* (Wilde 2005).

In summary, invasive plants are known or suspected of causing the following effects:

- Embedded seeds in animal body parts (e.g., foxtails), or entrapment (e.g., common burdock) leading to injury or death.
- Scratches leading to infection.

- Alteration of habitat structure leading to habitat loss or increased chance of predation (Schmidt and Whelan 1999).
- Change to effective population size through nutritional deficiencies or direct physical mortality.
- Poisoning due to direct or indirect ingestion of toxic compounds found on or in invasive plants.
- Altered food web and nutrient cycling (Allison and Vitousek 2004; Ehrenfeld 2003; Rimer and Evans 2006).
- Source-sink population demography, with more demographic sinks than sources.
- Lack of proper forage quantity or nutritional value at critical life periods.

Terrestrial Wildlife Species of Conservation Concern

Federally Listed Species

The following section discusses species that have been, are currently, are proposed for, or are candidates for listing under the federal Endangered Species Act (ESA). Threatened and endangered species evaluated include the Canada lynx (threatened), North American wolverine (proposed for listing), and yellow-billed cuckoo (proposed for listing). The yellow-billed cuckoo was proposed for listing in October 2013 (USFWS 2013c) and has subsequently been added to the FEIS. Three species, the bald eagle, peregrine falcon, and gray wolf (Rocky Mountain Distinct Population Segment (DPS)) have been delisted (USFWS 2007a, USFWS 20011a) and are currently managed as Region 6 sensitive species. The gray wolf outside the Rocky Mountain DPS, which is federally endangered, does not occur within the project area and will not be evaluated in detail in this analysis. The project area is within the range of and provides habitat for the Columbia spotted frog and greater sage grouse. Because they have not been formally listed, these two species are analyzed as Forest Service sensitive species.

Table 54. ESA species (listed, proposed, candidate, delisted)

Common Name	Scientific Name	Conservation Status	Species Presence
Canada Lynx	*Lynx Canadensis*	Threatened	Not Present
North American Wolverine	*Gulo gulo luscus*	Proposed Threatened	Suspected
Yellow-billed Cuckoo	*Coccyzus americanus*	Threatened	Suspected
Gray Wolf (Rocky Mountain DPS)[1]	*Canis lupus*	Delisted-Sensitive	Suspected
Gray Wolf outside Rocky Mountain DPS	*Canis lupus*	Endangered	Not Present
Bald Eagle[1]	*Haliaeetus leucocephalus*	Delisted-Sensitive	Documented
American Peregrine Falcon[1]	*Falco peregrinus anatum*	Delisted-Sensitive	Documented
Greater Sage Grouse[1]	*Centrocercus urophasianus*	Candidate-Sensitive	Documented
Columbia spotted frog[1]	*Rana luteiventris*	Candidate-Sensitive	Documented

[1]Evaluated as a Region 6 sensitive species (USDA Forest Service 2011)

The following is a brief description of the species' life history, threats, and generally recognized species protection measures. The species status and available habitat on the project area and the amount of habitat currently affected by known invasive plant sites are also discussed. Additional information on federally listed species can also be found in the biological assessment prepared for the R6 2005 FEIS, which is incorporated by reference into this analysis.

Canada lynx

Status, Life History and Habitat Description **-** The population, distribution, life history, habitat status and recovery objectives for Canada lynx are detailed in Ruggiero et al. (1999), Ruediger et al. (2000), USDI Fish and Wildlife Service (2006) and USDI Fish and Wildlife Service (2007c). The following is a summary of lynx habitat preferences and biology.

Lynx are highly specialized predators of snowshoe hare (*Lepus americanus*) and habitat can generally be described as moist boreal forests that have cold, snowy winters and a snowshoe hare prey base (USDI Fish and Wildlife Service 2006). Lynx habitat generally consists of lodgepole pine, subalpine fir, and Engelmann spruce whereas dry forest types (e.g., ponderosa pine and climax lodgepole pine) generally do not provide suitable habitat (Ruediger et al. 2000).

Snow conditions also determine the distribution of lynx (Ruggiero et al. 1999) as lynx are adapted for hunting snowshoe hares and surviving in areas that have cold winters and deep, fluffy snow for extended periods. Because of the patchiness and temporal nature of high quality snowshoe hare habitat, lynx populations require large boreal forest landscapes to ensure that sufficient high-quality snowshoe hare habitat is available at any point in time so that lynx may move freely among patches of suitable habitat and among subpopulations of lynx (USDI Fish and Wildlife Service 2009a).

Lynx are highly mobile and long-distance movements (greater than 60 miles) are characteristic (Aubry et al. 2000 in Ruggiero et al. 1999). Lynx disperse primarily when snowshoe hare populations decline. Sub-adults also disperse when prey is abundant and lynx make exploratory movements outside their home range (USDI Fish and Wildlife Service 2009a).

Lynx den sites are located where coarse woody debris, such as downed logs and windfalls, in older regenerating stands or in mature forest is available (USDI Fish and Wildlife Service 2007c). Lynx productivity is highly dependent on the quantity and quality of winter snowshoe hare habitat, which is a limiting factor for lynx persistence.

Threats **-** Risk factors for lynx include direct human threat (shooting, trapping, vehicle collisions), as well as changes in forage and denning habitat. Lynx have evolved a competitive advantage in deep snow environments due to their large paws that allow them to hunt prey where other predators cannot because of snow conditions. There is a concern that compacted snow routes allow these other predators access into isolated areas that are normally used exclusively by lynx (Wisdom et al. 2000). This increased access can also increase lynx vulnerability to harvest, collision, or harassment. These concerns have not been conclusively verified, however. Fire suppression and logging have altered the mosaic of habitats needed for prey species and denning sites (ibid.). Invasive plants have not been identified as a threat to lynx.

Project Area Status **-** The Blue Mountains represent the southern extent of lynx distribution, which would explain the rarity of this species on the periphery of its range both historically and now (USDI FWS 2005). Lynx habitat in northeast Oregon is categorized as “peripheral area”. Only four relatively recent specimens are known, one from Wallowa County in 1964, Benton County in 1974, Harney County in 1993 (McKelvey et al. 2000), and near Burns in 1994. Self-maintaining populations of lynx in Oregon have not existed historically (Verts and Carraway 1998). Based on limited verified records, lack of evidence of reproduction, and occurrences in atypical habitat that correspond with cyclic highs, lynx have never maintained resident populations, although they are considered an infrequent and casual visitor by the state of Oregon (Ruediger et al. 2000, pp. 4-7).

Winter track surveys for lynx and wolverine were conducted by the Forest from 1991-1994 and no confirmed lynx tracks were found. Hair snares were used to survey for lynx, according to the National Lynx Survey, during the summers of 1999-2001. There were no lynx detections confirmed from this survey effort. It is unknown whether lynx are currently present on the Forest, but there are no verified records and there is no evidence of occupation or reproduction that would indicate colonization or sustained use by lynx.

Occupied lynx habitat includes lands that either 1) have had at least two verified lynx observations or records since 1999 or 2) where there is evidence of lynx reproduction on the national forest (USDI FWS 2006a). The project area is considered unoccupied lynx habitat because neither of these conditions exists.

Lynx habitat within the project area was mapped using the vegetation and environmental conditions for the Northern Rocky Mountains geographic area, and more specifically, the Blue Mountain Section, including northeast Oregon and west-central Idaho. Primary vegetation was based on the direction provided in the Canada Lynx Conservation Assessment and Strategy (LCAS) (Ruediger et al. 2000), and follow-up guidance from the Forest Service Regional Office and the Lynx Biology Team. Sixth code Hydrologic Unit Codes (HUC), were used as the basis for delineating lynx habitat across the Malheur National Forest. Although the Lynx Conservation Agreement (May 2006), states that the LCAS does not apply to forests that are considered as having unoccupied habitat, the lynx analysis units (LAU) acreage was used to identify potential lynx habitat on the MNF. Suitable lynx habitat occurs in the Strawberry, Glacier, and Indian Lynx Analysis Units.

Table 56 identifies the total amount and type of suitable lynx habitat within project area LAUs, as defined in the LCAS, as well as known invasive plant infestations within suitable habitat.

Currently, 16 acres of suitable lynx habitat are affected by invasive plants. Roads serve as one of the primary vectors for the spread of invasive plants. Lynx prefer remote habitat within forested areas, therefore, only a few acres of invasive weeds have been identified within suitable habitat.

Table 55. Acres of Lynx habitat in the project area

Habitat	Denning(ac)	Foraging(ac)	Total(ac)
Suitable Lynx Habitat	26,849	14,158	41,007
Habitat Affected by Invasive Plants	8	8	16

Wolverine

Status Life History and Habitat Description - The wolverine is now a proposed threatened species, per findings of the USDI Fish and Wildlife Service, 50 CFR Part 17, 78 FR 7864, Endangered and Threatened Wildlife and Plants: Threatened Status for the Distinct Population Segment of the North American Wolverine Occurring in the Contiguous United States, dated February 4, 2013, found at http://federalregister.gov/a/2013-0148. It has a global rank of G4 and is a State threatened species.

Wolverine is a solitary and highly mobile species that tends to inhabit remote areas and occurs at relatively low densities (Banci 1994). Wolverines range widely from subalpine talus slopes to big game winter ranges, occupying higher ranges in the summer and riparian habitats in the spring. Ruggiero et al. (1999) found that wolverines used higher elevations in the snow-free season to avoid high temperatures and human activity. Wolverine habitat is best defined in terms of adequate year-round food supplies in large sparsely inhabited areas, rather than in terms of particular types of topography or plant associations. No particular habitat components or habitat management techniques can presently be singled out for wolverine and success of wolverine may relate to the availability of large areas of remote, rugged uplands that are difficult to access by humans (Hatler 1989). Wolverines occur in low densities in all places they have been studied (Ruggiero et al. 1994). This is generally attributed to naturally low reproductive rates and delayed sexual maturity of the species.

Wolverines are opportunistic feeders and consume a variety of foods depending on availability. They primarily scavenge carrion, but they also prey on small mammals and birds and eat fruits, berries, and insects (USDI Fish and Wildlife Service 2010). In both Montana and Idaho, big game carrion appears to be the major food source with snowshoe hare, squirrels, and small mammals making up the rest of their diet (Hornocker and Hash 1981). Large mammal carrion is an important dietary component, particularly in winter when other prey is scarce (Banci 1994, Pasitschniak and Lariviere 1995), and wolverine rely heavily on the presence of other predators. Wolverines will also search for caches made by itself, other wolverines, or other carnivores during the winter.

Female wolverines use two kinds of dens for reproduction. Females use natal (birthing) dens to give birth and raise kits early postpartum, prior to weaning. They are excavated in snow and persistent, stable snow greater than 5 ft. in depth appears to be a requirement for natal denning, (USDI Fish and Wildlife Service 2013a). In Montana, natal dens occur above 7,874 feet and are located on north aspects in avalanche debris typically in alpine habitats near timberline (USDI Fish and Wildlife Service 2013a). Prior to weaning, females may move kits to one or multiple alternate den sites, referred to as maternal dens. The movement of kits from natal to maternal dens may be a response by the female to den disturbance, better food availability in the new location, predation risk, or deteriorating den conditions in the natal den (Magoun and Copeland 1998).

Post-weaning dens are called rendezvous sites. These dens may be used through early July. Females leave their kits at rendezvous sites while foraging, and return periodically to provide food for the kits. These sites are characterized by natural (unexcavated) cavities formed by large boulders, downed logs (avalanche debris), and snow (Inman et al. 2007). They may also occur in talus or coniferous riparian zones.

Wolverine home ranges are generally extremely large and the availability and distribution of food is likely the primary factor in determining wolverine movements and home range. Home ranges of adult wolverines range from less than 38.5 square miles to 348 square miles (USDI Fish and Wildlife Service 2010). Home ranges of adult males and females overlap extensively with the range of one male covering the ranges of two to six females, which is considered one reproductive unit. Witmer et al. (1998) suggested long-term conservation of wolverine can be achieved through maintenance of large, remote areas of habitat, and engaging in management activities that do not decrease ungulate prey density.

Threats - Wolverines have few natural predators although both interspecific and intraspecific mortalities have been documented. Wolverines are susceptible to mortality through hunting and trapping and human caused disturbances near den sites (Banci 1994, Hornocker and Hash 1981, Copeland 1996). Wolverine naturally occur at low densities (Hornocker and Hash 1981, Copeland 1996).

In their proposed rule to list the wolverine as threatened (USDI Fish and Wildlife Service 2013a), it was determined that the impacts of climate change constitute a threat to the contiguous U.S. DPS of the wolverine. Wolverine populations in the remaining U.S. range appear to be at numbers so low that their continued existence could be at risk. These risks come from three main factors: 1) small total population size, 2) effective population below that needed to maintain genetic diversity and demographic stability, and 3) fragmented nature of wolverine habitat in the contiguous United States that results in smaller, isolated island patches separated by unsuitable habitats. Other threats are secondary and only rise to the level of threats to the DPS as they may work in concert with climate changes to affect the third risk factor; habitat. In their finding on the wolverine DPS, the USFWS discussed a variety of impacts to wolverine habitat including: 1) climate change, 2) human use and disturbance, 3) dispersed recreational activities, 4) infrastructure development, 5) transportation corridors, and 6) land management. The primary impact of climate change on wolverines is expected to be changes to the availability and distribution of wolverine habitat.

Project Area Status - Prior to 1973, wolverines were classified as furbearers in Oregon. Numerous animals have been collected or sighted around the northwest. A query of the Oregon Natural Heritage database reveals that there are about 150 observations of wolverines in Oregon, with most occurring in the mountainous northeast (Baker, Grant, Umatilla, Union, and Wallowa Counties) region (ODFW 2013). Although recent sightings, tracks and a road kill document their presence (Csuti et al. 2001), they are considered rare throughout all of Oregon, Washington, Idaho, and California.

Periodically throughout the 1990s, wolverine surveys were conducted across the Forest. Records for eastern Oregon include a partial skeleton and tufts of fur found near Canyon Mountain, Grant County (1992), tracks and a possible denning site discovered in the Strawberry Mountain Wilderness (1997), tracks that were noted in the Monument Rock Wilderness (1997), and hair and track collection on Snow Mountain Ranger District, Ochoco National Forest (1992). There have been additional unconfirmed sightings reported periodically on the Forest although there are no recent verified locations or physical evidence of their occurrence. Sightings are mostly from wilderness, or more remote, high-elevation areas.

In the Blue Mountains, source habitat for wolverine occurs primarily in wilderness and large roadless areas; although no den sites have been identified. Areas of low human impacts, low human disturbance, and high deer and elk concentrations are preferred. The best source habitat is located in the Strawberry Mountain Wilderness, Monument Rock Wilderness, Vinegar Hill-Indian Rock Scenic Area, the Jump Off Joe, Dixie Butte and Dry Cabin Wildlife Emphasis Areas, and the Shaketable, McClellan Mountain, Aldrich Mountain Roadless, and Baldy Mountain Roadless Areas.

Collectively, the Malheur National Forest includes approximately 82,555 acres of wilderness and approximately 180,822 acres of roadless areas, and these lands are most likely to be used for denning or dispersal. Using the forest GIS habitat layer, potentially suitable den habitat exists on approximately 1,200 acres forest-wide, with 430 acres occurring in more remote wilderness or roadless areas. Of this, almost 80 percent occurs in the Strawberry wilderness. Because deep, persistent snow is characteristic of dispersal habitat (Schwartz et al. 2009), wolverine dispersal habitat is more likely to occur on upper elevation ridges and mountains whereas potential foraging habitat occurs across much of the Forest.

Invasive plants have not been identified as a primary threat to wolverine. Of the 1,200 acres of den habitat, known infestations of invasive plants occur on less than one acre. The low level of invasive weeds is likely a result of the low management/use levels associated with wilderness/roadless areas, although extensive surveys have not been conducted in remote areas of the Forest.

Yellow-billed Cuckoo

Status, Life History, and Habitat Description - The yellow-billed cuckoo in the western United States was accorded federal candidate status in July 2001. On October 3, 2013, the Western U.S. DPS was proposed as a threatened species under the Endangered Species Act (USDI FWS 2013b). Historical records for the state show that breeding cuckoos were most often sighted in willow bottoms along the Willamette and Columbia Rivers (USDI FWS 2013b).

Western yellow-billed cuckoos breed in dense willow and cottonwood stands in river floodplains. They are migratory—arrive in Oregon in mid-May—and fly south to their wintering grounds in September. Cuckoos eat large insects, including caterpillars and cicadas, and occasionally small frogs and lizards. Breeding coincides with the emergence of cicadas and tent caterpillar (USDA FWS 2013b). In California, caterpillars and katydids appeared to be preferred food whereas white tree frogs and grasshoppers were utilized more while raising young (California PIF 1998).

Western cuckoos breed in large blocks of riparian habitats, particularly woodlands, cottonwoods (*Populus fremontii*), and willows (*Salix sp.*). Dense understory foliage appears to be an important factor in nest site selection, while cottonwood trees are an important foraging habitat. At the landscape level, the amount of cottonwood/willow-dominated vegetation cover and the width of riparian habitat appeared to influence cuckoo distribution and abundance. Although yellow billed cuckoos occasionally lay eggs in the nests of other birds (USDI FWS 2011, USDI FWS 2001), unlike other cuckoos, they often build their own nests. Nests are usually loose platforms of twigs lined with leaves or finer material and in the West are often placed in willows, cottonwoods, and shrubs (Washington Dept. of Fish and Wildlife 2012). Cuckoos require horizontal branches for nesting, and nest tree height varies from approximately 10 to 25 feet above the ground with dense understories (Center for Biodiversity 1998, California PIF).

The cuckoo is likely even more sensitive to habitat loss than other riparian obligate species, such as the willow flycatcher, because it is dependent on the combination of a dense willow understory for nesting, a cottonwood overstory for foraging, and large patches of habitat in excess of 50 acres (Center for Biodiversity 1998). It is also not known to utilize non-native vegetation in the majority of its range (Center for Biodiversity 1998).

Threats - Historically, the yellow-billed cuckoo bred throughout much of North America. Available data suggests that within the last 50 years the species' distribution west of the Rocky Mountains has declined substantially, although this species probably was never common in Oregon (USDI FWS 2013b). Loss of streamside habitat is regarded as the primary reason for the population decline. The greatest threat to the species is reported to be loss of riparian habitat, and it is estimated that 90 percent of the cuckoo's stream-side habitat has been lost. Habitat loss in the west is attributed to agriculture, dams and river-flow management, overgrazing, and competition from exotic plants, such as tamarisk. Activities that alter or destroy riparian habitat are of particular concern, including unmanaged cattle grazing, which contributes to the loss of sub-canopy vegetation and cottonwood regeneration (USDI FWS 2013b).

Project Area Status - In Oregon, the last confirmed breeding records were in the 1940s. However, four cuckoo sightings were made west of the Cascade Mountains between 1970 and 1994, and at least 20 records east of the Cascades. A survey in eastern Oregon and Klamath County in 1988 located no birds, but identified potential breeding habitat along the lower Owyhee River (Littlefield 1988, p. 34 In USDI FWS 2011). Most recent records were from May and June of 1999 (Johnson and O'Neil 2001, pp. 460–461) and a single yellow-billed cuckoo was sited during the breeding season (June 26-27 1999) along Bonita Road in Malheur County (approximately 15 miles east of the project area) (USDI FWS 2011). Recent records of cuckoos from eastern Oregon are at the Malheur National Wildlife Refuge in Harney County, approximately 30 miles south of the project area, and from Malheur and Deschutes counties (USDI FWS 2013b).

Suitable habitat was identified by using Oregon GAP data including cottonwood riparian woodlands and willow riparian floodplain habitat. Approximately 2,136 acres of suitable habitat was identified along the Middle Fork of the John Day River. Approximately 28 acres of this suitable habitat is proposed for treatment.

Gray Wolf

***Habitat and Threats* -** The gray wolf is a habitat generalist inhabiting a variety of plant communities, typically containing a mix of forested and open areas with a variety of topographic features (Verts and Carraway 1998, Witmer et al. 1998). Habitat can include forests of all types, rangelands, brushland, steppes, agricultural lands, wetlands, deserts, tundra, and barren ground areas, although the gray wolf appears to be more prey dependent than cover dependent. Prey species include white-tailed and mule deer, moose, elk, woodland caribou, bighorn sheep, mountain goat, beaver, and snowshoe hare, with small mammals, birds, and large invertebrates sometimes being taken, although ungulates comprise 90 percent or more of their diet (USDI FWS 1987). They are also opportunistic feeders and will prey on carrion when it is available (Witmer et al. 1998).

Wisdom et al. (2000) suggested four major challenges to wolf conservation within the Interior Columbia Basin: excessive mortality from humans, mortality related to roads, displacement from habitat by human activities and population isolation. Consequently, the ability of wolves to persist will be determined largely by the degree of human tolerance for the species (Oregon DFW 2005).

Project Area Information - In Oregon, wolves have increased steadily since re-introduction and wolf numbers are currently well above recovery objectives. In northeastern Oregon suitable habitat includes Eagle Cap, Wenaha-Tucannon, North Fork John Day, Strawberry Mountain wilderness areas, Hells Canyon NRA, designated roadless areas on public lands, and areas characterized by low density of open roads. Such areas would be characterized as highly suitable because human densities and activity levels are low whereas ungulate numbers are considered adequate to support wolves (Oregon DFW 2005).

The Idaho wolf population has been increasing steadily, and dispersal into the Blue Mountains is expected to continue (Oregon DFW 2005). In July 2008, a wolf pack that includes both adults and pups was confirmed in a forested area of northern Union county and was the first evidence of multiple wolves and wolf reproduction in Oregon. By the end of 2012, Oregon's minimum wolf count was 53 wolves including seven packs and at least five breeding pairs. Another breeding pair was added in February 2013 (Oregon DFW 2013b).

While occasional wolf sightings are reported, the gray wolf has not been confirmed within the project area. Wolf sighting information to date seems to indicate transient or lone individuals that are not part of a resident pack. However, the project area provides suitable remote forest habitat and supports large populations of big game (Oregon DFW 2005). As a result and considering a pack has been documented approximately 75 miles northeast in Union county, it is likely that wolf use could occur within the project area.

Although foraging or dispersal habitat is relatively widespread, remote habitat suitable for denning or rendezvous sites is restricted to relatively un-roaded areas. Consequently, suitable wolf habitat largely occurs within wilderness and roadless areas, which make up almost 263,377 acres on the Forest.

Currently only 16 acres of the wilderness/roadless lands on the Forest have documented infestations of invasive plants. However, as described under wolverine, due to the lack of surveys in these remote areas, infestations may be larger than is currently documented. Although not a threat to wolves, invasive plants may adversely affect the quality of habitat for big game populations.

Forest Service (R6) Sensitive Species

Several terrestrial mammals, birds, amphibians, and invertebrate species found or suspected to be on the Malheur National Forest are Forest Service Sensitive Species (Table 57, Regional Forester's Sensitive Species List 2011 (USDA Forest Service 2011a)). Management of Forest Service Sensitive Species is a proactive approach for meeting the Agencies obligations under the Endangered Species Act and the National Forest Management Act (NFMA), and National Policy direction as stated in the 2670 section of the Forest Service Manual and the U.S. Department of Agriculture Regulation 9500-4. The primary objectives of the Sensitive Species program are to ensure species viability throughout their geographic ranges and to preclude trends toward endangerment that would result in a need for federal listing. Species identified by the Fish and Wildlife Service as "candidates" for listing under the ESA, as well as species that have been de-listed from ESA are managed as R6 Sensitive Species (USDA Forest Service 2011a). Other species of regional and local conservation concern are also managed as Sensitive Species. This section contains a general description of the species' life history, project area habitat, and threats. The two woodpeckers shown below are also Management Indicator Species (discussed in the next section below).

Table 56. Forest Service sensitive species in the project area

Common Name	Scientific Name	Species Status[2]	Project Area Documentation[1]
Mammals			
Gray wolf (Northern Rocky Mtn. DPS)	*Canis lupus*	DL east of Hwy 395, S	S
Pygmy rabbit	*Brachylagus idahoensis*	S	S
Townsend's big-eared bat	*Corynorhinus townsendii*	S	D
Pallid bat	*Antrozous pallidus*	S	S
Fringed myotis	*Myotis thysanodes*	S	S
Birds			
Bald eagle	*Haliaeetus leucocephalus*	DL, S	D
American peregrine falcon	*Falco peregrinus anatum*	DL, S	D
Grasshopper sparrow	*Ammodramus savannarum*	S	S
Wallowa rosy finch	*Leucosticte tephrocotis wallowa*	S	S
Greater sage grouse	*Centrocercus urophasianus*	C, S	D
Bufflehead	*Bucephala albeola*	S	D
Upland sandpiper	*Bartramia longicauda*	S	D
Bobolink	*Dolichonyx oryzivorus*	S	D
Lewis' woodpecker	*Melanerpes lewis*	S,	D
White-headed woodpecker	*Picoides albolarvatus*	S,	D
Amphibians			
Columbia spotted frog	*Rana luteiventris*	C, S	D
Invertebrates			
Shortface lanx	*Fisherola nuttalli*	S	S
Johnson hairstreak	*Callophrys johnsoni*	S	S
Silver-bordered fritillary	*Boloria selene*	S	D
Harney basin duskysnail	*Colligyrus depressus*	S	D
Columbia clubtail	*Gomphus lynnae*	S	S

1 D - species had been recently documented, S - species thought to occur or that may have suitable habitat
2 C - candidate for ESA listing, DL - delisted from ESA, S - Region 6 Sensitive Species

Pygmy Rabbit

Habitat and Threats - Oregon populations of pygmy rabbits are listed as a species of concern under the Endangered Species Act (USDI Fish and Wildlife Service 2013b). They typically occur in areas of tall, dense, sagebrush (*Artemisia* spp.) cover and are highly dependent on sagebrush to provide food, cover, and protection from predators throughout the year (USDI Fish and Wildlife Service 2005c, USDI Fish and Wildlife Service 2013b). The winter diet of pygmy rabbits is up to 99 percent sagebrush. While big sagebrush is the main food of this species, native grasses and forbs are also eaten in mid-late summer. Additionally, there is evidence that pygmy rabbits prefer native grasses as forage over other foods during this period (USDI Fish and Wildlife Service 2005c).

These rabbits may be active at any time of the day or night, although most activity occurs during mid-morning (USDI Fish and Wildlife Service 2005c). Pygmy rabbits dig their own burrows and need deep loose textured soils for burrow construction, although they occasionally make use of burrows abandoned by other species. As a result, they may occur in areas of shallower or more compact soils that support sufficient shrub cover (USDI Fish and Wildlife Service 2013b).

Pygmy rabbits are slow and subject to predation in open areas. Predation is the primary cause of mortality among adults and juveniles and can be as high as 50 percent in the first five weeks of life (USDI FWS b). Accordingly, pygmy rabbits tend to stay close to their burrows and have small home ranges, although home range size and movement distance is variable (U.S. Fish and Wildlife Service 2005c). Loss of sagebrush is the main reason for decline of pygmy rabbit populations (USDA Forest Service 2013b). Agriculture, livestock grazing and associated developments, type conversions of big sagebrush to livestock forage, prescribed and wild fires, invasive plants, and roads also degrade their habitat. The invasive cheatgrass (*Bromus tectorum*) is of particular concern because it invades the understory of big sagebrush shrubs making a critical habitat site unsuitable for the rabbit (Weiss and Verts 1984). Cheatgrass and other invasive plants replace important forage species, introduce a perpetuating fire cycle into big sagebrush habitat (Whisenant 1990), may reduce predator detection, impede movement, and limit dispersal of the pygmy rabbit. McAdoo et al. (2004) stated that weed control is an example of the highest priority habitat treatments for sagebrush-associated wildlife and invasive plants are considered a threat to the rabbit's habitat (USDI FWS 2013b). Finally, due to its dependence on cover and limited dispersal ability, fragmentation of sagebrush habitat is considered a threat to this species (USDI FWS 2005c).

Project Area Information - The project area is near the northern boundary of this species range (USDI FWS 2005c) and historically, pygmy rabbits have been collected from Deschutes, Klamath, Crook, Lake, Grant, Harney, Baker, and Malheur Counties in Oregon. However, the range of the pygmy rabbit in Oregon may have decreased and boundaries of the current distribution are not known (USGS 2007). Not all potentially suitable sites appear to be occupied and populations are susceptible to rapid declines and local extirpation (Weiss and Verts 1984). Historical and suitable pygmy rabbit habitat was surveyed on State, Bureau of Land Management (BLM) and private land in Malheur, Harney, Lake and Deschutes Counties in 2004/2005 (USGS 2007). Sighting within Harney County indicate that this species occurs mainly in the sagebrush basin south of Burns Oregon. Also, an active burrow was documented southeast of Burns, approximately 17 miles south of the Forest boundary (USGS 2007).

While there have been no surveys conducted on the Malheur National Forest, and pygmy rabbits have not been documented within the project area, suitable habitat exists. Using GIS and Oregon GAP data for big sagebrush communities, suitable pygmy rabbit habitat was identified on approximately 24,715 acres within the project area. However, it is recognized that this is likely an overestimate of the acres of suitable habitat since many sites would not have preferred cover and soil conditions. Currently less than 10 acres of invasive plants have been documented in suitable habitat.

Townsend's Big-eared Bat

Habitat and Threats - Townsend's big-eared bats inhabit a wide variety of habitats from old-growth forests to desert. They roost in caves, mines, rock crevices, buildings, bridges, and hollows of trees, but they are primarily cave-dependent. The Townsend's big-eared bat is a moth specialist with over 90 percent of its diet composed of moths. It captures prey in flight or by gleaning from foliage (Csuti et al. 2001). They forage in edge habitats along streams and woodlands, and within a variety of wooded types. They can travel long distances while foraging, including movements of over 90 miles during a single evening (WBWG 2005).

The primary threat to the Townsend's big eared bat is disturbance and/or destruction of roost sites (e.g., recreational caving, mine exploration, mine reclamation) and studies in Oregon and Washington have reported sizeable reduction in numbers due to human visitation and mining (WBWG 2005). Invasive plants are not considered a threat to Townsend's big-eared bats or their habitat.

Project Area Information - Townsend's big eared bats have been documented from all five project area counties (NatureServe 2013). Also, they have been recently documented on the Emigrant Creek district, and from caves in Dayville and the John Day fossil beds, approximately ten miles east of the project area (Reames 2013).

Due to the variety of habitat utilized, foraging habitat occurs across the forest whereas roost and hibernacula occurs in buildings, bridges, or other structures scattered across the project area. Suitable Townsend's big-eared foraging habitat includes forested and shrub habitat scattered across the project area, and of this, approximately 1,975 acres have documented infestations of invasive plants. Invasive plants do not pose direct threats to this species.

Pallid Bat

Habitat and Threats - The Pallid bat is a year-round resident and most commonly inhabits arid deserts and grasslands often near rock outcrops and water and is less abundant in conifer and mixed forests. This bat usually roosts in rock crevices or buildings, and less frequently roosts in caves, tree hollows, and mines. It prefers narrow crevices in caves for hibernation and shows strong fidelity to roosts both within and between years (NatureServe 2013). Pallid bats are opportunistic generalists that glean a variety of arthropod prey from surfaces, as well as capture insects on the wing (WBWG 2005). Food items include flightless arthropods, crickets, moths, beetles, and may eat small vertebrates (NatureServe 2013, WBWG 2005). They forage over open shrub-steppe grasslands, oak, savannahs, open ponderosa pine forest, talus slopes, gravel roads, and orchards (WBWG 2005).

Pallid bats tend to roost gregariously and are sensitive to disturbance. Loss of modification of foraging habitat due to prescribed fire, urban development, agriculture, or pesticide use pose potential threats (WBWG 2005). Approximately 1,043 acres of preferred riparian, woodland, shrub, and grassland habitats are known to contain invasive plants. Invasive plants do not pose a direct threat to this species.

Project Area Information - The pallid bat has been documented from Haney, Grant, and Malheur Counties (NatureServe 2013), including Goose Rocks and the Palisades (John Day Fossil Beds), approximately 10 miles east of the project area. Suitable cliffline habitat occurs along the Malheur River canyon, Devine Canyon down to Burns, Oregon, along Middle Fork and Coyote Bluff, and this species has been documented at three mine sites in the Vinegar Hill area in 2009 and 2010 (Reames 2013).

Potential roost and hibernacula occur in cliffline habitat along primary river corridors and in buildings or structures scattered across the forest. Pallid bat foraging habitat includes open canopy ponderosa pine stands, woodlands, grassland and shrub habitats, which occur on approximately 361,000 acres across the Forest. Invasive plants have been documented on 428 acres of this. Invasive plants are not a direct threat to this species.

Fringed Myotis

Habitat and Threats - The fringed myotis is a year-round resident in Oregon (NatureServe 2013). While distribution is patchy, it is most common in drier woodlands (oak, pinyon juniper, and ponderosa pine), but it is found in a variety of habitats including desert scrub, mesic coniferous forest, grassland, and sage-grass steppe (WBWG 2005). This species roosts in buildings, underground mines, rocks, cliff faces, and bridges, although roosting in large decadent trees and snags is common. Maternity roosts are colonial whereas males are thought to roost singly or in small groups. Hibernation occurs in caves, mines, and buildings (WBWG 2005).

The fringed bat feeds on a variety of invertebrate taxa and the relative importance of prey items may vary according to prey availability, geography, and season. The two most important items commonly reported in its diet are beetles (*Coleoptera*) and moths (*Lepidoptera)*; however, flightless taxa such as crickets and spiders have been reported. This species is adapted to foraging within the forest interior, as well as along forest edges. Modification or loss of roosting habitat is the primary threat, including human impacts to caves and hibernacula as well as reduction in forest and suitable snags. Chemicals that affect bats or their prey are also a threat (WBWG 2005).

Project Area Information - The fringed myotis has been documented from Haney and Grant Counties (NatureServe 2013), including at the Dunstan Preserve (Middle Fork John Day). Due to the variety of habitat utilized, foraging habitat occurs across the forest whereas roost habitat occurs within mature forested habitat, as well as in caves and buildings and along clifflines. While invasive plants are not considered a direct threat to this species, approximately 2,124 acres of suitable foraging/roost habitat currently contain invasive plants.

Bald Eagle

Habitat and Threats - Bald eagles are protected under the migratory bird treaty act (USDI FWS 2008) and the Bald and Golden Eagle Protection Act (USDI FWS 1999b). Management direction is outlined in the Bald and Golden Eagle Protection Act.

Bald eagles are most common along coasts, major rivers, lakes and reservoirs (U.S. Fish and Wildlife Service 1986), and require accessible prey and trees for suitable nesting and roosting habitat (Stalmaster 1987). Food availability, such as aggregations of waterfowl or salmon runs, is a primary factor attracting bald eagles to wintering areas and influences the distribution of nests and territories (Stalmaster 1987). Bald eagles feed primarily on fish during the breeding season, and eat waterfowl, seabirds, and carrion during the winter (U.S. Fish and Wildlife Service 1995).

Bald eagles usually nest in trees near water, but are known to nest on cliffs and (rarely) on the ground. Nest sites are usually in large trees along shorelines in relatively remote areas that are free of disturbance. Adults tend to use the same breeding areas year after year, and often the same nest, though a breeding area may include one or more alternative nests (U.S. Fish and Wildlife Service 1999a). Wintering eagles can be found concentrated at salmon spawning areas and waterfowl wintering areas, and a communal winter roost generally hosts several eagles each evening at the same site. Winter roosts also tend to offer more protection from the weather than diurnal roosts (USDI 1986). Isolation is an important feature of winter and night roosts, which are usually located in remote areas with less human disturbance.

A current threat to bald eagles is mortality caused by a new disease, avian vacuolar myelinopathy (AVM) (U.S. Fish and Wildlife Service 1999a). A recent hypothesis implicates a type of cyanobacteria that grows on the invasive aquatic plant, *Hydrilla verticillata* (Wilde 2004). The cyanobacteria are thought to produce a neurotoxin that is fatal to herbivorous birds and their avian predators. Mortalities caused by AVM can have localized impact on bald eagles, but there is currently no evidence that the overall recovery of the population is affected (U.S. Fish and Wildlife Service 1999a). The invasive aquatic plant *Hydrilla verticillata* is not known to occur within the project area.

Bald eagles are still protected by The Bald and Golden Eagle Protection Act, The Lacey Act, and the Migratory Bird Treaty Act whereas management direction is provided in the National Bald Eagle Management Guidelines (USFWS 2007b). The guidelines contain recommendations for avoiding disturbance to nesting, roosting, and foraging eagles. Agencies are also directed by the Recovery Plan to address the issues of forested habitat management, prey species management, forest insect risk management, and contingency planning for wildfire risks to eagle habitat.

Project Area Information - The Malheur National Forest has four known bald eagle nest sites, including two nests on the Emigrant Ranger District (Silvies River and Delintment Nests) and two nests on the Blue Mountain District (Galena and Bear Valley). Also two nests occur immediately south of the proclamation boundary on Bureau of Land Management (BLM) administered lands (personal communication between Clark Reams and Howard Richburg 2013). The Silvies River and Delintment Lake territories fall within the Harney Basin/Warner Mountains recovery zone (RZ21), which has a habitat management goal of 16 nesting territories and a population goal of 10 breeding pairs of bald eagles. The Blue Mountain nests fall within the Blue Mountains recovery zone (RZ9), which has a habitat management goal of 14 nesting territories and a population goal of 8 breeding pairs of bald eagles.

Four designated bald eagle winter roosts on the Forest (Management Area 5) cover a total 2,507 acres. Eagles typically arrive in early November and depart about the end of April. The birds often utilize private lands in the valleys during the day and fly to different roost areas on the Forest in the evening. The Rattlesnake and Coffeepot roosts are located on the Emigrant Creek District along the southern edge of the Forest. Roosts on the Blue Mountain Ranger District are on the perimeter of Bear Valley. Winter bird count surveys are conducted annually; the Emigrant Creek roost sites get consistent high use, peaking at about 50 to 70 birds. The Blue Mountain roost sites are used annually, but they only support a few eagles. The LRMP establishes management area direction for communal winter roost areas, which includes maintaining the integrity of the roost sites, maintaining large diameter trees, and minimizing or avoiding disturbance during roosting periods. Seasonal closures are typically applied to management activities from December 1st through April 1st to help minimize disturbance.

Invasive plants do not pose a threat to the bald eagle. Infestations have been mapped within 3 acres of designated winter roost, and 9 acres of infestations are mapped within one-half mile of the Bear Valley nest.

American Peregrine Falcon

Habitat and Threats - Peregrine falcons inhabit cliffs located generally within approximately 0.5 miles of riparian habitat (source of prey). Peregrines are aerial predators who feed mostly on birds. Much of the prey consists of species the size of pigeons and doves; however, avian prey ranges in size. Disturbance by human activity during the nesting season can cause nest sites and new territories to be abandoned, egg breakage, or diversion of adult attention. Peregrine falcons in the Pacific Northwest are most affected by bio-accumulation of contaminants, and direct disturbance (Pagel 2006). Invasive plants do not adversely affect peregrine falcons.

Project Area Information - While there are no known nests, peregrine falcons have been observed on the Malheur National Forest. Use occurs seasonally as individuals migrate through the area in the spring and fall.

In 1992, surveys to identify probable nest sites were conducted on the Malheur National Forest. Cliff systems were rated high, medium, or low potential as hack sites or cross-foster locations. Sixteen cliff systems were surveyed. Locations included Aldrich Mountain, Baldy Mountain, Canyon Mountain, Coyote Bluffs, Fields Peak, Nipple Butte/Lake Butte, Malheur River Canyon/Black Canyon, McClellen Creek, Moon Mountain, Riley Creek, Ragged Rocks, Silvies Canyon, and multiple cliff systems in and around Strawberry Lakes. Most of the cliff systems are located along the series of mountain ranges that parallel the John Day Valley on the south side of the valley, primarily the Aldrich and Strawberry Mountains on the Blue Mountain and Prairie City Ranger Districts. Coyote Bluffs and Ragged Rocks are located in the Middle Fork John Day River drainage on the Blue Mountain Ranger District. Silvies Canyon is located south on the Emigrant Creek District. The Malheur River Canyon cliffs are located on the Prairie City Ranger District. Strawberry Lakes was rated high potential for nesting habitat; Ragged Rocks and Black Canyon were rated medium to high potential. The remaining cliff systems were rated medium to low potential. Sites have been periodically surveyed but no nesting peregrines have been identified at any of the sites. While there are no nest sites known to occur on the Forest, suitable foraging habitat occurs across the project area.

Grasshopper Sparrow

Habitat and Threats **-** Although this species has a widespread distribution, it often breeds locally and is considered rare or uncommon in much of its range (Slater 2004). In Oregon, it is considered one of the more enigmatic and erratic birds and a small population may appear in an area, persist for a few years, and then disappear, only to return in the future. Suitable habitat in the state is concentrated north of the project area in Morrow, Umatilla, and Gillam Counties, although suitable grassland habitat occurs in both Harney and Malheur Counties (OSU 2013).

The grasshopper sparrow is found in a variety of open grassland types, but it is area sensitive, and large tracks of grassland are more likely to support populations (Slater 2004, PIF 2000, Dechant 2002a). They prefer grasslands of intermediate height, often associated with clumped vegetation interspersed with patches of bare ground. Other habitat requirements include moderately deep litter and sparse coverage of woody vegetation and shrubs (NatureServe 2013, Slater 2004, Oregon DFW 2013, Janes 1983, Dechant 2002a). In Morrow County, the grasshopper sparrow occurs at low densities, and Holmes and Miller (2010) found that grasshopper sparrows were most numerous in perennial grasslands and least abundant in depleted sagebrush and sagebrush/annual grass communities.

The grasshopper sparrow forages almost exclusively on bare ground and eats insects, other small invertebrates, grain, and seeds (NatureServe 2013). During the breeding season, grasshoppers (*Orthoptera*) have been documented comprising the majority (greater than 60 percent) of their diet with seeds taken secondarily (Slater 2004). The greatest threats to grassland species, such as the grasshopper sparrow, include continued habitat loss due to encroachment of woody vegetation (Oregon DFW 2013, Slater 2004), habitat fragmentation, and habitat degradation from grazing and fire (Slater 2004). Conservation issues specific to the grasshopper sparrow in the Columbia basin (Altman and Holmes 2000) include; 1) conversion of bunchgrass habitat to agriculture, 2) alteration of bunchgrass habitat from intensive grazing and exotic grass/forb invasions, 3) vulnerability due to agricultural use, 4) shrub encroachment from overgrazing and fire suppression, and 5) early season mowing.

Project Area Information **-** While the grassland sparrow has not been documented on the Forest, larger grassland habitat greater than 20 acres in size exists on 46,523 acres and of this, 71 acres are infested with invasive plants. However, this would be considered an overestimate of suitable habitat because not all acres would have the structural characteristics preferred (i.e., clumped vegetation of intermediate height with patches of bare ground). Also in many areas, they have been documented preferring grasslands greater than 75 acres in size (NatureServe 2013).

Wallowa Rosy Finch

Habitat and Threats **-** This species is restricted to the Wallowa Mountains in Northeast Oregon and winters to West-Central Nevada (Clements 2012). Like *Leucosticte tephrocotis*, the Wallowa rosy-finch breeds on the highest alpine peaks, as well as in barren cirques below timbered peaks on the Wallowa Mountains. Young remain with adults until fall and they move to lower altitudes and latitudes during the winter (OSU 2013). Nests are usually in rock crevices or holes in cliffs. Foraging occurs on the ground for seeds and in the spring they glean wind-transported insects from snow. Later in the season, they may glean insects from vegetation or may chase flying insects in the air (NatureServe 2013). While most high elevation habitats are protected, this species can be most benefitted by monitoring and protection of known sites.

Project Area Information **-** Habitat locations for this species have not been mapped on the Malheur National Forest. However, habitats are not likely to be infested with invasive plants because they lie in remote, high elevation areas that are distant from primary invasive plant vectors. Thus, potentially suitable habitat is not likely to be infested with invasive plants, and invasive plants are not a direct threat to the Wallowa rosy finch.

Greater Sage Grouse

Status and Habitat Description - A Greater Sage Grouse and Sagebrush Habitat Conservation Team, consisting of state and federal agencies, private landowners, conservation groups, and academics, was established in 2001 to craft a comprehensive set of planning guidelines for sage grouse and sagebrush habitats in Oregon. The primary goal of the guidelines is to maintain existing sagebrush-steppe habitats in order to sustain sage grouse populations and protect options for future management.

Sage grouse breed on sites called leks (strutting grounds) in March-April. The same lek sites tend to be used year after year and are established in open areas surrounded by sagebrush, which is used for escape and protection from predators (Connelly et al. 1991). Optimum sage grouse nesting habitat consists of a healthy sagebrush ecosystem including sagebrush plants and an herbaceous understory composed of grasses and forbs.

Sage grouse nesting and early brood-rearing occurs in April-June, which is considered a critical time for sage grouse. Early brood-rearing generally occurs relatively close to nest sites; however, movements of individual broods may be highly variable (Connelly 1982). Hens with broods tend to select habitats having a wide diversity of plant species that support an equivalent diversity of insects that are important chick foods. In June and July, as sagebrush habitats dry and herbaceous plants mature, hens usually move their broods to moister sites in or adjacent to sagebrush cover where more succulent vegetation is available (Connelly and Markham 1983, Connelly et al. 1988). Examples of such habitats include low sagebrush (*Artemisia nova; A. arbuscula*) plant communities, wet meadows, and riparian areas (Connelly et al. 1988, Connelly and Markham 1983).

Major threats to the species are habitat conversion and degradation. Declines in sage grouse populations have been linked to agricultural conversion, rangeland conversion, livestock management, wildfire, prescribed fire, fire rehabilitation, structure and infrastructure development, juniper expansion, and invasions of exotic species (Blus et al. 1989; Braun 1987, Braun 1998, Connelly et al. 2000, Quigley and, Swensen et al. 1987, Wisdom et al. 2000, USDI Fish and Wildlife Service 2003c).

Cheatgrass (*Bromus tectorum*) invasion has particularly degraded sage grouse habitat by altering fire cycles in the sagebrush-steppe ecosystem (Crawford et al. 2004). Cheatgrass fills voids between shrubs and facilitates frequent fires. The frequent fires prohibit re-establishment of the big sagebrush and create cheatgrass monocultures that are unsuitable for sage grouse. Additional threats include herbicide and insecticide use (Crawford et al. 2004). Insecticide application to alfalfa fields in Idaho resulted in mortality to sage grouse that fed on contaminated insects (Blus et al. 1989, Connelly and Blus 1991). Herbicides were commonly used in sage grouse habitat until the1980s to reduce cover of sagebrush and increase livestock forage, and these habitat alterations created areas unsuitable for sage grouse.

Project Area Information - The largest sagebrush habitats are located on the Emigrant Creek and Prairie City Ranger Districts, particularly along the southern boundary of the Forest where sagebrush shrublands extend off the Forest and on to BLM lands. Habitat on National Forest System land is often considered marginal when compared to larger expanses of habitat located on Bureau of Land Management (BLM) and private lands to the south of the Forest and in larger valleys, such as Bear Valley and Silvies Valley. On the northern half of the Forest, sagebrush habitats are small and highly fragmented. There have been incidental sightings of sage grouse on the Forest, but sightings are uncommon. There are no documented leks or key brood-rearing habitat identified. Sage grouse use appears to be occasional and random within suitable habitat.

In 1993, Oregon Department of Fish and Wildlife (ODFW) biologists estimated that Bear Valley had about 60 birds and a stable population. In 2003, ODFW decreased the 1993 grouse population estimates, indicating the decline was primarily due to predation (coyotes), but also because of livestock grazing and agricultural conversion. Approximately 139,500 acres of suitable habitat have been mapped on the Malheur National Forest and 79 acres of invasive plants have been mapped within this habitat.

Bufflehead

Habitat and Threats - The bufflehead is a tree-nesting, diving duck whose population has declined in some of its range (Marshall et al. 2003). For nesting, it uses mountain lakes surrounded by woodlands with snags (mostly aspen, but it will use ponderosa pine and Douglas-fir). Buffleheads are common in parts of Oregon and Washington during winter, but are rare during the breeding season. Buffleheads eat animal matter, with common diet items including aquatic insects and larvae, physid snails, fish, and sometimes herring eggs or salmon carrion. They also eat seeds of aquatic plants, such as smartweed, alkali bulrush, and sago pondweed (Marshall et al. 2003). Although no threats to buffleheads were identified, the lack of suitable breeding habitat (tree cavities adjacent to lakes) would be limiting in many areas.

Project Area Information - Although breeding has not been documented in eastern Oregon, the Forest provides stopover habitat during migration and buffleheads have been documented adjacent to the Forest in Bear Valley. Suitable habitat includes Forest lakes and wetlands, which occur on approximately 350 acres Forest-wide, and these areas could be used as “stopover” habitat during migration. Currently less than an acre of suitable Bufflehead habitat is known to be infested with invasive plants. Invasive plants have been identified as a threat to waterfowl (Blossey 1999).

Upland Sandpiper

Habitat and Threats - Upland sandpipers are a rare breeder in large montane meadows within forests of eastern Oregon and are almost never observed away from their breeding grounds (Oregon DFW 2013). They generally nest in extensive, open tracts of short grassland habitat, including native prairie, dry meadows, pastures, domestic hayfields, and short-grass savanna, plowed fields along highway rights-of-ways, and on airfields. Preferred habitat includes large areas of short grass for feeding and courtship with interspersed or adjacent taller grasses for nesting and brood cover (Dechant 2002b).

In the Blue Mountains, upland sandpiper habitat is large, flat or gently rolling expanses of grassland in mountain valleys and open uplands with small creek drainages and wet to dry meadows. Use areas have a wide diversity of plants, and forb abundance is particularly important. Occurrence of upland sandpipers is positively correlated with patch size and they often utilize meadows, which are generally at least 125 acres in size. They selectively nest where the vegetation is between 6 and 13 inches tall and avoid fields containing relatively uniform stands of grass, tall undisturbed stands of grass, or those seeded to smooth brome. Upland sandpipers have strong site fidelity, returning to the same area about the same time each year. Other key habitat features near nest sites are loafing and feeding areas that have shorter, sparser vegetation than nesting areas and the proximity of a small shrub or tree. Sandpipers are very secretive and easily disturbed by humans (Altman 2000).

Upland sandpipers feed primarily on insects, but also eat berries and seeds of grasses and forbs (Csuti et al. 2001). They prefer upland sites that have higher soil moisture than adjacent areas and foraging sites often had surface water during spring. A moderate threat to upland sandpiper habitat exists from declines associated with plowing of natural grasslands, degradation and fragmentation of habitat due to increased urbanization, farming practices, and forest succession (NatureServe 2013).

Project Area Information - From the 1980s through 1991, Oregon had the largest population of nesting sandpipers west of the Rockies. Seven locations make up the Oregon population, and two of those areas are Bear Valley and Logan Valley on the Malheur National Forest. In Bear Valley and Logan Valley, numbers of nesting upland sandpipers have been declining since the mid-1980s.

Bear Valley and Logan Valley locations accounted for over half of the sandpipers in the state in 1984, when 23 pair (7 nests) and 3 singles were found in Bear Valley, and 12 pair (2 nests) and 6 singles were found in Logan Valley. Nests have been found along ditches or near moist areas, often adjacent to sagebrush. Both Bear Valley and Logan Valley have areas of short grasses mixed with forbs and scattered sagebrush patches. The removal of sagebrush and the seeding of non-native grasses have altered the habitat in Bear Valley east of Highway 395, where upland sandpipers nested in the 1980s. Although bird numbers have declined, management has not changed in the rest of Bear Valley, which contains the majority of the occupied habitat. Logan Valley management has apparently changed and lodgepole pine has encroached in the valley. Water regimes and drainage patterns have also changed, which have affected the character of the habitat

Potential upland sandpiper habitat includes all grassland and shrubland habitat that is 125 acres in size or more and on slopes of less than 25 percent (Dechant 2002b). Approximately 78,669 acres exist Forest-wide, although due to the height and structural preferences, preferred habitat would be less. Of the larger grassland/shrub habitats that provide potentially suitable habitat, 72 acres are currently infested with invasive weeds.

Bobolink

Habitat and Threats - The bobolink is a bird of open prairies, grasslands, wet meadows, pastures, and grain crops. In Oregon, there are only a few disjunct populations that breed in irrigated hay meadows fringed with willows or in wet, grassy meadows with local growths of forbs and sedges. Many of these areas are mowed and/or grazed, which facilitates nesting of bobolinks. Bobolinks eat grass and forb seeds, as well as insects. During the breeding season, more insects are included in the diet, especially caterpillars. Keys to management are to provide large areas of suitable habitat (native and tame grasslands of moderate height and density with adequate litter, controlling succession, and protecting nesting habitat from disturbance during the breeding season (early May to mid-July) (Dechant et al. 2001).

Project Area Information - Limited habitat exists in areas that have grasslands, wet meadows, willows, or other water-loving shrubs. Oregon GAP data was used to identify potential bobolink habitat, which includes all, grasslands, wetlands, wet meadows, and willow bottoms. These areas total 17,080 acres and 50 acres of invasive plants are known to occur on these lands.

Lewis' Woodpecker

Status and Habitat Description - Breeding habitat includes open forest and woodland, often logged or burned, including oak, coniferous forest (primarily ponderosa pine), riparian woodland, orchards, and less commonly pinyon-juniper (Millen-McLean 2012d, NatureServe 2013). Important habitat features include an open tree canopy, a brushy understory with ground cover, large dead trees, and downed woody debris (DWD). They prefer open ponderosa pine at high elevations and open riparian vegetation at low elevations (NatureServe 2013, Altman and Holmes 2000, Thomas et al. 2009).

Unlike other woodpeckers, this species seldom excavates its own cavity for nesting and greatest densities often occur in areas of high snag density, such as burned areas (Mellen-Mclean 2012a). In late summer, wandering flocks move from valleys into mountains, and in winter, this species uses oak woodlands and fruit orchards. Lewis' woodpeckers feed on adult emergent insects in summer and ripe fruit and nuts in the fall and winter. Unlike other woodpeckers, this species does not bore for insects but will take insects aerially (hawking), glean insects from tree branches or trunks, or drop from perch to capture insects on the ground (NatureServe 2013). Within the Columbia Plateau, historical levels of source habitat have declined by 95 percent (Altman and Holmes 2000) and this species has been locally extirpated in parts of its range (Altman et al. 2000).

Project Area Information - While the Lewis' woodpecker has been documented from three counties within the project area (Grant, Crook, and Baker) (NatureServe 2013), most of the existing sightings have occurred in burned areas. However, scattered sightings have also occurred within ponderosa pine woodland and cottonwood riparian communities in the northern portion of the project area. Habitat for this species was identified by looking at dry ponderosa pine with large snags and open canopies, cottonwood/willow communities, and more recent post fire (since 1990) habitat. Currently approximately 275 acres of invasive plants have been mapped within the 311,700 acres of post-fire suitable habitat. Invasive plants are not considered a direct threat to forested habitat preferred by this species.

White-heated Woodpecker

Habitat and Threats - White-headed woodpeckers occur mainly in open ponderosa pine or mixed-conifer forests dominated by ponderosa pine, usually in old-growth or in stands with old-growth components. They excavate cavities in snags, as well as stumps, logs, and dead tops of live trees. Pine seeds are a major part of its diet in the fall and winter, although they also probe, glean, and pry off loose bark for insects and catch insects in the air. Over the course of the year, pine seeds and insects make up 60 percent and 40 percent of its diet respectively (NatureServe 2013). Populations in Oregon are decreasing due to fragmentation and a loss of forest cover (Audubon 2013).

Project Area Information - The white-headed woodpecker is currently documented from over 60 locations across the forest with nesting confirmed in ponderosa pine woodland. Habitat for this species was identified by selecting dry ponderosa, Douglas fir, and dry pine communities with an open canopy (10-40%) and tree sizes greater than or equal to 21 inches dbh. Using this criteria, there are currently 21,509 acres of white-headed woodpecker habitat scattered across the project area. Of this acreage, invasive plants are known to occur on approximately 10 acres. Invasive plants are not considered a direct threat to forested habitat preferred by this species.

Columbia Spotted Frog

Status and Habitat Description - The Great Basin Distinct Population Segment (DPS) of the Columbia spotted frog is a federal candidate species and is found in Oregon, Idaho, and Nevada. It has been documented on the Malheur, Ochoco, Umatilla, and Wallowa-Whitman National Forests. Columbia spotted frogs are highly aquatic and usually stay near permanent, quiet water along the grass and sedge margins of streams, lakes, ponds, springs, and marshes. Breeding habitats include a variety of relatively exposed, shallow-water (less than two feet), emergent wetlands, such as sedge fens, riverine over-bank pools, beaver ponds, and the wetland fringes of ponds and small lakes. Vegetation in the breeding pools generally is dominated by herbaceous species, such as grasses, sedges, and rushes, and froglets and adults live in well-vegetated ponds, marshes, or slow, weedy streams that meander through meadows (Corkran and Thomas 2006). Springs may be used as over-wintering sites for local populations (Hayes et al. 1997). After breeding, adults often disperse into adjacent wetland, riverine, and lacustrine habitats. Columbia spotted frogs are capable of long movements, including across uplands (Bull and Hayes 2001).

Larvae have a diet of algae, plant material, and other organic debris. Adults eat arthropods (ants, beetles, mosquito larvae, spiders, and grasshoppers), mollusks, tadpoles, crayfish, and other invertebrate prey (NatureServe 2013, Hayes et al. 1997, Csuti et al. 2001). Threats to the species include mining, livestock grazing, road construction, agriculture, and direct predation by bullfrogs and non-native fishes. Also, environmental stressors, such as pesticides, herbicides, fertilizers, and heavy metals may slow reactions or cause behavioral changes that make spotted frog tadpoles more vulnerable to predation (Lefcort et al. 1998, Rosenshield et al. 1999, Marco et al. 1999, Bridges 1999b, Bridges and Semlitsch 2000).

Project Area Information - Columbia spotted frogs are believed to be in all sub-basins of the project area and this species is often found in natural ponds and lakes, rock pits, old mining ponds, livestock stockponds, and slow moving streams that retain water year-round. Spotted frog surveys have been conducted periodically since the 1980's, and although not all areas of the Forest were surveyed, they did confirm that the species is fairly well distributed, but occurs at low levels. Most spotted frogs on the Forest have been found in small pools along perennial streams or in mining ponds and small lakes. Suitable breeding habitat was estimated using existing wetland habitat, sedge meadow habitat from Oregon GAP data and all lands within 300 feet of forest water bodies and springs. This totals approximately 58,700 acres and has 52 acres of documented invasive plants. This species could be affected by invasive plants, especially in wetland habitats.

Shortface Lanx

Status and Habitat Description **-** Shortface lanx are a non-migrant freshwater snail that can be found in the main channel of fast flowing streams and rivers. This species is sporadically distributed in the Columbia River and a few major tributaries in Oregon, Washington, Montana, and Idaho. In Oregon, healthy populations of shortface lanx persist in the Deschutes River and smaller populations occur in the John Day and Imnaha Rivers (USDA Forest Service 2010a).

Habitat includes unpolluted, cold, well-oxygenated streams and rivers between approximately 100 ft. and 300 ft. in width. They feed by scraping algae and diatoms from rock surfaces and require streams/rivers with a cobble/boulder substrate (USDA Forest Service 2010a). Habitat loss and pollution are the primary threats to this species. Populations have been lost from most tributaries and almost all the Columbia River due to impoundments and the loss of rocky substrate (USDA Forest Service 2010a).

Project Area Information **-** In Oregon, the shortface lanx has been documented on the Wallowa Whitman National Forest and is suspected on the Malheur and Ochoco Forests (USDA Forest Service 2010a). Suitable habitat includes approximately 16 miles of river habitat associated with the John Day and Malheur Rivers. Invasive plants are not considered a direct threat to this species, and there are no documented invasive plants within 100 feet of suitable habitat.

Johnson Hairstreak

Status and Habitat Description **–** This butterfly has been reported in Oregon from the Cascades Coast Range, Siskiyou Mountains, Blue Mountains, and Wallowa Mountains (USDA Forest Service 2011b) and is associated with old growth and mature forests. Habitats include clearings among conifer forests, especially mature ponderosa pine, although lodgepole pine, true fir, Douglas fir and western larch are also utilized (Pyle 2002). Larvae feed exclusively on aerial shoots of dwarf mistletoe (*Arceuthobium* species) and adults feed on the nectar of flowers in several families. All sightings in Washington and Oregon have been in coniferous forests (Pyle 2002).

Threats to this species include habitat loss, pesticides, such as *Bacillus thuringiensis*, and herbicides that are applied to flowering plants that this species visits. Also, there is some evidence of hybridization with the thicket hairstreak (*C. spinetorum*) (USDA Forest Service 2011b).

Project Area Information **-** While there have been no surveys on the Forest and this species has not been documented, Johnson's hairstreak has been documented from Baker County (Oregon Biodiversity 2010) and use is possible. While suitable habitat for this species was not identified, it could occur in coniferous forest containing host plants. Invasive plants are not considered a direct threat to habitat for this species.

Silver-Bordered Fritillary

In Oregon, these butterflies have been found in Big Summit Prairie in Crook County, from the Strawberry Mountains in Grant County, and from Baker County (USDA Forest Service 2010b, Oregon Biodiversity 2010). Habitat for this species can be found in bogs, open riparian areas, and in marshes containing large amounts of Salix and larval food plants (Warren 2005 In USDA Forest Service 2010b). Adults lay eggs on or near violets, usually marsh violet (*Viola palustris*) and bog violet (*V. nephrophylla*). Adults feed on nectar of various composites. Sunny habitats encourage adult flight and in Baker County annual broods are likely to occur from mid to late May whereas Grant County populations fly between early June and Mid-August (USDA Forest Service 2010b).

The silver-bordered fritillary is dependent upon maintenance of wet meadow habitat and its associated food plants. Downcutting of creeks and subsequent draining and drying out of meadow habitat, due in part to loss of beaver populations, loss of native plant species due to livestock grazing, and invasion of non-native grasses are threats to this species.

Project Area Information - While not documented on National Forest System lands, silver-bordered fritillary have been documented on adjacent private land and use of suitable wet meadow habitat on the forest is likely. Suitable habitat, includes riparian/wetland non-forest communities identified from the forest wetland and vegetation GIS layers, combined with Oregon GAP wet/sedge meadow habitat. Currently there are approximately 22,100 acres of potentially suitable habitat and with 34 acres known to contain invasive plants.

Harney Basin Duskysnail

Status and Habitat Description - To date in Oregon this species is only documented from the Silvies River drainage in Harney County and from the Fremont Winema National Forest in Lake County (USDA Forest Service 2013). Little is known about the feeding habitats, growth, reproduction, or life span of this recently described species. Hydrobiidae snails, in general, feed on algae, diatoms, and detritus. Habitat includes shallow, cold springs and runs at elevations between approximately 4,480 and 4,670 feet with surrounding vegetation of sage scrub (Deixis MossuscDB 2009, Hershler 1999 In USDA Forest Service 2013). While abundance estimates of this species have not been conducted, the Forest Service noted very high abundance at one large spring site and most rocks had many snails attached; thousands of individuals were thought to be present (2013).

Any modification of the cold-water spring environment where this species lives could be a potential threat to its survival. A number of habitat threats have been identified for this species, including livestock grazing, water and site degradation associated with recreation, and wildfire and retardant chemicals. Conservation strategies include protecting known sites and maintenance of water quality and substrate conditions (USDA Forest Service 2013).

Project Area Information - This species has been documented on the Malheur National Forest and is suspected on the Ochoco National Forest and adjacent BLM land (USDA Forest Service 2013). The Malheur National Forest site (Spring Creek) where this species occurs is a large cold-water perennial spring flowing out of a lava cliff. The springs create a fast, cold flow, are about 15 ft. wide and one to eight inches deep. Fish are present, and yellow monkey flower (*Mimulus* sp.), water cress (*Nasturtium* sp.), and other aquatic and riparian plants are prevalent. Spring Creek is one of the larger springs in a complex of springs and appears to be a secure habitat for this species due to a lava boulder field offering protection from grazing; however, part of the site is a favorite local recreational site that receives a high level of riparian disturbance and recreation (USDA Forest Service 2013).

There are no known invasive plants at the Spring Creek site, although invasive plants are mapped in the surrounding watershed. Invasive plants are not considered a direct threat to this species.

Columbia Clubtail

Status and Habitat Description - In Oregon, the Columbia clubtail is known to occur over a somewhat short stretch (about 15 miles) of the John Day River in Wheeler and Grant Counties and from a single location on the Owyhee River near Rome in Malheur County. Although this dragonfly is fairly common in areas where it is found, it has one of the most restricted ranges of any North American odonate (USDA

Forest Service 2012). This non-migratory dragonfly can be found in a variety of river habitats, which can range from sandy or muddy to rocky, shallow rivers with occasional gravelly rapids. Water flow tends to be slow moving and larval river habitat is most critical. Eggs are laid in the water, and after hatching, larvae burrow in the mud and overwinter. After emerging from the water, adults forage among shrubs from mid-June to mid-August (USDA Forest Service 2012). Threats include activities that affect siltation or runoff and introduction of predatory fish (ibid.).

Project Area Information - While not documented on the Forest, it has been documented below the Forest boundary in the John Day River and suitable habitat is present. Forestwide there are approximately 100 miles of riverine habitat, which may provide breeding and winter habitat. There are currently 51 acres of invasive plants within 300 feet of Forest riverine habitat. This species is not adversely affected by invasive plants.

Management Indicator Species

Management Indicator Species (MIS) are selected species whose welfare is believed to be an indicator of the welfare of other species using the same habitat, or a species whose condition can be used to assess the impacts of management actions on a particular area (Thomas et al. 1979). Management Indicator Species on the Forest are identified in table 58 and are grouped into three categories including 1) big game (commonly hunted species), 2) old growth, and 3) primary cavity excavators (PCE's). The following section discusses MIS by the habits they represent

Table 57. Management Indicator Species on the Malheur NF and Ochoco NF

Representing	Species	Habitat/Indicator
Big Game (commonly hunted species)	Rocky Mountain Elk	General forest habitat conditions and winter range
Old Growth Primary Cavity Excavator	Pileated Woodpecker	Late-successional coniferous forests with dense canopy, high basal area, and large diameter snags
Old Growth	Pine Marten	Mature and old growth mesic coniferous forest with high structural diversity in the understory
Old Growth	Three-toed Woodpecker	Old growth lodgepole pine
Primary Cavity Excavator	Primary Cavity Nesters	Dead/down (snag) habitat

Big Game

Rocky Mountain Elk - Rocky Mountain elk was selected as an indicator species in the LRMP to represent general forest habitat and winter ranges. Concern arises from its importance as a game species. Habitat quality for elk is evaluated in terms of forage, cover (satisfactory and marginal), elk screening, and open road density. The Habitat Effectiveness Index (HEI) model (Thomas et al. 1988) was not applied as the model is not a suitable tool for evaluating invasive plant management effects on elk. In addition, there would be no change in cover or road density; therefore, the habitat effectiveness index would not change from the existing condition from invasive species management. Treatments may increase forage; however, no treatment area is large enough to meaningfully change the habitat effectiveness index.

The presence of humans degrades elk habitat by causing animal stress and hunting vulnerability. This is primarily associated with motorized use of open roads and the availability of vegetation (live and dead) to screen elk. Elk preferentially select habitats based on increasing distance from open roads (Rowland et al. 2000). Vulnerability and hunting mortality have been found to be higher in forested stands with greater road densities and less vegetation to provide screening (Weber et al. 2000).

Elk habitat on the Forest was mapped as part of a cooperative effort sponsored by the Rocky Mountain Elk Foundation. This effort concluded that the project area contains an estimated 624,673 acres of elk winter range whereas the entire forest is used during the summer. Invasive plants have been documented on approximately 582 acres of the forest winter range and 2,124 acres of elk summer range. Of this, 517 acres (89 percent) of the winter range infestations and 1,860 acres (88 percent) of the summer range infestations are adjacent to roads. Approximately 500 acres of elk-calving habitat also occur on the Malheur National Forest, although there are currently no known invasive plants on these lands.

Invasive plant management is not expected to affect Oregon State Management Objectives or hunting permits at this time. However, invasive plants probably affect deer and elk more than any other species analyzed in this section and can out-compete and replace native forage plants for these ungulates. Consequently, eradicating, controlling, and/or containing invasive plants would improve elk and deer habitat.

Old Growth

Forest LRMP management area 13 (MA-13) provides for the management of old growth through a network of dedicated old growth (DOG) areas and replacement old growth (ROG) areas. Forestwide, a total of 104,453 acres occur in the DOG/ROG network, which is managed in part to provide habitat for old growth MIS, including the pileated woodpecker, pine marten, and three-toed woodpecker. There are 98 acres of invasive plants known to occur within the Forest DOG/ROG network.

***Pileated Woodpecker* -** Pileated woodpeckers prefer late successional stages of coniferous or deciduous forest. Because they nest in large diameter snags, roost in large diameter hollow trees, and use large logs and snags for foraging, pileated woodpeckers primarily associate with older stands. Approximately 80 percent of the pileated woodpecker foraging in northeastern Oregon occurs in dead trees and dead and down logs (Mellen-Mclean 2012a).

The pileated woodpecker is fairly common throughout the Malheur National Forest in mature and late-successional mixed-conifer forest, and this species is documented in suitable habitat across the Forest. Forest-wide, pileated woodpecker habitat was identified using two sources, including old growth stands that are being emphasized for pileated woodpecker habitat, as well as stands that have the species and structural conditions characteristic of nesting, roosting, and foraging (i.e., multi-story stands (OFMS), including an average overstory diameter of 20 inches dbh. or greater. There are approximately 224,197 acres of suitable pileated woodpecker habitat forestwide, and of this, invasive plants are known to occur on 247 acres. When looking only at pileated woodpecker habitat within MA 13 old-growth areas (e.g., DOGs and ROGs), suitable habitat exists on approximately 87,880 acres, and of this, approximately 78 acres are known to contain invasive plants.

***Pine Marten* -** Pine (American) marten have a wide, year-round distribution across the Blue Mountains (Mellen-McLean 2012b). Pine marten associate with late-seral coniferous forests characterized by closed canopies, large trees, and abundant standing and downed woody material. Of particular importance is the quantity of downed debris on the forest floor as it provides protection from predators, access to the under snow environment for hunting and resting, and thermal protection from heat and cold (Ruggiero et al. 1994). Marten also show a strong preference for riparian habitat (Baldwin and Bender 2008). They eat a variety of small mammals, particularly squirrels, as well as voles, mice, pica, and rabbits and do not tolerate concentrated human use or habitat modification (Maser et al. 1981).

The historical and current density and distribution of marten in the Forest is unknown, but they are thought to occur in low numbers. Suitable pine marten habitat occurs on 314,134 acres across the project area and includes primary habitat or multi-structure forest greater than 20 inches dbh., as well as secondary habitat, or multi-structure forest between 15 inches and 20 inches dbh. Of the total habitat, 355 acres currently have invasive plants. Approximately 15,523 acres of old growth lands (DOGs and ROGs) within the project area are managed for pine marten, and invasive plants are known to occur on approximately 18 acres within these habitats. Invasive plants do not pose a direct threat to this species or its habitat.

Three-toed Woodpecker - The tree-toed woodpecker is an indicator for lodgepole pine and mixed conifer forests. Primary habitat includes higher elevation lodgepole pine, fir/hemlock, and Douglas-fir mixed (Marshall et al. 2003). They are associated with mature and overmature stands with elevated levels of dead and dying wood associated with insect and disease related mortality or stand replacing wildfire (Wisdom et al. 2000). They are locally abundant in areas of insect outbreaks, and their populations are irruptive as they follow outbreaks across the landscape. When available, post fire habitat is preferred, although numbers of nests decrease between three and five years post fire. They specialize on bark beetles (*Scolytidae*) versus the black-backed woodpecker, which specializes on wood boring beetles (*Cerambycidae)* (Leonard 2001).

Potentially suitable habitat was identified by taking stands with a higher density of snags, greater than 10 inches dbh. of preferred nesting and foraging cover types (Mellon-Mcleanon 2012c), and recent post-fire habitat. Approximately 360,000 acres of suitable habitat exists, and of this, 428 acres are currently infested with invasive plants. No invasive plants have been mapped within the 631 acres of old growth habitat managed for this species. Invasive plants do not pose a direct threat to this species.

Primary Cavity Nesters (Snags and Dead Wood)

Primary cavity excavators, include Lewis' woodpecker, yellow-bellied sapsucker, red-breasted sapsucker, Williamson's sapsucker, downy woodpecker, hairy woodpecker, white-headed woodpecker, three-toed woodpecker, black-backed woodpecker, pileated woodpecker, and northern flicker. Table 59 identifies preferred habitat for those species not discussed above as MIS or sensitive species whereas a discussion of suitable habitat for these species is below. Collectively these species utilize a variety of habitats, although they all depend upon dead trees and down logs for reproduction and foraging.

Virtually all of the forested land provides potentially suitable habitat because primary cavity nesting species utilize a wide variety of snag species and size classes. Although native plant infestations occur within sites containing snags, because invasive plants do not affect standing dead or downed wood habitat, they are not adversely affecting cavity nesting species or their habitat.

Table 58. Habitat for Cavity Nesters (MIS)

MIS Cavity Nesting Species	Habitat
Red-naped Sapsucker	Riparian habitat, especially aspen, cottonwoods, and pine forest communities.
Red-breasted Sapsucker	Mature, moist coniferous and mixed deciduous-coniferous forest. Typically nest in large trees.
Williamson's Sapsucker	Open, late-successional lower montane forests (Douglas fir, western larch, grand fir, white fir, and ponderosa pine) and aspen and cottonwood stands with high densities of snags.
Downy Woodpecker	Riparian habitat and lowland deciduous forest at low to mid elevations consisting of a mixture of grasses, shrubs, and hardwoods.
Hairy Woodpecker	Ponderosa pine forest at low to mid elevations with trees 10 to 20 inches diameter.
Black-backed Woodpecker	Post fire habitat, and forest with insect and disease related mortality. Associated with high densities of smaller diameter snags (9 to 15 inches dbh.)
Northern Flicker	Habitat generalist that prefers open areas such as open woodlands, meadows, fields, and regeneration sites. Nests in large snags.

Red-naped and Red-breasted Sapsucker - Source habitat for the red-naped sapsucker consists of riparian habitats, especially aspen, cottonwoods, alder, and pine, although habitat is less abundant in mixed conifer forest (Marshall et al. 2003, Wahl et al. 2005). Nest trees most common are aspen with heart rot, but ponderosa pine are also selected. Red-naped sapsuckers are considered common within suitable habitat across the Forest.

Williamson's Sapsucker - In northeastern Oregon, this species occurs in mature and old-growth mixed-conifer forests at approximately 3,500 to 6,500 ft. in elevation. Preferred habitat is comprised of open, later seral stages of montane and lower montane forest (Douglas fir, western larch, grand/white fir, ponderosa pine, aspen, and cottonwood) (Wisdom et al. 2000, Wahl et al. 2005, Marshall et al. 2003). Both live and dead trees are used for nesting, although snags are a critical component of breeding habitat (Bull et al. 1980). Williamson's sapsuckers feed at sapwells in ponderosa pine and Douglas-fir and glean insects from the bark of trunks and limbs (Marshall et al. 2003). Home range size is estimated at 10 to 22 acres (Johnson and O'Neil 2001). Williamson's sapsuckers are fairly common across the Forest.

Downy Woodpecker - In Oregon, the downy woodpecker is widely distributed in low to moderate elevation habitat deciduous riparian woodlands and lowland deciduous forest (Marshall et al. 2003). These woodpeckers are also found in parks and orchards. Territory size ranges from five to nine acres and nesting occurs in trees and snags greater than eight inches dbh. Downy woodpeckers have been documented across the Forest.

Hairy Woodpecker - Habitat for this species includes dry and wet coniferous forest at low to mid-elevations, as well as deciduous forest and riparian areas. The hairy woodpecker uses all ages of forest, although older stands are often preferred for nesting. Nesting occurs in moderately decayed snags, primarily in ponderosa pine trees between 10 and 20 inches dbh. Highest densities occur in un-salvaged forests and recent (1 to 5 years) post-fire habitat with moderate to high densities of snags. Older burns do no support high levels of wood-boring beetles used for foraging (Saab et al. 2007). Home range size has been reported at between 22 and 37 acres (Marshall et al. 2003). This species is frequently detected at point count surveys across the Forest.

Black-backed Woodpecker - This species is largely restricted to post fire habitat (Saab and Dudley 1998). In the Blue Mountains, it is associated with high elevation boreal and montane coniferous forest, especially recent (less than 5 years) post-fire habitat (Dixon and Saab 2000). However, it is occasionally observed in mixed conifer, lodgepole pine, Douglas fir, and spruce-fir forests (Hutto 1995). Observations of this species on the Forest occur primarily in areas of large stand-replacing wildfires.

Northern Flicker - The northern flicker is a common resident woodpecker in Oregon. It is a habitat generalist, although it is most abundant in open forests and forest edges. This species utilizes coniferous and deciduous forest, riparian woodlands, and urban areas (Marshall et al. 2003, Wahl et al. 2005). Nesting typically occurs in open areas with snags that exhibit some decay and Marshall et al. (2003) found that 71 percent of the nest trees had broken tops. Northern flickers are detected on a fairly regular basis during breeding bird surveys across the Forest, particularly in post-fire habitat.

Featured Species

Featured species identified in the Malheur and Ochoco LRMPs include species that require special protection. These species and their preferred habitat are displayed in table 60. Some of these species have already been discussed and narrative affected environment discussion is not repeated here.

Table 59. Habitat for Featured Species

Featured Species	Habitat
Northern goshawk	Mature mixed conifer forest with predominantly closed-canopy conditions for nesting and a diversity of forest and non-forest conditions for foraging
Blue grouse	Coniferous forests (Douglas-fir, grand fir, subalpine fir) with a mixture of deciduous trees and shrubs near edges and clumps, and mistletoe infected Douglas-fir located on ridge tops or upper slope positions
Sage grouse	See Sensitive Species Section.
Osprey	Large, old trees with dead tops or large snags suitable for nesting adjacent to large rivers or lakes.
Pronghorn antelope	Open grasslands with low sagebrush being an important component.
California bighorn sheep	Alpine desert grasslands associated with mountains, cliffs, foothills, and river canyons.
Upland sandpiper	See Sensitive Species Section.

Northern Goshawk

The northern goshawk can be found in landscapes that contain large blocks of mature forest, large trees for nesting, and abundant prey (squirrels, grouse, hares, larger songbirds). They use broad landscapes that incorporate multiple spatial scales, including more closed-canopy stands for nesting, foraging, and post-fledging habitat (PFA). Nest stands are typically composed of large trees, closed canopies, and multiple canopy layers (McGrath et al. 2003, Reynolds et al. 1982) whereas PFAs typically include a variety of forest types and conditions, including young forest and openings (Reynolds et al. 1992). Goshawks are classified as prey generalists (Squires and Reynolds 1997) and forage for small birds and mammals in open understories below the forest canopy and along small forest openings (Reynolds et al. 1992). Foraging areas are usually more open than nesting areas, but would contain large trees, snags, down logs, vegetative layering, and other structural elements important to prey species (Reynolds et al. 1992).

There are 142 goshawk nests and associated post-fledgling areas across the Forest. Nesting and foraging habitat occurs on approximately 400,700 acres; invasive plants have been mapped within about 567 acres of these habitats. Post-fledgling areas cover approximately 27,000 acres; invasive plants have been mapped within 18 acres of this habitat. Because of its preference for closed-canopy forest, invasive plants are not considered a direct threat to the goshawk.

Blue (Dusky) Grouse

Blue grouse prefer coniferous forest (Douglas fir, grand fir, and sub-alpine fir) with a mixture of deciduous trees and shrubs near edges and. They utilize large, mistletoe infected Douglas fir trees, generally located within the upper third of slopes as winter roosts whereas dense coniferous thickets of small trees, stumps, and down logs are used by blue grouse for resting, drumming, and escape cover. They also utilize dense deciduous areas in riparian corridors. Blue grouse home ranges are typically 1.25 to 5 acres, and are usually associated with openings and rocky areas. The food items of blue grouse vary from a simple winter diet of primarily coniferous needles to a summer diet consisting of a variety of green leaves, fruits, seeds, flowers, animal matter, and conifer needles. While vegetation makes up over 90 percent of their diet, young birds feed almost exclusively on insects (Schroeder 1984).

Blue grouse occur across the Malheur National Forest. Winter roost habitat occurs on approximately 6,800 acres. Invasive plants do not pose a direct threat to this species. Invasive plants have been mapped on approximately 1,870 acres of suitable coniferous forest habitat. One acre of invasive plants has been mapped within winter roost habitat. Invasive plants are not considered a direct threat to blue grouse.

Bighorn Sheep

Bighorn sheep generally inhabit open areas of rocky slopes, ridges, rim rocks, cliffs, and canyon walls with adjacent grasslands or meadows, and few trees (Verts and Carraway 1998). Dense forest communities are avoided. Their primary diet consists of bunchgrass, but also includes significant amounts of forbs and shrubs during the growing seasons. In the spring, they will also utilize cheatgrass, which is an invasive annual plant. Most bighorn sheep use forage areas within one-half mile, but up to 1 mile of escape terrain. Summer and winter range must provide freedom from disturbance and a proper juxtaposition of forage, escape terrain, and water.

California bighorn sheep were introduced into the Strawberry Mountain Wilderness and near Aldrich Mountain. Excellent summer range and adequate quality winter range have contributed to an expanding or stable population. The Aldrich Mountain herd unit totals 69,060 acres and contains 13 acres of known invasive plants whereas less than an acre is known to occur in the 58,688 acres Strawberry Mountain unit. Based on known infestations, invasive plants are not currently affecting bighorn sheep or their habitat.

Osprey

Osprey are highly migratory raptors that typically breed and nest along larger rivers, lakes, and reservoirs. Osprey feed almost exclusively on fish and documented nests in Oregon are almost always located close to water with adequate fish populations. Osprey have been documented on the Forest and suitable nesting and foraging habitat exists along rivers and lakes. Currently 67 acres of invasive plants are mapped within 300 feet of waterbodies or rivers that may be used for nesting or foraging. Invasive plants are not a direct threat to osprey.

Pronghorn Antelope

In Oregon, pronghorn antelope habitat includes sagebrush steppe, as well as areas occupied by widely spaced juniper or ponderosa pine. For most of the year, water is essential and animals are seldom found far from available sources, with most herds within 2.5 and 5 miles of water. In spring and summer, broad leaved herbaceous vegetation is the preferred food, although pronghorn will browse on tips of sagebrush in winter and occasionally eat some grasses. Common food plants include longleaf phlox, wallflower, and balsamroot. Pronghorn are fairly common in the open valley areas on the Forest and adjoining private, state, and federal lands. Populations appear to be increasing slightly.

Approximately 78,000 acres of pronghorn habitat occur adjacent to larger blocks of habitat on private lands. Approximately 122 acres of invasive plants are mapped within this habitat. Invasive grasses can reduce habitat for local populations of antelope (California Department of Fish and Game 2013).

Landbirds

Landbirds evaluated in this analysis include focal species associated with priority or unique habitats identified in the Partner in Flight (PIF) Conservation Strategy for Landbirds of the Northern Rocky Mountains of Eastern Oregon and Washington (Altman 2000) and for the Columbia Plateau of Eastern Oregon and Washington (Altman and Holmes 2000). These focal species and their habitat are displayed in the following tables

Table 60. Northern Rocky Mountain Habitat Types - Landbird Focal Species and Their Habitats

Habitat	Habitat Feature	Focal Species
Priority Habitats		
Dry Forests	Large patches of old forest with large trees/snags	White-headed Woodpecker[1]
	Old Forest with grassy openings and dense thickets	Flammulated Owl
	Open understory with regenerating pines	Chipping Sparrow

Habitat	Habitat Feature	Focal Species
	Patches of burned old forest	Lewis' Woodpecker[1]
Mesic Mixed Conifer (Late Successional)	Large snags	Vaux's Swift
	Overstory canopy closure	Townsend's Warbler
	Structurally diverse, multi-layered	Varied Thrush
	Dense shrub layer in forest openings or understory	MacGillivray's Warbler
	Edges and openings created by wildfire	Olive-sided Flycatcher
Riparian Woodland	Large snags	Lewis' Woodpecker[1]
	Canopy foliage and structure	Red-eyed Vireo
	Understory foliage and structure	Veery
Riparian Shrub	Willow/alder shrub patches	Willow Flycatcher
Unique Habitats		
Sub-alpine Meadows		Hermit Thrush
Montane Meadows (wet/dry)		Upland Sandpiper[1]
Steppe Shrublands		Vesper Sparrow
Aspen		Red-naped Sapsucker
Alpine		Gray-crowned Rosy Finch

1 – Also evaluated as an MIS or featured species

Table 61. Columbia Plateau Habitat Types - Landbird Focal Species and Their Habitats

Habitat	Habitat Feature	Focal Species
	Priority Habitats	
Steppe-Grassland	Native bunchgrass cover	Grasshopper Sparrow[1]
Steppe-Shrubland	Interspersion of tall shrubs and openings	Loggerhead Shrike
	Burrows	Burrowing Owl
	Deciduous trees and shrubs	Sharp-tailed Grouse
Sagebrush	Large areas with diverse understory	Sage Grouse[1]
	Large contiguous patches	Sage Sparrow
	Sagebrush cover	Brewer' Sparrow
	Sagebrush height	Sage Thrasher
Shrublands	Ecotonal edges of herb, shrub and tree habitat	Lark Sparrow
	Upland sparsely vegetated desert shrub	Black-throated Sparrow (BR and OW only)
Juniper-Sage Steppe	Scattered mature juniper trees (savannah)	Ferruginous Hawk
Riparian Woodland	Large snags (cottonwood)	Lewis' Woodpecker[1]
	Large canopy trees	Bullock's Oriole
	Subcanopy foliage	Yellow Warbler
	Dense shrub layer	Yellow-breasted Chat
	Large structurally diverse patches	Yellow-billed Cuckoo[1]
Riparian Shrub	Dense shrub patches	Willow Flycatcher
	Shrub-herbaceous interspersion	Lazuli Bunting
	Unique Habitats	
Aspen	Large trees and snags with regeneration	Red-naped Sapsucker
Agricultural Fields	Mesic Conditions	Bobolink

Habitat	Habitat Feature	Focal Species
Cliffs and Rimrock	Undeveloped foraging areas	Prairie Falcon
Juniper Woodland	Mature trees with regeneration	Gray Flycatcher
Mountain Mahogany	Large diameter trees with regeneration.	Virginia' Warbler

[1] – Also evaluated as an MIS, federally proposed sensitive or featured species

Nationwide Birds of Conservation Concern

In an effort to conserve bird species of concern and comply with the Migratory Bird Treaty Act, the United States Fish and Wildlife Service developed a Nationwide Birds of Conservation Concern (BCC) list in 2002. This BBC list was updated in 2008 (USFWS-2008) and identifies species, sub-species, and populations of migratory and non-migratory birds in need of additional conservation action. These species are deemed the highest priority for conservation actions and would be considered prior to taking management actions. Bird Conservation Regions (BCRs) were developed based on similar geographic parameters and each BCR identifies species of concern. The project area includes BCR 10, (Northern Rockies) and table 63 lists bird species of concern within this region.

Table 62. Birds of Conservation Concern

Bird Species	Preferred Habitat
Bald Eagle[1]	Forest with Large Trees Near Open Water
Swainson's Hawk	Elevated Nest Sites In Open Country
Ferruginous Hawk	Elevated Nest Sites In Open Country
Peregrine Falcons[1]	Cliffs, Wide Range Of Habitats
Upland Sandpipers[1]	Grasslands
Long-Billed Curlew	Grasslands
Yellow-Billed Cuckoos	Dense Riparian Cottonwoods
Flammulated Owl	Open Ponderosa Pine Forests
Black Swift	Cliffs Associated With Waterfalls For Nesting, Forage In Forest and Open Areas
Calliope Hummingbird	Open Forest And Shrubs At Higher Elevations And Riparian Areas.
Lewis's Woodpeckers[1]	Mature Open Forest With Large Snags
Williamson's Sapsucker[1]	Coniferous Forest and Aspen With Snags
White-Headed Woodpeckers[1]	Old Open Forest With Large Snags.
Olive-Sided Flycatcher	Edges And Openings Within Forest
Willow Flycatcher	Dense Shrub Patches
Loggerhead Shrike	Grasslands, Open Woodlands, Juniper/Sage
Sage Thrasher	Large Patches Of Sagebrush
Brewer's Sparrow	Dense Sagebrush
Sage Sparrow	Large Patches Of Sagebrush
McCown's Longspur	Sparse Grasslands
Black Rosy-Finch	Above Timberline In Bare Rock, Cirques, Cliffs
Cassin's Finch	Open Mature Coniferous Forest

1 – Also evaluated as an MIS, federally proposed sensitive or featured species

Gamebirds below Desired Condition

This list includes species whose populations are below long-term averages or management goals, or for which there is evidence of declining population trends (USDI Fish and Wildlife Service 2013c). Table 64 displays gamebirds below desired condition (GBBDC) species that may occur within the project area (Cornell Lab of Ornithology 2013) with feeding strategies and preferred habitat.

Table 63. Gamebirds below desired condition

Species	Habitat
Canvasback	Wetlands, ponds, and lakes (plants and aquatic insects)
Mourning Dove	Open forest and woodlands (seeds)
Ring-necked Duck	Marshes and ponds; open water wetlands (plants and aquatic invertebrates)
Wood Duck	Swamps, ponds, and wetlands with snags (insects, seeds and fruit, acorns)
Mallard	Wetlands, ponds, and lakes; roadside ditches (aquatic plants and insects)
Northern Pintail	Open country with shallow wetlands (insects and seeds)
Redhead	Lakes and ponds (plants)
Lesser Scaup	Lakes and ponds (aquatic insects and plants)
American Wigeon	Wetlands, ponds, marshes, and rivers (aquatic insects and plants)

Pollinators

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

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

Colony Collapse Disorder

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

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

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

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

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

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

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

3.7.3 Environmental Consequences

This section evaluates effects to wildlife and wildlife habitat discussed in section 3.7.2 and includes an analysis for each of the alternatives considered, as well as an evaluation of effects to threatened, endangered, regionally sensitive, management indicator, and featured species, as well as birds of conservation concern.

Analysis Methodology

The Forest Service contracts with Syracuse Environmental Research Associates, Inc. (SERA) to conduct ecological risk assessments for herbicides proposed for use on National Forest System lands. The information contained in this document relies on these risk assessments and interpretations from the R6 2005 FEIS.

To determine potential effects, representative wildlife and data from existing laboratory and field studies were used to discover which species might be at greatest risk from herbicide use. The general categories analyzed and exposure scenarios developed depended upon available toxicity data and species of concern in Oregon.

An exposure scenario was developed, when enough data was available, and a quantitative estimate of dose received by the animal type in the scenario was calculated (SERA 2007). The scenarios used to calculate doses include direct spray of small mammals; birds and mammals eating vegetation or insects sprayed with herbicide; predatory mammals and birds eating small mammals or fish; and small mammals drinking contaminated water. The risk assessments prepared by SERA (2001a, b; 2003a-d; 2004a-f; 2007; 2011a-d) contain detailed analysis of the potential effects of each herbicide. Portions of risk assessments pertaining to wildlife are summarized in Appendix P of the R6 2005 FEIS.

The quantitative estimates of dose were compared to available toxicity data to determine potential adverse effects. For this analysis, the most sensitive response (i.e., a sub-lethal effect that occurred at the lowest dose) from the most sensitive species was used to determine "toxicity indices" for each herbicide. When a calculated dose was greater than the toxicity index, the analysis stated that there was a potential for adverse effects. This approach assumes maximum potential effects of herbicides even though the pdfs and herbicide-use buffers would minimize potential exposure.

The toxicity index acts as a threshold; doses below the index would result in no known (or discountable) effect, and doses substantially above a threshold could pose some risk. The level of risk depends on how far above the threshold a particular dose is estimated to be. Due to the nature of the toxicity data, doses only slightly above the toxicity index would still be considered to pose no likely risk (Hazard Quotients of 2-10).

To analyze potential effects from proposed invasive plant treatments on the project area, each species of conservation concern was assigned to an exposure scenario category (e.g., small insectivorous bird, large herbivorous mammal, etc.). Results of risk assessments for each herbicide were then applied to each species within the exposure scenario category to evaluate risk of each herbicide or surfactant.

Professional judgment was used to evaluate the life history traits (e.g., diet, habitat, activity patterns, seasonal occurrence, etc.) of each wildlife species to determine the likelihood of exposure to herbicides or surfactant used to treat invasive plants. The combinations of likelihood of exposure, dose estimated from exposure scenarios, and GIS wildlife location data for the Malheur National Forest was used to determine the risk of effect from herbicide treatments.

Effects of herbicide and non-herbicide treatments were evaluated using professional judgment and knowledge related to the life history of the species evaluated; local knowledge and documentation of Forestwide wildlife; available research and literature on treatments and species ecology; and information provided in the R6 2005 Invasive Weed EIS.

Data Limitations

Compared to data available for mammals and birds, available data is not sufficient to conduct quantitative estimates of exposure and toxicity data for amphibians for most herbicides. The Forest Service/SERA Risk Assessments use information from the literature, when available, and the calculated concentrations of herbicide in water from runoff or accidental spill to determine risk to amphibians. When data on amphibians were not available, fish were used as surrogate species. Data suggest that amphibians may be as sensitive to herbicides as fish (Berrill et al. 1994; Berrill et al. 1997; Perkins et al. 2000). For the purposes of this analysis, herbicides that pose potential risk to fish (as determined by the quantitative estimates from exposure scenarios) were also considered to pose a risk to amphibians.

Data is limited regarding the potential effects of herbicides on mollusks. Only glyphosate and picloram have been tested on a terrestrial mollusk, the brown garden snail (*Helix aspersa*). Neither glyphosate nor picloram appeared to pose a risk to the snail (USDA Forest Service 2005e). Relyea (2005b) found no effect to three species of aquatic snails from the glyphosate formulation Roundup®.

Insufficient data is available in many cases to allow for a quantitative risk assessment. For instance, there is no quantitative scenario for a predatory bird that eats primarily other birds, such as the peregrine falcon, so the "fish-eating bird" scenario was used as a surrogate. This scenario likely overestimates the dose to the peregrine falcon because the hypothetical fish consumed are from a pond contaminated by a large spill of herbicide. These hypothetical fish likely have higher concentrations of herbicide in their bodies (and thus a higher dose to the predatory bird) than would a small bird that incidentally ingested herbicide before it was preyed upon. Data was insufficient to assess risk of chronic exposures for insect-eating birds and mammals for several herbicides.

Direct spray of small mammals and consumption of small mammals that have been directly sprayed by predatory birds or mammals exceed the toxicity indices for a few herbicides. However, these scenarios, while possible, were determined to not be plausible. Many small mammals are nocturnal and spend daylight hours in burrows or in trees or seek cover if disturbed, reducing the likelihood that they would be directly sprayed. In the case of predatory birds or mammals, the predator would have to consume an entire day's diet worth of directly sprayed small mammals to receive the dose that exceeded the toxicity index.

Research has not been conducted on the effect of proposed herbicides to most free-ranging wildlife, so the relevant data to specifically evaluate effects to different wildlife species is incomplete or unavailable. Specific relevant data that is lacking includes:

- For several herbicide/species group combinations, both NOAEL and LOAEL values have not been determined.
- There is insufficient data to assess risk of chronic exposures for large grass-eating birds or small insect-eating birds and mammals.
- The toxicity of the herbicides to amphibians, reptiles, terrestrial invertebrates, birds, and other animals found in Region 6 is either unknown or limited, and cannot be fully characterized with the available data on surrogate species.
- Analysis of effects for any project involving herbicide use relies on extrapolations from laboratory animals to free-ranging wildlife and controlled conditions to the natural environment.
- There is less data available for birds than mammals, so mammal toxicity values must be used in bird exposure scenarios for some of the herbicides considered.

Limitations notwithstanding, a substantial amount of scientific data on the toxicity of proposed herbicides to birds and mammals, and some amphibians and invertebrates exist. The data is generated by manufacturers to meet EPA regulations before an herbicide may be registered for use and by independent researchers that publish findings in peer-reviewed literature. So while some data is lacking, adequate information exists to assess potential impacts of the herbicides proposed on wildlife.

Effects of Alternative A (No Action)

Under alternative A, no proposed project activities would occur, and therefore, no direct or indirect treatment-related effects would occur. While current levels of invasive plant control may continue on lands of other ownership, invasive plants would continue to establish and spread within the project area at the rate of approximately 8 to 12 percent per year (R6 2005 FEIS) (consistently applied prevention measures since 2005 assume this rate to be reduced by half (R6 2005 ROD)). Native plants and habitats would increasingly be threatened by invasive plants. Effects on wildlife would vary. For closed-canopy forest species (e.g., goshawk) or species that are not affected by invasive plants (e.g., woodpeckers or bats), or species that occupy habitat away from invasive plant vectors (e.g., Wallowa rosy finch), there would be little effect to existing or future habitat.

Due to their proximity to invasive plant vectors and more open canopy conditions, habitats, such as grassland/meadows, sagebrush, open-canopied forest (e.g., savannah) and many wetland/riparian areas, would continue to be affected by invasive plants. Wildlife dependent on these communities would have a reduced cover or forage as native habitat is replaced by non-natives. Infestations that become so well established that future treatment is cost-prohibitive could result in permanent loss of habitat (Asher 2002). For example, habitat loss via invasive plant infestation has been reported to occur in Oregon spotted frog habitat that is invaded by reed canarygrass (Hayes 1997). Sage grouse and pygmy rabbits could be displaced if invasive plants expand into native rangeland (Connelly et al. 2000, Weiss and Verts 1984) and foraging habitat for elk and other big game could decrease (Rice et al. 1997). The spread of invasive wetland plants can also reduce waterfowl nesting habitat (Blossey 1999).

Consequently under alternative A, the long-term loss of native vegetation and habitat due to continued encroachment of invasive plants would adversely affect species, such as elk, antelope, grasshopper sparrow, greater sage grouse, upland sandpiper, bobolink, Columbia spotted frog, silver-bordered fritillary and several migratory birds of concern.

Effects Common to all Action Alternatives

This section discusses general effects on wildlife that are common to all action alternatives and is based on effects of invasive plant treatments to wildlife that are evaluated in detail in the R6 2005 FEIS, the corresponding Biological Assessment (USDA Forest Service 2005c), project files, and SERA risk assessments.

General Effects of Treatment

All treatment methods have the potential to disturb, temporarily displace, or directly harm various wildlife species. Conversely, successful control of invasive plant infestations provides long-term benefits to wildlife, by restoring native habitats. Potential adverse effects to wildlife are determined largely by the potential for exposure to treatment. Because most invasive species are shade intolerant, the majority of treatments occur in openings, early structural habitat, or in forested habitat with a relatively open canopy. Consequently, species that occur primarily in closed-canopy forests are less likely to be affected by proposed treatments. Conversely, species that prefer or require relatively open habitats are more likely to be adversely affected by both invasive plants and treatments.

The effects of invasive plant treatments on wildlife are relative to the size and locations of existing and future invasive plant infestations, the type of treatment used, and the timing and duration of the treatments. Treatments along disturbed roadsides are not likely to substantially affect terrestrial wildlife populations since this vegetation type does not provide essential habitat for native wildlife species and it consists of long, narrow areas spread over large distances. Treatment of large areas may create more disturbances for longer periods than treatment of small infestations. Treatment of dense infestations can create bare ground, which may reduce cover and expose certain species to increased predation. However, dense infestations of invasive plants do not typically occur in areas of the Malheur National Forest that provide suitable habitat for most wildlife species.

For the most part, invasive plant treatments would not alter habitat structure or composition for terrestrial wildlife species. Most of the invasive plants on the Malheur National Forests are forbs, thus woody species, and shrubs and trees would not likely be affected by treatments. Impacts to non-target forbs and grasses would generally be minor and occur within treated areas or within short distances of treated areas (less than 100 feet, 15 feet for spot treatment). In some cases, removal of invasive plants could cause a localized decrease in vegetative cover provided. However, due to the patchy nature of invasive plant infestations, there would be little cover lost. Unlike other management activities (i.e., timber harvest), invasive plant treatments are not likely to reduce available habitat or prey availability.

Manual and Mechanical Treatments

Disturbance from manual and mechanical treatments is likely to pose greater risks to terrestrial wildlife species than herbicide or cultural methods (USDA Forest Service 2005e). Small species that lack rapid mobility (e.g., amphibians, mollusks) and ground nesting birds are vulnerable to crushing or injury from people or equipment. Manual treatments can take longer to implement than other methods, increasing the length of time of disturbance. Manual treatments are often used at small sites, where the potential to affect wildlife would be minimal, but may also be used in large areas with scattered invasive plants. In these situations, crews of 3-5 people may be in an area for more than a day. Bare ground is likely to be patchy in distribution with this method and less likely to interfere with animal movement or dispersal. Mechanical methods can generate more noise disturbance than other methods. Hand held mechanical equipment like chainsaws and trimmers can be used very selectively on target plants and may be less likely than larger equipment to harm wildlife. Use of vehicle mounted equipment, like mowers, is less selective and more likely to directly affect small animals than use of hand operated equipment, such as string trimmers.

Biological Control

Biological control is proposed on sites that are either too large to be sprayed with herbicides, where invasive plant species are so abundant that other methods would not be practical, or where the biological control agent is effective on the target plant species and treatment can reduce or eliminate the need for herbicides.

Biological control will not directly affect native wildlife species; however, recent studies have found that native rodents may take advantage of the food source provided by biological control agents (Pearson et al. 2000). Effects include short-term disturbance similar to that described under manual treatment during release. Although some bio control agents available have adverse effects to non-target wildlife, only APHIS and State-approved biological control agents would be used. Also, agents demonstrated to have direct negative impacts on non-target organisms would not be released. As a result, there are no adverse effects to wildlife anticipated under any of the action alternatives.

Due to the maintenance of native vegetation and habitat, indirect effects of biological control include reducing invasive plant populations and providing a supplemental food source, both of which can have long-term benefits to wildlife.

Cultural/Restoration

Restoration or reclamation of sites infested with invasive plants follow treatment restoration standard 13 (USDA Forest Service 2005b) and incorporate guidelines for re-vegetation of invasive weed sites and other disturbed areas on National Forests and Grasslands in the Pacific Northwest (Erickson et al. 2003). On degraded sites where reproducing individuals of desirable species are absent or in low abundance, re-vegetation with well-adapted, competitive, native grasses, forbs, and legumes can be used to direct and accelerate plant community recovery, reduce erosion, and restore native wildlife habitat conditions. Restoration treatments proposed under the action alternatives include mulching, seeding, and planting. Effects on wildlife are similar to those described under manual treatments and include short-term avoidance of the site during treatment. Due to the small amount of treatment proposed, scattered nature of proposed sites, widespread availability of unaffected habitat, and with implementation of pdfs to protect species of conservation concern, effects to wildlife would be limited to short-term disturbance of the site during treatment.

Herbicide Effects to Wildlife

Results of numerous field studies indicate the likelihood for direct adverse effects to wildlife from herbicide use is low (Marshall and Vandruff 2002, Dabbert et al. 1997, Fagerstone et al. 1977, Rice et al. 1997, Sullivan et al. 1998, Cole et al. 1997, Cole et al. 1998, Johnson and Hansen 1969, Nolte and Fulbright 1997, McMurry et al. 1993a, and McMurry et al. 1993b); however, use of herbicides to treat invasive plants does have the potential to harm free-ranging wildlife (USDA Forest Service 2005b p. 1-11). Herbicides can also cause some malformation or mortality to amphibians that have been exposed to herbicides or surfactants in water (Relyea 2005).

Risk from herbicide exposure was determined using data and methods outlined in the SERA risk assessments. A quantitative estimate of dose was compared to toxicity indices (table 65 and table 66). If a dose exceeded the toxicity index, then it was determined to have potential for an adverse effect. Quantitative estimates of dose for each animal group for each herbicide are contained in the project file worksheets. Wildlife species evaluated were placed into groups based on taxa type (e.g., bird, mammal), body size, and diet (e.g., insect-eater, fish-eater, or plant-eater). Exposure scenarios for the various groupings were used to quantitatively estimate dose and characterize risk at both the typical and highest application rate for each herbicide/surfactant. Exposure scenario results were evaluated in terms of whether or not they exceeded the NOAEL (no observed adverse effect level) for an acute exposure (i.e., consumed contaminated prey exclusively during a 24-hour period) or chronic exposure (i.e., consumed contaminated prey for 90 days). Table 65 and table 66 display the toxicity indices for birds and mammals used in this analysis whereas table 67 displays exposure scenarios results. Toxicity indices represent the most sensitive endpoint from the most sensitive species for which adequate data are available. Toxicity results are discussed in more detail in Appendix P of the R6 2005 FEIS.

Changes between the DEIS and FEIS related to herbicide exposure were based on information in the updated risk assessments for imazapyr, picloram glyphosate and triclopyr (SERA 2011). Changes include updated toxicity indices that are displayed in table 65 and table 66, and updated exposure scenarios that are displayed in table 67. Changes in table 67 also include adding an exposure scenario for small birds. While there was no change in updated exposure scenarios for imazapyr, there were changes in the updated assessments for glyphosate, picloram, and triclopyr. In all cases, changes in the updated risk assessments were associated with the consumption of contaminated vegetation, particularly by small mammals and birds consuming grasses that contain the highest concentration of picloram. The following summarizes results and changes for the updated exposure scenarios presented in table 67:

- Glyphosate – In the DEIS, a large mammal (acute exposure) and large bird (chronic exposure) consuming vegetation exceeded the toxicity index at the highest application rate. In the updated assessment, in addition to the large bird and large mammal consuming vegetation, small mammals and small birds consuming vegetation (chronic and acute exposures) also exceeded the toxicity index at the highest application rate. There was no change in typical application rates between the original and updated assessment.
- Picloram –In the DEIS, only a large mammal consuming vegetation (acute exposure) exceeded the toxicity index at the highest application rate. In the updated assessment for acute exposures, the large mammal consuming vegetation did not exceed the toxicity index at any application rate whereas small mammals and small birds consuming vegetation exceeded the toxicity index at the highest application rate. For long-term scenarios (i.e., chronic), small mammals and birds consuming vegetation exceeded the toxicity index at both the typical and highest application rates.
- Triclopyr – In the DEIS, only a large bird (acute and chronic) and large mammal (chronic only) consuming vegetation exceeded the toxicity at the typical and highest application rate. In the updated assessment, all animal groups consuming vegetation (acute and chronic) exceeded the toxicity index at the typical and highest application rate.

The FEIS also includes changes in pdfs that are designed to reduce toxicity risk including: 1) broadcast application of glyphosate and spot application of triclopyr would be limited to at or below the typical application rate, 2) picloram, imazapyr and metsulfuron methyl could be used every other year, and 3) aminopyralid could be used once a year. Additionally because NPE and POEA based surfactants have been dropped in the FEIS, associated risks that were identified in the DEIS have been eliminated. Other changes in the FEIS related to herbicide exposure and risk include updated information on invertebrates and mollusks, which are discussed in the pollinator and species-specific sections of this analysis.

Ultimately, the risk for adverse effects depends on a number of factors, such as wildlife feeding strategy, seasonal activity, and types and amounts of herbicides used. Also, implementation of pdfs, herbicide-use buffers, and treatment limits reduce risk. As a result and considering none of the first year/first choice herbicides under alternatives B and C would result in adverse effects from herbicide exposure, wildlife would not receive an acute or chronic exposure or concern under any alternative.

Table 64. Toxicity indices for birds

Herbicide	Duration	Endpoint	Dose (mg/kg/day)	Species	Effects Noted at LOAEL
Aminopyralid	Acute	NOAEL	14	Quail	Ruffled appearance at 23 mg/kg
	Chronic	NOEC	184*	Mallard	No adverse effects to adults or offspring at highest dose tested (184 mg/kg/day)
Chlorsulfuron	Acute	NOAEL	1686	Quail	No significant effects at highest dose
	Chronic	NOAEL	140	Quail	No significant effects at highest dose
Clopyralid	Acute	NOAEL	670	Mallard & Quail	No signs of toxicity reported, LOAEL not determined
	Chronic[1]	NOAEL	15	Rat	Thickening of gastric epithelium at 150 mg/kg/day
Glyphosate	Acute	NOAEL	540	Mallard & Quail	No significant effects
	Chronic	NOAEL	43	Quail	Decreased body weight and changes in bone composition
Imazapic	Acute	NOAEL	1100	Quail	No effects at highest dose
	Chronic	NOAEL	113	Quail	Decreased weight gain in chicks at 170 mg/kg/day
Imazapyr	Acute	NOAEL	2510	Mallard & Quail	No effects at highest dose
	Chronic	NOAEL	610	Mallard & Quail	No signs of toxicity
Metsulfuron methyl	Acute	NOAEL	1043	Quail	No significant effects at highest dose
	Chronic	NOAEL	120	Mallard & Quail	No significant effects at highest dose
Picloram	Acute	NOAEL	1600	Mallard	No effects to adults. Low mortality to young at highest dose
	Chronic[1]	NOAEL	65	Quail	Decreased body weight of chicks. LOAEL 127 mg/kg/day
Sethoxydim	Acute	NOAEL	>500	Mallard & Quail	No or low mortality at highest doses tested. LOAEL not available.
	Chronic	LOAEL[2]	10	Mallard	Decreased number of normal hatchlings at 10 mg/kg/day
Sulfometuron methyl	Acute	NOAEL	312	Mallard	Decreased weight gain at 625 mg/kg/day

Herbicide	Duration	Endpoint	Dose (mg/kg/day)	Species	Effects Noted at LOAEL
	Chronic[1]	NOAEL	2	Rat	Effects on blood and bile ducts at 20 mg/kg/day
Triclopyr	Acute	NOAEL	126	Quail	LOAEL 350 mg/kg. Incoordination, lethargy (based on gavage exposure, which is extreme and more toxic than dietary exposure)
	Chronic	NOAEL	7.5	Mallard & Quail	Reduced eggshell thickness at 15 mg/kg/day

* The chronic toxicity index is higher than the acute toxicity index because the acute value is based on a gavage study and the chronic value is based on a dietary exposure study. There are substantial differences in effects from the different dose methods. Effects from gavage dosing were rapidly reversed, but are used in the assessment of risk to be conservative. This may lead to a gross overestimate of acute risk (SERA 2007, p. 96-97).

1 Chronic toxicity studies in birds are not available, so the value from mammal studies is used.

2 Based on one study in which a NOAEL was not determined, so the LOAEL is used.

Sources: SERA 1998, 2001, 2003, 2004, 2007; 2011, Bakke 2003;

Table 65. Toxicity indices for mammals

Herbicide	Duration	Endpoint	Dose (mg/kg/day)	Species	Effect Noted at LOAEL
Aminopyralid	Acute	NOAEL	104	Rabbit	Weight loss and in coordination at 260 mg/kg
	Chronic	NOAEL	50	Rat	Cecal enlargement at 500 mg/kg/day
Chlorsulfuron	Acute	NOAEL	75	Rabbit	Decreased weight gain at 200 mg/kg
	Chronic	NOAEL	5	Rat	Weight changes at 25 mg/kg/day
Clopyralid	Acute	NOAEL	75	Rat	Decreased weight gain at 250 mg/kg
	Chronic	NOAEL	15	Rat	Thickening of gastric epithelium at 150 mg/kg/day
Glyphosate	Acute	NOAEL	500	Rabbit	Diarrhea at 350 mg/kg
	Chronic	NOAEL	500	Rabbit	Diarrhea at 350 mg/kg
Imazapic	Acute	NOAEL	350	Rabbit	Decreased body weight at 500 mg/kg
	Chronic	NOAEL[2]	45	Dog	Microscopic muscle effects at 137 mg/kg
Imazapyr	Acute	NOAEL	250	Dog	No effects at highest doses tested
	Chronic	NOAEL	250	Dog	No effects at highest doses tested
Metsulfuron methyl	Acute	NOAEL[3]	25	Rat	Decreased weight gain at 500 mg/kg
	Chronic	NOAEL	25	Rat	Decreased weight gain at 125 mg/kg
Picloram	Acute	NOAEL	200	Rabbit	Decreased weight gain at 172 mg/kg
	Chronic	NOAEL	20	Dog	Increased liver weight at 35 mg/kg[4]
Sethoxydim	Acute	NOAEL	160[4]	Rabbit	Reduced number of viable fetuses, some dam mortality at 480 mg/kg
	Chronic	NOAEL	9	Dog	Mild anemia at 18 mg/kg/day
Sulfometuron methyl	Acute	NOAEL	87	Rat	Decreased body weight at 433 mg/kg
	Chronic	NOAEL	2	Rat	Effects on blood and bile ducts at 20 mg/kg/day
Triclopyr	Acute	NOAEL	100	Rat	Malformed fetuses at 300 mg/kg
	Chronic	NOAEL	5	Dog	Effect on kidney at 2.5 mg/kg/day

2 Imazapic – NOAEL calculated from a LOAEL of 137 mg/kg/day and application of a safety factor of 3 to extrapolate from a LOAEL to a NOAEL.

3 The acute NOAEL of 24 mg/kg is very close to the chronic NOAEL, so chronic value is used for acute exposures.

4 Source of the value used by EPA (180 mg/kg) is not well documented, so the lower value of 160 mg/kg from a rabbit study is used as the toxicity index for this analysis.

Source: SERA 1998, 2001, 2003, 2004, 2007, 2011 and Bakke, 2003.

Symbol meanings for the following table are as follows:

-- Exposure scenario results in a dose below or equivalent to the toxicity index.
* Exposure scenario results in a dose that exceeds the toxicity index at typical and highest application rates.
♦ Exposure scenario results in a dose that exceeds the toxicity index at highest application rates only.

Table 66. Exposure scenario results from FS risk assessments for mammals, birds, and honeybees, using the typical and highest application rates and assuming upper residue rates

Animal/Scenario	Aminopyralid	Chlorsulfuron	Clopyralid	Glyphosate	Imazapic	Imazapyr	Metsulfuron methyl	Picloram	Sethoxydim	Sulfometuron methyl	Triclopyr
Acute Exposures											
Direct spray, bee	--	--	--	♦	--	--	--	--	--	--	--
Direct spray, sm. mammal	--	--	--	--	--	--	--	--	--	--	--
Consume contaminated vegetation											
small mammal	--	--	--	♦[1,4]	--	--	--	♦[1,4]	--	--	*[1,4]
large mammal	--	--	--	♦	--	--	--	--[2,4]	--	--	*[1,4]
large bird	--	--	--	--	--	--	--	--	--	--	*
small bird	--[3]	unk	--[3]	♦[4]	--[3]	--[4]	--[3]	♦[4]	-[3]-	--[3]	*[4]
Consume contaminated water											
Spill, sm. mammal	--	--	--	--	--	--	--	--	--	--	--
Consume contaminated insects											
small mammal	--	--	--	♦	--	--	--	♦	--	--	--
small bird[2]	--	unk	--	♦	--	--	--	--	--	--	*
Consume contaminated prey											
carnivore (sm. mammal)	--	--	--	--	--	--	--	--	--	--	--
predatory bird (sm. mammal)	--	--	--	--	--	--	--	--	--	--	--
predatory bird (fish)	--	--	--	--	--	--	--	--	--	--	--
Chronic Exposures											
Consume contaminated vegetation											
small mammal, on site	--	--	--	♦[1,4]	--	--	--	*[1,4]	--	--	*[1,4]
lg. mammal, on site	--	--	--	--	--	--	--	--	--	♦	*
lg. bird, on site	--	--	--	♦	--	--	--	--	♦	♦	*
small bird on site	--[3]	unk	--[3]	♦[1,4]	--[3]	--[4]	--[3]	*[1,4]	--[3]	--[3]	*[1,4]
Consume contaminated water											
small mammal	--	--	--	--	--	--	--	--	--	--	--
Consume contaminated insects#											
small mammal	--	--	unk	unk*	--	--	--	unk	unk	unk	unk
small bird	--	--	unk	unk	--	--	--	unk	unk	unk	unk
Consume contaminated prey											

Animal/Scenario	Aminopyralid	Chlorsulfuron	Clopyralid	Glyphosate	Imazapic	Imazapyr	Metsulfuron methyl	Picloram	Sethoxydim	Sulfometuron methyl	Triclopyr
carnivore (sm. mammal)#	--	--	--	--	--	--	--	--	--	--	*
predatory bird (sm. mammal)#	--	--	--	--	--	--	--	--	+	--	--
predatory bird (fish)	--	--	--	--	--	--	--	--	--	--	--

Data are lacking regarding chronic exposures, so effects are assumed by comparing acute dose vs. chronic NOAEL, which will likely over-estimate actual risk.

unk – unknown; insufficient data to assess risk.

*unknown only at highest rates; typical rates pose no apparent risk.

+ Previous versions of this table showed an exceedance at high application rate for a chronic scenario. That is not shown here, because the actual estimated dose is equivalent to the toxicity index, rather than an exceedance.

1 – The DEIS showed no toxicity at typical or highest application rate.

2 – The DEIS showed the toxicity index was exceeded at the highest application rate.

3 – Based on available risk data, did not exceed the toxicity index at the typical and highest application rate

4 – Based on updated risk assessment results

While the amount of each herbicide/surfactant applied varies, many of the pdfs were specifically designed to ensure that any application rates used were below levels that would result in an exposure of a non-target species that exceeded the NOAEL.

Standards in the Malheur National Forest LRMP require that adverse effects to wildlife from invasive plant treatment be minimized or eliminated through project design and implementation. All action alternatives were designed to comply with these standards. Project design features (pdfs) and herbicide-use buffers place restrictions on how and where herbicides are applied.

Results of the herbicide analysis indicate that birds and mammals consuming vegetation or insects that have been sprayed with some of the herbicides have the most potential to receive doses above the toxicity index, although other scenarios occasionally exceeded the toxicity index. While all proposed herbicides are considered low risk, in order to compare toxicity risks, proposed herbicides/surfactants were placed into the following four categories of “relative risk”.

- **Herbicides that Do Not Pose a Risk** – These include herbicides that do not pose a risk to wildlife at either typical or highest application rates and include aminopyralid, clopyralid, chlorsulfuron, imazapic, imazapyr and metsulfuron methyl. There are no exposure scenarios anticipated that would result in adverse effects to wildlife from application of these herbicides.
- **Lower Risk Herbicides** – Sethoxydim, and sulfometuron methyl do not pose a risk to wildlife at typical application rates, but do pose a risk to some species at the highest application rate. While data is lacking to fully assess chronic impacts to an insectivorous small mammal or bird, with implementation of pdf F2, these herbicides would not be applied above the typical application rate. This minimizes the potential for exceeding the threshold of concern for wildlife to be exposed to harmful levels of these herbicides.
- **Moderate Risk Herbicides** – Glyphosate does not pose a risk at typical application rates, but does pose an acute and chronic risk for some groups at the highest application rate. While data is lacking to fully assess chronic impacts to an insectivorous small mammal or bird, with implementation of pdf F2, this herbicide would not be applied above the typical application rate.
- **Higher Risk Herbicides**– These include herbicides that pose a risk to one or more groups at both the typical and highest application rate and include triclopyr and picloram. Picloram is also more

persistent in some soil types. While data is lacking to fully assess chronic impacts to an insectivorous small mammal or bird, with implementation of the Malheur National Forest LRMP standard, triclopyr is limited to spot/selective methods only. Additionally pdf H3 restricts use of picloram on certain soil types whereas pdf H4 limits retreatment using picloram to every other year. As a result and considering the small amount of picloram proposed for broadcast application (alternative D), it is unlikely that these herbicides would pose a risk to wildlife.

Adherence to invasive plant treatment standards and pdfs; actual animal behavior and feeding strategies; and/or seasonal presence/absence within treatment area reduce these risks. As a result and considering the limited spatial extent of infestation (over 80 percent of sites are 0.25 acres or less), the likelihood that wildlife would be exposed to harmful levels of herbicides is reduced. The categories or risk in the FEIS are the same as those presented in the DEIS, except that picloram has been moved from moderate to higher risk, because the updated exposure scenario exceeded the toxicity index for small mammals and birds (chronic exposure) at the typical and highest application rate.

As described above, effects to wildlife vary depending on the type of herbicide application proposed or the use of non-herbicide treatments. In addition, the effectiveness of the action alternatives at controlling or containing invasive plants varies by treatment. Table 68 displays the first year/first choice treatments that would occur in each action alternative and identifies alternative treatments within wildlife habitats that are considered to be "at risk" from invasive plants. The information presented is used in the alternative analysis to compare the extent and type of treatment within habitats affected and to help assess the effectiveness of each of the alternatives at controlling invasive plants.

Table 67. First year/first choice treatments by habitat type and action alternative

Habitat	Invasive Plant Acres	Alternative B Acres			Alternative C Acres			Alternative D Acres		
		Herbicide		No Herbicide	Herbicide		No Herbicide	Herbicide		No Herbicide
		Bcast	Spot		Bcast	Spot		Bcast	Spot	
Dry Forest[4]	1,386	845	541	0	0	532	854	390	996	0
Mesic Mixed Conifer	355	219	136	0	0	109	246	87	268	0
Riparian Woodland[1,3]	678	367	312	0	0	34	644	19	660	0
Riparian Shrub[1,3]	64	29	35	0	0	2	62	1	63	0
Montane Meadow	47	30	18	0	0	16	31	14	34	0
Steppe Shrubland[2,3]	72	43	29	0	0	27	45	19	53	0
Sagebrush[3]	79	14	65	0	0	22	57	14	65	0
Juniper Woodland	28	14	14	0	0	8	20	5	23	0
Grassland[3]	122	73	49	0	0	25	97	20	102	0
Wetland[3]	69	38	31	0	0	5	64	3	66	0

1 – Some of the riparian habitats are also included as other forest or non-forest communities

2 – Some inclusions of sagebrush are included in steppe shrublands

3 – Habitats that are considered to be most "at risk" from invasive plants

4 – Understory vegetation within open canopy dry forest can be adversely affected by invasive plants.

Herbicide Effects to Pollinators

The honey bee is a standard test subject for required toxicity testing of pesticides, so there is data on risk to bees in the risk assessments for all herbicides included in this project. Considering the herbicides proposed for use in this project, only glyphosate and triclopyr at the highest application rate pose a potential risk to bees. Consequently, pdf F2 requires that broadcast application of glyphosate and spot treatment of triclopyr be limited at or below the typical application rate (See table 10).

For glyphosate, a relatively large number of acute toxicity studies have been conducted on bees and other species of terrestrial insects, using technical grade glyphosate as well as various glyphosate formulations, for contact spray and dietary exposures (Appendix 4 in SERA 2011). Contact spray of glyphosate does not pose a risk of mortality to bees. Consumption of contaminated food can pose a risk to terrestrial invertebrates at the highest application rate (at typical rate no HQs are greater than 1). For glyphosate without the POEA surfactant (which is the case for this project), only the upper bound estimates at the highest application rate exceeded the NOAEL (HQ= 2-4).

Imazapyr poses no risk to bees even at the highest application rate proposed in this project. The EPA classifies imazapyr as practically non-toxic to bees, and results of the Forest Service risk assessment state that this conclusion is clearly justified. Neither contact nor estimated oral doses exceeded the NOAEL (HQ <1), even at the highest application rate and upper exposure estimates.

Similarly, chlorsulfuron, clopyralid, imazapic, picloram, sethoxydim or sulfometuron methyl, at the highest application rate and upper exposure estimates did not exceed the NOAEL (HQ<1) for bees in direct contact or estimated dietary exposures.

Triclopyr TEA and BEE at the highest application rates and upper exposure estimates exceed the NOAEL for dietary exposures (HQ = 2-5). Central estimates of exposure, even at the highest application rates are equivalent to the NOAEL. Direct spray scenarios do not pose a risk to bees (SERA 2011).

None of the herbicides indicated a risk to bees in the risk assessment. With implementation of pdf F2, which restricts broadcast application of glyphosate and triclopyr to the typical application rate (or less for triclopyr), and Malheur LRMP standards that limit application of triclopyr to spot techniques only, it is not expected that bees or pollinators would be exposed to toxic levels of herbicide under any action alternative.

Effects of Alternative B

Direct and Indirect Effects

Under alternative B, a total of 2,124 acres would be treated with herbicides, including 1,281 acres of broadcast application and 843 acres of spot treatments during the first year of treatment. Future treatments would be determined by the effectiveness of the initial herbicide treatments. Due to the ability to use aminopyralid and thus broadcast spray more area, Alternative B is expected to include less future manual and mechanical treatments than alternatives C or D. See Chapter 3.1.4 for a discussion about how alternatives C and D may result in more repeated entries.

Effects of manual, mechanical, and biocontrol treatments would be similar to those described previously in the Effects Common to All Action Alternatives section. Because alternative B would have fewer manual/mechanical treatments and considering these treatments pose a greater risk of disturbance to wildlife than herbicides, the likelihood of disturbance or mortality during treatment is reduced under this alternative. The likelihood of direct effects are further reduced, when you consider that 1 percent or less of the affected habitats would be treated (table 68), existing sites are small and scattered, and approximately 88 percent of known sites occur along open roads, which provide less preferred habitat for many wildlife species. Finally, using the implementation process described under section 2.4.2., Forest Service personnel would develop annual treatment prescriptions for all existing and new (EDRR described below) invasive plant infestations. This would include identification of wildlife species of local interest or their habitats and implementation of appropriate pdfs, including modification of treatment methods/timing if necessary to reduce potential risks. Collectively for these reasons, the likelihood of mortality for any wildlife species is low and any disturbance would be short-term in nature.

Effects of herbicide application would be similar to those described previously in the Effects Common to All Alternatives section. None of the first-choice herbicides would result in an acute or chronic dose that exceeds the toxicity index for any group of wildlife species. While other herbicides could be used in subsequent years to achieve objectives, there are no adverse effects from herbicide exposure anticipated under this alternative with implementation of pdfs, Forest standards and treatment buffers, and considering annual treatment prescriptions would identify species/habitats of concern and modify treatment type and timing if necessary.

Effects to habitat vary by the size of the infestation and effectiveness of treatment. For example, while bare ground can be created in dense patches of invasive plants, effects to wildlife would be reduced because these areas do not provide preferred habitat. Considering approximately 250 acres have 50 percent infestation or more, cover would be retained on all sites. Alternative B includes a full range of treatment options, including broadcast spraying and use of aminopyralid near standing water, wetlands, and across riparian areas; therefore, it is estimated that treatment effectiveness would be approximately 80 percent. Also alternative B would be most effective at controlling larger infestations should they be detected in the future. As a result, alternative B would effectively control invasive plants and promote the long-term maintenance of native vegetation and wildlife, including “at risk” habitat identified in Chapter 3.7.2.

Malheur National Forest Land and Resource Management Plan (LRMP) Amendment

The proposed LRMP amendment to add aminopyralid would likely improve the effectiveness of treatment (chapter 3.1.4). This would result in neutral or positive impacts to wildlife on the Malheur National Forest because aminopyralid poses no likely risk to wildlife and would effectively treat invasive plants, which can degrade habitat.

Early Detection/Rapid Response

In addition to proposed treatments, alternative B would allow treatment of new detections (EDRR), as long as the treatment method is within the scope of this EIS. The treatment of newly found sites adds additional risk factors to wildlife just by adding additional exposure areas. This also expands the treatment into areas that may not have been originally anticipated. However, the implementation planning process identified in chapter 2 would be used with each new infestation site to determine treatment. Also, the pdfs provide layers of caution, so even if the exact locations are not known, the potential for adverse effects are minimized. Implementation of pdfs and herbicide-use buffers and treatment limits would work together to provide sideboards to deal with the uncertainty of treating new sites (USDA Forest Service 2008b) and ensure that direct and indirect effects are consistent with those anticipated in the FEIS. Alternative B would be most effective at controlling infestations detected in the future (see chapter 3.1.4).

Effects of Alternative C

Direct and Indirect Effects

Under alternative C, non-herbicide treatments would be increased on 1,389 acres, and more repeated manual/mechanical treatments would occur in subsequent years (see chapter 3.1.4 for discussion about why more repeated treatments would be necessary for alternative C). Effects of non-herbicide treatments would be similar to those discussed previously in the Treatment Effects Common to All Action Alternatives section. The likelihood of direct effects is increased somewhat under this alternative because manual/mechanical treatments can increase the likelihood of disturbance to less mobile species. Like alternative B, when you consider that 1 percent or less of the affected habitats would be treated (table 68), existing sites are small and scattered, and approximately 88 percent of the known sites occur along open roads, which provide less preferred habitat for many wildlife species, the likelihood of direct effects are low. Potential for effects are further reduced when you consider implementation of pdfs, and that annual treatment prescriptions would be prepared for all new infestations that would identify wildlife species of local interest or their habitats, and modify treatment methods if necessary to reduce potential risks. Treatment risks are increased somewhat under this alternative, due to the increased use of manual/mechanical treatments, but collectively for these reasons the likelihood of mortality for any wildlife species is low and any disturbance would be short term.

Effects of herbicide treatments would be similar to those discussed previously in the Treatment Effects Common to All Action Alternatives section. Like alternative B, none of the first year/first choice herbicides resulted in an acute or chronic dose that exceeded the toxicity index for any wildlife species. While other herbicides could be used in subsequent years to achieve objectives, there are no adverse effects to wildlife from herbicide exposure anticipated with implementation of pdfs, Forest standards and treatment buffers, and considering annual treatment prescriptions would identify species/habitats of concern and modify treatment type and timing if necessary.

Like alternative B, cover would be retained on all treatment sites and there would be little change in wildlife habitat conditions in the short-term. However, requiring only non-herbicide treatments on much of the infested areas would reduce effectiveness compared to using herbicides in combination with non-herbicide treatments (see chapter 3.1.4), and overall treatment effectiveness would be reduced by almost half from that of alternative B. Therefore, while implementation of alternative C would help contain or control invasive plants, it would be less effective than alternatives B or D.

Malheur National Forest Land and Resource Management Plan (LRMP) Amendment

The proposed LRMP amendment to add aminopyralid would likely improve the effectiveness of treatment (chapter 3.1.4). This would result in neutral or positive impacts to wildlife on the Malheur National Forest.

Early Detection/Rapid Response

Like alternative B, alternative C would allow treatment of new detections (EDRR) as long as the treatment method is within the scope of this EIS. The treatment of newly found sites adds additional risk factors to wildlife just by adding additional exposure areas. This also expands the treatment into areas that may not have been originally anticipated. However, the implementation planning process identified in chapter 2 would be used with each new infestation site to determine treatment and reduce risks. The pdfs provide layers of caution so that even if the exact locations are not known, the potential for adverse effects are minimized. Implementation of pdfs, buffers and treatment limits all work together to provide sideboards to deal with the uncertainty of treating new sites (USDA Forest Service 2008b) and ensure that direct and indirect effects are consistent as discussed in the alternative and species-specific analysis presented. Alternative C would be the least effective of the action alternatives at controlling future infestations due to the restrictions on treatment.

Effects on Alternative D

Direct and Indirect Effects

Alternative D is similar to alternative B, except that aminopyralid would not be approved for use. As a result, use of chlorsulfuron (a lowest risk herbicide) would increase and some moderate risk (glyphosate) to higher risk (picloram) herbicides would be used as first year/first choice treatments. Use of herbicides other than aminopyralid would also require increased use of spot application within all habitats except sagebrush. Effects of treatment would be similar to those described previously in the Effects Common to All Action Alternatives section. While more spot application would increase risks of direct effects from those of alternative B, when you consider 1 percent or less of any of the affected habitats would be treated (table 68), existing sites are small and scattered, and approximately 88 percent of the known sites occur along open roads, the likelihood of direct effects are low. Potential for effects are further reduced with implementation of pdfs and considering annual treatment prescriptions would be prepared for all existing and new infestations that would modify treatment methods and timing if necessary to reduce potential risks. Treatment risks are increased somewhat under this alternative; however, like the other action alternatives, with implementation of pdfs, the likelihood of mortality for any wildlife species is low.

Use of moderate to higher risk herbicides would occur on approximately 788 acres or 37 percent of infested acres treated during the first year. However, no adverse effects to wildlife from herbicide exposure are anticipated because of implementation of pdfs; following Forest standards and treatment buffers; and development of annual treatment prescriptions that identify species/habitats of concern and modify treatment type and timing if necessary,.

Proposed treatments would reduce existing infestation of invasive plants across the project area and promote native wildlife habitat. Like alternatives B and C, reductions in cover would be small and scattered and there would be little change in the availability of wildlife habitat. Because aminopyralid is not approved under this alternative, treatment effectiveness of the sites would be approximately 66 percent of the sites treated. Much of the reduction in effectiveness would occur along streamsides due to increased buffers if aminopyralid were not approved. While alternative D would be effective at reducing invasive plants, it would be less effective at promoting the long-term maintenance of native vegetation and wildlife habitat than alternative B.

Malheur National Forest Land and Resource Management Plan (LRMP) Amendment

No amendment is proposed for alternative D.

Early Detection/Rapid Response

Like alternative B, alternative D would allow treatment of new detections (EDRR), as long as the treatment method is within the scope of this EIS. While treatment would add additional risks to wildlife, annual prescriptions would be developed and treatment timing/methods modified if necessary. Like the other action alternatives, project design features, annual prescriptions, and herbicide-use buffers all work together to provide sideboards to deal with the uncertainty of treating new sites (USDA Forest Service 2008b) and ensure that direct and indirect effects are consistent with those anticipated. Alternative D would be less efficient in reducing invasive plants than alternative B.

Cumulative Effects of the Action Alternatives

Ongoing and future projects, including the relationship between land management and invasive plants are discussed under section 3.1.5 whereas alternative cumulative effects are discussed above. Potential cumulative effects to wildlife are assessed for each of the action alternatives evaluated in the EIS, as well as for the individual species evaluated. Future projects can be reasonably predicted for about a decade for potential cumulative effects evaluation.

Past management activities on the Forest in combination with only manual/mechanical invasive plant treatments has resulted in an increase in invasive plant infestation across the Forest. Ongoing and future actions will continue to promote the spread of invasive plants. Activities on NFS lands that could further increase the spread of invasive plants and affect wildlife habitat include prescribed burning; timber harvest and reforestation treatments; fuel reduction; plantation thinning; road closures; maintenance and decommissioning; facility/recreation projects; and grazing. These activities will occur forestwide, are spread out over 60 6th field watersheds (HUC6), and would be implemented over the next 10 years. Other activities that may occur outside of these watersheds include mineral development and access/travel management. A complete list of future activities can be found in table 28. Treatments that do not result in disturbance would result in little increase in the spread of invasive plants. Implementation of Forest standards that require re-seeding with native vegetation; use of weed free hay; and equipment cleaning provisions would reduce the likelihood invasive plants would spread due to recreation/facility construction activities. Consequently of the anticipated future activities, timber harvest, prescribed burning, recreation, mineral development, and grazing have the most potential to increase the spread of invasive plants.

While future management activities would comply with Forest standards designed to reduce the spread of invasive plants (e.g., equipment cleaning clauses and use of weed-free seed during re-vegetation), disturbance and increased levels of light would promote establishment of invasive plants on many of the lands affected by management. While it is not anticipated that grazing use would change, ongoing grazing would also continue to promote the spread of invasive plants, particularly in dry forest and shrub-steppe habitats. Continued grazing could also reduce wildlife cover and forage. On NFS lands, range administration adjustments, such as changes in livestock movement patterns, alterations of season of use, adherence to allowable use standards, and delayed re-introduction following wildfire would be used to reduce grazing impacts. Passive restoration may include keeping cattle away from treated areas until the area recovers with native vegetation; therefore, it is expected that wildlife cover and forage conditions would be maintained following treatment.

Disturbance associated with mining could also increase the spread of invasive plants, although per LRMP direction, special use permits are managed to prevent the spread of invasive plants. Recreational activity on NFS land is expected to increase and ongoing activities across all ownerships would continue to cause ground disturbances that can contribute to the introduction, spread, and establishment of invasive plants on NFS lands (USDA Forest Service 2005a). While access/travel management may result in disturbance associated with road restoration, any future development would include provisions to reduce the spread of invasive plants.

Under all action alternatives, some level of invasive plant control would occur on 2,124 acres and of this, 1,067 acres occur within watersheds where some future management activity is anticipated. Watersheds that contain both invasive plant treatments and future management activities are displayed in table 69.

Table 68. Watersheds containing planned future activities and invasive plant treatments

Watershed	Future Activity[1]	Invasive Plant Treatment Acres[2]
Birch Creek	P	1
Bosenberg Creek	G	4
Bridge Creek	T,R,G	26
Crane Creek	T,B,	12
Deardorff Creek	T	11
Dry Cr. John Day River	P	<1
Elk Creek	T,B	24
Emigrant Creek	T,R	44
Granite Boulder Creek	R,P	120
Long Creek	P	1
Indian Creek	P	1
Lake Creek	G	3
Lick Creek	G	8
Little Boulder Creek	T,B,R	139
Long Creek	P	18

Watershed	Future Activity[1]	Invasive Plant Treatment Acres[2]
Lower Bear Creek	T,B	1
Lower Deer Creek	T	1
Lower Scotty Creek	T,B	3
Middle Bear Creek	T,B	2
Middle Silvies River	R	6
Mill Creek	R	145
North Basin	T,B,F,R	15
Pine Creek	B,R,	79
Slide Creek	P	6
Starr Creek	T,F,B	16
Summit Creek	T,B,G	15
Upper Big Creek	G	5
Upper Camp Creek	G	14
Upper Deer Creek	P	1
Upper Fox Creek	P	22
Upper Long Creek	P	18
Upper Malheur River	P	45
Upper South Fork John Day River	T	46
Upper Silver Creek	T,B,R	20
Upper Silvies River	T,B,F,R,P	56
Van Aspen-Silvies River	T,B	15
Vinegar Creek	T,B,R	81
Wiley Creek	P,B,R	2
Wolf Creek	T	38
Total Invasive Plant Treatment		**1,067**

1 – Activity Codes (T)-Timber harvest, (B)-Burning, (F)-Fuel Reduction, (R)-Recreation/facility, (P)-Plantation thinning, (G)-Grazing improvements.

2 – Invasive plant treatments that do not occur in watersheds with future treatments are not displayed.

Thirty-nine watersheds would receive invasive plant treatments, as well as future management. While all activities have the potential to increase invasive plants, the likelihood of spread is reduced by implementation of LRMP standards designed to reduce invasive plant infestation. Measures are included in all special use and grazing permits that help prevent the spread of invasive plants, and grazing use would be modified following treatment to ensure establishment of native vegetation. Finally as described in section 2.3.2, we would continue to monitor invasive plants and treatments according to National and Regional Forest Service policy to ensure treatment and pdf effectiveness. Therefore, potential impacts from invasive plants to wildlife and wildlife habitat would be reduced.

All ongoing or future activities (identified in table 28) would increase human access and, therefore, disturbance to wildlife, although effects vary by species. Approximately 88 percent of the treatments currently occur close to open roads, so there would be little increase in human access due to proposed activities. In addition, pdfs are in place that reduce or restrict access to sensitive wildlife habitat. Treatment would be limited to a few days a year at any site, and 1 percent or less of any watershed would be affected. Therefore, any disturbance associated with herbicide or non-herbicide treatments would be short term, and there are no long-term adverse effects associated with increased access.

All ongoing and future activities would alter wildlife habitat; however, timber harvest and associated reforestation treatments, prescribed burning, and plantation thinning would result in the greatest change in habitat. These activities would reduce the overstory canopy, create more open understory conditions within forested stands, or alter woody/herbaceous vegetation within non-forest. Effects to wildlife vary by species and are discussed in part in the individual species analysis presented in the following sections. Potential effects to wildlife are also determined by the amount of habitat affected, effects to species considered at risk or threatened, endangered, and sensitive species, and the availability of unaffected habitat. As shown in table 69, these activities would occur across 32 watersheds that also contain invasive plant treatments. When you consider 1) project pdfs are in place to protect at risk species from herbicide and non-herbicide treatments, 2) forest plan standards will reduce impacts from future management on many at risk wildlife species and sensitive wildlife habitats, 3) future management actions would maintain or improve wildlife habitat for fire dependent species, species that utilize open understories, and aspen/shrubland steppe dependent species, 4) proposed treatments would reduce the spread of invasive plants, and 5) one percent or less of any watershed would be affected by proposed activities, implementation of anticipated future activities combined with proposed activities for the action alternatives is not expected to reduce the availability of wildlife habitat or significantly affect wildlife.

In addition to proposed treatments, all action alternatives would allow treatment of new detections (EDRR), as long as the treatment method is within the scope of this EIS. The treatment of newly found sites adds additional risk factors to wildlife just by adding additional exposure areas. This also expands the treatment into areas that may not have been originally anticipated. The decision process identified in section 2.3.2 of the EIS would be used with each new infestation site to determine treatment. In addition, pdfs have been set up to provide layers of caution so that even if the exact locations are not known, the potential for adverse effects are minimized. Implementation of pdfs, buffers, and treatment limits (i.e., leaving stream corridors untreated) all work together to provide sideboards to deal with the uncertainty of treating new sites (USDA Forest Service 2008b).

Since wildlife move and migrate, some species could be exposed to herbicides on NFS lands, as well as adjacent lands that are within their home range or along travel corridors. Consequently, species could be exposed to the same herbicide on multiple ownerships, or a combination of different herbicides. Wildlife could also be exposed to other chemicals, such as insecticides, rodenticides, fungicides, and others. While potential for multiple herbicide exposures to wildlife exists, the risk that adverse effects would occur depends on a number of factors, such as wildlife feeding strategy, seasonal activity, and the types and amounts of herbicides used. The following considerations collectively reduce potential impacts from herbicide exposure on wildlife:

- While total acres of herbicides proposed on lands of other ownerships are not available, counties are responsible for controlling noxious weeds along county roads and other county property outside of and within the Forest. They also work with conservation districts, weed management areas, and watershed councils to control noxious weeds on private property. So while additive herbicide exposures are possible if herbicide is used on neighboring lands during the same day as NFS land are treated, activities occurring on the Forest Service, other federal agencies, states, and counties would be coordinated, making treatment overlaps unlikely.
- The herbicides proposed for use do not significantly bio-accumulate (R6 2005 FEIS). For additive doses to occur, two exposures would have to occur at approximately the same time. At proposed application rates and with implementation of pdfs, it is unlikely that any species would receive additive doses beyond those evaluated for chronic and acute exposures in the USDA Forest Service risk assessments.

- The likelihood that wildlife would receive a toxic level of herbicides are reduced because herbicides used are excreted within 48 hours and herbicide persistence is reduced through implementation of pdfs.
- While pdfs add a measure of protection for non-target wildlife on NFS lands, wildlife may be more vulnerable on lands of other ownerships where protective measures are unknown. However, treatments are spread out over 100 HUC 6 watersheds, which vary in size between 10,000 and 38,000 acres, and therefore 1 percent or less of all affected watersheds would be proposed for treatment. The widely scattered nature of proposed treatments, combined with the small size of infestations (over 80 percent are less than one-quarter acre) and availability of unaffected habitat, reduce the likelihood that any wildlife species utilizing multiple ownerships would be exposed to toxic levels of herbicide from proposed treatments.
- The management direction included in all action alternatives, as well as the environmental conditions and animal behavior, would tend to minimize actual impacts for EDRR. Prior to implementation, treatments could be planned to avoid situations that may harm to wildlife. For example, certain herbicides could be avoided in specific areas or times of the year where/when species that utilize grass, such as amphibians may be at risk, or more specific application methods could be used.

As a result, it is unlikely that proposed treatments would measurably contribute to any other activities on private land that would result in significant effects to wildlife.

Effects to Federally Listed Species

Effects determinations for federally listed species are shown in the following table.

Table 69. Findings and determinations for ESA-listed wildlife species in the project area

Species	Action Alternative Determination	Reason
Canada Lynx	No Effect	Lynx have not been documented on the Forest and suitable habitat would be unaffected by treatments.
North American Wolverine	No Effect	Wolverine use of the project area is low and use would not occur within treatment sites.
Yellow-billed Cuckoo	No Effect	Yellow-billed cuckoo have not been documented on the Forest. Little riparian habitat is proposed for treatment and pdfs would protect breeding birds should they become established.

Canada Lynx

Direct, Indirect, and Cumulative Effects, and Determination

The Malheur National Forest is categorized as a “peripheral area” based on the Draft Lynx Recovery Outline (USDI FWS 2005a) and there is no documentation of lynx reproducing in the state of Oregon. The Forest has not had a verified lynx observation since 1999; therefore, the Forest is considered “unoccupied” habitat (USDI FWS 2006a). Currently only eight acres of foraging and den habitat are proposed for treatment. Due to the small amount of suitable habitat affected and considering the project area is not considered occupied lynx habitat, there would be no direct, indirect, or cumulative effects and implementation of the action alternatives would have **No Effect** on lynx.

North American Wolverine

Direct, Indirect, and Cumulative Effects, and Determination

Wolverines occur in remote areas and have not been recently documented on the Forest. In addition, there is less than an acre of invasive plants proposed for treatment within potential den habitat. Wolverine utilize higher elevations during the snow free period to avoid high temperatures and human activity (Ruggiero et al. 1999), thus direct effects to wolverine from proposed treatments are not anticipated. Similarly, because they prefer closed-canopy forest habitat at upper elevations, wolverine habitat would not be adversely affected by invasive plants. As a result, there are no direct, indirect, or cumulative effects to this species anticipated, and implementation of alternatives B through D would have No Effect on the wolverine.

Yellow-billed Cuckoo

Direct and Indirect Effects

Approximately 2,136 acres of riparian woodland habitat occurs on the Forest. Of this, 28 acres are proposed for treatment with herbicides, including 27 acres with broadcast application and 1 acre of spot application. Aminopyralid and chlorsulfuron are the proposed herbicides.

Treatment – Effects of manual and mechanical treatments are discussed above and potential effects include disturbance to nesting birds by people, equipment, or noise. Yellow-billed cuckoo nest in large riparian areas in shrubs or trees approximately 10 to 16 feet off the ground (Washington DFW 2012, Center for Biodiversity 1998). Because woody vegetation is not targeted for treatment, it is unlikely nests would be affected, although nesting birds could be disturbed or displaced during treatment. In order to reduce the likelihood that breeding birds, nests, or young are harmed, the following project design feature would be implemented.

- J13-a - If a known breeding site is proposed for treatment, a biologist will be contacted to determine necessary protection measures. These measures may include limitations on vehicle entry, modifications to treatment type or timing, or applying buffers. Protection measures would be coordinated with the USFWS.

With implementation of this design feature, treatment within occupied habitat would be modified or deferred to protect nesting birds. Disturbance to migrating birds could occur, although effects would involve short-term (a few days) displacement and unaffected suitable habitat would continue to be available.

Herbicides - Risk of effects from herbicide exposure was evaluated using the insectivorous bird scenario. Aminopyralid is the first year/first choice herbicide on all sites and no adverse effects from herbicide exposure are anticipated.

Of the herbicides approved, triclopyr exceeded a dose of concern for an acute exposure at the typical and highest application rates whereas glyphosate exceeded the NOAEL at the highest application rate. Data was lacking to evaluate a chronic exposure of clopyralid, glyphosate, picloram, sethoxydim, sulfometuron methyl, and triclopyr on small birds consuming insects.

Triclopyr is restricted to spot techniques and pdf J2 restricts broadcast application of clopyralid, glyphosate, picloram, sethoxydim, and sulfometuron methyl to typical application rates whereas triclopyr is restricted to the typical application rate or less. With implementation of these design features, the likelihood of herbicide exposure is reduced. The cuckoo’s feeding strategy further reduces risk in that it forages over a large area (California PIF 1998); sites proposed for treatment are small and scattered. Much of its foraging takes place on woody vegetation (Birds of North America 2013, California Partner In Flight 1998), which would not be targeted for treatment. As a result and considering the small amount of habitat proposed for treatment, it is unlikely that a bird would receive an acute (consume nothing but contaminated prey for an entire day) or chronic exposure (consume nothing but contaminated prey for 90 days) of concern. Finally, with implementation of pdf J13-a, which protects known breeding sites, there are no adverse effects from herbicide exposure anticipated.

Cumulative Effects

Ongoing/future projects, including the relationship between land management and invasive weeds, are discussed under section 3.1.5 whereas alternative cumulative effects are discussed above. While riparian habitat on NFS land would be maintained with implementation of LRMP direction and standards, there could be a reduction in suitable yellow-billed cuckoo habitat on other ownerships within the project area due to future development or changes in vegetation. This species prefers dense understory vegetation, so overgrazing could also reduce habitat. On NFS lands, range administration adjustments, such as changes in livestock movement patterns, alterations of season of use, adherence to allowable use standards, and delayed re-introduction following wildfire, would be used to reduce grazing impacts to riparian vegetation and suitable yellow-billed cuckoo habitat.

Herbicides are commonly applied on lands of other ownerships for a variety of agricultural, landscaping, and invasive plant management purposes and it is possible that birds could be exposed to the same herbicide on multiple ownerships, or a combination of different herbicides. While potential for multiple herbicide exposures exists, the risk that adverse effects would occur are reduced when you consider that 1) coordinated efforts make treatment overlap unlikely, 2) proposed herbicides do not significantly bio-accumulate (R9 2005 FEIS), 3) proposed herbicides are excreted within 48 hours, and 4) the small amount of habitat proposed for treatment. As a result and considering pdfs would protect breeding birds from treatments, there are no adverse effects from herbicide exposure anticipated, and implementation of the proposed action would not measurably contribute to any other past, ongoing, or foreseeable future activity and result in adverse effects to the yellow-billed cuckoo.

Summary and Determination

Yellow-billed cuckoos have not been documented within the project area, although suitable habitat exists. Based on the above analysis and the following rationale, a No Effect determination is made for the yellow-billed cuckoo.

- ♦ Breeding yellow-billed cuckoos have not been documented within the project area.
- ♦ Only one percent of the suitable project area habitat is proposed for treatment.
- ♦ Should breeding occur in the future, project design features would ensure that breeding birds are not adversely affected.
- ♦ Any disturbance to migrating birds would be short-term.
- ♦ At proposed application rates and with implementation of pdfs, there are no adverse effects from herbicide exposure anticipated.
- ♦ Proposed actions would reduce the spread of invasive plants into riparian vegetation and help to maintain native habitat.

Effects to Forest Service Sensitive Species

Table 70. Sensitive Species determinations and rationale

Species	Action Alternative Determination[1]	Rationale
Gray Wolf	MIIH	Unlikely to be present in treatment areas. Future den and rendezvous sites protected. See section above for details.
Pygmy Rabbit	MIIH	Not documented within the project area and unlikely to be present in treatment areas. Pdfs minimize potential effects from herbicide exposure and treatment. Treatment would promote native habitat.

Species	Action Alternative Determination[1]	Rationale
Townsend's Big-eared Bat	No Impact	Not present during treatment. Due to foraging behavior and with implementation of pdfs, no adverse effects from herbicide exposure are anticipated.
Pallid Bat	No Impact	Not present during treatment. Due to foraging behavior and with implementation of pdfs, no adverse effects from herbicide exposure are anticipated
Fringed Myotis	No Impact	Not present during treatment. Due to foraging behavior and with implementation of pdfs, no adverse effects from herbicide exposure are anticipated
Bald Eagle	No Impact	Few invasive plant acres near suitable nesting, foraging, or roost habitat. Pdfs effectively reduce potential impacts to nesting or roosting birds. At proposed application rates and methods, no adverse effects from herbicide exposure are anticipated.
American Peregrine Falcon	No Impact	No known nests within the project area. Project design features effectively reduce potential impacts to nesting birds. At proposed application rates and methods, no adverse effects from herbicide exposure are anticipated.
Grasshopper Sparrow	No Impact	Not documented within the project area. Pdfs restrict activities within occupied habitat and make herbicide exposure unlikely. Suitable habitat maintained.
Wallowa Rosy Finch	No Impact	Not present in treatment areas. Suitable habitat not proposed for treatment.
Greater Sage Grouse	MIIH	Nesting not documented within the project area. Pdfs restrict activities to breeding birds and reduce the likelihood of disturbance or herbicide exposure. Suitable habitat maintained.
Bufflehead	No Impact	Not present in treatment areas. Pdfs make herbicide exposure highly unlikely. Suitable habitat maintained.
Upland Sandpiper	MIIH	Nesting not recently documented on the Forest. Pdfs reduce treatment and herbicide exposure effects within occupied habitat. Suitable habitat maintained.
Bobolink	No Impact	Not documented within the project area. Pdfs minimize potential for effects and make herbicide exposure highly unlikely. Suitable habitat maintained.
Lewis' and White-headed Woodpeckers	MIIH	Nest habitat would not be affected. Foraging behavior and project design features make herbicide exposure unlikely. Low likelihood of disturbance.
Columbia Spotted Frog	MIIH	Low likelihood of disturbance. Pdfs restrict treatment in suitable breeding habitat and make herbicide exposure unlikely. Suitable breeding habitat maintained.
Shortface Lanx	No Impact	Not present in treatment areas.
Johnson's Hairstreak	No Impact	Not present in treatment areas.
Silver-bordered Fritillary	MIIH	Occurrence within the project area is unlikely. Pdfs restrict treatment within occupied habitat and make herbicide exposure unlikely. Suitable habitat maintained.
Haney Basin Duskysnail	MIIH	Not present in treatment areas. Pdfs protect future sites and make herbicide exposure highly unlikely.
Columbia Clubtail	No Impact	Not documented in the project area. Pdfs restrict treatment within breeding habitat and herbicide exposure highly unlikely.

[1] – MIIH – may impact individuals or habitat (MIIH), but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species

Gray Wolf

Direct and Indirect Effects

Treatment - No known denning or rendezvous sites exist on or near the Malheur National Forest. While no packs have become established, transient individuals may occasionally travel through looking for new territory or mates, and there is potential for wolves to become established on the project area in the future.

Direct effects from invasive plant treatments include disturbance caused by noise, people, and vehicles. However, invasive plant projects involve very short-term disturbance with few people and often only a few visits in the same growing season. Although wolves will travel over large distances, they are most likely to occur in wilderness and roadless areas, away from human disturbance. These areas tend to have minimal invasive plant infestations, so the likelihood of disturbance is low. Additionally, project design features are in place that prevent invasive plant treatments occurring in close proximity to den or rendezvous sites. As a result, it is unlikely individual animals would be affected by treatment and if disturbance were to occur, it would be limited to short-term avoidance by foraging or transient individuals.

While proposed treatments would help maintain habitat for elk, deer, or other prey species, there would be little change in gray wolf habitat.

Herbicides - None of the proposed herbicides would result in an acute exposure that exceeds the toxicity index; however, chronic exposures to carnivores could occur at the typical and highest application rate with triclopyr or at the highest application rate for picloram. A Malheur National Forest LRMP standard limits triclopyr to selective applications (no broadcast) whereas pdf F2 restricts application of picloram and triclopyr to typical application rates (or less for triclopyr). Few treatments are proposed within preferred wolf habitat. Wolves forage over large areas and would not forage exclusively on contaminated prey; there are no adverse effects from herbicide exposure anticipated under any alternative.

Cumulative Effects

Ongoing and future projects, including the relationship between land management and invasive weeds, are discussed under section 3.1.5 whereas alternative cumulative effects are discussed above. Anticipated activities could result in disturbance to wolves, although with implementation of pdf J1-a, any future den and rendezvous sites would be protected. Therefore, while future treatments could result in disturbance to foraging or transient individuals, effects would be short term and limited to a few days at any site. Also 88 percent of the proposed activities occur close to open roads, which would be avoided by wolves. Finally, many of the future management actions (e.g., harvest and prescribed burning) would be expected to maintain or improve big game habitat through aspen restoration and increases in forage on both summer and winter range. As a result and considering adverse effects from herbicide exposure are not anticipated, none of the alternatives would measurably contribute to any other past, ongoing, or foreseeable future activity and result in significant effects to the wolf.

Summary and Determination

To date gray wolves have not been confirmed on the Malheur National Forest, although use is likely and it is possible that short-term disturbance could occur from proposed treatments. As a result, the project May Impact, may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.

- Project design features would prevent disturbance to any den or rendezvous sites established on the Forest.
- At proposed application rates and with implementation of pdfs, there are no adverse effects from herbicide exposure anticipated.

- Invasive plants and invasive plant treatments are less likely to occur in preferred remote habitat.
- Any disturbance from invasive plant treatment would be short-term in nature.
- Treatment would help maintain native plant communities and preferred big game habitat.

Pygmy Rabbit

Direct and Indirect Effects

Treatment - Pygmy rabbits are not known to occur on the project area. Should rabbits occupy the forest in the future, all proposed treatments have the potential to result in disturbance during implementation. Because less mobile young would be in burrows underground, there is no direct mortality anticipated. Implementing pdf J-6c and coordinating the timing, location, and method of treatment with a biologist in suspected use areas would limit any direct effects to short-term disturbance during treatment.

Loss of habitat for the pygmy rabbit could occur with expansion of invasive plants on rangelands (Weiss and Verts 1984); therefore, proposed invasive plant treatments would result in a beneficial effect to pygmy rabbit habitat by reducing the future spread of invasive plants and a possible loss of habitat.

Herbicides - Exposures of concern could occur at the typical and highest application rates for picloram and triclopyr and the highest application rate for glyphosate. The likelihood of exposure is reduced with implementation of the LRMP standard that restricts use of triclopyr to selective techniques, with pdf F2 that restricts glyphosate to typical application rates, and with implementation of pdfs that restrict use of picloram to certain soil types (H3) and restrict use to a single application on any area within two calendar years (H4). Finally, within occupied habitat, treatment type and timing would be modified and activities would be restricted to manual techniques (J7-a). As a result, there are no adverse effects from herbicide exposure anticipated.

Cumulative Effects

Ongoing and future projects, including the relationship between land management and invasive weeds, are discussed under section 3.1.5 whereas alternative cumulative effects are discussed above. Because of the small size of their home range (Heady and Laundre 2005), it is unlikely pygmy rabbits would be affected by herbicide treatment on lands of other ownerships as well as NFS lands. Most of the treatments identified in table 28 occur in forested stands or on unsuitable pygmy rabbit habitat, although continued grazing and allotment improvements could affect this species. As described under alternative effects, allotments are managed to prevent invasive plant introduction and to promote restoration of native vegetation by deferring livestock following treatment if necessary. As a result and considering that proposed activities would maintain suitable habitat, none of the alternatives would measurably contribute to any other past, ongoing, or foreseeable future activity and result in significant effects to the pygmy rabbit.

Summary and Determination

The pygmy rabbit has not been documented on the forest. While short-term effects from treatment are possible should they become established in the future, based on the above analysis and the following rationale, implementation may impact individuals or habitat (MIIH), but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.

- First-year treatment would affect 10 acres of suitable habitat.
- Pygmy rabbits have not been documented on the project area. Should use on the forest occur in the future, project design features would modify treatment if necessary to reduce potential impacts.

- Proposed treatments would contain or control invasive weed infestations and help to maintain native sagebrush habitat over the long-term.

Townsend's Big-eared Bat, Pallid Bat and Fringed Myotis

Direct and Indirect Effects

Treatment - Since bats roost either in structures or in snag crevices during the day and forage at a time when treatment would not occur, the likelihood that a bat would be affected by treatment is remote, even though suitable habitat exists.

Herbicides - Acute exposures of concern to insectivorous mammals could occur with use of picloram or glyphosate at the highest application rate. Neither herbicide would be broadcast sprayed above the typical application rate, so no adverse acute exposure would occur. Chronic exposures from these herbicides could occur at the typical and highest application rate, although effects are greatly reduced when you consider 1) neither is a first choice herbicide under alternatives B and C, 2) under alternative D, picloram would only be broadcast sprayed as a first choice herbicide on 36 acres, 3) triclopyr is restricted to selective techniques, and 4) pdfs F2, H3 and H4 all restrict use of picloram. As a result and considering bat foraging behavior (i.e., forage over large areas in a single evening) that essentially eliminates the possibility that bats would consume nothing but contaminated prey for 30 days, there are no adverse effects from herbicide exposure anticipated.

Cumulative Effects

Anticipated cumulative effects are discussed by alternative above and include increased exposure to herbicides on lands of other ownership, and reduction of suitable foraging habitat due to future timber harvest. Less than 1 percent of the watersheds where future treatments would occur are proposed for management. Proposed activities would not modify suitable bat habitat and unaffected habitat would be available within all affected watersheds. As a result, and considering that bats forage over large areas and would not be exposed to toxic levels of herbicides, none of the alternatives would measurably contribute to any past, ongoing, or foreseeable future activity and result in significant effects to the pallid bat, fringed myotis, or Townsend's big-eared bat.

Summary and Determination

All alternatives would treat invasive plants in suitable bat habitat. However, roosting bats would be unaffected, and it is unlikely foraging bats would occur in treatment sites or be adversely affected by herbicides. As a result, implementation of the action alternatives would have No Impact on the pallid bat, fringed myotis, or Townsend's big-eared bat.

Bald Eagle

Direct and Indirect Effects

Treatment - Bald eagles are sensitive to human disturbance during the breeding season, particularly within sight distance of nest sites. Consequently human and vehicle presence can cause the birds to leave nests or stay away from the nest long enough to have detrimental effects to eggs or young (USDI FWS 1986). Mechanical methods are more likely to cause effects at greater distances than other treatment methods, because machinery creates louder noise than other methods.

While there are 3 acres of invasive plants treatment proposed within winter roost habitat and 9 acres fall within one-half mile of an eagle's nest, implementation of the following pdfs would reduce or eliminate noise and disturbance to nesting, roosting, and foraging eagles.

- pdf J2-a – Activities above ambient levels would not occur between October 31st and March 31st during early morning or late afternoon near known winter roosts and concentrated foraging areas. Distance to daytime foraging areas would also be avoided.
- pdf J2-b – Invasive plant treatments would not occur within 0.25 mile, or 0.50 mile line-of-sight, during the nesting/fledging season (January 1st through August 31st).

With implementation of these pdfs there are no direct impacts to eagle nests or reproduction anticipated. While disturbance to roosting or foraging eagles is possible, given the small amount of land along waterbodies proposed for treatment (67 acres), the likelihood of disturbance is remote.

Herbicides **-** The results of exposure scenarios indicate that no herbicide or surfactant proposed poses a plausible risk to birds from eating contaminated fish. All expected doses for all herbicides to fish-eating birds are well below any known no-observable-adverse-effect-level (NOAEL) (see Appendix P of the R6 2005 FEIS). Herbicide would not reach the upper canopies of mature trees where bald eagles nest, and with implementation of pdf J2-a, eagles would not be directly sprayed or encounter vegetation that has been sprayed. As a result, there are no adverse effects from herbicide exposure anticipated.

Cumulative Effects

Ongoing and future projects, including the relationship between land management and invasive weeds, are discussed under section 3.1.5 whereas alternative cumulative effects are discussed above. Anticipated cumulative effects include possible herbicide exposure on multiple land ownerships, disturbance from proposed future activities, or modification of nest habitat due to proposed timber harvest. All future activities would comply with bald eagle and golden eagle management guidelines (USDI Fish and Wildlife Service 2007b) and no impacts to nesting birds or reproduction are anticipated. While it is possible that eagles could be exposed to herbicides on lands of other ownerships, even if a bird fed for a lifetime upon fresh water fish that had been contaminated by an accidental spill of herbicide, they would not receive a dose that exceeded any known NOAEL. As a result, and considering that that the risk of adverse effects from proposed treatment have been effectively eliminated through implementation of pdfs J2-a and J2-b, no alternative would measurably contribute to any other past, ongoing, or future activity and result in significant effects to the bald eagle.

Summary and Determination

Invasive plant treatments are proposed in 3 acres of eagle winter roost habitat and on 9 acres within one-half mile of known nests. Based on the above analysis and the following rationale, implementation of the action alternatives will have No Impact to bald eagles:

- Implementation of project design features would effectively eliminate the likelihood that nesting or winter roosting eagles would be affected by disturbance associated with invasive plant treatment.
- Invasive plant treatments would not result in the removal of bald eagle nests or roost trees, or affect foraging habitat.
- With implementation of pdfs, there are no adverse effects to eagles from herbicide exposure anticipated.
- Projects conducted that are more than a 0.25 mile from a nest, or 0.5 mile line of sight distance from a nest, and do not result in the modification of eagle habitat, or result in noise above ambient levels, should have no effect on bald eagles (FWS 2003a).

American Peregrine Falcon

Direct and Indirect Effects

Treatment - While suitable habitat exists, there are no known peregrine falcon nests on the Malheur National Forest. Because peregrine falcons nest on cliffs away from any known invasive plants, future nests would not be impacted by any of the proposed treatments. The following pdfs were designed to reduce the possibility that nesting birds or their young would be affected by proposed activities:

- J3-a – Seasonal restrictions, which are based on elevation and proximity to the nest, will be applied near known nest sites and will be implemented until at least 2 weeks after all young have fledged.
- J3-b – All invasive plant treatments would be restricted within 0.5 miles of peregrine falcon nest during the nesting season (based on J3-a).
- J3-c – Invasive plant treatments involving motorized equipment or vehicles would be seasonally prohibited between 0.5 miles and 1.5 miles of known nests during the nesting season (based on J3-a).
- J3-d – Non-mechanized or low-disturbance invasive plant treatment activities may occur between 0.5-1.5 miles of known nests during the nesting season, but would be coordinated with a wildlife biologist to identify mitigation measures, if necessary.
- J3-e – Picloram and clopyralid would not be used within 1.5 miles of a peregrine nest more than once per year.

With implementation of the above pdfs, there are no effects to nesting birds or their young from proposed treatments anticipated. Also, due to the small amount of habitat proposed for treatment and widespread availability of unaffected habitat, the likelihood that foraging birds would be affected is remote.

Herbicides - There is no quantitative scenario for a predatory bird that eats primarily other birds, such as the peregrine falcon, so the “fish eating bird” and “mammal eating bird” were used as surrogate scenarios. The fish eating bird scenario likely overestimates the dose to the peregrine falcon because the hypothetical fish consumed are from a pond contaminated by a large spill of herbicide. These hypothetical fish likely have higher concentrations of herbicide in their bodies (and thus a higher dose to the predatory bird) than would a small bird that incidentally ingested herbicide before it was preyed upon. Also, the small mammal in the “mammal-eating bird scenario” is directly sprayed.

It would be practically impossible to directly spray a bird that a peregrine falcon would then immediately prey upon. Except for triclopyr (small mammal scenario), which cannot be broadcast sprayed, no herbicide dose exceeded the toxicity indices for fish-eating or mammal-eating birds even at highest application rates. As a result, no adverse effects from herbicide exposure are anticipated.

Cumulative Effects

Ongoing and future projects, including the relationship between land management and invasive weeds, are discussed under section 3.1.5 whereas alternative cumulative effects are discussed above. It is not expected that future treatments would adversely affect nest sites, although disturbance to foraging birds could occur. With implementation of pdfs (J3-a through J3-e) proposed treatments would not adversely affect nesting birds, although as described above, effects include possible herbicide exposure on lands of other ownerships. Also, hexachlorobenzene (HCB), the contaminant in picloram and to a lesser extent clopyralid, does bio-accumulate in animal tissue; however, it is present in very small amounts (picloram, 8 parts per million and clopyralid, less than 2.5 parts per million). The risk of bio-accumulation of HCB from picloram and clopyralid use is, therefore, very low. The R6 2005 FEIS states that HCB is a ubiquitous and persistent chemical in the environment and the amount released from Forest Service use would be inconsequential in comparison to existing background levels and annual releases from manufacturing. However, use of picloram and clopyralid in remote locations could constitute the primary source of HCB in those areas. Monitoring of peregrine falcons in the Pacific Northwest has revealed HCB in their blood samples, and peregrine populations in the Pacific Northwest appear to continue to be affected by contaminants, although not HCB specifically. Eggshell thinning induced by DDE, the metabolite of DDT, affect populations in the Pacific Northwest and elsewhere, and residual levels of DDE continue to be detected in some peregrines (Henny et al. 1996). Reproductive failure at peregrine nests has also occurred in Oregon due to eggshell thinning (Peterson 2006). However, with implementation of pdf J3-e, the use of picloram and clopyralid within secondary nest zones would be restricted whereas pdfs H3 and H4 restrict the use of picloram. Broadcast application would be restricted to the typical application rate, and implementing pdfs to protect the nest sites makes the likelihood for HCB contamination remote and discountable.

None of the herbicides proposed would result in a level of concern and no alternative would measurably contribute to any other past, ongoing, or future activity and result in significant effects to the peregrine falcon.

Summary and Determination

There are currently no known nest sites on the Forest. Should a nest become established in the future, implementation of project design features would ensure that nesting peregrine falcons would not be adversely affected by treatments or be exposed to toxic levels of herbicide. Implementation of the action alternatives would have No Impact to peregrine falcons.

Grasshopper Sparrow

Direct and Indirect Effects

Treatment **-** Grasshopper sparrows are not known to occur within the project area. Should they become established in the future, pdf J9-a restricts treatment within occupied habitat and there are no impacts to nesting birds or young anticipated. It is unlikely that foraging or migrating birds would be affected because of the small amount of habitat proposed for treatment (71 acres).

Invasive plants can adversely affect habitat for some grassland birds, such as the grasshopper sparrow (Scheiman et al. 2003). Treatments under the action alternatives would help to contain or control existing as well as future infestations and maintain native grassland habitat.

Herbicides **-** Risk of effects from herbicide exposure was evaluated using the insectivorous bird scenario. For an acute exposure at typical and highest application rates, triclopyr exceeded a dose of concern whereas glyphosate exceeded the NOAEL at the highest application rate. Data was lacking to evaluate a chronic exposure of clopyralid, glyphosate, picloram, sethoxydim, sulfometuron methyl, and triclopyr on small birds consuming insects. The likelihood of exposure is reduced with implementation of the Malheur National Forest LRMP standard that restricts use of triclopyr to spot techniques only; pdf F2 that restricts broadcast application of clopyralid, glyphosate, picloram, sethoxydim, sulfometuron methyl, and triclopyr to typical application rates; and pdfs H3 and H4 that restrict the frequency and use of picloram. With implementation of these design features and considering the small size and scattered nature of proposed treatments sites (scattered across 40 watersheds), it is highly unlikely that a bird would receive an acute or chronic exposure. As a result, there are no adverse effects from herbicide exposure anticipated under any alternative.

Cumulative Effects

Ongoing and future projects, including the relationship between land management and invasive weeds, are discussed under section 3.1.5 whereas alternative cumulative effects are discussed above. With the exception of continued grazing and water development, few ongoing and future management activities would occur within suitable grasshopper sparrow habitat. As described under the alternative effects, grazing use is not expected to change, grazing will be deferred following invasive weed treatments until native vegetation is established, and continued grazing is not expected to reduce grassland habitat. While individuals could be exposed to herbicides applied on lands of other ownerships, due to the small and scattered nature of treatment sites and small amount of habitat proposed for treatment, it is unlikely a bird would receive multiple exposures. As a result, and considering treatment would not occur within occupied habitat during the nesting season, none of the alternatives would measurably contribute to any other past, ongoing, or future activity and result in significant effects to the grasshopper sparrow.

Summary and Determination

Proposed treatment would contain and control existing and future infestations of invasive plants and help maintain native grassland communities and suitable grasshopper sparrow habitat over the long term. While suitable grasshopper sparrow habitat is proposed for treatment, nesting has not been documented on the forest. Project design features are in place that restricts treatment if habitat becomes occupied; therefore, implementation of the action alternatives would have No Impact on the grasshopper sparrow**.**

Wallowa Rosy Finch

Direct, Indirect, and Cumulative Effects

The Wallowa rosy finch occupies upper elevation sites away from primary invasive weed vectors. As a result, there are no treatments proposed within suitable habitat, and it is unlikely they would be affected by future treatments. As a result, there are no direct, indirect, or cumulative effects from treatment anticipated under any alternative.

Summary and Determination

The Wallowa rosy finch has not been documented on the Forest, and it is unlikely that high elevation habitat would be affected by invasive plants or treatment. As a result, implementation of the action alternatives would have No Impact to this species.

Greater Sage Grouse

Direct and Indirect Effects

Treatment **-** While there are no known leks or brood rearing habitats on the Forest, sage grouse are known to use the project area. Documentation of use is incidental and scattered. About 79 acres of mapped infestations are within the 139,500 acres of suitable habitat for sage grouse within the project area.

Sage grouse are sensitive to disturbance caused by noise, people, and vehicles. All treatment methods could cause some disturbance to sage grouse. Should a lek be discovered, the following project design features would reduce adverse impacts to nesting birds.

- pdf J4-a - Glyphosate use would be limited to the typical application rate (within greater sage grouse habitat).
- pdf J4-b - Human activities within 0.3 mile of leks will be prohibited from the period of one hour before sunrise until four hours after sunrise and one hour before sunset until one hour after sunset from February 15-May 15.
- pdf J4-c - Do not conduct any vegetation treatments or improvement projects in breeding habitats from February 15-June 30.

With implementation of these pdfs and considering the marginal nature of sage grouse breeding habitat on NFS lands, no effects to breeding birds or reproduction is expected.

Disturbance to foraging birds could occur. However due to the small size and widely scattered nature of treatment sites, and widespread availability of adjacent unaffected habitat, disturbance effects would be minimal and short-term (one day). Sage grouse would likely avoid of the site during treatment.

Loss of habitat for sage grouse by invasive plant expansion on rangelands can occur (Connelly et al. 2000). Because all alternatives would contain or control existing and future invasive plant infestations, native sagebrush communities and suitable sage grouse habitat would be maintained.

Herbicides - Adult sage grouse consume vegetation, and chicks rely heavily on insects; thus, herbicide exposure was evaluated using a large vegetation-eating bird as well as a small bird consuming insects.

For adult birds and chicks at typical application rates, only triclopyr (if broadcast sprayed) exceeded the acute toxicity thresholds whereas glyphosate exceeded a dose of concern at the highest rate for small birds consuming insects. A Malheur National Forest LRMP standard restricts application to triclopyr to selective techniques or spot treatment whereas pdf F2 limits glyphosate broadcast and all use of triclopyr to typical rates or less per acre. As a result, it is unlikely adult birds or chicks would receive an acute exposure of concern.

Chronic exposures were also evaluated at the typical application rate for large birds consuming vegetation. Triclopyr exceeded a dose of concern whereas sethoxydim, sulfometuron methyl, and glyphosate exceeded the toxicity threshold at the highest application rate. Data is lacking to evaluate a chronic exposure of clopyralid, glyphosate, picloram, sethoxydim, sulfometuron methyl, and triclopyr on small birds consuming insects. While exposure from these herbicides are possible, when you consider that 1) pdf F2 restricts broadcast application of clopyralid, glyphosate, picloram, sethoxydim and sulfometuron methyl to typical application rates (and all use of triclopyr to typical rates) per acre, 2) triclopyr is restricted to spot techniques, 3) Only 79 acres of invasive plant treatment are proposed in suitable habitat and sites are small and scattered across 20 watersheds, and 4) the use of the project area by sage grouse is scattered and incidental, it is unlikely that birds would consume all of their diet from contaminated insects/vegetation for 90 days and receive a chronic dose of concern. As a result, there are no adverse effects from herbicide exposure anticipated under any alternative.

Cumulative Effects

Ongoing and future projects, including the relationship between land management and invasive plants are discussed under section 3.1.5 whereas alternative cumulative effects are discussed above. Other than continued grazing and water development, there are few future management activities anticipated within suitable sage grouse habitat. On NFS lands, range administration adjustments, such as changes in livestock movement patterns, alterations of season of use, adherence to allowable use standards, and delayed re-introduction following wildfire, would be used to reduce grazing impacts. Passive restoration may include keeping cattle away from treated areas until the area recovers with native vegetation. As a result, it is expected that grassland habitat would be maintained following treatment.

Suitable habitat occurs on NFS lands, as well as adjacent private and BLM lands, so potential cumulative effects include possible herbicide exposure or disturbance on all ownerships. Due to the small amount of habitat proposed for treatment, treatment restrictions within breeding habitat, and reduced risk of herbicide exposure, none of the alternatives would measurably contribute to any past, ongoing, or future activity and result in significant effects to sage grouse.

Summary and Determination

While no sage grouse leks have been documented in the project area, sage grouse use has been documented, and birds could be affected by treatment. Based on the above analysis and following rationale, implementation of the action alternatives may impact individuals or habitat (MIIH), but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.

- There are no sage grouse leks known to occur on the Forest and National Forest System lands do not provide quality nesting habitat similar to that on adjacent lands. Should a lek be established in the future, pdfs would restrict treatment during the nesting season.
- Sage grouse would not be exposed to toxic levels of herbicides.
- Disturbance-related effects to grouse will be short term and unaffected habitat is available.
- Proposed treatment would contain and control existing and future infestations of invasive plants and help maintain native sagebrush habitat.

Bufflehead

Direct and Indirect Effects

Treatment - Bufflehead nest in tree cavities and rarely breeds in Oregon. Considering the small amount of habitat proposed for first-year treatments, there are no direct effects from treatment anticipated.

Herbicides - These ducks eat aquatic invertebrates and fish, so risk from herbicide exposure was evaluated using a "fish-eating bird" scenario. Based on available data, no herbicide exceeded a dose of concern for any exposure (acute or chronic) at any application rate. As a result, no adverse effects from herbicide exposure are anticipated under any alternative.

Cumulative Effects

There are no direct or indirect effects associated with treatment; therefore, none of the alternatives would measurably contribute to any other past, ongoing, or future activity and result in significant effects to bufflehead.

Summary and Determination

Buffleheads have not been documented breeding within the project area and are unlikely to occur within treatment sites. As a result, and considering that none of the herbicides exceeded a dose of concern, implementation of the action alternatives would have No Impact to the Bufflehead.

Upland Sandpiper

Direct and Indirect Effects

Treatment - Approximately 79,000 acres of potentially suitable upland sandpiper habitat occurs on the Malheur National Forest and of this, 72 acres are currently known to contain invasive plants. Broadcast application would occur on 50 percent and 25 percent of the sites under alternatives B and D respectively whereas manual/mechanical treatments would occur on 68 percent of the sites under alternative C.

Potential effects of invasive plant treatment on upland sandpipers are mainly associated with disturbance that may occur during the nesting season caused by noise, people, and vehicles. If birds were to be in the immediate vicinity of treatment, they could be temporarily displaced. In addition, the cryptic nests of upland sandpipers are susceptible to crushing or trampling by people or vehicles. In order to reduce the likelihood that nests, eggs, or young are harmed, the following design feature would be implemented:

- pdf J8-a - No treatment would occur on sites that have historic or recent documentation of upland sandpipers during the nesting season (April 1st to August 1st), unless the site has been surveyed and no nesting is occurring.

Upland sandpiper would not receive a toxic dose of herbicide under any alternative. While all action alternatives would reduce invasive weeds, alternative B would provide the most effective control of invasive plants (see chapter 3.1.4).

With implementation of the above pdf, there are no impacts to nesting birds or their young anticipated. However, short-term disturbance to foraging birds outside the nesting season is possible.

Herbicides **-** Effects of herbicides are the same as those described under grasshopper sparrow, and there are no adverse effects anticipated under any alternative

Cumulative Effects

Ongoing and future projects, including the relationship between land management and invasive weeds, are discussed under section 3.1.5 whereas alternative cumulative effects are discussed above. With the exception of continued grazing and water development, few future management activities would occur within suitable upland sandpiper habitat. As described under the alternative effects, grazing use is not expected to change, grazing will be deferred following invasive weed treatments until native vegetation is established, and continued grazing is not expected to reduce wildlife cover and forage or upland sandpiper habitat. While they could be exposed to herbicides applied on lands of other ownerships, due to the small and scattered nature of treatment sites and small amount of habitat proposed for treatment, it is unlikely a bird would receive multiple exposures. As a result, and considering treatment would not occur within occupied nest habitat, none of the alternatives would measurably contribute to any past, ongoing, or future activity and result in significant effects to the upland sandpiper.

Summary and Determination

Upland sandpipers have not been documented breeding on the Forest, but use on adjacent private lands does occur and use of suitable habitat on the Forest is possible. Based on the above analysis and the following rationale, implementation of the action alternatives may impact individuals or habitat (MIIH), but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.

- Breeding upland sandpipers have not been documented on the Forest.
- Should a nest be documented, project design features are in place that restricts treatment during the breeding season.
- Given the type of herbicides proposed and with implementation of pdfs, none of the alternatives are expected to result in adverse effects from herbicide exposure.
- Proposed treatment would contain and control existing and future infestations of invasive plants and help maintain native grassland habitat required by upland sandpipers.

Lewis and White-headed Woodpeckers

Direct and Indirect Effects

Treatment **-** Approximately 275 acres of Lewis's woodpecker and 10 acres of white-headed woodpecker habitat are proposed for treatment. No snags or trees would be removed, so nest habitat would be unaffected. Foraging birds, particularly the Lewis woodpecker, which frequently forages on the ground, could be affected by the noise and disturbance associated with herbicide or non-herbicide treatments under all alternatives. Both species forage over large areas and considering the availability of unaffected habitat, direct effects would be limited to short-term disturbance at the treatment site.

Herbicides - At typical application rates, triclopyr could pose an acute risk to birds that eat insects. Glyphosate poses an acute risk at the highest application rate whereas data is lacking to fully assess chronic exposures of clopyralid, glyphosate, picloram, sethoxydim, sulfometuron methyl, and triclopyr on small birds consuming insects. Broadcast application of triclopyr is restricted to spot techniques whereas pdf F2 limits broadcast clopyralid, glyphosate, picloram, sethoxydim and sulfometuron methyl, and all use of triclopyr to typical application rates or less. As a result, the likelihood that a bird would be exposed to toxic levels of herbicide is reduced.

The likelihood of exposure is further reduced when you consider that birds forage over large areas and that many of the insects utilized occur within dead wood, under bark, or are taken from areas not exposed to herbicides. As a result, birds are not likely to consume an entire day's diet of contaminated insects (acute exposure) or forage exclusively on contaminated insects for 90 days (chronic exposure) and there are no adverse effects from herbicide exposure anticipated under any alternative.

Cumulative Effects

Ongoing and future projects, including the relationship between land management and invasive weeds, are discussed under section 3.1.5 whereas alternative cumulative effects are discussed above. These species could be affected by any activity that reduces snags or downed wood or modifies the overstory, particularly timber harvest and prescribed burning. As discussed previously, timber harvest and invasive plant treatments would occur within 39 watersheds, which include approximately 1,100 acres of treatment. Timber harvest would reduce habitat for some species due to reductions in the overstory. With implementation of Forest standards, a component of snags and downed wood would be retained on all sites. Proposed treatments would not reduce suitable habitat. As a result, and considering the low risk of herbicide exposure, none of the alternatives would measurably contribute to any other past, current, or foreseeable activity and there are no significant cumulative effects to snag- or downed-wood-dependent species anticipated.

Summary and Determination

Lewis Woodpecker and White-headed Woodpecker - Approximately 275 and 10 acres of Lewis and white-headed woodpecker habitats are proposed for first-year treatment. No direct effects to nesting birds or reproduction are anticipated and suitable habitat would be unchanged. Since treatment could cause short-term disturbance to foraging, implementation of the action alternatives may impact individuals or habitat (MIIH), but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.

Columbia Spotted Frog

Direct and Indirect Effects

Treatment – Invasive plants have been mapped within 52 acres of suitable breeding habitat of the Columbia spotted frog. Broadcast application of herbicides is proposed on 23 and 4 acres under alternatives B and D respectively whereas 48 acres of manual treatment would occur under alternative C.

Adult frogs, eggs, and larvae are not likely to be disturbed by invasive plant treatments during the breeding season because they are restricted to aquatic habitat. After breeding, however, adults will disperse into adjacent wetland and riparian/upland habitats utilized by frogs. While trampling and direct mortality could occur under all alternatives, with implementation of pdf J5-a, treatment methods, timing and location would be coordinated with a biologist prior to implementation when working in occupied habitat. As a result, and considering that frogs are less likely to inhabit areas infested with invasive plants, the likelihood of mortality or short-term disturbance is low.

Herbicides - Data on herbicide effects to amphibians is limited. There is some data to suggest that amphibians may be as sensitive to herbicides as fish (Berrill et al. 1994, Berrill et al. 1997, Perkins et al. 2000). Consequently, herbicides that pose potential risk to federally listed fish (as determined by the quantitative estimates from exposure scenarios) will also be considered to pose a risk to amphibians.

The likelihood of amphibian exposure to herbicides depends on the application method, habitat treated, and season of application. Although potential for exposure exist, adverse effects to amphibians are further reduced by implementation of pdfs that restrict herbicide application rates, restrict use of moderate to high risk herbicides, and require herbicide-use buffers. More specifically 1) project design features (F1, F2, H1, H2, H5, and H8-H10) reduce the likelihood for herbicide delivery to waterways in a concentration of concern, 2) herbicide restrictions on certain soil types (H3 and H6) reduce potential for runoff and leaching, 3) restrictions on extent of treatment in a given site (H4, H5 and H7) ensure herbicides would not be delivered in amounts greater than the SERA risk assessment scenarios and unsprayed areas would be retained to provide refugia, 4) herbicide use buffers would be modified to include roadside ditches that are hydrologically connected to streams when surface water is present in the ditch, 5) spills are extremely unlikely to occur given the many safety precautions in place, and 6) when working within occupied or suitable spotted frog habitat, use of herbicides that pose a risk would be restricted, and treatment methods, timing, and location would be coordinated with a wildlife biologist. Collectively these pdfs in combination with the use of low risk first year/first choice herbicides make it unlikely that the Columbia spotted frog would be adversely affected by herbicides.

Adult frogs could be dermally exposed to herbicides by moving through treated vegetation or soil. There is insufficient data to quantify the dose received from exposure to contaminated vegetation or soil, but it is likely to be much less than if the frog was in contaminated water and could easily absorb the solution through its skin. The likelihood of exposure is further reduced when you consider that the herbicide-use buffers restrict broadcast application of herbicides within breeding habitat, require that unsprayed areas be provided to serve as refugia for amphibians (H7 and H8) when treating lakes, ponds, or wetlands, and restricts herbicide use nears wells, springs, and stockponds (H9).

Results from exposure scenarios indicate that aminopyralid, chlorsulfuron, clopyralid, imazapic, imazapyr, metsulfuron methyl, and picloram pose a very low to no risk to amphibians, while the herbicides glyphosate, sulfometuron methyl, sethoxydim and triclopyr and some surfactants may pose some risk to fish and amphibians. However, these risks are minimized by the herbicide use buffers, the restrictions on surfactant use, and the herbicide use rates reduce the risk of adverse impacts to amphibians. PDF J5- a also includes a restriction on broadcasting of any herbicide within 100 feet of occupied habitat, and includes an additional restriction on use of sulfometuron methyl. Collectively, these measures would minimize the potential for any harmful exposures of herbicide to Columbia spotted frog.

Cumulative Effects

Ongoing and future projects, including the relationship between land management and invasive weeds, are discussed under section 3.1.5 whereas alternative cumulative effects are discussed above. There would be few if any effects to breeding habitat from ongoing or future timber harvest, burning or fuel treatments and implementation of LRMP standards would ensure that breeding habitat is maintained during any construction, water development, or restoration projects. Disturbance from activities at upland sites from future activities or recreational use could occur. While proposed treatments could further disturb individuals, when working in occupied habitat, treatment methods, timing and location would be coordinated with a biologist prior to implementation (pdf J5-a) and modified if necessary to reduce potential impacts.

Due to their restricted movement, frogs are unlikely to be exposed to herbicides on lands of other ownerships. Also, as described under direct and indirect effects, with implementation of pdfs and herbicide use buffers that restrict moderate to higher risk herbicides, there are no adverse effects from herbicide exposure anticipated. As a result, none of the alternatives would measurably contribute to any past, ongoing or future activity and result in significant effects to the Columbia spotted frog.

Summary and Determination

Disturbance to Columbia spotted frog eggs, larvae, or adults during invasive plant treatment would be minor and short term. Implementation of any action alternative may impact individuals or habitat (MIIH), but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species. Adult frogs, eggs, and larvae are not likely to be disturbed by invasive plant treatments during the breeding season because they are restricted to aquatic habitat. Due to the relatively low toxicity of most herbicides proposed, the low herbicide concentrations in water that could occur under normal operations, and implementation of pdfs, it is unlikely frogs, eggs, or larvae would be exposed to toxic levels of herbicide. If occupied habitat were proposed for treatment, the site would be reviewed by a local biologist and treatment methods modified if necessary to avoid adverse impacts. Proposed treatment would contain and control existing and future infestations of invasive plants and help maintain riparian/wetland habitat.

Shortface Lanx and Harney Basin Duskysnail

Direct and Indirect Effects

Treatment - The shortface lanx is a non-migrant freshwater snail that can be found in the main channel of fast flowing streams and rivers. There would be no mortality or disturbance to the shortface lanx because it is aquatic and inhabits larger streams and rivers.

The Harney basin duskysnail (HBD) inhabits cold springs and runs as well as adjacent sagebrush habitat. There are no treatments proposed within the Spring Creek watershed that contains the only known documentation of the Harney basin duskysnail within the project area. While it is possible that a site could be affected in the future, with implementation of the pdf J10-a and considering that treatment would not likely occur within a cold water spring habitat where this species would be found, it is not expected that the Harney basin duskysnail would be directly affected by treatment under any alternative.

- pdf J10-a - If an occupied site is proposed for treatment, a local biologist would be consulted to determine protection measures, if necessary. These measures may include limitations on vehicle entry, modifications to treatment type or timing, or implementation of herbicide-use buffers.

Invasive plant treatments would not remove or alter habitat or result in changes to the hydrologic regime. As a result, suitable habitat would be unchanged.

Herbicides– There is limited data on herbicide effects to aquatic snails. Relyea (2005a) found no effect to three species of aquatic snails from the glyphosate formulation Roundup®. Mona et al. (2013) reported gene damage in aquatic snails exposed to 5 mg/L (ppm), but not 0.5 mg/L, glyphosate, presumably from the formulations used in Egypt mentioned in the paper. However, the Mona et al. paper does not specify if they used technical glyphosate alone, or the formulations mentioned. Given the numerous papers that attribute adverse effect of glyphosate-based formulations to the surfactants present (e.g., Relyea 2005b, Relyea 2012, Diamond and Durkin 1997), we cannot determine if the effects noted in Mona et al. are from glyphosate itself or the formulation mixture with surfactants. Tate et al. (1997) reared three generations of aquatic snails in different sub-lethal concentrations of technical grade glyphosate. Glyphosate had little effect on the first and second generations, but for the third generation, growth rates of snail embryos and egg-laying capacity increased in the presence of glyphosate while hatching was inhibited and some abnormalities were observed at 0.1 mg/L and higher. Griselia et al. (2004) tested imazapyr and a Brazilian formulation of Arsenal® (which contains imazapyr and the surfactant nonylphenol ethoxylate) to find the LC50 to the aquatic snail *Biomphalaria tenagophila*. The LC50 for imazapyr was 45.9 mg/L and for Arsenal was 20.1 mg/L. Back et al. (2012) looked at aquatic snail and algal assemblages in eutrophic wetland plots treated with glyphosate (Aqua-Neat®) or imazapyr (Habitat®). Glyphosate plots were erroneously treated with concentrations 6-times higher than approved label rates (Back et al. 2013). Eight species of snails were recovered from the plots. Diversity of snail species was similar across treated and untreated plots, while snail densities were higher in herbicide-treated plots. The higher snail densities in herbicide-treated plots were attributed to increased light availability creating higher algal growth. No negative impacts to snail species were reported.

The GLEAMS model was run on four sites within the project area that had the greatest potential for herbicide delivery to water near fish habitat. Results indicate that herbicide concentrations in the water are at least three orders of magnitude less than levels of concern for fish, amphibians, and aquatic invertebrates (table 38, chapter 3.5.3). Very little herbicide would reach water even in an unbuffered scenario. The greatest amount of herbicide reaching streams in the GLEAMS model results was 0.0011ppm (same as mg/l) for imazapyr. The acute threshold of concern for this herbicide is 5 mg/l, several orders of magnitude larger than the expected peak concentration in water even in the unbuffered, high-risk sites.

Herbicides and Terrestrial Snails - Limited data regarding herbicide toxicity to land snails exists. There are studies conducted on brown garden snails (*Helix aspersa*) exposed to picloram and glyphosate. In Schuytema et al. (1994), snails were fed food contaminated with the herbicides at concentration up to 5000 mg/kg for 14 days. Neither glyphosate nor picloram appeared to pose a risk to the snail. The effect on hatching success and embryo development of *H. aspersa* snail eggs was tested for glyphosate along and a European formulations of Roundup® containing glyphosate and a commercial nonylphenol polyethoxylate (NPE) surfactant (Agral®) (Druart et al. 2010). After 14 days of exposure, hatching success for glyphosate alone was equivalent to controls, indicating that glyphosate itself had no effect. The Roundup® formulation completely inhibited hatching at 225 mg/l. Hatching response to NPE was quite variable, with EC50 (50% reduction in hatching success) ranging from 26-85 mg/l. Druart et al. (2010) observed the embryo development of non-hatched eggs from the hatching success studies. They report “embryos exposed to glyphosate were blocked late in their development…”.This result is presumably from Roundup® since glyphosate itself did not alter hatching success.

Based on the limited data available, glyphosate and picloram do not appear to pose a risk to terrestrial snails. It appears unlikely that herbicides would pose serious toxic risk to terrestrial snails, but this conclusion is made with reservation due to extremely limited data. The likelihood is further reduced with implementation of pdf J10-a, which restricts treatment within occupied Harney basin duskysnail habitat. With implementation of this pdf and considering there are no first-year treatments proposed near the Spring Creek site where this species has been documented, there are no adverse effects from herbicide exposure to the Harney basin duskysnail anticipated.

Cumulative Effects

Ongoing and future projects, including the relationship between land management and invasive weeds, are discussed under section 3.1.5 whereas alternative cumulative effects are discussed above. Of the activities anticipated, few treatments within suitable habitat would occur. In addition, LRMP standards are in place to reduce potential impacts to streams, rivers, and springs. While future grazing may adversely affect the Harney basin duskysnail or its habitat, as described under alternative effects, grazing use is not expected to change and upland and riparian habitat would be maintained. As a result and because proposed treatments would not alter existing habitat or likely result in exposure to harmful levels of herbicide, none of the alternatives would measurably contribute to any past, ongoing, or future activity and result in significant effects to these species.

Summary and Determination

Shortface Lanx – Based on the above analysis and the following rationale, there are no effects to the shortface lanx anticipated, and implementation of alternatives B, C, and D would have No Impact on this species.

- ♦ No effects of exposure have been noted in short-term exposures at concentrations predicted from the proposed project.
- ♦ If herbicide were to get into the water, contact time in flowing streams would be a matter of minutes, not hours or days, and certainly not for multiple generations of aquatic mollusks.
- ♦ No effects to aquatic snails were noted in generations 1 and 2.
- ♦ Glyphosate and imazapyr treatments in wetlands can increase aquatic snail populations and do not adversely affect food availability.
- ♦ Glyphosate is inactivated rather quickly by adsorption to soil and microbial breakdown in soil and water.
- ♦ The size and distribution of the invasive plant populations (relatively small and scattered), frequency of occurrence (patchy), environmental fate of glyphosate (not persistent), and size of the rivers make it impossible to achieve the predicted concentration over three snail generations.
- ♦ There are very limited acres of invasive plants, relative to uninfested land, adjacent to snail habitats, so only a small portion of the habitat would be treated.

Harney Basin Duskysnail – No treatments are proposed at the documented Harney basin duskysnail site. Project design features would modify treatment or timing if necessary should an occupied site be proposed for treatment in the future. As a result, and considering herbicide use buffers would further protect spring and seeps, the action alternatives may impact individuals or habitat (MIIH), but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.

Johnson Hairstreak

Direct, Indirect, Cumulative Effects and Determination

Johnson hairstreak has not been documented within suitable coniferous-forest habitat within the project area, and it is unlikely they would occur within treatment areas. Consequently, there would be no direct, indirect, or cumulative effects anticipated, and implementation of the action alternatives would have No Impact on this species.

Silver-bordered Fritillary

Direct and Indirect Effects

***Treatment* -** Of the approximately 22,000 acres of potentially suitable habitat, approximately 34 acres of riparian/wet meadow habitat are known to contain invasive weeds and are proposed for treatment. These sites are generally small and scattered across 45 watersheds.

Mechanical, manual, and herbicide treatment could harm eggs or larvae due to physical disturbance on the site. In order to reduce potential impacts, pdf J6-b requires that a local wildlife biologist be contacted if treatment is proposed on sites where the silver-bordered fritillary has been documented. Since butterfly populations fluctuate among meadows and between years, the local biologist can provide advice on where to prioritize treatments and to modify timing/treatment methods if necessary to reduce impacts. Consequently, the potential for adverse effects would be reduced. With implementation of this pdf and considering the small amount of habitat proposed for treatment, the likelihood that treatments would directly affect the silver-bordered fritillary is reduced.

The silver-bordered fritillary is dependent upon wet meadow habitat, and invasive plants can reduce the abundance and/or cover of larval food and nectar plants (violet). All action alternatives would promote native plant communities and help sustain silver-bordered fritillary habitat over the long term.

Herbicides - Data on herbicide effects to butterflies is limited with few studies in peer-reviewed literature. Where data is lacking, risk assessments rely on data from the honeybee and other insects as surrogates.

Herbicides could affect butterflies directly or through affects to adult nectar plants or caterpillar host plants. Russell and Schultz (2009) tested the toxicity of sethoxydim (in the formulation Poast®) to the larvae of Puget blue butterfly (*Icaricia icarioides blackmorei*), a Washington species of concern, and the non-native small white or cabbage white butterfly (*Pieris rapae*). Larvae were directly sprayed or fed sprayed food plants, mimicking a spring application. Poast® contains a petroleum solvent, which could be an important factor in the toxicity results. Due to issues with the exposure methodology for the cabbage white butterfly (larvae were placed in plastic cups and sprayed, which would create pooling of liquid around larvae and prevented foliar interception) and because it is a non-native species, results discussed will focus on results for the native Puget blue. Poast® did not alter percent survival of larvae, biomass of pupae, adult biomass, or morphological characteristics, but it did cause earlier emergence from the pupae and smaller wing sizes in adults. The effects of the sethoxydim formulation to the Puget blue butterfly were all sublethal (Russell and Schutlz 2009). The authors suggest that applications made in late summer and fall would reduce effects to species like the Puget blue since they stop feeding in summer and larvae retreat to ground litter.

Labar (2009) conducted a field study on effects of sethoxydim to the Puget blue butterfly applied on a Washington prairie. Plots were sprayed with Poast® mixed with the surfactant Agridex® in April of 2007 and 2008. Results of the field trial indicated the herbicide had very little to no impact on larval survival, flower species, or Puget blue oviposition, while adult butterflies spent significantly less time in sprayed plots than in controls. Labar (2009) also recorded habitat use of sprayed and unsprayed plots for silvery blue (*Glaucopsyche lygdamus*), ochre ringlet (*Coenonympha tullia*), and wood nymph (*Cercyonis pegala*) butterflies. Adults of these butterflies also avoided sprayed plots. The formulation Poast® contains a petroleum solvent that has a strong odor, so perhaps this contributed to the avoidance of sprayed plots by butterflies.

Stark et al.(2012) tested the toxicity of triclopyr BEE (in the formulation Garlon 4 Ultra®), sethoxydim (in the formulation Poast®), and imazapyr (in the formulation Stalker®) to Behr’s metalmark butterfly (*Apodemia virgulti*) by directly spraying the larvae and their food. All three herbicide formulations reduced the number of individuals reaching the pupae stage. If larvae did reach the pupae stage, there was 100 percent emergence to the adult stage. For Garlon 4 Ultra®, pupae weight was significantly larger and adult abdomen length significantly longer than controls. Poast® and Stalker® did not affect other parameters measured. The authors suggest that the effects were likely caused by the inert ingredients, combinations of inert ingredients, or effects of the formulations on food plant quality because the herbicide active ingredients tested all have different modes of action (Stark et al. 2012).

For chlorsulfuron and metsulfuron methyl, Kjaer and Heimbach (2001) evaluated survival and growth of the large white butterfly (*Pieris brassicae*) when host plants were treated for four consecutive days. Rates applied were up to 0.8 g a.i./ha (about 0.0007 lb/ac) for chlorsulfuron (in the formulation Glean®), and up to 0.003 lbs a.i./acre for metsulfuron methyl (in the formulation Ally®) (all European formulations). No significant effects on survival or growth rate occurred for either herbicide (Kjaer and Heimbach 2001). Using data from other insects, the FS risk assessments for chlorsulfuron and metsulfuron (SERA 2004a,

b) concluded that there were no likely adverse effects to invertebrates at typical and maximum application rates used by the Forest Service.

There is apparently no data for effects to butterflies for clopyralid, imazapic, or sulfometuron methyl. Using the honey bee or other insect data as a surrogate for butterflies, typical or highest application rates of clopyralid, imazapic, and sulfometuron methyl do not appear to pose a risk.

Sucoff et al. (2001) studied effects of herbicides on host plants, eggs, and larvae of the Karner blue butterfly (*Lycaeides Melissa*) from treatments with glyphosate, glyphosate-sulfometuron methyl mix, and glyphosate-triclopyr mix. Treatment did not inhibit flowering of the larval food plant. Glyphosate, triclopyr, and glyphosate-sulfometuron methyl mix treatments did not significantly reduce egg hatching, pupation of larvae, emergence of adults, pupae size, rate of development, or percent of eggs that produced adults. The glyphosate-triclopyr mix did significantly reduce egg hatching. Pdf (F2) restricting application rates of these herbicides should reduce toxic exposures. Effects are further reduced when you consider that triclopyr is not among the first-choice herbicides in any alternative and is restricted to spot application.

Effects on populations in field applications may be different from individual toxicity tests. Bramble et al. (1997) conducted a series of studies on the effects of using commercial formulations of herbicides (including glyphosate, picloram, triclopyr, and metsulfuron methyl with various surfactants) in rights-of-way maintenance, compared with mechanical maintenance, and observed no significant or substantial differences in butterfly populations.

The likelihood that individuals would be affected by herbicides depends on the likelihood that host plants would be affected or that they would be contaminated by drift. Implementation of pdf J6-a, will ensure that buffers would be implemented on any sites that contain host/nectar plants, reducing the likelihood of herbicide exposure or mortality to host plants. Additionally, J6-b requires that treatment in occupied habitat be coordinated with a biologist, so that the type or timing of treatment can be modified if necessary to reduce potential impacts. Also, use of ester formulations of herbicide in known silver-bordered fritillary habitat would be prohibited. Although data is limited, it is unlikely that adverse effects from herbicide exposure would occur to adults, pupae, or eggs under any alternative because of project design features to protect suitable host plants and occupied sites; the small amount of suitable habitat proposed for treatment (less than1 percent of the suitable habitat affected); and the low risk of preferred herbicides.

Cumulative Effects

Ongoing and future projects, including the relationship between land management and invasive weeds, are discussed under section 3.1.5 whereas alternative cumulative effects are discussed above. This species occupies non-forested riparian/wetland habitat, so other than continued grazing and recreational use, few of the anticipated ongoing and future activities would occur within suitable habitat. In addition, LRMP standards are in place to protect and maintain suitable wet meadow habitat. Since they are known to occupy adjacent private land, it is possible that adults could be exposed to herbicides on all land ownerships. The toxicity of proposed herbicides to invertebrates is low, and pdfs applied for activities on NFS lands further reduce the likelihood of multiple herbicide exposures. As a result and considering the small amount of habitat proposed for treatment within any watershed, it is unlikely that treatment on National Forest System land would result in toxic levels of herbicides to adult butterflies or measurably contribute to any past, ongoing or future activity and result in significant effects to this species.

Summary and Determination

Silver-bordered fritillary is not documented within the project area, although it is documented adjacent to the Malheur National Forest so use on the Forest is likely. Following the rationale of the above analysis, invasive plant treatments in any of the action alternatives may impact individuals or habitat (MIIH), but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.

- Within occupied habitat, project design features are in place that would protect host/nectar plants, and minimize the likelihood of adverse effects from treatment.
- Based on available data and with implementation of project design features, it is unlikely that proposed herbicides would adversely affect terrestrial invertebrates.
- Approximately 35 acres of preferred habitat are proposed for treatment (including 20 acres of spot application). Due to small amount of habitat affected and with application of pdfs that modify treatment type and timing, it is unlikely an occupied site would be affected.
- Proposed treatments would reduce invasive plants and help to maintain native riparian grassland habitat.

Management Indicator Species

Table 71. Treatment effects determinations for management indicator species (MIS)

Species	Treatment Effects Determination
Rocky Mountain Elk	Treatment effects limited to short-term disturbance. Herbicide exposure unlikely. Grassland habitat and local elk populations maintained. Implementation of any of the action alternatives would not contribute to a negative trend in viability for this species within the Malheur National Forest.
Pileated Woodpecker	No treatment or herbicide effects to nesting birds. Disturbance to foraging birds possible. No herbicide exposure anticipated. Suitable habitat and local populations maintained. Implementation of any of the action alternatives would not contribute to a negative trend in viability for this species within the Malheur National Forest.
Pine (American) Marten	Not likely to occur in treatment areas. Suitable habitat and local populations maintained. Implementation of any of the action alternatives would not contribute to a negative trend in viability for this species within the Malheur National Forest.
Three-toed Woodpecker	No treatment effects to nesting birds. Disturbance to foraging birds possible. No herbicide exposure anticipated. Suitable habitat and local populations maintained. Implementation of any of the action alternatives would not contribute to a negative trend in viability for this species within the Malheur National Forest.
MIS cavity excavators	No treatment effects to nesting birds. Disturbance to foraging birds possible. No herbicide exposure anticipated. Suitable habitat and local populations maintained. Implementation of any of the action alternatives would not contribute to a negative trend in viability for this species within the Malheur National Forest.

Rocky Mountain Elk

Approximately 2,124 acres of elk summer range are known to contain invasive plants. Of this, approximately 1,860 acres (88 percent) are adjacent to open roads. While there are no invasive plant treatments proposed within elk calving areas, approximately 517 acres of the elk winter range is currently known to contain invasive plant species. Treatment would occur across 100 watersheds (HUC 6) ranging in size from 10,000 to 40,000 acres. While six watersheds have 100 acres or more proposed for treatment (120 to 170 acres), one percent or less of all watersheds would be treated.

Direct and Indirect Effects

Treatment - Elk are sensitive to human disturbance, so proposed treatments can adversely affect big game due to increased human access. About 88 percent of proposed treatments are close to open roads, which are less likely to be used as habitat (Thomas 1979). In addition, treatments within any drainage would be short term (a few days) and unaffected habitat is available. As a result, disturbance would likely result in animals avoiding areas during treatment. Also with implementation of the following design features, the likelihood of disturbance during sensitive or key periods would be reduced:

- pdf J12-a –To reduce stress during the winter, restrict off-highway vehicle use within MA 41 (big game winter range) between December 1st and April 1st.
- pdf J12-b – To prevent harassment in designated calving areas, restrict off-highway vehicles and other motorized traffic use to designated roads and trails from May 1st to June 31st.

Invasive plants can reduce forage quality and quantity for big game (Rice et al. 1997, Bedunah and Carpenter 1989, Trammel and Butler 1996). As a result, treatment of invasive plants would beneficially affect elk (and deer) by preserving native forage species and maintaining the long-term suitability of foraging habitat.

Herbicides – Mammals, such as elk, that eat vegetation (primarily grass) that has been sprayed with herbicide have relatively greater risk for adverse effects because herbicide residue is higher on grass than it is on other herbaceous vegetation or seeds (Kenaga 1973, Fletcher et al. 1994, Pfleeger et al. 1996).

At the highest application rates, glyphosate and picloram exceeded levels of concern at acute exposures. Chronic exposure levels of concern resulted from sethoxydim applied at the highest rate and triclopyr at the typical and highest rates. The likelihood of exposure is reduced because triclopyr is restricted to spot techniques, pdf F2 prevents glyphosate and picloram from being broadcast sprayed above typical application rates, and pdfs H3/H4 restrict use of picloram on sensitive soils and frequency of application. The likelihood of exposure is further reduced when considering that elk forage over large areas and are not likely to consume an entire days diet of contaminated vegetation (acute exposure) or forage exclusively on contaminated vegetation for 90 days (chronic exposure). As a result and considering that 88 percent of the proposed treatments occur close to open roads that are less likely to be used by elk (Thomas 1979), it is unlikely that elk would be adversely affected by herbicide exposure.

Cumulative Effects

Ongoing and future projects, including the relationship between land management and invasive weeds, are discussed under section 3.1.5 whereas alternative cumulative effects are discussed above. As described, ongoing and future activities would be implemented on 60 watersheds forestwide. Proposed timber harvest would reduce elk cover, while adhering to Forest LRMP standards related to habitat effectiveness and hiding and thermal cover. In addition, much of the harvest, as well as prescribed fire and plantation thinning would improve elk forage on summer, winter, and transition ranges. As a result and considering that proposed treatments would help to maintain native forage over the long term, elk habitat would be maintained in all affected watersheds. While proposed treatments could increase disturbance to elk on summer range, effects would be short term. As a result and considering that 88 percent of proposed treatments occur close to roads where elk are less likely to occur, there are no long-term disturbance related effects anticipated.

Since elk utilize all land ownerships, anticipated cumulative effects include possible exposure to herbicides on state, private, and BLM land if applications occur at approximately the same time. Regardless, negative effects are unlikely since the herbicides proposed are rapidly eliminated and do not significantly bio-accumulate (USDA Forest Service 2005a). The risk of herbicide exposure over a level of concern would be avoided by implementation of pdfs that restrict herbicide application rates; provide herbicide-use buffers along streams, waterbodies, springs, and riparian areas; and minimize drift from broadcast application. The risk of exposure is further reduced when you consider that 1 percent or less of any watershed would be affected by treatment and that most treatment occurs in less preferred habitat adjacent to open roads. Collectively for these reasons, none of the alternatives would measurably contribute to any other past, current, or foreseeable activity related to herbicide exposure and there are no significant cumulative effects to elk anticipated.

Summary and Determination

There are no adverse effects from herbicide exposure anticipated. Proposed treatments may result in short-term disturbance during treatment. Ultimately, treatment would reduce invasive plants and help to maintain native big game range. As a result, local populations of elk and hunting opportunities would be maintained. Implementation of the action alternatives would not contribute to a negative trend in viability for elk on the Malheur National Forest.

Pine (American) Marten

Direct, Indirect, and Cumulative Effects

Marten prefer closed-canopy forest away from open roads (where 88 percent of proposed treatment sites are); therefore, it is unlikely they would be found in treatment sites. In addition, invasive plant treatments would not alter forested habitat. Considering no herbicide exceeded a level of concern for carnivores eating contaminated small mammals, proposed treatments would not adversely affect marten or alter their habitat under any alternative.

Summary and Determination

There are no direct, indirect, or cumulative effects to marten anticipated and implementation of the action alternatives would not contribute to a negative trend in viability for this species on the Malheur National Forest.

Cavity Nesters and Species Dependent on Downed Wood

Because they occupy similar habitats and have similar threats, cavity nesting species or species that require standing dead (snags) and downed woody debris are discussed collectively.[27] These species include pileated woodpecker, northern three-toed woodpecker, northern flicker, red-naped sapsucker, red-breasted sapsucker, Williamson's sapsucker, downy woodpecker, hairy woodpecker, and black-backed woodpecker.

Direct and Indirect Effects

Treatment **-** No snags or trees would be removed; therefore, nest habitat would be unaffected. Disturbance to foraging birds would occur, particularly to species, such as the pileated woodpecker or northern flicker that forage on the ground or in more open canopy conditions. Sites are small and scattered, so unaffected habitat is available and effects would be limited to short-term disturbance during treatment. Cavity nesting species are not at risk from herbicides and existing habitat would be unchanged.

Herbicides **-** Species that forage and nest in trees are not likely to be exposed to herbicides because woody vegetation would not be treated and no aerial application is proposed. Species, such as the pileated woodpecker and northern flicker, that feed on the ground or in low shrubs may consume contaminated insects.

Effects of herbicide exposure are the same as those described under the Lewis' and white-headed woodpecker. With implementation of pdfs, the likelihood of herbicide exposure is reduced. The likelihood of exposure is further reduced when you consider that birds forage over large areas and that many of the insects utilized occur within dead wood, under bark, or from areas not exposed to herbicides. As a result,

[27] Findings and determinations for the Lewis and white-headed woodpeckers were discussed previously in the Forest Service Sensitive Species section.

birds are not likely to consume exclusively contaminated insects, and there are no adverse effects from herbicide exposure anticipated under any alternative.

Cumulative Effects - Ongoing and future projects, including the relationship between land management and invasive weeds, are discussed under section 3.1.5 whereas alternative cumulative effects are discussed above. These species could be affected by any activity that reduces snags or downed wood, or modify the overstory, particularly timber harvest and prescribed burning. Timber harvest and invasive plant treatments would occur within 39 watersheds, which include approximately 1,100 acres of treatment. While timber harvest would reduce habitat for some species, habitat for others would be improved. Implementing Forest standards would retain a component of snags and downed wood on all sites. As a result, the proposed treatments would not modify suitable habitat or adversely affect species from herbicide exposure. None of the alternatives would measurably contribute to any other past, current, or foreseeable activity, and there are no significant cumulative effects to snag or downed wood dependent species anticipated.

Summary and Determination

Suitable habitat for MIS and sensitive cavity nesting species overlap with mapped infestations proposed for treatment. It is unlikely nesting birds would be affected and any disturbance to foraging birds would be short-term (usually one day or less). Suitable nesting habitat would be unaffected by treatment and implementation of the action alternatives would not contribute to a negative trend in viability for cavity nesting or downed wood dependent species on the Malheur National Forest.

Effects to Featured Species

California Bighorn Sheep

Direct and Indirect Effects

***Treatment* -** Less than 14 acres of bighorn sheep habitat is proposed for treatment and the likelihood of disturbance is remote. Should future treatments be proposed within occupied habitat, treatment modifications/timing would be made if necessary during preparation of annual prescriptions to ensure sheep are not disturbed and all alternatives comply with LRMP standard 55. Due to the small amount of habitat known to contain invasive plants, suitable habitat would be unchanged.

***Herbicides* -** Effects from herbicide exposure would be similar to those described under elk. With implementation of pdfs, the small amount of habitat proposed for treatment, and that sheep are not likely to consume exclusively contaminated vegetation, the likelihood of exposure is reduced. As a result, there are no adverse effects from herbicide exposure anticipated under any alternative.

Cumulative Effects

Ongoing and future projects, including the relationship between land management and invasive weeds, are discussed under section 3.1.5 whereas alternative cumulative effects are discussed above. Other than grazing and recreation, there are few ongoing and future activities within suitable habitat anticipated. As described under alternative cumulative effects, it is not anticipated that grazing use will change and bighorn forage conditions would be maintained. Considering the small amount of habitat proposed for treatment, and low likelihood of herbicide exposure, none of the alternatives would measurably contribute to any past, current, or foreseeable activity, and there are no significant cumulative effects anticipated.

Summary and Determination

Due to the small amount of habitat proposed for treatment and that there are no adverse effects from herbicide exposure, local populations of bighorn sheep and their habitat would be maintained under all alternatives.

Northern Goshawk

Direct and Indirect Effects

Treatment - There are 567 acres of goshawk nesting/foraging habitat and 18 acres of post fledgling habitat proposed for treatment. Invasive plants prefer a more open canopy habitat. The northern goshawk prefers closed-canopy, mature forest for nesting and foraging; therefore, its habitat is not at risk from invasive plants. With implementation of pdf J11-a that restricts activity within 0.50 mile of known nest sites, there are no effects to nesting goshawks anticipated. Foraging goshawks could be disturbed during treatment, although unaffected habitat is available and any disturbance would be short-term. Proposed treatments would not alter existing habitat.

Herbicides - At the typical application rate, no herbicide or surfactant exceeded the toxicity index for an acute or chronic exposure whereas sethoxydim equaled the NOAEL at the highest application rate. Project design feature F2 restricts broadcast application of sethoxydim to the typical application rate. As a result, and considering that goshawk forage over large areas and are unlikely to feed exclusively on contaminated prey, there are no adverse effects from herbicide exposure anticipated.

Cumulative Effects

Ongoing and future projects, including the relationship between land management and invasive weeds, are discussed under section 3.1.5 whereas alternative cumulative effects are discussed above. While activities such as timber harvest and prescribed burning would modify goshawk nesting and foraging habitat, LRMP standards would protect nest sites and PFA areas. Consequently, stand and landscape-level prey diversity would likely increase. Similarly, plantation thinning and reforestation treatments would increase understory and prey diversity. While there would be some road use changes resulting from access and travel management, with implementation of plan standards, nest habitat would be maintained. Mineral exploration could result in a long-term reduction in nest habitat whereas short-term disturbance could occur from future structural or instream restoration work. Disturbance from recreation would continue, although high use areas would continue to be avoided. While there may be a localized reduction in habitat from some ongoing and future activities, most anticipated activities would maintain nest habitat and maintain or improve foraging habitat. Since proposed actions would not modify habitat or result in adverse effects from herbicide exposure, none of the alternatives would measurably contribute to any past, current, or foreseeable activity, and there are no significant cumulative effects anticipated.

Summary and Determination

Suitable goshawk habitat would be maintained and any effects from treatment would be minor and short term. Local populations of northern goshawk and their habitat would be maintained under all alternatives.

Blue Grouse

Direct and Indirect Effects

Treatment - Blue grouse winter at upper elevations in habitat that is largely unaffected by invasive plants or treatment. They breed within openings at lower elevations, and treatments within open canopy forest and grassland/shrub habitats near forest could disturb grouse or result in mortality to nests or chicks. There are approximately 125 acres proposed for treatment in mountain meadow, step shrublands, or riparian/shrub habitats. Due to the small size of treatment sites and widespread availability of unaffected habitat, the likelihood of adverse impacts is low. This species is not at risk from invasive plants and suitable winter and summer habitat would be unchanged.

Herbicides - Adult blue grouse forage primarily on shrubs and herbaceous vegetation during the summer months, and chicks consume large quantities of insects. Thus, risk of effects from herbicide exposure was evaluated using the insectivorous bird scenario and the large bird consuming vegetation.

For adult birds and chicks at typical application rates, only triclopyr (if broadcast sprayed) exceeded the acute toxicity thresholds. Glyphosate exceeded a dose of concern at the highest rate for small birds consuming insects. Triclopyr is restricted to spot techniques. Project design feature F2 limits broadcast spray of glyphosate and triclopyr to the typical rate (or less for triclopyr). As a result, it is unlikely that adult birds or chicks would receive an acute exposure of concern.

Triclopyr exceeded a chronic dose of concern at the typical and highest application rate whereas sethoxydim, sulfometuron methyl, and glyphosate exceeded the toxicity threshold at the highest application rate. With implementation of pdf F2, which restricts broadcast application of clopyralid, glyphosate, picloram, sethoxydim, sulfometuron methyl, and triclopyr to typical application rates, and the Malheur National Forest LRMP standard that prevents broadcast application of triclopyr, the likelihood of exposure is reduced. Triclopyr is not a first-choice herbicide in any alternative. As a result of the small size and scattered nature of treatments sites, birds would not be expected to forage exclusively on contaminated insects or plants and be exposed to herbicides at levels of concern.

Cumulative Effects

Ongoing and future projects, including the relationship between land management and invasive weeds, are discussed under section 3.1.5 whereas alternative cumulative effects are discussed above. Approximately 125 acres of summer habitat could be affected by treatment. Activities that could occur in suitable riparian or uplands shrub habitat include prescribed burning, hazard tree removal, aspen restoration, spring development, stream restoration, or grazing. Activities in riparian habitat would be restricted with implementation of LRMP standards, and although there may be localized changes in vegetation, this community would be maintained. Continued grazing could reduce vegetation within upland shrub habitat, although use is not expected to change, and adherence to allowable use standards and modifications of livestock numbers or use following treatment would maintain vegetative structure and diversity. While prescribed burning could result in short-term impacts to understory vegetation, treatment would promote the maintenance of shrub diversity over the long term. Similarly, proposed treatments would help to reduce invasive plants and maintain native shrub, grass, and forb diversity. Therefore, none of the alternatives would measurably contribute to any past, current, or foreseeable activity and result in significant cumulative effects.

Summary and Determination

Proposed activities would not modify suitable habitat and no long-term effects from treatment are anticipated. As a result, suitable habitat and local populations of blue grouse would be maintained.

Osprey

Direct and Indirect Effects

Treatment **-** There are no known osprey nests on the Forest; however, pdf J11-a protects osprey nests should one become established in the future. Accordingly, there would be no effects to nesting birds or reproduction. Osprey forage and nest over standing water, so neither birds nor their habitat would be affected by treatment.

Herbicides **-** While osprey would not be directly sprayed, they could consume fish exposed to herbicides. Doses were estimated assuming that birds ate nothing but fish contaminated by a spill of 200 gallons into a 0.25 acre pond, over a lifetime. All expected doses to fish-eating birds for all herbicides are well below any known no-observable-adverse-effect-level (NOAEL) and the weight of evidence suggests that adverse effects to this species group from herbicides included in the action alternatives are not plausible.

Cumulative Effects

Ongoing and future projects, including the relationship between land management and invasive weeds, are discussed under section 3.1.5 whereas alternative cumulative effects are discussed above. Because osprey nest and forage exclusively over water, proposed activities on NFS lands are not expected to adversely affect osprey. While birds could be exposed to herbicides on lands of other ownerships, for adverse effects to occur, the two exposures would have to occur at approximately the same time. This is unlikely since the herbicides proposed are rapidly eliminated and do not significantly bio-accumulate (USDA Forest Service 2005a). Also with implementation of pdfs that limit the application rate, method, and frequency for higher-risk herbicides; provide herbicide buffers along streams, waterbodies, and riparian areas; and minimize drift from broadcast application, the risk of herbicide exposure is further reduced. As a result, none of the alternatives would measurably contribute to any past, current, or foreseeable activity related to herbicide exposure, and there are no significant cumulative effects to osprey anticipated.

Summary and Determination

Osprey and their habitat would be unaffected by invasive plants or proposed treatments and local populations would be maintained.

Pronghorn Antelope

Direct and Indirect Effects

Treatment **-** Approximately 122 acres of invasive plants would be treated within sagebrush habitat adjacent to private lands and suitable pronghorn habitat. This would occur across 25 watersheds with 70 (alternative B) to 83 (alternative D) percent of the herbicide application occurring as spot treatment. Under alternative C, 75 percent of the treatments would be with manual/mechanical methods.

Although pronghorn occupy more open habitat, the potential effects of invasive plant treatment to pronghorns would be similar to those discussed under the rocky mountain elk. Both species graze herbaceous plants, graze over large areas, and are sensitive to human disturbance. Direct effects would be limited to short-term disturbance during treatment and all alternatives comply with LRMP standard 52. Because treatments would contain or control invasive plants, pronghorn habitat would be maintained under all action alternatives.

Herbicides **-** Effects of herbicide use would be the same as those described for elk. While exposures of concern are possible, with implementation of the Malheur National Forest LRMP standard that restricts use of triclopyr to spot techniques and pdf F2 that prevents glyphosate and triclopyr from being broadcast sprayed above typical application rates, the likelihood of exposure is reduced. Considering that pronghorn forage over large areas and are not likely to consume exclusively contaminated vegetation, it is unlikely that antelope would be adversely affected by herbicide exposure.

Cumulative Effects

Ongoing and future projects, including the relationship between land management and invasive weeds, are discussed under section 3.1.5 whereas alternative cumulative effects are discussed above. Future activities that could affect pronghorn include grazing, livestock water development, and juniper management. While disturbance from water development and juniper management could occur, habitat would be maintained. Continued grazing could reduce forage, but use is not expected to change and livestock would be deferred following treatment if necessary to ensure establishment of native vegetation. As a result, suitable pronghorn habitat would likely be maintained. Animals could be exposed to herbicides on lands of other ownerships; however, as described under the alternative cumulative effects for elk, there are no adverse effects from herbicide exposure anticipated, and none of the alternatives would measurably contribute to past, current, or foreseeable activity and result in significant cumulative effects.

Summary and Determination

While proposed treatments may result in short-term disturbance during treatment, habitat would be maintained or improved and there are no adverse effects from herbicide exposure anticipated. As a result, local populations of pronghorn would be maintained.

Effects to Birds of Conservation Concern

This section evaluates effects to landbirds, birds of conservation concern, and game birds below desired condition identified in section 3.72. Table 73 displays species not evaluated previously grouped into similar feeding strategies for analysis.

Table 72. Exposure groups, habitat and species included in each group

Animal/Diet Group	Habitat	Species
Predatory Birds (small mammals)	Grassland, Shrub-steppe, Dry Forest, Juniper-steppe, Rimrock-cliff	Swainson's hawk, prairie falcon, burrowing owl, Ferruginous hawk, flammulated owl
Insectivorous Birds	Dry Forest, Mesic Mixed Conifer, Riparian Woodland and Shrub, Shrub-steppe, Alpine, Sagebrush, Juniper Woodland, open water/wetland.	chipping sparrow, Vaux's swift, Townsend's warbler, varied thrush, MacGillivay's warbler, red-eyed vireo, veery, willow flycatcher, hermit thrush, vesper sparrow, gray-crowned rosy finch, loggerhead shrike, lark sparrow, black-throated sparrow, Bullock's oriole, yellow warbler, yellow-breasted chat, yellow-billed cuckoo, lazuli bunting, gray flycatcher, Virginia warbler, yellow-billed cuckoo, olive-sided flycatcher, sage sparrow, Brewer' sparrow, sage thrasher, sage sparrow, black swift, calliope hummingbird, Williamson's sapsucker, McCown's longspur, black rosy finch, Cassins finch, long billed curlew.
Herbivorous birds	Shrub-steppe	sharp-tailed grouse,
Waterfowl	Wetlands, riparian areas and open water habitats	canvasback, ring-necked duck, wood duck, mallard, northern pintail, redhead, lesser scaup, American widgeon

Predatory Birds

Direct and Indirect and Cumulative Effects

With implementation of pdf J11-a, raptor nests would be protected, and no adverse effects to nesting birds or reproduction is anticipated under any alternative. LRMP standards are also in place to protect hawk and owl nests from other management activities. While foraging birds could be affected, the short-term (1 day or less), low magnitude, and limited extent (usually 1 acre or less scattered over larger areas) of disturbance that would occur with invasive plant treatments would not adversely affect species in this group.

Effects of herbicide exposure would be similar to those described for northern goshawk and peregrine falcon and as described, there are no adverse effects from herbicide exposure anticipated.

Cumulative effects would be similar to those described under northern goshawk.

Insectivorous Birds

Direct, Indirect, and Cumulative Effects

Effects to these species will vary. There would be little effect to forested species, such as the Townsend's warbler, that utilize closed-canopy forest and nest off the ground. However, for species, such as the veery or Brewer's sparrow, which nest on or near the ground or in shrubs, effects include possible mortality associated with trampling of the nest. Due to the small size of treatment sites and widespread availability of unaffected habitat, the likelihood of mortality is low. Direct effects would include short-term disturbance during treatment.

Risk of effects from herbicide exposure was evaluated using the insectivorous bird scenario and effects would be similar to those described for the grasshopper sparrow. While use of some herbicides could result in an adverse effect, implementation of the Malheur National Forest LRMP standard that restricts use of triclopyr to spot methods only and pdf F2 that restricts broadcast application of clopyralid, glyphosate, picloram, sethoxydim, sulfometuron methyl, and triclopyr to typical application rates, the likelihood of herbicide exposure is low. Exposure is further reduced when you consider the small and scattered nature of the treatment sites and availability of unaffected habitat, which would reduce the likelihood that birds would forage exclusively on contaminated insects. As a result, there are no adverse effects from herbicide exposure anticipated under any alternative.

Cumulative effects would be similar to those described under grasshopper sparrow.

Herbivorous Birds

Direct, Indirect, and Cumulative Effects

The Columbia sharp-tailed grouse has not been documented on the Forest, and there are no direct effects from treatment anticipated. If use within treatment sites is documented, necessary treatment modification would be made as part of the annual review and monitoring process, and it is unlikely that the Columbia sharp-tailed grouse would be directly affected by herbicide or non-herbicide treatments. While all alternatives would control invasive plants within sagebrush communities, alternative B would be the most effective because it has the widest range of treatment options, particularly with larger infestations.

Effects from herbicide exposure would be similar to those described under sage grouse. For adult birds consuming vegetation and chicks consuming insects, only triclopyr (if broadcast sprayed) exceeded the acute toxicity threshold at typical and highest application rates whereas glyphosate exceeded a dose of concern at the highest rate for small birds consuming insects and large birds consuming vegetation. Because triclopyr is restricted to spot application and with implementation of pdf F2 that limits both herbicides to typical application rates (less for triclopyr), it is not expected that adult birds or chicks would receive an acute exposure of concern.

For chronic exposures to adult birds, triclopyr exceeded a dose of concern at the typical and highest application rate whereas sethoxydim, sulfometuron methyl, and glyphosate exceeded the toxicity threshold at the highest application rate. Data is lacking to evaluate a chronic exposure of clopyralid, glyphosate, picloram, sethoxydim, sulfometuron methyl, and triclopyr on small birds consuming insects. While exposure from these herbicides are possible, when you consider that 1) pdf F2 restricts broadcast application of clopyralid, glyphosate, picloram, sethoxydim, and sulfometuron methyl to typical application rates (and all use of triclopyr to typical rates), 2) triclopyr is restricted to spot techniques, 3) the use and frequency of picloram is restricted (H3 and H4), 4) the small amount of habitat proposed for treatment that is scattered across 20 watersheds, and 5) birds would be unlikely to consume 100 percent of their diet from contaminated insects/vegetation for 90 days and receive a chronic dose of concern, there are no adverse effects from herbicide exposure anticipated under any alternative.

Cumulative effects would be similar to those described under sage grouse and upland sandpiper

Waterfowl

Direct, Indirect, and Cumulative Effects

While all alternatives would help to contain and control invasive plants, treatments proposed under alternatives C and D are less effective (see chapter 3.1.4); therefore, treatment effectiveness of invasive plants within wetland and riparian habitat would best be achieved under alternative B. Risk of disturbance is also greater under alternatives C and D because more repeated treatments may be necessary increasing use of spot herbicide application and manual/mechanical treatments.

Disturbance to waterfowl could occur under any alternative from herbicide or non-herbicide methods. With implementation of herbicide-use buffers, retention of untreated areas near water (H7-H9) and considering the small and scattered nature of treatment sites within suitable habitat, the likelihood of direct effects to nesting birds is low.

The diet of these species varies; species, such as the redhead, eat primarily plant material, and the canvasback, ring-necked duck, mallard, pintail, lesser scaup, and American widgeon eat a combination of plants and insects. Also, some species, such as the wood duck and pintail, eat vegetation or insects away from water within woodlands or open habitat. As a result, effects of herbicide exposure to waterfowl were evaluated using the insectivorous and herbaceous bird scenarios, as well as by evaluating the likelihood aquatic organisms would be affected.

Effects to aquatic invertebrates and plants were evaluated under the fisheries analysis and as described, concentrations of herbicides potentially delivered to any water body on the Malheur National Forest would remain well below levels capable of measurably affecting aquatic organisms, including: fish, amphibians, or aquatic invertebrates. Herbicide exposures to birds consuming insects or plant material would be similar to those described above (i.e., insectivorous and herbivorous birds) and the following pdfs reduce the likelihood that waterfowl would be exposed to toxic levels of herbicide.

- The Malheur National Forest LRMP restricts use of triclopyr to selective and spot techniques only.
- Project design feature F2 restricts broadcast application of clopyralid, glyphosate, picloram, sethoxydim, and sulfometuron methyl to typical application rates whereas triclopyr is restricted to the typical application rate per acre or less.
- Project design features (H1, H2, H5, and H8-H10) would reduce the likelihood for herbicides to be delivered to wetlands, lakes, ponds, wells, springs, or stock tanks.
- Restrictions on extent of treatment in a given site (H4, H5, and H7) ensure that herbicides would not be delivered in amounts greater than the SERA risk assessment scenarios and that unsprayed areas around wetlands, lakes, and ponds would be retained.

The likelihood of exposure to herbicide would be further reduced because of herbicide-use buffers and the application of pdfs around streams, wetlands, lakes, ponds, intermittent and ephemeral streams (table 11). Collectively, these measures in combination with the use of low risk herbicides will greatly reduce the likelihood that waterfowl would be exposed to toxic levels of herbicide. Considering that birds would unlikely forage exclusively on contaminated prey/plant material, there are no adverse effects from herbicide exposure anticipated.

Cumulative effects would be similar to those discussed under bufflehead and osprey.

Migratory Bird Summary

Migratory birds and their habitats, including species with viability concern, regional landbirds, birds of conservation concern and gamebirds below the desired condition were evaluated. While short-term effects to some migratory bird species may occur, the likelihood of mortality is low. Mitigation measures have been included to reduce effects and there are no long-term adverse effects from treatment anticipated, nor is it likely that migratory birds would be exposed to toxic levels of herbicide. There would be no reduction in native vegetation, and all alternatives would help to reduce invasive plants and maintain migratory bird habitat. All action alternatives are consistent with the Migratory Bird Treaty Act and Executive Order 13186.

3.8 Range

3.8.1 Introduction

This section discusses the effects of alternatives on range resources, with emphasis on the herbicide treatments proposed. The analysis addresses effects of the alternatives on livestock and the need for specific grazing administration during and after herbicide use.

Regulatory Framework and Compliance

Several of the goals, objectives, standards, and guidelines from the R6 2005 ROD are about grazing and range management. This invasive plant treatment project complies with the treatment and restoration standards and assumes compliance with the prevention standards. Prevention of invasive plants on grazing allotments is part of grazing projects and compliance with prevention standards is assumed for this analysis.

Table 73. Standards from the R6 2005 ROD and their relationship to range management

R6 2005 ROD Standard	Text of Standard	Relationship to Range Management
Prevention Standard 1	Prevention of invasive plant introduction, establishment, and spread will be addressed in grazing allotment and vegetation management plans.	Direction from Forest LRMP, the 2001 Guide to Noxious Weed Prevention Practices, and the 2005 ROD addressed in all projects.
Prevention Standard 2	Actions conducted or authorized by written permit by the Forest Service that will operate outside the limits of the road prism... require the cleaning of all heavy equipment… prior to entering National Forest System Lands.	Private lands associated with permittees are periodically surveyed to determine the presence of invasive species and the need for washing of vehicles, such as water trucks and ranch vehicles, before entry onto National Forest System Lands. Water trucks are generally restricted to roads or “haul routes” that like roads are compacted and disturbed. Destinations are water set areas used year after year.
Prevention Standard 3	Use weed-free straw and/or mulch for all projects, conducted or authorized by the Forest Service, on National Forest System lands. If state certified straw and/or mulch is not available, individual Forests should require sources certified to be weed-free using the North American Weed Free Forage Program standards (see Appendix O) or a similar certification process.	Where straw and/or mulch may be used as bedding for livestock operations and/or restoration projects.

R6 2005 ROD Standard	Text of Standard	Relationship to Range Management
Prevention Standard 4	Use only pelletized or certified weed free feed on all National Forest System Lands. If State certified weed free feed is not available, individual Forests should require feed certified to be weed free using the North American Weed Free Forage Program standards or a similar certification processes Choose weed-free project staging areas, livestock and packhorse corrals, and trailheads.	Would use weed free feed and hay by permittees on all allotments. Hay and other feeds are occasionally used to gather or attract livestock, generally in preparation for a move. Would have permittees avoid those areas that become infested with invasive plants for livestock operations, such as gather, herding, the staging of vehicles, and livestock watering. The bigger concern would be where the permittee transports horses onto the allotment and brings hay products in with the trailer or if the permittee stays overnight and feeds horses at a line camp. Standard conforms to Order No. R6-2009-001.
Prevention Standard 5	Retain native vegetation consistent with site capability and integrated resource management objectives to suppress invasive plants and prevent their establishment and growth.	Compliments CDO. Land and resource management plans, standards, and guidelines that call for maintaining or improving vegetation conditions on allotments.
Prevention Standard 6	Use available administrative mechanisms to incorporate invasive plant prevention practices into rangeland management. Examples of administrative mechanisms include, but are not limited to, revising permits and grazing allotment plans, providing annual operating instructions, and adaptive management. Plan and implement practices in cooperation with the grazing permit holder.	Accomplished long term through environmental analysis projects that lead to new allotment management plans and grazing permits. Cooperate with grazing permittee on an annual basis to incorporate invasive species prevention practices in annual operation plans and use adaptive management to recognize changing science and ecosystem conditions.
Treatment Restoration Standard 11	Prioritize infestations of invasive plants for treatment at the landscape, watershed, or larger multiple forest/multiple owner scale.	Provides an opportunity to focus on local problem areas and establish “community” based solutions that might include, but is not limited to, multiple ranches, state, and/or BLM lands.
Treatment Restoration Standard 23	Prior to implementation of herbicide treatment projects, National Forest system staff will ensure timely public notification. Treatment areas will be posted to inform the public and forest workers of herbicide application dates and herbicides used. If requested, individuals will be notified in advance of spray dates.	Permittees will be notified upon request of specific treatment dates. Permittees will be notified of invasive plant treatment areas and the potential for treatment by herbicides as needed on an annual basis. The most appropriate method would be during annual operating meetings.

3.8.2 Affected Environment

Currently, more than 99 percent of the Malheur National Forest is incorporated into cattle grazing range allotments (1,695,228 acres, based on GIS data for the Malheur National Forest). The Malheur National Forest administers 106 grazing allotments, of which 98 are active and 8 are vacant. There are currently invasive plant infestations mapped on 86 of these allotments (81%) including on five of the vacant allotments. Infested sites range in size from one plant to numerous plants scattered over large acreages. Over 90 percent of inventoried sites are less than 1 acre in size and an additional one percent of the sites are less than 5 acres in size. See table 75 below showing the extent of mapped invasive species within each allotment.

Certain invasive plants are known to be toxic to various classes of permitted livestock. Canada thistle has the potential to concentrate nitrates and cause nitrate poisoning in ruminants. Russian knapweed and yellow starthistle both produce a unique poisoning of horses that is generally fatal. Leafy spurge can cause excessive salivation and diarrhea in cattle; however, it does not appear to affect sheep and goats

(USDA Forest Service 2012c). Houndstongue and tansy may cause liver problems in livestock, particularly cattle and horses.

Table 74. Invasive plant species information by allotment

Allotment Name	Status Active (A) Vacant (V)	District	Forest land allotment acres	Number of mapped invasive plant sites	Number of mapped invasive plant sites mapped	Acres of mapped Invasive plants
Aldrich	A	BM	20572	1	1	8
Alkali	A	EC	26753	106	5	71
Allison	A	EC	21156	11	4	1.5
Antelope (Silvies)	A	BM	29381	7	5	1
Antelope (Upper Malheur)	A	PC	5512	2	1	0.14
Austin	V	BM	672	4	3	9
Balance Creek	A	BM	365	0	0	0
Bear Creek	A	BM	1532	9	3	18
Beech Creek	A	BM	3756	10	3	14
Biggs On/Off	A	BM	166	0	0	0
Big Sagehen	A	EC	21612	56	8	8
Blue Creek	A	EC	16738	39	7	6
Blue Mountain	V	BM	22709	196	8	243
Bluebucket	A	PC	23436	11	3	5
Bridge Creek	A		8354	13	3	1.5
Buck Mountain	A	EC	41479	2	2	0.14
Calamity	A	BM	23204	66	6	25
Camp Creek (Silvies)	A	BM	14958	10	4	13
Central Malheur	A	EC	11377	22	3	5
County Road	A	BM	0	0	0	0
Crooked Creek	A	BM	5076	10	3	1
Dark Canyon	A	BM	31808	40	9	5.29
Deadhorse	A	BM	15527	5	4	0.52
Deardorff	A	PC	11927	24	4	11
Deer Creek	A	BM	2998	2	2	0.21
Devine	A	EC	25390	146	6	26
Dixie	A	BM	26875	14	5	2
Dollar Basin	A	PC	16396	5	3	5
Donaldson	A	BM	8008	14	5	10
Donnelly	A	EC	56083	30	4	24
Emigrant Creek	V	EC	1609	2	1	0.20
Fawn Spring	A	BM	6615	18	6	4
Ferg	A	BM	478	1	1	0.10
Fields Peak	A	BM	30735	47	7	6
Flag Prairie	A	PC	28775	33	6	18
Flagtail	A	BM	14978	19	6	32

Allotment Name	Status Active (A) Vacant (V)	District	Forest land allotment acres	Number of mapped invasive plant sites	Number of mapped invasive plant sites mapped	Acres of mapped Invasive plants
Fox	A	BM	26589	63	7	30
Frenchy	A	BM	525	0	0	0
Green Butte	A	EC	45265	9	4	2
Hamilton	A	BM	3410	7	4	0.71
Hanscomb	A	BM	9105	4	3	0.74
Herberger	V	BM	553	0	0	0
Highway	A	BM	905	0	0	0
Hot Springs	A	PC	4693	0	0	0
House Creek	A	EC	3252	15	3	1
Hughet Valley	A	EC	1877	0	0	0
Hunter Cabin	A	BM	15892	0	0	0
Indian Creek	A	PC	2593	1	1	0.10
Indian Ridge	A	BM	3440	20	8	2.50
Izee	A	EC	22219	22	5	15
Jack Creek	A	BM	10358	55	8	17
Joaquin	A	BM	38	0	0	0
Justice	A	BM	825	0	0	0
Keeney Meadows	A	BM	450	1	1	0.08
Koehler	A	BM	1002	0	0	0
King	A	BM	2237	0	0	0
Lake Creek	V	PC	10195	15	5	7
Lewis Creek	A	BM	2604	0	0	0
Little Mowich	A	EC	317	0	0	0
Logan Valley	A	PC	3780	6	3	0.61
Lonesome	A	EC	32085	30	4	32
Long Creek	A	BM	50241	83	10	57
Lower Middle Fork	A	BM	59120	195	12	247
Lower Nicoll	A	EC	3966	0	0	0
Mcclellan	A	BM	2814	1	1	0.10
Mccoy Creek	A	PC	980	1	1	0.10
Mccullough	V	BM	627	5	2	13
Mt. Vernon / John Day	A	BM	50466	58	7	27
Muddy	A	EC	6621	13	3	1
Murderers Creek	A	BM	67075	20	11	53
Myrtle	A	EC	29407	32	5	7
Ninety Six	A	BM	300	0	0	0
North Fork	A	PC	31044	109	9	38
Ott	A	PC	29991	158	7	25
Pearson	A	BM	190	0	0	0
Pine Creek	A		40328	222	4	81
Poison	A	BM	74	0	0	0

Allotment Name	Status Active (A) Vacant (V)	District	Forest land allotment acres	Number of mapped invasive plant sites	Number of mapped invasive plant sites mapped	Acres of mapped Invasive plants
Rail Creek	A	PC	27135	2	2	0.20
Rainbow	A		30707	25	6	8
Reynolds Creek	A	PC	24028	261	7	42
Rosebud	A	BM	6912	34	5	44
Roundtop	A	BM	13708	44	7	12.5
Sawmill	A	EC	21461	2	2	0.09
Sawtooth	A		17724	43	7	237.1
Scatfield	A	EC	2327	0	0	0
Scotty Creek	A	BM	35817	7	2	13
Seneca	A	BM	19321	23	6	2
Silver Creek	A	EC	34716	6	3	1
Silvies	A	EC	8789	5	2	8
Slide Creek	A	BM	25540	32	5	27
Smoky	A	BM	9264	1	1	0.11
Snow Mountain	A	EC	12362	26	7	2
Snowshoe	A	BM	6386	2	1	0.20
Spring Creek	A	PC	57772	60	6	39
Star Glade	A	PC	1999	0	0	0
Story-Fry	A	EC	619	3	2	0.22
Sugarloaf	A		39879	43	10	6
Sullens	V	PC	46426	316	7	171
Summit Prairie	A	PC	25369	42	7	15
Upper Middle Fork	A	BM	54808	218	13	338
Van	A		6684	15	3	11
War Canyon	A	BM	541	0	0	0
West Malheur	A		22938	52	4	7
West Myrtle	A	EC	8541	25	4	6.50
Williams Pasture	A	BM	1146	0	0	0
Windy Point	V	BM	1306	0	0	0
Wolf Mountain	A		31608	28	6	12
York	A	BM	929	5	2	1

Table 75. Allotment use and invasive plants

Allotment Use	Allotment Acres	Percent of Total Forest Land	Infested Acres	Percent of Allotment Acreage Occupied by Invasive Plants
Active	1,614,599	95.01%	1682	0.10%
Vacant	80,629	4.74%	442	0.50%
Total	1,695,228	99.75%	2124	0.13%

Grazing and Invasive Plant Spread

Seed dispersal for many species, including diffuse knapweed, Canada thistle, scotch thistle, and whitetop, is largely by wind (Bullock and Clarke 2000, CWMA 2007, USDA Forest Service 2012a, USDA Forest Service 2012b, Zouhar 2004); however, these seeds and seeds of other invasive plants present in the Malheur National Forest range allotments can also be spread by vehicles, water transport, and animals (fur, hooves, and gastrointestinal ingestion and redistribution).

In areas where invasive species are interspersed with desirable forage, it is likely that seeds would either attach to fur or mud on hooves or be ingested and dispersed in feces. Some weed seeds are destroyed within the gastrointestinal tract; however, leafy spurge and spotted knapweed seeds can pass through sheep, goats, and mule deer and some of the seeds remain viable (Lacey et al. 1992). Leafy spurge seed was shown to be viable in feces 10 days post ingestion by mule deer. Long-lived seeds and hard seeded species of dicots and grasses consumed by grazers have been reported to survive passage through gastrointestinal tracts of cows and grizzly bears (Janzen 1984).

Cattle congregate along fence lines and around water developments, which can result in disturbed areas for plant species establishment. More than half the acreage five feet on either side of mapped fences in the GIS data set overlap with invasive plant infestations. This indicates a high potential for weed spread from cattle trailing along fence lines. Five water developments mapped in the GIS data set are within 25 feet of invasive plant infestations. Not all fence lines and water developments are mapped, so these are likely to be low estimates.

3.8.3 Environmental Consequences

Introduction

This section addresses the effects of the alternatives on grazing allotment administration and range resources (livestock and forage). The effect of invasive plant treatments on range administration is not a significant issue identified in Chapter 1.

As project design feature N2 suggests (Table 10), range administration adjustments to protect range resources from invasive plant treatments could be necessary and would be addressed through existing administrative mechanisms, such as grazing allotment management plans and grazing permits. Potential adjustments that could be used to address invasive plants or potential introductions may include:

- Changes in livestock movement patterns that require additional labor or may reduce outputs for certain allotments
- Alterations to season of use (length, turn-on, turn-off, etc.) and intensity of use that could reduce outputs and could include resting of pastures resulting in reduction of livestock use and output
- Passive restoration of native plant communities could require allotment resting for one to two seasons potentially reducing livestock use and output. In some cases, fencing can be used to mitigate impacts.
- Delayed reintroduction of livestock following wildfires resulting in reduced livestock use and outputs over time

The effects spatial area is the project area and nearby private, state and other federal lands. The time frame of the analyses includes the past 20 years and the next 15 years. Invasive species have been present on the Forest for over 20 years with variable management efforts. Over this time, the recognition of the ecologic implications of invasive plants has grown, so older documents, such as the Land Resource Management Plan, do not recognize specific details of invasive plant management.

Effects Common to Action Alternatives on the Range Resource by Treatment Method

Herbicide Use

Compared to the no-action alternative, more chemicals would be used in the environment while effectively treating invasive species in the three action alternatives. The potential for a spill to occur during herbicide operations would be greater than under the no-action. Minimal to no effects are anticipated to grazers or operators due to strict adherence to label handling directions and spill containment protocols.

Livestock grazing is a known cause of invasive plant spread (DiTomaso 2000). Removal of livestock would reduce one of the vectors of invasive species spread, but this is not proposed in this project. No studies have rigorously tested this hypothesis or the effects of wild ungulates in spreading non-native plant species. Scientific support is growing for the hypothesis that large herbivores facilitate the invasion and establishment of invasive plants; however, substantial controversy exists about the specific process in time and space and the associated predictions of effects. See the Introduction to Cumulative Effects section in chapter 3.1.5 for a discussion of the relative influence of grazing compared to other potential vectors on the Malheur National Forest.

Label Restrictions Relative to Range

Table 77 describes the herbicide label restrictions relevant to grazing management.

Table 76. Herbicide label restrictions relevant to range

Herbicide	Restriction	Remarks
Aminopyralid	Grasses treated in the preceding 18 months CAN NOT be moved off the farm or ranch where harvested unless allowed by supplemental labeling. Hay treated in the preceding 18 months CAN NOT be used for silage, haylage, bailage and green chop unless allowed by supplemental labeling. Do not use hay or straw from areas treated within the preceding 18 months or manure from animals feeding on treated hay in compost. Do not use grasses treated within the preceding 18 months for seed production.	May be used up to the water's edge.
Chlorsulfuron	None for grazing or range administration	--
Clopyralid	Redeem: Do not graze treated areas until plants are dry and no longer palatable to livestock. Withdraw livestock from grazing treated grass at least 3 days prior to slaughter.	See label for cropland grazing restrictions post treatment in pastures. Redeem: Herbicide application may increase palatability of treated plants.
Glyphosate	None for grazing or range administration	Roundup®: ingestion of this product or large amounts of freshly sprayed vegetation may cause temporary gastrointestinal irritation.
Imazapic	Plateau: None. Plateau DG: Do not use on areas to be grazed.	--
Imazapyr	Arsenal: none. Chopper: none. Stalker: none.	--
Metsulfuron methyl	None for grazing or range administration	--
Sethoxydim	None for grazing or range management.	--

Herbicide	Restriction	Remarks
Sulfometuron methyl	None for grazing or range management.	--
Picloram	Tordon 101/22K/K: allow one week of grazing/feeding in non-exposure area before moving livestock onto broadleaf cropland. Tordon 22K: herbicide application may increase palatability of treated plants. Don't graze treated areas until plants are dry and no longer palatable. Meat animals grazing for up to 2 weeks after treatment should be removed from treated areas 3 days prior to slaughter.	--
Triclopyr	Garlon 4: Do Not allow lactating dairy animals to graze treated areas until the following growing season after treatment. Do not harvest hay for 14 days after treatment. Withdraw livestock from grazing treated areas at least 3 days before slaughter.	

Treating pastures that are currently in rest due to grazing management rotations would eliminate any potential effects. If movement of livestock is not possible and pastures or allotments require treatment while animals are present, all label use restrictions would be followed in addition to pdfs that require permittee notification prior to any proposed application. In addition, timely notification and coordination would occur during annual operating instruction/plan meetings and by posting/signing areas to be treated prior to and after treatment (R6 FEIS 2005).

Herbicides that may adversely affect grazing animals (clopyralid, triclopyr, and picloram) have label restrictions on grazing after herbicide treatment (table 77). These herbicides would have more potential for adverse effects to livestock than the first-choice herbicides: however, use of label restrictions and pdfs would minimize potential effects.

Other Treatment Methods

Manual treatments would be used in small areas and would not likely affect livestock, except to remove the invasive plants, including possibly toxic species, and potentially increase the amount of forage. Mechanical treatment would most likely involve mowing along roadsides. Mechanical treatments would not likely affect livestock use. It would temporarily remove invasive plants, but would not eliminate them. Biological controls would reduce amounts of invasive plants and allow for native species to expand. Cultural controls would be used in very small areas and would not likely affect livestock.

An actual reduction in Animal Unit Month (AUM) attributed to invasive plant management cannot be quantified at the project scale due to unavailable data, variability between allotments, and the ongoing process of Allotment Management Plan revision. All action alternatives would include restoration, where needed, to facilitate recovery of native plants.

Early Detection/Rapid Response

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

The action alternatives would allow treatment of new detections (EDRR), as long as the treatment method is within the scope of this EIS. The implementation planning process identified in Chapter 2 would be used with each new infestation site to determine treatment. The pdfs have been set up to provide layers of caution so that even if the exact locations are not known, the potential for adverse effects are minimized. Implementation of pdfs and herbicide-use buffers and treatment limits would work together to provide sideboards to deal with the uncertainty of treating new sites (USDA Forest Service 2008b).

Direct, Indirect, and Cumulative Effects of Alternative A

Implementation of alternative A means there would be no treatment and no direct, indirect, or cumulative effects on range. Invasive plants would continue to degrade livestock forage and could spread into neighboring rangelands. Alternative A would not meet the purpose and need or comply with current management direction relative to invasive plants and range.

Direct and Indirect Effects of Alternative B

Effective invasive plant treatments on grazing allotments would help retain and increase the native vegetation that provides livestock forage. Livestock exposure to toxic weed species would be reduced.

First-choice herbicides proposed for alternative B are expected to have no adverse effects to livestock. Other herbicides that may be used have some potential impacts on livestock as discussed above but risks would be minimized by pdfs that keep rates low and coordination with permittees that ensures label requirements for moving livestock during spraying are followed (table 10, N Group).

There are no restrictions on livestock use for the first-choice herbicides. There are restrictions on uses of grass, hay, and straw sprayed with aminopyralid, but none for livestock grazing. There are grazing restrictions with use of clopyralid, imazapic, picloram, and triclopyr. Project design features would be adequate to prevent effects to livestock.

Given the relatively short half-lives, the low rates of application proposed, and the minimal effects of the first-choice herbicides proposed under alternative B, it is not likely that repeated applications in the same areas would have effects to livestock. Herbicide risk assessments considered chronic exposure, and even under those scenarios, effects were below the established thresholds.

Management options include timing and duration of grazing, patterns of use, requirements to use only weed-free feed, and the potential of quarantine periods if these activities are implemented on allotments. Operators may experience a slight loss of grazing opportunity; however, many of the grazing strategies within allotments have deferred rotations and by focusing invasive weed treatments to the pastures during the resting phase would avoid most or all potential impacts to operators.

Alternative B would be more effective at reducing invasive plants (80 percent) than the other alternatives and restoration may begin sooner, so benefits of invasive weed treatment would be experienced earlier under alternative B.

Direct and Indirect Effects of Alternative C

This alternative would result in fewer acres of herbicide use; no broadcast herbicide application; no herbicide use within 100 feet of streams and within 200 feet of wells; and no use of Picloram. Impacts to livestock operators would be similar to those described in alternative B. The potential for exposure of livestock and livestock managers would be slightly decreased as less chemical would be used within riparian areas. Livestock would not be exposed to effects from picloram.

Manual and mechanical treatments would increase. Approximately 1,389 acres would be treated solely with non-herbicide methods. Non-herbicide treatments would not affect livestock, but treatments in riparian areas where cattle congregate could result in short periods of bare soils that could result in increased erosion and sedimentation with cattle use. As noted in chapters 3.4 and 3.5, sediment delivery from this project would be minimal.

Direct and Indirect Effects of Alternative D

Compared to alternative B, more chlorsulfuron, glyphosate, metsulfuron methyl, and picloram, would be used instead of aminopyralid. The herbicide use rates, pdfs, and herbicide-use buffers associated with aminopyralid would become non-applicable. Alternative D would have less broadcast spraying and more spot spraying, so there would be less potential for damaging or destroying non-target vegetation and forage. Alternative D would use picloram on 27 acres. Picloram has the potential for adverse effects to livestock, but project design features and label restrictions would lower risks. When picloram is used, grazing would be eliminated during herbicide treatment until treated plants are dry and no longer palatable. Meat animals grazed for up to two weeks in areas treated with Tordon 22k should be removed three days prior to slaughter. Project design features are adequate to prevent harmful herbicide exposure to livestock. Permittees would be notified of herbicide application and would be required to move cattle to follow pdfs and herbicide label restrictions.

Cumulative Effects of Action Alternatives

Long-term effects of the action alternatives would be beneficial to range resources. Implementation of action alternatives would gradually reduce the extent and abundance of invasive plant species on range allotments. Coordination with neighbors would increase overall weed control effectiveness because treatments would reduce invasive infestations on National Forest system land, weed seeds, and invasive plants spreading onto neighboring lands. As the spread of invasive species on National Forest System lands decreases, the likelihood of weeds spreading onto private, tribal, state, and lands of other ownerships would also decrease. Over time, this could reduce herbicide use on National Forest and adjacent land ownerships.

Since grazing allotments cover essentially the entire Malheur National Forest, any activities that produce ground disturbance on the Forest may increase the spread of invasive plants and reduce the amount of forage available for livestock. Therefore, although treatments proposed under alternative B would reduce invasive infestations and all management activities follow guidelines to prevent or reduce the spread of weeds, new infestations or spread of remaining infestations would continue to occur. As a result, herbicide applications would likely continue to be needed over time. We expect, however, that after current infestations are reduced or eradicated with initial treatments, follow-up treatments and treatments of new infestations would require less herbicide over smaller areas. Herbicide treatment of invasive species on lands near or adjacent to the Forest would likely continue, and amounts, types, and methods of application cannot be anticipated.

The action alternatives all include the EDRR component allowing treatment of newly detected infestations; however, other landowners may or may not have the flexibility, funds, or staffing to implement EDRR. Because the extent of future treatment programs on lands of other ownerships is unknown, the effect this would have on invasive plants migrating onto National Forest System lands is also unknown.

Table 28 and table 29 list projects and activities that are ongoing or foreseeable on the Malheur National Forest. The other projects do not involve weed treatment or herbicide use. Since no direct or indirect effects to livestock or range management are expected, this project would not add to any effects from those projects and activities. Therefore, there would be no adverse, cumulative effects to range resources from this project. In the long term, all action alternatives would favor re-establishment of desirable plant communities within the project area and across ownership boundaries, especially where coordinated treatments occur.

3.9 Recreation and Special Places

3.9.1 Introduction

Introduction of invasive species can have notable impacts on recreational resources and activities. These impacts may have a range of effects depending on species, plant architecture, plant chemical composition, and/or associated environmental alteration.

Invasive species may be introduced at developed campgrounds, dispersed camp sites, trailheads, snow parks i.e., recreation parking areas for unloading/loading snow machines, boat launch areas, visitor centers, or interpretive sites. Even more insidious is when invasive species are introduced along trails or at remote wild and scenic, wilderness, or other back country areas. In these special designated areas, detection, mapping, and treatments may often present a greater challenge. Wilderness or Wild River special areas typically prohibit use of motorized equipment for treatment, and often may restrict other treatments commonly used in other areas, such as biological control.

This section of the EIS discusses potential herbicide effects on people and animals when used in areas frequented by recreationists, such as campgrounds, dispersed camping sites, interpretive sites, and trail systems. It also addresses the effects of herbicide use changing the wild character of roadless areas (IRAs), Wildernesses, Wild and Scenic Rivers (WSR), National Scenic Areas (NSA), National Scenic Trails (NST), and Research Natural Areas (RNA).

The public has expressed concerns about herbicide use in these special areas, as well as preventing or controlling invasive species vectors associated with recreational uses, including OHV travel, recreation stock use, and other traditional recreation uses, such as site seeing, recreational driving, hiking, camping, and picnicking.

The Forest Service uses a nationally recognized classification system called the Recreational Opportunity Spectrum (ROS) to describe different recreation settings, opportunities, and experiences that help guide recreation management decisions and activities on National Forest lands (USDA Forest Service 1986).

ArcGIS 9.3.1 geographic information system (GIS) was used to analyze the proposed activities in regards to recreation use and facilities, dispersed recreation sites, and the recreation opportunity spectrum (ROS) classes within the project area. The recreation analysis considered the area within the project area, unless otherwise noted. Estimates of recreation use are derived from the National Visitor Use Monitoring (NVUM) inventories done on the Malheur NF in 2003-04 and 2009-10. These inventories are conducted for all national forests on a 5-year cycle. These two NVUM surveys are the basis for estimating present recreation use and demand and for projecting the growth of recreation use on the Malheur NF.

Data Gaps and Limitations

The NVUM inventory process has limitations that should be understood. Visitor use is measured at specific predetermined recreation sites falling into high, medium, or low use categories. Small or infrequently used sites are not included in the inventories. However, they may represent a significant contribution to a given recreational pursuit and not be adequately represented in the data. In addition, participation is voluntary and some visitors, or activities, may better lend themselves to interviewing. For example, a party pulling a pack string may be less inclined to participate because the disruption may provide opportunity for the string to get into trouble. Consequently, the data is collected from a segment that is willing or able to participate and extrapolated to represent visitor use as a whole.

Invasive species survey data for Wilderness Areas, Wild portions of the Wild and Scenic Rivers, and for the Scenic Area are limited. Invasive species surveys in these more remote areas with limited access makes surveying for invasive species a more time and funding intensive workload.

3.9.2 Affected Environment

Recreation Uses

Recreation use was inventoried on the Malheur National Forest during the years 2004 and 2010. There was a dramatic decrease in the total number of forest visitors between the two sample dates. In 2004, Forest visits were estimated at 422,666 person days compared to only 261,400 person days in 2010, nearly a 40% decline in the number of forest visits between the two sample years.

The NVUM system was used to capture the data. The Recreation Report provides detailed data showing that hunting is a major use on the Forest, along with driving for pleasure, camping, hiking, relaxing and viewing wildlife. Most of these activities necessitated the use of motorized vehicles to access all or part of the activity. This consistent association between recreation activities and motorized use is an important consideration for successful invasive species management on the Forest.

Wilderness

The Forest contains two wilderness areas: Strawberry Mountain (68,700ac.) and Monument Rock (12,620 acres, see maps in the recreation report). The Wilderness Act prohibits the use of motor vehicles, motorized equipment, motorboats, landing of aircraft, use of mechanical transport, and structures or installations within wilderness. These restrictions limit many of the major invasive species vectors. However, recreators, pets, pack stock, livestock grazing, wildlife, and natural seed dispersal have successfully introduced invasive plants into these areas.

Current invasive species surveys have documented 2.2 acres of invasive plant infestations at 8 locations in the wildernesses. The wilderness surveys are not considered complete and ongoing awareness and additional surveying will be essential for managing invasive species within these special areas. In addition, invasive plant sites occur at or near some of the wilderness trail heads and on roads leading to, and adjacent to, the wilderness areas. It is likely more infestations will arise in the future. Higher use levels, such as near trail heads, along trails, in riparian areas, in recent burns, or in concentrated use campsites are known vectors for spread (see Chapter 3.1).

Wild and Scenic Rivers

Two congressionally designated wild & scenic rivers (WSR) lie within the Forest, the Malheur River WSR and the North Fork of the Malheur WSR (see maps in the recreation report). The Malheur River WSR is 12 miles long with 6 miles designated as Wild and 6 miles designated as Scenic. The WSR corridor is comprised of 2,961 acres designated wild and 797 acres designated scenic totaling 3,758 acres. The North Fork of the Malheur River WSR is designated a scenic WSR for 22.9 miles with the corridor encompassing 7,034 acres.) The Malheur National Forest LRMP, as amended by their respective Malheur and North Fork Malheur WSR Plans, generally prohibits motorized use off Forest system roads and trails within both the Scenic and Wild boundaries of both rivers. These motorized access restrictions will aid in reducing the risk of introducing invasive plant species. There remain other vectors associated with recreational uses (e.g., dispersed campsites, hiking, horseback riding, and livestock grazing) in some areas, which may serve as vectors for invasive plant species. Current invasive plant surveys in the WSRs indicate infestations totaling 0.9 acres. Additional infestation will most likely be associated with areas of heavier use, such as near trail heads, along the river riparian zones, along trails, in concentrated campsites, and in recent burns.

Inventoried Roadless areas (IRA)

Inventoried Roadless Areas (IRA) were identified under the 2001 Roadless Area Conservation Rule. Nineteen IRAs are designated on the Malheur National Forest (maps in the recreation report). These IRAs have a total of 188,000 acres of National Forest System land. The LRMP recognizes these special areas as combined portions of the Semi-Primitive Non-Motorized, Semi-Primitive Motorized, and Wild and Scenic River Management Areas (MAs 10, 11, and 22). The motorized vehicle restrictions in portions of the IRAs are somewhat similar to restrictions in Wild and Scenic Rivers corridors and Semi-Primitive Non-Motorized management areas. This will aid in reducing the likelihood of invasive species introduction and spread within IRAs via motorized recreation activities. The Semi-Primitive motorized IRA would have reduced motorized access and hence less potential for infestation spread by motor vehicle access, but not quite to the extent enjoyed by Wilderness and Wild Rivers areas. Current IRA invasive plant infestations total 25 acres comprised of 50 known locations. Additional infestations will most likely occur in areas receiving heavier visitor use, such as along trails, in riparian zones, in concentrated campsites, and in recent burns.

Table 77. Acres of Inventoried Roadless Areas

Inventoried Roadless Areas	Acres
Aldrich Mountain	4,924.72
Baldy Mountain	6,415.93
Cedar Grove	113.98
Dixie Butte	12,207.98
Dry Cabin	12,273.64
Flag Creek	7,716.41
Fox Creek	5,845.93
Glacier Mountain	19,568.38
Greenhorn Mountain	15,927.16
Jumpoff Joe	3,889.62
Malheur River	7,282.54
McClellan Mountain	21,213.02
Myrtle Silvies	11,678.69
Nipple Butte	11,353.90
North Fork Malheur	18,068.60
Pine Creek	5,461.57
Shaketable	6,763.89
Silver Creek	7,948.20
Utley Butte	9,699.11
Total IRA Acreage	**188,353.26**

National Scenic Areas

The Malheur National Forest has one National Scenic Area, the Vinegar Hill – Indian Rock Scenic Area comprised of 17,234 acres (see map in recreation report). The management direction for Scenic Areas is to manage this area to preserve and protect outstanding natural esthetics. Current known invasive plant infestations total 2.4 acres. Motorized travel is restricted within the NSA to winter use only. As with other special areas that prohibit or restrict motorized access, which is a major source of invasive introductions, the likelihood of introducing or spreading invasive species is commensurately reduced. Additional infestations will most likely occur in areas receiving heavier visitor use, such as along trails, in riparian zones, in concentrated campsites, and in recent burns.

Other Semi-Primitive Areas

Recreation opportunities on the Malheur NF are focused toward meeting forest management objectives as identified in the Malheur LRMP. However, the rise in motorized activity over the past two decades represents a substantial change with profound potential toward affecting opportunities within the full (recreation opportunity spectrum) ROS. An increase in motorized activity in the more primitive ROS holds the potential for introducing and spreading invasive species into less frequented areas, hence decreasing the likelihood of implementing EDRR (early detection/rapid response).

Maintaining a road infrastructure in the face of shrinking budgets is increasingly problematic and has resulted in an increase in the number of “challenging” and rugged roads on the Forest, e.g., Deer Creek or Crane Crossing. In addition, management presence has diminished generally across the Forest as budgets for field going personnel and signing has diminished. When considered in combination, the extensive road system, predominant importance of road based recreation activities, and low Forest Service presence increase the opportunity for invasive species establishment and overall diminish the success of implementing an effective EDRR strategy. Protection of primitive areas is of particular interest and concern.

3.9.3 Environmental Consequences

Introduction

Table 79 below shows the number of invasive plant sites currently within recreation resource areas and how many acres are proposed for herbicide treatment based on the current inventory.

Table 78. Invasive Plants Sites that may be Treated by Recreation Resource Area: No Action Compared to Action Alternatives

Recreation Resource Areas	Number of known sites	Acres Alternative A	Acres Action Alternatives
Wilderness Acres	8	0	2.2
Wild and Scenic Rivers	15	0	0.9
Scenic Areas	4	0	2.4
Other Semi-Primitive Areas (ROS)	15	0	4.2
IRAs	50	0	61.2
Within 500 meters of developed recreation sites	108	0	121

The analysis area encompasses these types of recreation areas.

Alternative A – No Action

Under the no-action alternative, there would be no direct effects to the Malheur National Forest recreation resource areas of Wilderness, Wild and Scenic Rivers, Scenic Areas, Semi-Primitive Non-Motorized ROS areas, IRAs, and developed and dispersed recreation sites.

The current infestations would most likely continue to expand and new infestation sites would establish. Over time, it would be expected that the Wilderness character and values would be negatively affected by expanding infestations. The Wild and Scenic River Outstanding Remarkable Values (ORV) would be negatively affected by expanding infestations. The Scenic Area outstanding natural esthetics would be negatively affected by expanding invasive species infestations. Over time, the SPNM and IRA area’s natural environments would be negatively affected by expanding infestations. This degradation would further reduce the natural beauty and character of the SPNM and IRA areas.

Dispersed recreation also occurs throughout the Malheur National Forest. Dispersed recreation includes a wide variety of activities including hunting, fishing, driving for pleasure, firewood cutting, horseback packing and riding, road and mountain biking, camping, picnicking, wild plant collecting (mushrooms, camas, ferns, etc.), and OHV riding. Over time, it would be expected that the scenic and natural appearing forest character of dispersed recreation sites would be impaired depending on the particular recreation activity and the nature of the invasive infestation.

Direct and Indirect Effects of Action Alternatives

All action alternatives provide for some level of effective invasive species treatments. These alternatives differ in that alternative C imposes strict limitations on herbicide application and alternative D, while similar to alternative B, would not provide for application of aminopyralid. Alternative C would eliminate broadcast spraying, eliminate picloram and prohibit herbicide use within 100 feet from creeks, lakes, ponds, and wetlands.

Wilderness Areas

Invasive species would continue to be pulled by hand or hand tools where practical. Cultural, mechanical, and motorized control methods would not be utilized in wilderness areas. Herbicide application would be used in accord with the pdf D1 using non-motorized methods, such as spot spraying with backpack or mule packed application equipment.

Infestations that would affect wilderness character and values would be evaluated for treatment and if suitable given a high priority for treatment. New sites would be evaluated for suitable treatment(s) using the EDRR process. In order to conduct treatments other than hand pulling a minimum decision analysis would be conducted and documented.

The use of herbicides in wilderness areas may reduce the wilderness experience for some users in the short term, but active treatment provides the best protection of wilderness character and values. The purpose and need for invasive plant treatment is not driven primarily by convenience or administrative cost. In addition, invasive plants have an adverse effect by disrupting natural processes. Invasive species may alter native plant communities and have indirect effects with wildlife species that rely on the native plant communities. Invasive species may also alter fire regimes that may ultimately alter wilderness ecological processes.

By following the pdfs, it is anticipated invasive species infestations would be reduced or eliminated, and the rate of spread retarded. This would result in recovery or protection of wilderness character and values. It is likely that most sites discovered in wilderness in the future would be relatively small infestations and the effects of treatment would be minor. The visual impact of the short-lived blue dye may result in visual impacts to the recreation experience of some visitors. However, these effects would be short term and limited to the vicinity of the treated site. Compared with implementing alternative B, alternatives C and D would have less cost effectiveness (see Chapter 3.1.5).

Wild and Scenic Rivers

Infestation sites in the Wild and Scenic River corridors would be treated. Depending on the chosen alternative, the treatment method would vary among alternative by the method and herbicide used. Compared with implementing alternative B, alternative D is estimated to decrease cost effectiveness. Under alternative C, no herbicide would be used within 100 feet of streams (treatment there would consist of hand pulling, biological, cultural, and mechanical methods). Alternative C would be less effective overall in treating infestations (see Chapter 3.1.5).

The use of herbicides in Wild and Scenic Rivers may reduce the 'wild' experience for some users in the short term especially in the Wild designated corridor, but active treatment provides the best protection of the outstanding and remarkable values. Treating Wild and Scenic River infestations would have short-term adverse effects by introducing human manipulation, but would result in long-term beneficial effects to wilderness character and values by restoring natural conditions.

By utilizing the appropriate pdf treatment methods, it is anticipated invasive species infestations would be eliminated, reduced, and the rate of spread retarded. This would result in recovery or protection of Wild and Scenic ORVs. It is likely that most sites discovered within the Wild and Scenic River corridors in the future would be relatively small infestations and the effects of treatment would be minor. The visual impact of the short-lived blue dye may result in visual impacts to the recreation experience of some visitors. However, these effects would be short term and limited to the vicinity of the treated site.

Scenic Areas

Infestation sites in the Scenic Area would be treated by hand pulling, mechanical, motorized (where accessible), cultural, and herbicide application. Depending on the chosen alternative, the treatment method would vary among alternative by the method and herbicide used. Under alternative C, no herbicide would be used within 100 feet of streams, including Wild and Scenic Rivers.

By following the pdfs, it is anticipated invasive plants infestations would be reduced or eliminated. This would result in recovery or protection of the outstanding natural esthetics of the Scenic Area. It is likely that most sites discovered within the Scenic Area in the future would be relatively small infestations and the effects of treatment would be minor. The visual impact of the short-lived blue dye may result in visual impacts to the recreation experience of some visitors. However, these effects would be short term and limited to the vicinity of the treated site.

ROS Semi-Primitive Non-Motorized (SPMN) and Inventoried Roadless IRAs

Infestation sites in the SPMN and IRA areas would be treated by hand pulling, mechanical, motorized (where accessible), cultural, and herbicide application. Depending on the chosen alternative, the treatment method would vary among alternative by the method and herbicide used.

By following the pdfs, it is anticipated invasive species infestations would be reduced or eliminated, and the rate of spread retarded. This would result in recovery or protection of the native species. It is likely that most sites discovered within the SPNM and IRA areas in the future would be relatively small infestations and the effects of treatment would be minor. The visual impact of the short-lived blue dye may result in visual impacts to the recreation experience of some visitors. However, these effects would be short term and limited to the vicinity of the treated site.

Recreation Sites

Infestation sites in and near recreation sites would be treated by hand pulling, mechanical, motorized (where accessible), cultural, and herbicide application. Depending on the chosen alternative, the treatment method and herbicide used would vary. It is estimated using alternative C and D would be less effective overall in treating infestations due to the limitations on herbicide type and allowed use.

By following the pdfs, it is anticipated invasive plant infestations would be reduced or eliminated. This would result in recovery or protection of the scenic and natural appearing forest character. It is likely that most sites discovered within and near the recreation sites in the future would be relatively small infestations, and the effects of treatment would be minor. The visual impact of the short-lived blue dye may result in visual impacts to the recreation experience of some visitors. However, these effects would be short term and limited to the vicinity of the treated site. Recreation sites undergoing treatment would be marked and forest visitors would be discouraged from recreating near recently treated sites and may choose to relocate to alternative recreation sites. However, this effect would be of short duration.

Dispersed Recreation

Infestation sites in and near dispersed recreation sites would be treated by hand pulling, mechanical, motorized (where accessible), cultural, and herbicide application. Depending on the chosen alternative, the treatment method and herbicide used would vary. It is estimated using alternative C and D would be less effective overall in treating infestations due to the limitations on herbicide type and allowed use.

Dispersed recreation occurs throughout the Malheur National Forest. Dispersed recreation includes a wide variety of activities including hunting, fishing, driving for pleasure, firewood cutting, horseback packing and riding, road and mountain biking, camping, picnicking, wild plant collecting (mushrooms, camas, ferns, etc.) and OHV riding. Dispersed recreation most likely will occur in all of the treatment areas to some extent. By following the pdfs, it is anticipated invasive species infestations would be reduced or eliminated, and the rate of spread retarded. This would result in recovery or protection of the scenic and natural appearing forest character. It is likely that most sites discovered within and near dispersed recreation sites in the future would be relatively small infestations and the effects of treatment would be minor. The visual impact of the short-lived blue dye may result in visual impacts to the recreation experience of some visitors. However, these effects would be short term and limited to the vicinity of the treated site. Dispersed recreation sites undergoing treatment would be temporarily marked and forest visitors would be discouraged from recreating near recently treated sites. Visitors may relocate to alternative recreation sites. This impact would be of short duration.

Cumulative Effects

There are some foreseeable projects in recreation special uses that most likely will have additional invasive species effects. In 2011, the Forest completed implementation of the 2007 revised Outfitter-Guide policy. It is likely the Malheur National Forest will issue a minor number of special use permits for providing recreation services on Forest lands. The public has expressed interest or obtained temporary special use permits for activities, such as backpacking trips in the wilderness areas, ice climbing, road biking tourism, mountain biking tours, hunting, and horse day rides. As with current recreational activities, these additional services have the potential to act as invasive species infestation vectors.

It is also likely the Malheur National Forest will implement the 2005 Travel Management Rule in the foreseeable future. Two likely effects of addressing former Chief Bosworth’s four threats including “unmanaged recreation” (http://www.fs.fed.us/projects/four-threats/) are an increased use of OHVs on some Forest System roads and a dramatic reduction in cross-country OHV use. It is likely any increased recreation use on roads will commensurately increase the likelihood of invasive species infestations. However, eliminating uncontrolled cross-country travel is anticipated to significantly reduce the risk of invasive species infestations along closed roads and in the general forest area (GFA) no longer accessible to unmanaged OHV travel. Heightening public awareness of common pathways for invasive plant spread will help reduce that risk.

Because the effects of invasive plant treatments on recreation and scenic resources are minimal, limited, localized, and short-term, there is very little chance this project would accumulate with effects brought on by past, present, or future management activities.

Table 79. Summary of Potential Cumulative Effects on Recreation

Foreseeable Project Category	Potential Cumulative Effects on Recreation
Vegetation and Fuels Management Projects	Invasive plant treatments on the Forest may overlap in time and space with vegetation management projects. Vegetation management plans include measures to protect recreation and scenic resources, where applicable. Impacts from invasive plant treatments to recreation and scenic resources are limited to minor, short term visual effects and temporary closing of recreation sites. Measures protect the public from herbicide exposures that would exceed thresholds of concern. The impacts of invasive plant treatment are not likely to add to vegetation management impacts on recreation and scenic resources in any discernible way.
Allotment Management Plans and Grazing Projects	Impacts from invasive plant treatments to recreation and scenic resources are limited to minor, short term visual effects and temporary closure of recreation sites. Measures protect the public from herbicide exposures that would exceed thresholds of concern. Less than 1% of the acres in active allotments would be treated in a given year. The impacts of invasive plant treatment are not likely to add to grazing impacts on recreation and scenic resources in any discernible way.
Recreation Projects	Invasive plant treatments on the Forest may overlap in time and space with recreation projects. Impacts from invasive plant treatments to recreation and scenic resources are limited to minor, short term visual effects and temporary closing of recreation sites. Measures protect the public from herbicide exposures that would exceed thresholds of concern. Invasive plant treatment may improve the condition of recreation sites over the long term, contributing to the benefit of recreation projects.
Special Uses	Invasive plant treatments on the Forest may overlap in time and space with special use projects. Special use permits include measures to prevent the spread of invasive plants and protect recreation and scenic resources, where applicable. Major projects like pipelines and road realignments include restoration plans. Impacts from invasive plant treatments to recreation and scenic resources are limited to minor, short-term visual effects and temporary closures of recreation sites. Measures protect the public from herbicide exposures that would exceed thresholds of concern. The impacts of invasive plant treatment are not likely to add to the impacts of special use projects on recreation and scenic resources in any discernible way.
Aquatic and Riparian Habitat Restoration Projects	Invasive plant treatments on the Forest may overlap in time and space with aquatic and riparian habitat restoration. Restoration projects are often designed to promote native riparian vegetation, which may improve recreation and scenic values. Impacts from invasive plant treatments to recreation and scenic resources are limited to minor, short term visual effects and temporary closure of recreation sites. Measures protect the public from herbicide exposures that would exceed thresholds of concern. Invasive plant treatments will aid in restoration of riparian areas and are not likely to add to the impacts of restoration projects on recreation and scenic resources in any discernible way.
Travel Management Rule Implementation	Invasive plant treatments on the Forest will overlap in time and space with the Travel Management project. Impacts from invasive plant treatments to recreation and scenic resources are limited to minor, short term visual effects and temporary closures of recreation sites. Measures protect the public from herbicide exposures that would exceed thresholds of concern. Invasive plant treatments are not likely to add to the impacts of Travel Management on recreation and scenic resources in any discernible way.

3.10 Archeological Resources

3.10.1 Introduction

This section focuses on archaeological resources. The USDA Forest Service Advisory Council on Historic Preservation (ACHP) and the Oregon State Historic Preservation Office (SHPO) have a 2004 programmatic agreement addressing the management of cultural resources on national forests in the State of Oregon. There are several actions that were determined to have no potential to affect historic properties, including invasive plant species eradication through the application of herbicides and hand removal (including hand tools, such as shovels to dig up roots); recurrent brushing (hand, machine, chipping) activities to control vegetation within clearing limits of existing roads, trails, parking lots, and power line corridors; mulching and re-vegetating bare, erosion-prone surfaces, such as cuts and fills; and re-introduction of endemic or native floral species into their historic habitats.

Specific treatments that would be classified as actions with no potential to affect cultural resources, and therefore subject to Forest Specialist approval, on behalf of SHPO, include the following:

- Herbicide Application Methods (selective/hand, spot, and broadcast spray)
- Biological agents
- Cultural Methods limited to stock grazing
- Manual/Mechanical Methods (mowing, weed whipping, and hand pulling)
- Manual/Mechanical Methods (grubbing and wrenching) in areas that occur on landslides, flood deposits, previously surveyed areas where no archaeological sites occur, skid trails, landings, and road cuts and fill.

3.10.2 Affected Environment

The Malheur National Forest lies at the interface between the Columbia Plateau and Great Basin Culture Areas, and has been used by native peoples for thousands of years. To date, more than 5,000 archaeological sites have been identified within the Forest. Site-specific information regarding archaeological, historical, and traditional cultural resources is not presented in this document. The potential for impact is minor and short term to non-existent so site-specific archaeological information is not needed to make an informed decision. Comprehensive Archaeological Resource information is on file at the Malheur National Forest Headquarters in John Day, Oregon.

3.10.3 Environmental Consequences

Introduction

Effects to archaeological resources are assessed for each treatment method: manual, mechanical, cultural, and herbicide. Most of the proposed treatment areas have been previously disturbed by present day human activities, such as road construction and use (shoulders, cuts and fills). Archaeological sites are sometimes bisected by high use areas, such as roads, and thus could overlap invasive plant infestations. Geographic areas proposed for treatment include roadsides, quarries, administrative sites, campgrounds, parking areas, artificial clearings, meadows, and forested areas. Archaeological resources may occur in all of these locations although they may not be affected by the project, depending on the ground-disturbing potential of the action.

Alternative A – No Action

No action means that no treatments would take place and thus, no direct, indirect, or cumulative impacts on archaeological resources would occur.

Action Alternatives

Most of the treatment methods are not ground disturbing and therefore would have no direct or indirect effect on archaeological (cultural) resources. The sole exception may be weed wrenching and grubbing, manual techniques that have potential to disturb archaeological resources to a minor degree.

Should any action alternative be implemented, project design features would minimize or eliminate potential impacts, which are already of a minor nature. If weed wrenching and grubbing with a shovel is planned in areas that are outside landslides, flood deposits, previously surveyed areas, skid trails, landings, road shoulders, cut, and fills, the Forest Service archaeologist would have an opportunity to review treatment locations to determine if archaeological resources could be affected. Weed wrenching and grubbing techniques will not be used in known archaeological sites. Alternative treatment methods will be selected from those that would have low potential to affect archaeological resources. With application of the pdf, no significant direct or indirect adverse effects to archaeological resources are anticipated, and no contribution to cumulative adverse effects would occur.

Tribal Consultation and Treaty Rights

The Forest Service has communicated by letter with three affected tribes: The Confederated Tribes of the Warm Springs, the Confederated Tribes of the Umatilla Indian Reservation, and the Burns Paiute Tribe. The Forest Service outlined the project details and potential effects to archaeological resources.

The Warm Springs and Umatilla tribes signed treaties with the federal government in 1855 and later ratified by Congress. These treaties ceded to the United States legal title to millions of acres of land, and reserved and guaranteed certain rights exercised by Indian people to fishing, hunting, gathering roots and berries, and other activities. An 1868 treaty with the Burns Paiute Tribe was never ratified by Congress.

Executive Order 12898 directs federal agencies to consider patterns of subsistence hunting and fishing if an action will affect fish and wildlife. Under the proposed action, no adverse effects to treaty fishing sites, traditional cultural plant gathering areas, traditional plants, or subsistence related activities would occur.

The risk associated with direct herbicide contact and with ingesting contaminated fish, berries, or other plants is discussed in Section 3.2 Human Health. Given the types of treatments considered and the project design features (pdfs), no direct, indirect, or cumulative adverse effects on tribal or treaty rights would occur.

3.11 Specifically Required Disclosures

3.11.1 Irreversible or Irretrievable Impacts

No irreversible or irretrievable uses of resources are associated with this project. This project restores native vegetation in areas where non-native plants have been introduced. Herbicide treatments in accordance with the alternatives would have relatively short-lived impacts; effects on non-target species would be minimized; and effects would not be permanent. No adverse impacts on roadless areas or degradation of roadless area quality would occur.

3.11.2 Long-term Productivity

Soils would be protected in this project and no loss of long-term productivity is predicted. The no-action alternative could have negative impacts on long-term productivity if invasive plants become so dense as to change soil characteristics, and capacity for restoration to desirable plant communities is lost. The natural resources issues associated with this project have been resolved through adherence to project design feature (pdfs) that reduce or eliminate the potential for adverse effects. However, some adverse effects are inherent to invasive plant treatments and cannot be avoided. These include:

- Taxpayers will likely be responsible for the costs of some if not all of the treatments.
- Herbicide toxicity exceeding thresholds of concern are unlikely, but possible in the event of a large herbicide spill. The pdfs make the potential for a large spill extremely unlikely.
- Minor to moderate physical injuries during forestry work are possible.
- There may be temporary local effects on some groups of soil micro-organisms that are sensitive to certain herbicides. However, the pdfs address the potential for long-term impact to soil organisms or productivity.

- Some common non-target plants are likely to be killed by their close proximity to treatments. This is most likely with broadcast herbicide treatments and less likely (but possible) for all other treatment methods. The adverse effects of the invasive plants themselves far outweigh the potential for adverse effects of treatment.

3.11.3 Energy Requirements and Conservation Potential

No unusual energy requirements are associated with this project. No unusual equipment would be used.

3.11.4 Non-significant Land and Resource Management Plan (LRMP) Amendment

An amendment to the Malheur National Forest LRMP is proposed in Alternatives B and C to allow the use of aminopyralid. This is a non-significant amendment based on the National Forest Management Act implementing regulation for plans prepared under the 1982 Planning Rule (36 CFR 219.17)[28]. The proposed amendment would add one word (aminopyralid) to the existing standard 16 from the R6 2005 ROD that approved use of ten other herbicides. The risk assessment for aminopyralid was completed after a decision was made on the R6 2005 ROD. If the Forest Plan is amended, aminopyralid could be used for any invasive plant treatment on the Forest in accordance with this EIS.

Changes to the land management plan that are not significant can result from:

1. Actions that do not significantly alter the multiple-use goals and objectives for long-term land and resource management.
2. Adjustments of management area boundaries or management prescriptions resulting from further on-site analysis when the adjustments do not cause significant changes in the multiple-use goals and objectives for long-term land and resource management.
3. Minor changes in standards and guidelines
4. Opportunities for additional projects that contribute to achieving the management prescription.

Multiple Use Goals and Objectives

The proposed LRMP amendment does not affect multiple use goals and objectives and is intended to help the Forest Service achieve these goals on the Malheur National Forest.

Management Areas

The proposed amendment does not affect the boundaries or management direction for any management areas outlined in the LRMP.

Standards and Guidelines

The proposed LRMP amendment would approve use of an herbicide, aminopyralid, that is not currently listed among the ten approved by the Regional Forester in 2005 (R6 2005 ROD). The Risk Assessment (SERA 2007) for aminopyralid demonstrates that use of this herbicide would not pose new or significant risks compared to the ten already approved. Table 21 (chapter 3.1.2) shows a comparison between

[28] Under the 2012 Planning Rule (Title 36, Code of Federal Regulations, Part 219–Planning), the responsible official may complete and approve the plan revision in conformance with the provisions of the prior planning regulation, including the transition provisions of the reinstated 2000 rule (36 CFR part 299, published at 36 CFR parts 200 to 299, revised as of July 1, 2010). The transition provisions allow the use of the 1982 planning procedures (See CFR parts 200 to 299, Revised as of July 1, 2000). See the following hyperlink for the 1982 planning procedures http://www.fs.fed.us/emc/nfma/includes/nfmareg.html

aminopyralid and the herbicides already approved. Aminopyralid is generally a lower risk herbicide, and the proposed use would not pose additional risks to human health or the environment.

Additional Project Opportunities

The proposed LRMP amendment would allow more effective and efficient treatment of invasive plants by adding aminopyralid, an herbicide that is very effective on most of the invasive species found in the project area. It was developed specifically for wildland use and is effective at low rates. It requires less restrictions than most of the other herbicides already approved in the LRMP (for instance it can be broadcast sprayed to the water's edge, which would improve treatment effectiveness and efficiency relative to other herbicides).

3.11.5 Floodplains and Wetlands

Floodplains and wetlands would not be adversely affected by this project. As discussed in chapters 3.4, adverse effects to water quality and beneficial uses of water would be negligible. The extent of treatment and potential for water contamination is low, and all alternatives are designed to protect water resources.

3.11.6 Prime Farmlands

No prime farmlands would be adversely affected by this project. There could be a beneficial impact to the extent that the alternatives reduce the potential for invasive plant spread from the Malheur National Forest to prime farmlands.

3.11.6 Permits and Licenses

The R6 2005 ROD Standard 15 requires that application of any herbicides to treat invasive plants will be performed or directly supervised by a state or federally licensed applicator.

As discussed in Chapter 1.7.2, a Clean Water Act (National Pollution Discharge Elimination System - NPDES) permit is required for herbicide use that may directly enter streams (streambanks, target vegetation hanging over water bodies, treatment sites generally within three feet from a water body). Treatments on small portions of riparian infestations (currently mapped or detected in the future) may meet the criteria; however, the target invasive species on the Malheur National Forest are not riparian dependent. The current mapping is not refined enough to determine whether a permit will ultimately be needed; however, NPDES Pesticide General Permits would be obtained prior to implementing any treatments in which herbicide could be directly introduced into surface waters.

As discussed in Chapter 2 for the Implementation Planning Process that apply to all action alternatives, Form FS-2100-2 Pesticide Use Proposal, would be developed prior to herbicide treatment. In addition, as per FSH 2109.14.3, a pesticide use plan would be developed.

Chapter 4. Consultation and Coordination

List of Preparers and Consultation

Archer, Vince – Soils Scientist
Bautista, Shawna – Pesticide Use Coordinator; Herbicide Toxicology Analyst
Brooks, Paula J – Botanist
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A variety of specialists and managers from the Malheur National Forest and the Pacific Northwest Regional Office contributed information. Local invasive plant management information was obtained from Oregon State Department of Agriculture and local county invasive plant management staff. Consultation is ongoing with Native American Indian tribes, including the Confederated Tribes of the Warm Springs, the Confederated Tribes of the Umatilla Indian Reservation, and the Burns Paiute Tribe; the United States Fish and Wildlife Service; and the National Marine Fisheries Service. Several individuals and interest groups submitted comments during scoping periods in 2006 and 2011 (see chapter 1).

List of People to Whom This EIS has been Sent

Agencies and members of the public expressing interest in the project received notice that the Final EIS is available on request and on the web http://www.fs.fed.us/nepa/nepa_project_exp.php?project=35614. Hard copies or CD-ROM versions of the FEIS have been mailed directly to:

Individuals

Dick Artley
John D. George

Organizations, Industry, and Local Agencies

Executive Director	Northwest Coalition for Alternatives to Pesticides
Doug Heiken	Oregon Wild
Kristin Ruether	Oregon Natural Desert Association
Phil Turrell	Rocky Mountain Elk Foundation, Harney County Chapter
Harold Shepard	Center for Tribal Water Advocacy
Oregon Eastside Forest Committee	Juniper Group Sierra Club
Dan Bishop	Prairie Wood Products
	John Day, Snake Resource Advisory Committee
Karen Coulter	League of Wilderness Defenders, Blue Mountains Biodiversity Project
Jason Kehrberg	Grant Soil and Water Conservation District

Oregon State Agencies

Oregon Department of Fish and Wildlife

Federal Agencies

Director, NEPA Policy and Compliance, Department of Energy
U.S. Environmental Protection Agency, Region 10, EIS Review Coordinator
U.S. Fish and Wildlife Service

Local Officials

Judge Steve Grasty	Harney County Court
Judge Scott Meyers	Grant County Court

Tribal Contacts

Honorable Les Minthorn	Confederated Tribes of the Umatilla Indian Reservation
Honorable Diane Teeman	Burns Paiute Tribe
Honorable Ron Suppah	Confederated Tribes of Warm Springs
Honorable Stanley ‘Buck’ Smith	Confederated Tribes of Warm Springs

References

Allison, S.D. and P.M. Vitousek. 2004 Rapid nutrient cycling in leaf litter from invasive plants in Hawaii. Oceologia 141:612-619.

Altman, B. 2000. Conservation strategy for landbirds in the northern Rocky Mountains of eastern Oregon and Washington. Version 1.0. May. Oregon-Washington Partners in Flight. 121pp.

Altman, R and A Holmes 2000. Conservation Strategies for Landbirds in the Columbia Plateau of Eastern Oregon and Washington. 131 pp.

Anderson, J.J. and J.J. Dulka. 1985. Environmental fate of sulfometuron methyl in aerobic soils. J. Agric. Food Chem. 33: 596-602

Archer, A. J. 2001. Taeniatherum caput-medusae [Online]. Available: http://www.fs.fed.us/database/feis. [Accessed Aug 11, 2003].

Arora, David. 1986. Mushrooms Demystified. A comprehensive guide to the fleshy fungi. Second edition. Ten speed press, 1986.

Asher , J. 2000. War on weeds: winning it for wildlife. Paper presented at North American Wildlife and Natural Resources conference. Rosemont, Illinois. March 27. 17 pp.

Aubry, K.B., G.M. Koehler, J.R. Squires. 2000. Ecology of Canada lynx in southern boreal forests. Pages 373-369. In Ruggiero, Leonard F.; Aubry, Keith B.; Buskirk, Steven W.; Koehler, Gary M.; Krebs, Charles J.; McKelvey, Kevin S.; Squires, John R. 1999. Ecology and conservation of lynx in the United States. General Technical Report RMRS-GTR-30WWW. Fort Collins, CO: United States Department of Agriculture, Forest Service, Rocky Mountain Research Station. Available at: http://www.fs.fed.us/rm/pubs/rmrs_gtr030.html

Audubon 2013. White-headed Woodpecker. Available at: http://www.audubon.org/. Accessed 5/23/2013.

Bakke, D. 2001. A Review and Assessment of the Results of Water Monitoring for Herbicide Residues for the Years 1991 to 1999, Unpublished report by the Forest Service Pacific Southwest Regional Pesticide Use Specialist.

Bakke, David. 2002, 2007. Analysis of issues surrounding the use of spray adjuvants with herbicides. Unpublished report by the Forest Service Pacific Southwest Regional Pesticide Use Specialist.

Bakke, David. 2003. Human and Ecological Risk Assessment of Nonylphenol Polyethoxylate-based (NPE) Surfactants in Forest Service Herbicide Applications. Unpublished report by the Forest Service Pacific Southwest Regional Pesticide Use Specialist.

Banci, V.A. 1994. Fisher (Pages 44 and 47) and Wolverine (Pages 99-127). In L.F. Ruggiero, K.B. Aubry, S.W. Buskirk, L.J. Lyon, and W.J. Zielinski, eds. 1994. The scientific basis for conserving forest carnivores, American marten, fisher, lynx and wolverine in the western United States. United States Department of Agriculture For. Serv. Rocky Mt. For. and Range Exp. Stn., Gen. Tech. Rep. RM-254, Fort Collins, CO.

Barrows, C. W. 1996. Tamarisk control and common sense. In: Proceedings of the California Exotic Pest Plant Council; October 4-6; San Diego, CA.

Bashkin, M., T.J. Stohlgren, Y. Otsuki, m. Lee, P. Evangelista, and J. Belnap. 2003. Soil characteristics and plant exotic species invasions in the Grand Staircase-Escalante national Monument, Utah, USA. Applied Soil Ecology. 22(1): 67-77

Bautista, S. 2008. Climate Change and Invasive Plants: Information for PNW Invasive Plant NEPA. Unpublished report.

Bautista, S.L., and S.P. Bulkin. 2008. Herbicide Information Summary and Project Design Criteria Crosswalk. Forest Service Unpublished Internal Report. United States Department of Agriculture Forest Service, Region 6. Portland, OR. 36p.

Beck. 2008. Diffuse and Spotted Knapweed. Colorado State Extension Service. Fact Sheet 3.111.

Bedunah, D.; Carpenter, J. 1989. Plant community response following spotted knapweed (*Centaurea maculosa*) control on three elk winter ranges in western Montana. 1998 Knapweed Symposium; Bozeman, MT.: Plant & Soil Department and Extension Service, Montana State University.

Benefield, C.B., J. DiTomaso, G.B. Kyser, S. Orloff, K.R. Churches, D.B. Marcum and G.A. Nader. 1999. Success of mowing to control yellow starthistle depends on timing and plant's branching form. California Agriculture 53:17-21. Available online at: http://californiaagriculture.ucanr.org/landingpage.cfm?article=ca.v053n02p17&fulltext=yes

Berg, N. 2004. Unpublished. Assessment of Herbicide Best Management Practices: Status of Our Knowledge of BMP Effectiveness. Pacific Southwest Research Station, United States Department of Agriculture Forest Service, Albany CA.

Berrill, M., S., Bertram, and B., Pauli. 1997. Effects of Pesticides on Amphibian Embryos and Larvae. Herpetological Conservation 1: p.233-45.

Berrill, M., S., Bertram, L., McGillivray, M., Kolohon, and B., Pauli . 1994. Effects of low concentrations of forest-use pesticides on frog embryos and tadpoles. Environmental Toxicology and Chemistry 13(4): p.657-64.

Blossey, B. 1999. Before, during, and after: the need for long-term monitoring in invasive plant species management. Biological Invasions 1:301-311. - Deschutes

Blus, L.J., C.S. Staley, C.J. Henny, G.W. Pendleton, T.H. Craig, E.H. Craig, and K.K. Halford. 1989. Effects of organophosphorus insecticides on sage grouse in southeastern Idaho. Journal of Wildlife Management 53: 1139-1146.

Bollag, J.M., and S.Y. Liu. 1990. Biological Transformation Processes of Pesticides. In Pesticides in the Soil Environment. H.H. Cheng. (ed.) Soil Science Society of America book series, no. 2. Madison, Wis., USA: Soil Science Society of America. p. 169-211

Bramble, W.C., R.H. Yahner, and W.R. Byrnes. 1997. Effect of herbicides on butterfly populations of an electric transmission right-of-way. Journal of Arboriculture 23(5) 11 pp.

Braun, C.E. 1987. Current issues in sage grouse management. Proceedings of the Western Association of Fish and Wildlife Agencies 67: 134-144.

Braun, C.E. 1998. Sage grouse declines in western North America: what are the problems? Proceedings of the Western Association of Fish and Wildlife Agencies 78: 139-156.

Bridges, C.M. & Semlitsch, R.D. (2000) Variation in pesticide tolerance of tadpoles among and within species of Ranidae and patterns of amphibian decline. Conservation Biology 14: 1490-1499.

Bridsall, J.L., W. McCaughey and J.B. Runyon. 2011. Roads impact the distribution of noxious weeds more than restoration treatments in a lodgepole pine forest in Montana, United States. Restoration Ecology: 1-7.

Brooks, H.C. 1979. Plate Tectonics and Geologic History of Blue Mountains. Oregon Geology, Volume 41, Number 5.

Brotherson, J. D.; Field, D. 1987. Tamarix: impacts of a successful weed. Rangelands. 9: 110-112.

Brown, C.E. and T.P. Thayer. 1966. The Geologic Map of the Canyon City Quadrangle, Oregon. USGS Miscellaneous Geologic Investigations Map I-447.

Brown, M.L., Duncan, C.A., and Halstvedt, M.B. 2001. Cost and efficacy of spotted knapweed management and with integrated methods. Techline (May): p. 2-5.

Bull, E.L. and M.P. Hayes. 2001. Post-breeding season movements of Columbia spotted frogs (Rana luteiventris) in northeastern Oregon. Western North American Naturalist 61(1): 119-123. – Deschutes EIS

Bull, Evelyn L. 1980. Resource partitioning among woodpeckers in northeastern Oregon. Ph.D. Dissertation, Univ. Idaho, Moscow. 109 pp. In Mellen-McLean, Kim 2012d. MIS Information Sheet. Primary Cavity Nesters/Excavators. 29 pp.

Bullock, J.M. and R.T. Clarke. 2000. Long distance seed dispersal by wind: measuring and modeling the tail of the curve. Oecologia 124:506-521.

Buonopane, M., G. Snider, B.K. Kerns, and P.S. Doescher. 2013. Complex restoration challenges: weeds, seeds, and roads in a forested Wildland Urban Interface. Forest Ecology and Management. 295: 87-96

Busse, M.D., A.W. Ratcliff, C.J. Shestak, and R.F. Powers. 2001. Glyphosate toxicity and the effects of long-term vegetation control on soil microbial communities. Soil Biology & Biochemistry (33) 1777-1789.Callaway, R., G.C. Thelen, A. Rodriguez, and W.E. Holben. 2004. Soil biota and exotic plant invasion. Nature. 427: 431-433

Carlson, G. 1974. Malheur National Forest Soil Resource Inventory. Unpublished In-Service Report. United States Department of Agriculture Forest Service, Pacific Northwest Region, Malheur National Forest. John Day, OR. 137p.

Castelle, A.J., A.W. Johnson, and C. Conolly. 1994. Wetland and Stream Buffer Size Requirements—A Review. Journal of Environmental Quality 23:878-882

Castelle, A.J., And A.W. Johnson. 2000. Riparian Vegetation Effectiveness. National Council for Air and Stream Improvement. Technical Bulletin 799.

Cattle, S. I. Cousin, F. Darboux and Y. Le Bissonnais. The Effect of Soil Crust ageing, Through Wetting and Drying, on Some Surface Structural Properties. SuperSoil 2004: 3rd Australian New Zealand Soils Conference, 5-9 December 2004, University of Sydney Australia. www.regional .org.au/au/asssi/

Cerdan, O., V. Souchere, V. Lecomte, A. Couturier, and Y. Le Bissonnais. 2001. Incorporating Soil Surface Crusting Process in an Expert-Based Runoff Model: Sealing and Transfer by Runoff and Erosion Related to Agricultural Management. Catena 46 189-205.

Chew, F. S. 1981. Coexistence and local extinction in two Pieris butterflies. American Naturalist. 118: 655-672.

Clements, J. F., T. S. Schulenberg, M. J. Iliff, B.L. Sullivan, C. L. Wood, and D. Roberson. 2012. The eBird/Clements checklist of birds of the world: Version 6.7. Downloaded from http://www.birds.cornell.edu/clementschecklist/downloadable-clements-checklist. Accessed 4/22/2013.

Cole, E.C., W. C. McComb, M. Newton, , C.L. Chambers and J.P. Leeming. 1997. Response of amphibians to clearcutting, burning, and glyphosate application in the Oregon Coast Range. Journal of Wildlife Management. 61:p.656-64.

Cole, E.C., W. C. McComb, M. Newton, J.P. Leeming, and C.L. Chambers. 1998. Response of small mammals to clearcutting, burning, and glyphosate application in the Oregon Coast Range. Journal of Wildlife Management. 62(4): p. 1207-16.

Colorado Weed Management Associations (CWMA) 2007. Diffuse knapweed. http://www.cwma.org/nx_plants/diff.htm

Connelly J.W., H.W. Browers, R.J. Gates. 1988. Seasonal movements of sage grouse in southeastern Idaho. J. Wildl. Manage. 52:116–122.

Connelly, J. W., JR. 1982. An ecological study of sage grouse in southeastern Idaho. Dissertation, Washington State University, Pullman, USA.

Connelly, J. W., M. A. Schroeder, A. R. Sands, C. E. Braun. 2000. Guidelines to manage sage grouse populations and their habitats. Wildlife Society Bulletin 28(4): 967-985.

Connelly, J.W. and O.D. Markham. 1983. Movements and radio nuclide concentrations of sage grouse in southeastern Idaho. Journal of Wildlife Management 47:169-177.

Connelly, J.W.; M.A. Schroeder; A.R. Sands; and C.E. Braun. 1991. Sage grouse use of nest sites in southeastern Idaho. Journal of Wildlife Management 55: 521-524.

Copeland, J.P. 1996. Biology of the Wolverine in Central Idaho. Master's Thesis. 152 pp.

Corkran, C. C., and C. R. Thoms. 2006. Amphibians of Oregon, Washington, and British Columbia. Lone Pine Publishing, Auburn, WA.

Crawford, J.A.; R.A. Olson; N.E. West; J.C. Mosley; M.A. Schroeder; T.D. Whitson; R.F. Miller; M.A. Gregg; and C.S. Boyd. 2004. Ecology and management of sage-grouse and sage-grouse habitat. Journal of Range Management 57: 2-19.

Csuti, B., A. J. Kimerling, T. A. O'Neil, M. M. Shaughnessy, E. P. Gaines, and J. C. Hak 2001. Atlas of Oregon wildlife: distribution, habitat, and natural history. Oregon State University Press, Corvallis, OR. 492 pp.

Dabbert, C.B., R.B. Mitchell, and D. Oberheu. 1997. Northern bobwhite egg hatchability and chick immunocompetence following field application of clopyralid. Bulletin of Environmental Contamination and Toxicology. 58: 801-806

Daly, M. Halbleib, J.I. Smith, W.P. Gibson, M.K. Doggett, G.H. Taylor, J. Curtis, and P.P. Pasteris. 2008. Physiographically sensitive mapping of climatological temperature and precipitation across the conterminous United States. International Journal of Climatology. 34p.

D'Antonio, C. M.; Vitousek, P. 1992. Biological invasions by exotic grasses, the grass/fire cycle, and global change. Annual Review of Ecological Systems. 23: 63-87.

Dassonville, N., S. Vanderhoeven, V. Vanparys, M. Hayez, W. Gruber, and P. Meerts. 2008. Impacts of alien invasive plants on soil nutrients are correlated with initial site conditions in NW Europe. Oecologia. 157(1) : 131-140

Davidson, E.A., E. Belk, and R.D. Boone. 1998. Soil water content and temperature as independent or confounded factors controlling soil respiration in a temperate mixed hardwood forest. Global Change Biology. 4: 217-227.

Dechant, J.A., M.F. Dinkins, D.H. Johnson, L.D. Igl, C.M. Goldade. B.D. Parkin, and B.R. Euliss. 2002b. Effects of management practices on grassland birds.: Upland Sandpiper. Northern Prairie Wildlife Research Center, Jamestown, ND. 34 pp.

Dechant, J.A., M.L. Sondreal, D.H. Johnson, L.D. Igl, C.M. Goldade, M.P. Nenneman, and B.R. Euliss. 2002a. Effects of management practices on grassland birds: Grasshopper Sparrow. Northern Prairie Wild Research Center, Jamestown, ND. 28 pp.

Dechant, J.A., M.L.Sondreal, D.H.Johnson, L.D.Igl, C.M. Goldae, A.L. Zimmerman, and B.R. Euliss. 1999. (revised 2001). Effects of management practices on grassland birds: Bobolink. Northern Prairie Wildlife Research Center, Jamestown, ND 24 pp.

Deixis MolluscDB database. 2009. Unpublished collection of mollusk records maintained by Ed Johannes. In United States Department of Agriculture Forest Service. 2013. Species Fact Sheet. Harney Basin Duskysnail (*Colligurus depressus*). 17 pp.

Desser, Rochelle. 2007. Rationale for 80 percent annual effectiveness estimate in cost analysis for invasive plant projects. Unpublished report. R6 Invasive Plant NEPA and Monitoring Coordinator. Portland, OR.

Desser, Rochelle. 2008. Source and Effectiveness of Project Design Features/Criteria for Herbicide Use in Invasive Plant Treatment Projects Forest Service Region Six. Unpublished report. R6 Invasive Plant NEPA and Monitoring Coordinator. Portland, OR.

Desser, Rochelle. 2014. 2014 Treatment and Prevention Monitoring, Region 6 Invasive Plant Program. Unpublished report. R6 Invasive Plant NEPA and Monitoring Coordinator. Portland, OR.

DiTomaso, J.M. 1999. Prescribed burning for control of yellow starthistle (*Centaurea solstitialis*) and enhanced native plant diversity. Weed Science 47: 233 – 242.

DiTomaso, J.M. 2000. Invasive plants in rangelands: Species, impacts, and management. Weed Science 48: 255-265.

Dixon, R. D. and V. A. Saab. 2000. Black-backed woodpeckers. In The birds of North America. ed. Poole, A. and F. Gill, Cornell, New York: Cornell Laboratory of Ornithology and the Academy of Natural Science.

Dooley, S. and J. Beckstead. 2010. Characterizing the interaction between a fungal seed pathogen and a deleterious rhizobacterium for biological control of cheatgrass, Biological Control. 53: 197-203

Dudley, T. L. 2000. Noxious wildland weeds of California: Arundo Donax. In: Bossard, C. C.; Randall, J. M.; Hoshousky, M. C., eds. Invasive plants of California wildlands. Berkeley, CA: Univ. of California Press: 53-58.

Durkin and Durkin, 2005. A Note on Plausible Initial Pesticide Residues on Selected Mushrooms: Hen of the Wood, Shiitake, and Portabello. Unpublished Internal Forest Service review of residues on mushrooms and associated health risks.

Ehrenfeld, J.G. 2003. Effects of exotic plant invasions on soil nutrient cycling processes. Ecosystems 6: 503-523.

Ehrenfeld, J.G., P. Kourtev, and W. Huang. 2001. Changes in soil functions following invasions of exotic understory plants in deciduous forests. Ecological Applications 11(5) 1287-1300.

Ehrenfield, J.G. 2003. Effects of exotic plant invasions on soil nutrient cycling processes. Ecosystems. 6: 503-521Eviner and Firestone 2007

Elliot, W.J. 2004. WEPP internet interfaces for forest erosion prediction. Journal of the American Water

Erickson 2006. Personal communication, effectiveness of manual and mechanical treatments on the Umatilla National Forest

Erickson, Vicky, Scott Wood and Jean A Riley. 2003. Guidelines for Revegetation of Invasive plant Sites and Other Disturbed Areas on National Forests and Grasslands in the Pacific Northwest. Unpublished Draft internal Forest Service document.

Esteves, M. X. Faucher, S. Galle, and M. Vauclin. 2000. Overland Flow and Infiltration Modeling for Small Plots During Unsteady Rain: Numerical Results Versus Observed Values. Journal of Hydrology 228 265-282.Fischer, R.A., and J.C. Fischenich, 2000. Design recommendations for riparian corridors and vegetated buffer strips. United States Army Engineer Research and Design Center. ERDC-TN-EMRRP-SR-24.

Fagerstone, K.A., H.P. Tietjen, and G..K. LaVoie. 1977. Effects of range treatment with 2,4-D on prairie dog diet. Journal of Range Management 30(1): 57-60.

Fieldler, C.E., E.K. Dodson, and K.L. Metlen. 2010. Invasive plant response to forest disturbance in the western United States. In: S. Jose and H.P. Singh, eds. Invasive Plant Ecology CRC Press, Boca Raton, FL. In review.

Fischer, R.A., and J.C. Fischenich, 2000. Design recommendations for riparian corridors and vegetated buffer strips. United States Army Engineer Research and Design Center. ERDC-TN-EMRRP-SR-24.

Fletcher, J.S., J.E. Nellessen, and T.G. Pfleeger. 1994. Literature review and evaluation of the EPA food-chain (Kenaga) nomogram, and instrument for estimating pesticide residue on plants. Environ. Toxicol. And Chemistry 13(9):p.1383-91.

Flory, S.L., and K. Clay. 2009. Effects of roads and forest successional age on experimental plant invasions. Biological Conservation. 142: 2531-2537

Ganapathy, C. 1997. Environmental Fate of Triclopyr. Environmental Monitoring and Pest Management Branch, Department of Pesticide Regulation, Sacramento California.

Gelbard, J.L. and J. Belnap. 2003. Roads as conduits for exotic plant invasions in a semiarid landscape. Conservation Biology 17: 420-432.

Germaine, S. S.; Rosenstock, S. S.; Schweinsburg, R. E; Richardson, W. S. August 1998. Relationships among breeding birds, habitat, and residential development in greater Tucson, Arizona. Ecological Applications. 8(3): 680-691.

Greene, R.C., G.W. Walker, and R.E. Corcoran. 1972. The Geologic Map of the Burns Quadrangle, Oregon. USGS Miscellaneous Geologic Investigations Map I-680.

Grismer, M.E., and M.P. Hogan. 2005. Simulated rainfall evaluation of revegetation /mulch erosion control in the Lake Tahoe Basin: 2. Bare soil assessment. Land Degradation & Development. 16: 397-404

Gundale, M.J., S. Sutherland, and T.H. DeLuca. 2008. Fire, native species, and soil resource interactions influence the spatio-temporal invasion pattern of *Bromus tectorum*. Ecography. 31: 201-210

Guo, D., P. Mou, R.H. Jones, and R.J. Mitchell. 2004. Spatio-temporal patterns of soil available nutrients following experimental disturbance in a pine forest. Oecologia. 138: 613-621

Hansen, M.J. and A.P. Clevenger. 2005. The influence of disturbance and habitat on the presence of non-native plant species along transport corridors. Biological Conservation 125:249-259.

Hanula, J.L. and S. Horn. 2011. Removing an exotic shrub from riparian forests increases butterfly abundance and diversity. Forest Ecology and Management 262:674-680.

Hart, S. C., T. H. DeLuca, G. S. Newman, M. D. MacKenzie, and S. Boyle. 2005. Post-fire vegetative dynamics as drivers of microbial community structure and function in forest soils. Forest Ecology Manual. 230: 166-184

Hatler, D.F. 1989. A Wolverine Management Strategy for British Columbia. Wildlife Bulletin No. B-60. May 1989. Prepared for Ministry of Environment. 140 pp.

Hawkes, C.V., I.F. Wren, D.J. Herman, and M.K. Firestone. 2005. Plant invasion alters nitrogen cycling by modifying the soil nitrifying community. Ecology Letters. 8: 976-985

Hayes, Marc, J.D. Engler, , R.D. Haycock, D.H. Knopp, W.P. Leonard, K.R. McAllister, and L.L. Todd. 1997. Status of the Oregon spotted frog (*Rana pretiosa*) across its geographical range. In The Spotted Frog of Oregon. Oregon Chapter of The Wildlife Society, Corvallis, OR. August 15.

Heady, L.T. and J.W. Laundre 2005. Habitat use patterns within the home range of pygmy rabbits (*Brachylagus idahoensis*) in southeastern Idaho. North American Naturalist, Vol. 65, No. 4. pp. 490-500.

Henny, C.J., W.S. Seegar, and T.L. Maechtle. 1996. DDT decreases in plasma of spring migrant peregrine falcons, 1978-1994. J. Wildl. Manage. 60: 342-349.

Holmes, A.L. and R.F. Miller 2010. State and Transition Models for Accessing Grasshopper Sparrow Habitat Use. Journal of Wildlife Management. 74(8): 1834-1840.

Hornocker, Maurine G. and Howard S. Hash. 1981. Ecology of the wolverine in northwestern Montana. Canadian Journal of Zoology 59, (September 1980): 1286-1301.

Horton, J. S. 1977. The development and perpetuation of the permanent tamarisk type in the phreatophyte zone of the southwest. Gen. Tech. Rep. 43. United States Department of Agriculture, Forest Service, Rocky Mountain Forestry and Range Experiment Station. p. 124-127.

Houston, A.P.C., S. Visser, and R.A. Lautenschlager. Response of microbial processes and funal community structure to vegetation management in mixed wood forest soils. Canadian Journal of Botany. 76: 2002-2010

Hutto, Richard L. 1995. Composition of bird communities following stand-replacement fires in northern Rocky Mountain (United States.) conifer forests. Conservation Biology 9, 1041–58.

Inman, R.M., K.H. Inman, A.J. McCue, and M.L. Packila. 2007. Wolverine harvest in Montana: survival rates and spatial considerations for harvest management. Pages 85-96 in Wildlife Conservation Society. Greater Yellowstone Wolverine Program, Cumulative Report, May 2007. Ennis, MT.

Jakle, M. D.; Gatz, T. A. 1985. Herpetofaunal use of four habitats of the middle Gila River drainage, Arizona. Paper Presented at the North American Riparian Conference; April 16-18, 1985; Tucson, AZ.

James, J.J., B.S. Smith. E.A. Vasquez, and R.L. Sheley. 2010. Principles for ecologically based invasive plant management. Invasive Plant Science and Management. 3: 229-239

Janes, S.W. 1983. Status. Distribution, and Habitat Selection of the Grasshopper Sparrow in Morrow County, Oregon. The Murrelet, Vol. 64, No 2. pp. 51-54.

Janzen, D. 1984. Dispersal of Small Seeds by Big Herbivores: Foliage is the Fruit

Jepsen, S., LaBar, C., Zarnoch, J. 2010. *Gonidea angulata* (Lea, 1838) Western ridged mussel Bivalvia: Unionidae. Xerces Society for Invertebrate Conservation. 19 pp.

Johnson, D. H., and T. A. O'Neil, Managing Directors. 2001. Wildlife-habitat relationships in Oregon and Washington. Oregon State University Press, Corvallis, OR. 736 pp. In Mellen-McLean, Kim 2012d. MIS Information Sheet. Primary Cavity Nesters/Excavators. 29 pp.

Johnson, D.R., and Hansen, R.M. 1969. Effects of range treatment with 2,4-D on rodent populations. Journal of Wildlife Management 33: 1125-132.

Johnson, M. L. 1995. Reptiles in the state of Washington (1954). Northwest Fauna 3:5-80. The Society of Northwestern Vertebrate Biology, Olympia, WA.

Kenaga, E.E. 1973. Factors to be considered in the evaluation of the toxicity of pesticides to birds in their environment. In: Environmental Quality and Safety: Global Aspects of Chemistry, Toxicology and Technology as Applied to the Environment. Vol. II. New York, NY: George Thieme Publishers, Stutgart Academic Press, Inc.

Kiviat, E. 1996. Short communications: American goldfinch nests in purple loosestrife. Wilson Bulletin. 108(1): 182-186.

Korb, J.E., N.C. Johnson, and W.W. Covington. 2004. Slash pile burning effects on soil biotic and chemical properties and plant establishment: recommendations for amelioration. Restoration Ecology. 12(1): 52-62

Kulmatiski, A., K.H. Beard, J.R. Stevens, and S.M. Cobbold. 2008. Plant-soil feedbacks: a meta-analytical review. Ecology Letters. 11: 980-992

Lacey J. R., R. Wallender, and K. Olson-Rutz. 1992. Recovery, germinability, and viability of leafy spurge (*Euphorbia esula*) seeds ingested by sheep and goats. Weed Technol. 6:559–602.

Lacey, J. R., Olson, B. E. 1991. Environmental and economic impacts of noxious range weeds. In: James, L. F.; Evans, J. O.; Ralphs, M. H.; Child, R. D., eds. Noxious range weeds. Boulder, CO: Westview Press

Lacey, R.C., C.B. Marlow and J.R. Lane. 1989. Influence of spotted knapweed (*Centaurea maculosa*) on surface runoff and sediment yield. Weed Technology (3) 627-631.

Lauenroth, W.K., D.G. Milchunas, J.L. Dodd, R.H. Hart, R.K. Heitschmidt, and L.R. Rittenhouse. 1994 . Effects of grazing on ecosystems of the Great Plains . Pages 69 - 100 in Vavra, M., W.A. Laycock, and R.D. Pieper Editor(s). Ecological implications of livestock herbivory in the West. Society for Range Management, Denver, CO.

Laufman, J. 2007. Umatilla National Forest Invasive Plants Treatment Project, Botany Report and Biological Evaluation.

Lefcort, H., R. A. Meguire, L. H. Wilson, W. F. Ettinger. 1998. Heavy metals alter the survival, growth, metamorphosis, and antipredatory behavior of Columbia spotted frog (Rana luteiventris) tadpoles. Archives of Environmental Contamination and Toxicology 15:447–456.

Lejeune, K. and T. Seastedt (2001). "*Centaurea* Species: the Forb That Won the West." Conservation Biology 15(6): 1568-1574.

Leonard, Jr., David L. 2001. American Three-toed Woodpecker (*Picoides dorsalis*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/588doi:10.2173/bna.588

Lloyd, R.A., K.A. Lohse, and TPA Ferré. Influence of road reclamation techniques on forest ecosystem recovery. Front. Ecol. Environ. 11(2): 75-81

Lor, S.K. 2000. Habitat use and population status of marsh birds in western New York. Ithaca, NY: Department of Natural Resources, Cornell University. 135 p. Thesis.

Mack, R. N. 1981. Invasion of Bromus tectorum L. into western North America: an ecological chronicle. Agro-Ecosystems. 7: 145-165.

Magoun, A.J. and J.P. Copeland. 1998. Characteristics of Wolverine Reproductive Den Sites. Journal of Wildlife Management. 62(4): 1313-1320.

Marco, A., C. Quilchano, and A. R. Blaustein. 1999. Sensitivity to nitrate and nitrite in pond breeding amphibians from the Pacific Northwest, USA. Environmental Toxicology and Chemistry 18:2836–2839.

Marrs, R., C. Williams, A. Frost, and R. Plant. 1989. Assessment of the effects of herbicide spray drift on a range of plant species of conservation interest. Environmental Pollution. 59: 71-86.

Marshall, D. B., M. G. Hunter, and A. L. Contreras, Eds. 2003. Birds of Oregon: a general reference. Oregon State University Press, Corvallis, OR. 768 pp.

Marshall, J.S., and L.W. Vandruff. 2002. Impact of Selective Herbicide Right-of-Way Vegetation on Birds. Environmental Management 30(6): p. 801-6.

Maser, Chris; Mate, Bruce R.; Franklin, Jerry F.; Dyrness, C. T. 1981. Natural history of Oregon coast mammals. Gen. Tech. Rep. PNW-133. Portland, OR.: United States Department of Agriculture Forest Service, Pacific Northwest Range and Experiment Station. 496 p.

Mazzacano, C. 2008. Fisherola nuttalli (Haldeman 1841) Giant Columbia River limpet; shortface lanx Gastropoda: Lymnaeidae. Xerces Society for Invertebrate Conservation. 5 pps.

McAdoo, J.K.; S.R. Swanson; B.W. Schultz; and P.F. Brussard. 2004. Vegetation management for sagebrush-associated wildlife species. P. 189-193 in United States Department of Agriculture Forest Service Proceedings RMRS-P-31. – Deschutes Weed EIS

McAllister, K. R., and W. P. Leonard. 1997. Washington state status report for the Oregon Spotted Frog. Washington

McGrath, Michael T., Stephen DeStefano, Robert A. Riggs, Larry L. Irwin, and Gary J. Roloff. 2003. Spatially explicit influences on northern goshawk nesting habit in the Interior Pacific Northwest. Wildlife Monographs 154, 1–63. In Samson, Fred B. 2006a. A conservation assessment of the northern goshawk, black-backed woodpeckers, flammulated owl, and pileated woodpecker in the Northern Region. United States Department of Agriculture, Forest Service.

McKelvey, K.S., K.B. Aubry, and Y.K. Ortega. 2000 History and distribution of lynx in the contiguous United States. Pages 207-264 In Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, G.M. Koehler, C.J. Krebs, K.S. McKelvey, and J.R. Squires. (Tech. Eds). 1999. Ecology and conservation lf lynx in the United States. Univ. Press of Colorado. Boulder, Co. 480 pp.

McMurray, S.T., R.L. Lochmiller, J.F. Boggs, D.M. Leslie Jr., Engle and others. 1993a. Woodrat Population Dynamics Following Modification of Resource Availability. American Midland Naturalist (129): p. 48-56.

McMurray, S.T., R.L. Lochmiller, J.F. Boggs, D.M. Leslie Jr., Engle and others. 1993b. Opportunistic Foraging of Eastern Woodrats (*Neotoma floridana*) in Manipulated Habitats. American Midland Naturalist (130): p. 325-37..

Mellen-McLean, Kim 2012c. MIS Information Sheet. American Tree-toed Woodpecker (*Picoides dorsalis)*, Three-toed Woodpecker (*Picoides tridactylus*) and Northern Three-toed Woodpecker (*Picoides tridactylus dorsalis*). 16 pp.

Mellen-McLean, Kim 2012d. MIS Information Sheet. Primary Cavity Nesters/Excavators. 29 pp.

Mellen-McLean, Kim, 2012b. MIS Information Sheet. American Marten (*Martes Americana*). 20 pp.

Mellen-McLean, Kim. 2012a. MIS Information Sheet. Pileated Woodpecker (*Dryocopus pileatus*). 18 pp.

Meyer, N. 2009. Soil and Plant Response to Slash Pile Burning in a Ponderosa Pine Forest. M.S. Thesis, Department of Land Resources and Environmental Sciences. Montana State University, MT. 98pp.

Miller, Dr. Tim. (Associate Scientist, WSU Extension, Department of Crop Science. Mt. Vernon.) 2014. Personal communication (email) about the effectiveness of herbicides with Shawna Bautista, USDA Forest Service, Region 6 Pesticide Coordinator. Portland, OR.

Mills, G.. S.; Dunning Jr., J. B.; Bates, J. M. 1989. Effects of urbanization on breeding bird community structure in Southwestern desert habitats. The Condor. (91): 416-28.

Moore, D.C. and M.J. Singer. 1990. Crust Formation on Soil Erosion Processes. Soil Sci. Soc. AM J., 54:1117-1123.

Morse, R.A. and N.W. Calderone. 2000. The value of honey bees as pollinators of United States crops in 2000. Bee Culture Magazine 128: 1-14.

Mosley JC, Bunting SC, Manoukian ME. 1999. Cheatgrass. In: Sheley RL, Petroff JK, editors. Biology and Management of Rangeland Weeds. Corvallis (OR): Oregon State University Press. p 175-188. In: http://www.fws.gov/invasives/stafftrainingmodule/methods/chemical/review.html. Accessed 5/26/13

National Academy of Science. 2013. Assessing Risks to Endangered and Threatened Species from Pesticides. National Academies Press. Washington, DC. 175 pp. http://www.nap.edu/catalog.php?record_id=18344

NatureServe Explorer: An online encyclopedia of life [web application]. 2013. Version 1.6. Arlington, VA, USA: NatureServe. Available: http://www.natureserve.org/explorer/

NatureServe. 2013. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer (Accessed: May 29, 2013).

Newmaster, S.G., F.W. Bell, and D.H. Vitt. 1999. The effects of glyphosate and triclopyr on common bryophytes in northwestern Ontario. Canadian Journal Forest Research 29: 1101-1111.

Nolte, K. R.; Fulbright, T. E. 1997. Plant, small mammal, and avian diversity following control of honey mesquite. Journal of Range Management. 50(2): 205-212.

Norton, J.B., T.A. Monaco, and U. Norton. Mediterranean annual grasses in western North America: kids in a candy store. Plant Soil. 1-5

Olson, B. E., 1999. Impacts of noxious weeds on ecologic and economic systems. Pages 4-18 in Biology and Management of Noxious rangeland weeds. R. L. Sheley and J. K. Petroff (Eds.). Oregon State University Press, Corvallis, Oregon.

Olson, B.E. 1999. Impacts of noxious weeds on ecologic and economic systems. In: Sheley, R.L.; Petroff, J.K., eds. Biology and management of noxious rangeland weeds. Corvallis, Oregon: Oregon State Univ. Press. p. 4-18.

Oregon Biodiversity. 2010. Rare, Threatened and Endangered Species of Oregon. Oregon Biodiversity Information Center. October 2010. 109 pp.

Oregon Department of Agriculture. Pesticide testing and licensing website: http://www.oregon.gov/ODA/PEST/pages/licensing_index.aspx

Oregon Department Of Environmental Quality. 2010. Water Pollution. Division 41. Water Quality Standards: Beneficial Uses, Policies, and Criteria For Oregon. 340-041-0001 to 0350

Oregon Department of Fish and Wildlife. 2005. Oregon Wolf Conservation and Management Plan. 116 pp.

Oregon Department of Fish and Wildlife. 2006. Oregon Conservation Strategy. Available at: http://www.dfw.state.or.us/conservationstrategy/read_the_strategy.asp Accessed 4/15/2013.

Oregon Department of Fish and Wildlife. 2009. Richard W. Carmichael. Conservation and Recovery Plan for Oregon Steelhead Populations in the Middle Columbia River Steelhead Distinct Population Segment

Oregon Department of Fish and Wildlife. 2013. http://dfw.state.or.us/Wolves/population.asp (Accessed 04/10/2013)

Oregon State University. 2013. Oregon Explorer. Available at: http://oregonexplorer.info/wildlife/ThreatenedandEndangeredSpecies/DecliningandAt-Risk. Accessed 4/19/2013.

Ortega, Y.K., D.E. Pearson. 2005. Weak vs. strong invaders of natural plant communities: assessing invisibility and impact. Ecological Applications. 15(2): 651-661

Pacific Bioversity Institute. 2013. Columbia clubtail species profile. http://www.pacificbio.org/initiatives/ESIN/OtherInvertebrates/LynnsClubtail/LynnsClubtail_pg.html (Accessed: May 29, 2013).

Pagel, J. unpublished data. 2006. Peregrine falcon nest site data, 1983-2006 collected for PNW Interagency Peregrine Falcon Program, Ashland OR

Partners in Flight. 2000. Conservation Strategy for Landbirds in the Columbia Plateau of Eastern Oregon and Washington. Version 1.0. March 2000. 144 pp.

Pasitschniak, Arts, M., and S. Larivière. 1995. Gulo gulo, Mammalian Species. Amer. Soc. of Mammalogists, 499: 1-10.

Perkins, Peggy J., Boermans, Jerman H., Stephenson, Gerald R. 2000. Toxicity of Glyphosate and Triclopyr using the frog embryo. Teratogenesis Assay-Xenopus. Environmental Toxicol and Chemistry 19(4): p.940-5.

Peterson, David L. 2006. Biological Status Assessment and Petition to Remove the Peregrine Falcon from Oregon's List of Endangered Species. Oregon Department of Fish and Wildlife Commission.

Peterson, Vanelle. (Dow Chemicals Representative) 2014. Personal communication about herbicide effectiveness with Shawna Bautista, USDA Forest Service, Region 6 Pesticide Coordinator. Portland, OR.

Pfleeger, T.G.., A. Fong, R. Hayes, H. Ratsch, and C. Wickliff. 1996. Field evaluation of the EPA (Kenaga) nomogram, a method for estimating wildlife exposure to pesticide residue on plants. Environmental Toxicology and Chemistry 15(4): p. 535-43.

Pyle, R.M. 2002. The Butterflies of Cascadia, A Field Guide to All the Species of Washington, Oregon, and Surrounding Territories. Seattle Audubon Society, Seattle, Washington. 420 pp. In United States Department of Agriculture Forest Service. 2011b. Species Fact Sheet. Johnson's Hairstreak (Callophrys johnsoni). 8 pp.

Quigley, T.M., and S.J. Arbelbide. Tech Eds., 1997. An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins. Gen. Tech. Rep. PNW-GTR-405. Portland, OR. United States Department of Agriculture, Forest Service, Pacific Northwest Research Station. Vol. 4.

Raloff, J. 1998. Botanical 'velcro' entraps hummingbirds- burrs cause bird fatalities. [Online]. Available: http://www.findarticles.com/p/articles/mi_m1200/is_n16_v154/ai_21250276. Accessed July 2004.

Randall, J.M. 1996. Weed control for the preservation of biological diversity. Weed Technology. 10: 370-383.

Ratcliff, A.W., M.D. Busse, and C.J. Shestak. 2006. Changes in microbial community structure following herbicide (Glyphosate) additions to forest soils. Applied Soil Ecology. 34: 114-124

Rawinski T. J. 1982. The ecology and management of purple loosestrife (*Lythrum salicaria L.*) in central New York. Ithaca, N.Y.: Cornell University, ix: 88.

Rawinski, T. J.; Malecki, R. A. 1984. Ecological relationships among purple loosestrife, cattail and wildlife at the Montezuma National Wildlife Refuge. New York Fish and Game Journal. 31(1): 81-87.

Reames, Clark, 2013a. Personal communication with Scott Reitz. Townsend's big-eared bat. documentation. March 6, 2013.

Reames, Clark. 2013b. Personal communication with Howard Richburg. Bald Eagle Nest Locations. May 22, 2013.

Rees, J. and P. Lee. 1990. Management of bald eagles, Haliaeetus leucocephalus, and their habitats on National Forests of the Pacific Northwest. United States Department of Agriculture Forest Service, Portland, OR. 61 pp. + appendices. – Deschutes EIS

Relyea, R.A. 2005. The impact of insecticides and herbicides on the biodiversity and productivity of aquatic communities. Ecological Applications 15(2): p. 618-27.

Reynolds, R. T., R. T. Graham, M. H. Reiser; and others. 1992. Management recommendations for the northern goshawk in the southwestern United States. General Technical Report RM-217. Ft. Collins, CO: United States Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 184 p.

Rice, P. 2000. Restoration of native plant communities infested by invasive weeds – Sawmill Creek Research Natural Area. United States Department of Agriculture Forest Service Proceedings RMRS-P-17: 29-30.

Rice, P. M.; Toney, C.; Bedunah, D. J.; Carlson, C. E. 1997. Plant community diversity and growth form responses to herbicide applications for control of Centaurea maculosa. Journal of Applied Ecology. 34: 1397-1412.

Rinella, M.J., B.D. Maxwell, P.K. Fay, T. Weaver, and R.L. Sheley. 2009. Control effort exacerbates invasive-species problem. Ecological Applications. 19(1): 155-162

Rosenshield, M.L., Jofre, M.B., and W.H. Karasov. 1999. Effects of polychlorinated biphenyl 126 on green frog (*Rana clamitans*) and leopard frog (*Rana pipiens*) hatching success, development, and metamorphosis. Environmental Toxicology and Chemistry 18:2478-2486.

Rowland, M.M, and Wisdom, M.J. 2002. Research problem analysis for Greater Sage-grouse in Oregon. Final Report. Oregon Department of Fish and Wildlife; United States Department of the Interior, Bureau of Land Management, Oregon/Washington State Office; and United States Department of Agriculture, Forest Service, Pacific Northwest Research Station: 75 p. – Deschutes EIS

Rowland, M.M., M.J. Wisdom, B.J. Johnson, and J.G. Kie. 2000. Elk distribution and modeling in relation to roads. J. Wildl. Manage. 64(3): 672-684.)

Ruediger, B., J. Claar, S. Gniadek, B. Holt, L. Lewis, S. Mighton, B. Naney, G. Patton, T. Rinaldi, J. Trick, A. Vandehey, F. Wahl, N. Warren, D. Wenger, and A. Williamson. 2000. Canada lynx conservation assessment and strategy. United States Department of Agriculture Forest Service, United States Department of the Interior Fish and Wildlife Service, United States Department of the Interior Bureau of Land Management, and United States Department of the Interior National Park Service. Forest Service Publication #R1-00-53, Missoula, MT. 142 pp. (http://www.fs.fed.us/r1/wildlife/carnivore)

Ruediger, Bill, Jim Claar, Steve Mighton, Bob Naney, Tony Rinaldi, Fred Wahl, Nancy Warren, Dick Wenger, Al Williamson, Lyle Lewis, Bryon Holt, Gary Patton, Joel Trick, Anne Vandehey, and Steve Gniadek. 2000. Canada lynx conservation assessment and strategy. United States Department of Agriculture Forest Service, United States Department of the Interior Bureau of Land Management, United States Department of the Interior Fish and Wildlife Service and United States Department of the Interior National Park Service. 120 pp.

Ruggiero, Leonard F., K. B. Aubry, S. W. Buskirk, G. M. Koehler, C. J. Krebs, K. S. McKelvey, and J. R. Squires. 1999. Ecology and Conservation of Lynx in the United States. Univ. Press of Colorado. Boulder, CO and United States Department of Agriculture, Forest Service, Rocky Mountain Research Station. General Technical Report, RMRS-GTR-30WWW, October. 480p

Ruggiero, Leonard F., Keith B. Aubry, Steven W. Buskirk, L. Jack Lyon, and William J. Zielinski. 1994. The scientific basis for conserving forest carnivore’s American marten, fisher, lynx, and wolverine in the western United States. General Technical Report RM-254. Fort Collins, CO: United States Department of Agriculture, Forest Service.

Saab, Victoria A., Robin E. Russell, and Jonathan G. Dudley. 2007. Nest densities of cavity-nesting birds in relation to postfire salvage logging and time since wildfire. Condor 109:97-108. http://www.rmrs.nau.edu/publications/rmrs_2007_Saab_et_al/rmrs_2007_Saab_et_al.pdf

Saab, Victoria, and Jonathan Dudley. 1998. Responses of cavity-nesting birds to stand-replacement fire and salvage logging in ponderosa pine/Douglas-fir forests of southwestern Idaho. United States Department of Agriculture Forest Service, Rocky Mt. Res. Sta., Ogden, UT. Res. Paper RMRS-RP-11. 17 p. http://www.rmrs.nau.edu/publications/saab_dudley_1998/saab_dudley_1998.pdf

Samson, Fred B. 2006a. A conservation assessment of the northern goshawk, black-backed woodpeckers, flammulated owl, and pileated woodpecker in the Northern Region. United States Department of Agriculture, Forest Service.

Scheiman, D.M., Bollinger, E.K., and D.H. Johnson. 2003. Effects of Leafy Spurge Infestations on Grassland Birds. USGS. Northern Prairie Wildlife Research Center. Paper 230. Available at: http://digitalcommons.unl.edu/usgsnpwrc/230.

Schmidt, K.A., and C.J. Whelan. 1999. Effects of exotic Lonicera and Rhamnus on songbird nest predation. Volume 13.6. p. 1502-6.

Schroeder, R.L. 1984. Habitat suitability index models. Blue grouse. United States Fish and Wildlife Service. FWS/OBS-82/10.81. 19 pp.

Schwartz, C.C., J.P. Copeland, N.J. Anderson, J.R. Squires, R.M. Inman, K.S. McKelvey, K.L. Pilgrim, L.P. Waits, and S.A. Cushman. 2009. Wolverine gene flow across a narrow climatic niche. Ecology, 90(11), pp. 3222-3232.

Seastedt, T.R., R.J. Hobbs, and K.N. Suding. 2008. Management of novel ecosystems: are novel approaches required? Front. Ecol. Environ. 6(10): 547-553

Sheley RL, Jacobs JS, Martin JM. 2004. Integrating 2,4-D and sheep grazing to rehabilitate spotted knapweed infestations. Journal of Range Management 57(4):371-375. In: http://www.fws.gov/invasives/stafftrainingmodule/methods/chemical/review.html. Accessed 5/26/13

Sheley, R.L. and J.K. Petroff, eds. 1999. Biology and management of noxious rangeland weeds. Oregon State University Press, Corvallis, OR.

Sheley, R.L., B.E. Olson, and L. Larson. 1997. Effect of weed seed rate and grass defoliations level on diffuse knapweed. Journal of Range Management 50: 39-43.

Sheley, R.L., J.K. Petroff, and M.M. Borman. 1999a. Introduction. In R.L. Sheley and J.K. Petroff, eds. Biology and Management of Noxious Rangeland Weeds. Oregon State University Press, Corvallis, OR.

Sheley, R.L., S. Kedzie-Webb, and B.D. Maxwell. 1999b. Integrated Weed Management on Rangeland. In R.L. Sheley and J.K. Petroff, eds. Biology and Management of Noxious Rangeland Weeds. Oregon State University Press, Corvallis, OR.

Sheley, R.L., T.J. Scejcar and B.D. Maxwell. 1996. A Theoretical Framework for Developing Successional Weed Management Strategies on Rangeland. Weed Technology: 10:. 766-773.

Slater, G.L. 2004. Grasshopper Sparrow (*Ammodramus savannarum*) A Technical Conservation Assessment. Prepared for United States Department of Agriculture Forest Service Rocky Mountain Region, Species Conservation Project. October 2004. 46 pp.

Smith, G.R. 2001. Effects of Acute Exposure to a Commercial Formulation of Glyphosate on the Tadpoles of Two Species of Anurans. Bull. Environ. Contam. Toxicol. 67:483-8.

Squires, J. R., and P. L. Kennedy. 2006. Northern goshawk ecology: an assessment of current knowledge and information needs for conservation management. Studies in Avian Biology 31: 8-62.

Squires, J. R., and R. T. Reynolds. 1997. Northern Goshawk. No. 298. In The birds of North America. The Academy of Natural Sciences, Philadelphia, Pennsylvania, and The American Ornithologists' Union, Washington, DC, USA. Available at; http://bna.birds.cornell.edu/bna/species/298doi:10.2173/bna.298

Stalmaster, M.V. and J.R. Newman. 1978. Behavioral responses of wintering bald eagles to human activity. J. Wildl. Manage. 43:506-513. – Deschutes EIS

Stark, J.D., Chen X.D., and C. Johnson (2012) Effects of Herbicides on Behr’s Metalmark Butterfly, a Surrogate Species for the Endangered Butterfly, Lange’s Metalmark. Environmental Pollution 164: 24-27.

State of Oregon. 2004. Pipeline, Oregon Drinking Water News; Oregon Drinking Water Standards, 19(4) Fall 2004. Drinking Water Program, Oregon Health Division. www.dhs.state.or.us/publichealth/dwp

Stebbins, R. C. 1985. The Peterson Field Guide Series: A Field Guide to Western Reptiles and Amphibians. Houghton Mifflin Company, Boston, MA. 336 pp.

Steinlein, T. 2013. Invasive alien plants and their effects on native microbial soil communities. Progress in Botany. 74: 293-319

Sucoff , E., Nichols, T.& Lu, EY. 2001. Herbicide effects on host plants of Karner Blue butterfly and on butterfly development from egg to adult. Department of Forest Resources Staff paper Series Number 151. University of Minnesota College of Natural Resources: St. Paul Minnesota 47 pp. In . United States Department of Interior Fish and Wildlife Service. 2012. Federal Register proposed rule to list the Mardon Skipper as federally threatened or endangered. Volume 77 Number 171. 27 pp.

Suding, K.N., K.D. LeJeune, T.R. Seastedt. 2004. Competitive impacts and responses of an invasive plant: dependencies on nitrogen and phosphorus availability. Oecologia. 141: 526-535

Sullivan, T.P., C. Nowotny, and R.A. Lautenschlager. 1998. Silvicultural use of herbicide in sub-boreal spruce forest: implications for small mammal population dynamics. Journal of Wildlife Management 62(4): p. 1196-206.

Sullivan, T.P/ and D.S. Sullivan. 2003. Vegetation management and exosystem disturbance: impact of glyphosate herbicide on plant and animal diversity in terrestrial systems. Environmental Review 11:37-59.

Sutherland, S. 2004. What makes a weed a weed: life history traits of native and exotic plants in the USA. Oecologia. 141: 24-39

Swenson, J.E.; C.A. Simmons, and C.D. Eustace. 1987. Decrease of sage grouse Centrocercus urophasianus after ploughing of sagebrush steppe. Biological Conservation 41: 125-132.

Syracuse Environmental Research Associates (SERA), Inc. 2001. Preparation of Environmental Documentation of Risk Assessments for the USDA/Forest Service. SERA MD 2007-01a

Syracuse Environmental Research Associates (SERA), Inc. 2001. Sethoxydim [Poast] - Human Health and Ecological Risk Assessment. Fayetteville, New York. October 31, 2001.

Syracuse Environmental Research Associates (SERA), Inc. 2003. Documentation for Worksheets Version 2.04b - Human Health and Ecological Risk Assessments. SERA WSD 01-2.04. June 22, 2003.

Syracuse Environmental Research Associates (SERA), Inc. 2003. Glyphosate Human Health and Ecological Risk Assessment. Fayetteville, New York. March 1, 2003.

Syracuse Environmental Research Associates (SERA), Inc. 2003. Picloram - Revised Human Health and Ecological Risk Assessment. Fayetteville, New York. June 30, 2003.

Syracuse Environmental Research Associates (SERA), Inc. 2003. Triclopyr - Revised Human Health and Ecological Risk Assessment. Fayetteville, New York. March 15, 2003.

Syracuse Environmental Research Associates (SERA), Inc. 2004. Chlorsulfuron Human Health and Ecological Risk Assessment. Fayetteville, New York. November 21, 2004.

Syracuse Environmental Research Associates (SERA), Inc. 2004. Clopyralid Human Health and Ecological Risk Assessment - Final Report. Fayetteville, New York. December 5, 2004.

Syracuse Environmental Research Associates (SERA), Inc. 2004. Imazapic Human Health and Ecological Risk Assessment. Fayetteville, New York. December 23, 2004.

Syracuse Environmental Research Associates (SERA), Inc. 2004. Imazapyr Human Health and Ecological Risk Assessment. Fayetteville, New York. December 18, 2004.

Syracuse Environmental Research Associates (SERA), Inc. 2004. Metsulfuron Methyl Human Health and Ecological Risk Assessment. Fayetteville, New York. December 9, 2004.

Syracuse Environmental Research Associates (SERA), Inc. 2004. Sulfometuron methyl Human health and ecological risk assessment. Fayetteville, New York. December 14, 2004.

Syracuse Environmental Research Associates (SERA), Inc. 2007. Aminopyralid Human health and Ecological Risk Assessment. Fayetteville, New York. Jun. 28, 2007

Syracuse Environmental Research Associates (SERA), Inc. 2007. GLEAMS Driver User Guide, Version 1.8. Fayetteville, New York.

Syracuse Environmental Research Associates (SERA), Inc. 2011. Glyphosate Human health and Ecological Risk Assessment. Fayetteville, New York 13066-0950. March 25, 2011.

Syracuse Environmental Research Associates (SERA), Inc. 2011. Imazapyr Human Health and Ecological Risk Assessment. Fayetteville, New York.

Syracuse Environmental Research Associates (SERA), Inc. 2011. Picloram Human health and Ecological Risk Assessment. Fayetteville, New York 13066-0950. Sep. 29, 2011.

Syracuse Environmental Research Associates (SERA), Inc. 2011. Triclopyr Human health and Ecological Risk Assessment. Fayetteville, New York 13066-0950. May 24, 2011.

The American Naturalist,123:338-353.

Thomas, J. W., H. Black, Jr., R. J. Scherzinger, and R. J. Petersen. 1979. Wildlife Habitats in Managed Forests: The Blue Mountains of Oregon and Washington. [United States Department of Agriculture, Agriculture Handbook 553]. Washington, D.C. (Pages 60-77).

Thomas, J.W., D.A. Leckenby, M.Henjum, R.J. Pedersen and L.D. Bryant. 1988. Habitat-Effectiveness Index for Elk on Blue Mountain Winter Ranges. Pacific Northwest Research Station. General Technical Report PNW-GTR-218. Portland, OR. 28 pp.

Thompson, D. Q., Stuckey, R. L.; Thompson, E. B. 1987. Spread, impact, and control of purple loosestrife (Lythrum salicaria) in North American wetlands. Washington, D.C.: United States Department of the Interior Fish and Wildlife Service; Research Report No. 2. 55 p. http://www.npwrc.usgs.gov/resource/plants/loosstrf/index.htm

Trammell, M. A.; Butler, J. L. 1995. Effects of exotic plants on native ungulate use of habitat. Journal of Wildlife Management. 59(4): 808-816. Shawna's 2011 summary

Tu, C.M. 1994. Effects of herbicides and fumigants on microbial activities in soil. Bulletin of Environmental Contamination and Toxicology. 52(1): 12-17

Tu, M., C. Hurd, and J.M. Randall. 2001. Weed Control Methods Handbook: Tools & Techniques for Use in Natural Areas. The Nature Conservancy.

United States Department of the Interior, Fish and Wildlife Service. 2013. Federal Register. Proposal to list the distinct population segment of North American wolverine occurring in the contiguous United States as a threatened species under the Endangered Species Act. 28 pp.

United States Department of the Interior, Fish and Wildlife Service. 2012. Federally listed, proposed, candidate species and species of concern within Grant County, Oregon. August 11, 2012. 3 pp.

United States Department of the Interior, Fish and Wildlife Service. 2010. Federal Register. 12 month Finding on a Petition to List the North American Wolverine as Endangered or Threatened.

United States Department of the Interior, Fish and Wildlife Service. 2006. Final Environmental Assessment: Designation of Critical Habitat for the Contiguous United States Distinct Population Segment of the Canada Lynx. Denver, Colorado. 74 pp.

United States Department of the Interior, Fish and Wildlife Service. 2003. Endangered and threatened wildlife and plants; 90-day finding on a petition to list the western sage grouse. February 7, 2003. Federal Register 68(26): 6500-6504.

United States Deparment of the Interior Fish and Wildlife Service. 2013. Website listing Federally listed, proposed and candidate species by State and County. Queried on May 5, 2014. http://www.fws.gov/endangered

United States Department of Agriculture, Agricultural Research Service. 2007. Colony Collapse Disorder (CCD) Steering Committee. Colony collapse disorder action plan. Downloaded June 6, 2008 from: http://www.ars.usda.gov/is/br/ccd/ccd_actionplan.pdf

United States Department of Agriculture, Forest Service 2010. Species Fact Sheet. Silver-bordered Fritillary (*Boloria selene*). 3 pp.

United States Department of Agriculture, Forest Service and Animal and Plant Health Inspection Service. 2012. Gypsy Moth Management in the United States, a Cooperative Approach - Final Environmental Impact Statement. NA-MB-01-12. Newtown Square, Pennsylvania.

United States Department of Agriculture, Forest Service. 1990. Land and Resource Management Plan for the Malheur National Forest and Appendices. Pacific Northwest Region. Available at: http://www.fs.usda.gov/detail/malheur/landmanagement/?cid=fsbdev3_033814.

United States Department of Agriculture, Forest Service.1990. ROS Primer and Field Guide.

United States Department of Agriculture, Forest Service. 1993. Malheur Wild and Scenic River Management Plan.

United States Department of Agriculture, Forest Service. 1993. North Fork of the Malheur Scenic River Management Plan.

United States Department of Agriculture, Forest Service. 1995. Forest Service Manual (FSM) 2600, Wildlife, Fish and Sensitive Plant Habitat Management. R-6 Supplement 2600-95-3, effective 6/29/95.

United States Department of Agriculture, Forest Service. 1995. Regional Forester's Forest Plan Amendment #2. Interim Management Direction Establishing Riparian, Ecosystem and Wildlife Standards for Timber Sales. Revised. 11 pp.

United States Department of Agriculture, Forest Service. 1998. Watershed Protection and Management. Forest Service Manual. R6 Supplement 2500-98-1, Chapter 2520. United States Department of Agriculture Forest Service, Region 6, Portland, OR. 7p.

United States Department of Agriculture, Forest Service. 1999. Noxious Weed Strategy, Pacific Northwest Region, Portland, OR

United States Department of Agriculture, Forest Service. 2001. Guide to Noxious Weed Prevention Practices. www.fs.fed.us/rangelands/ftp/invasives

United States Department of Agriculture, Forest Service. 2001. Special Areas; Roadless Area Conservation Rule 36 CFR Part 294.

United States Department of Agriculture, Forest Service. 2003. Malheur National Forest National Visitor Use Monitoring Report. United States Forest Service, Malheur National Forest, John Day, OR.

United States Department of Agriculture, Forest Service. 2004. Implementing the National Fire Plan Using Livestock Grazing to Manage Vegetation (Official Letter).

United States Department of Agriculture, Forest Service. 2005. Biological Assessment for the United States Department of Agriculture Forest Service, Pacific Northwest Region, Invasive Plant Program. Pacific Northwest Region, Portland, OR. June 17, 2005. 452pp + appendices.

United States Department of Agriculture, Forest Service. 2005. Fisheries Biological Assessment for United States Department of Agriculture Forest Service, Pacific Northwest Region, Invasive Plant Program, Environmental Impact Statement. United States Department of Agriculture Forest Service, Pacific Northwest Region, Portland, OR. 221pp.

United States Department of Agriculture, Forest Service. 2005. Pacific Northwest Region Invasive Plant Program: Preventing and Managing Invasive Plants. Final Environmental Impact Statement. Volumes I, II, and III. (R6-NR-FHP-PR-02-05). Pacific Northwest Region. Oregon (R6 2005 FEIS).

United States Department of Agriculture, Forest Service. 2005. Pacific Northwest Region Invasive Plant Program Record of Decision. Pacific Northwest Region, Portland, OR. October 2005, R6-NR-FHP-PR-02-05. 39 pp. + appendices. (R6 2005 ROD).

United States Department of Agriculture, Forest Service. 2005. Pacific Northwest Region Invasive Plant Program Appendix J. The Effects of Non-herbicidal Methods of Invasive Plant Treatments on Wildlife, Fish and Plants. Pacific Northwest Region, Portland, OR.27 pp.

United States Department of Agriculture, Forest Service. 2005. Pacific Northwest Region Invasive Plant Program Appendix P. Summary of Herbicide Effects to Wildlife. United States Department of Agriculture Forest Service, Pacific Northwest Region, Portland, OR. February 2005. 141 pp.

United States Department of Agriculture, Forest Service. 2006. Lynx Conservation Agreement between United States Department of Agriculture Forest Service and United States Department of the Interior Fish and Wildlife Service. 9 pp.

United States Department of Agriculture, Forest Service. 2007. Spotted Knapweed. Prepared by Alaska Region. R10-TP125. 2 pp.

United States Department of Agriculture, Forest Service. 2008. Gifford Pinchot National Forest and Columbia River Gorge National Scenic Area (Washington Portion) FEIS and ROD

United States Department of Agriculture, Forest Service. 2008. Malheur National Forest. Environmental Assessment Balance Thinning and Fuels Project. John Day, Oregon.

United States Department of Agriculture, Forest Service. 2008. Memorandum of Understanding between the United States Department of Agriculture and the United States Fish and Wildlife Service to Promote the Conservation of Migratory Birds. 13 pp.

United States Department of Agriculture, Forest Service. 2008. Umatilla and Wallowa-Whitman National Forests Invasive Plant Biological Assessment. Pendleton and Baker City, Oregon.

United States Department of Agriculture, Forest Service. 2009. Malheur National Forest National Visitor Use Monitoring Report. United States Forest Service, Malheur National Forest, John Day, OR.

United States Department of Agriculture, Forest Service. 2010. Species Fact Sheet. Shortface Lanx (*Fisherola nuttalli*) 6 pp.

United States Department of Agriculture, Forest Service. 2011. Regional Forester's Sensitive Species List. Pacific Northwest Region, Portland Oregon. December, 2011.

United States Department of Agriculture, Forest Service. 2011. Species Fact Sheet. Johnson's Hairstreak (*Callophrys johnsoni*). 8 pp.

United States Department of Agriculture, Forest Service. 2012. Field Guide for Managing Canada Thistle in the Southwest. Southwest Region. TP-R3-16-14.

United States Department of Agriculture, Forest Service. 2012. Field Guide for Managing Knapweeds in the Southwest. United States Department of Agriculture Forest Service Southwest Region. TP-R3-16-14.

United States Department of Agriculture, Forest Service. 2012. Field Guide for Managing Leafy Spurge in the Southwest. United States Department of Agriculture Forest Service Southwest Region. TP-R3-16-14.

United States Department of Agriculture, Forest Service. 2012. National Best Management Practices for Water Quality Management on National Forest System Lands. Volume 1: National Core BMP Technical Guide.

United States Department of Agriculture, Forest Service. 2012. Species Fact Sheet. Columbia Clubtail (*Gomphus lynnae*). 3 pp.

United States Department of Agriculture, Forest Service 2013. National Strategic Framework for Invasive Species Management. Available [ONLINE] @ http://www.fs.fed.us/publications/invasive/invasive-framework-2013.pdf

United States Department of Agriculture, Forest Service. 2013. Disturbed WEPP 2.0. Available [ONLINE] @ http://forest.moscowfsl.wsu.edu/cgi-bin/fswepp/wd/weppdist.pl [May 23, 2013]

United States Department of Agriculture, Forest Service. 2013. Natural Resource Manager Database. National Forest Service database for sensitive plant data management. Formerly known as NRIS.

United States Department of Agriculture, Forest Service. 2013. Species Fact Sheet. Harney Basin Duskysnail (Colligurus depressus). 17 pp.

United States Department of the Interior, Fish and Wildlife Service. 2007. Biological Opinion on the effects of the Northern Rocky Mountain Lynx Amendment on the Distinct Population Segment (DPS) of Canada Lynx (Lynx Canadensis) in the contiguous United States. 85 pp.

United States Department of the Interior, Fish and Wildlife Service. 1999. Bald and Golden Eagle Protection Act. Title 16. Conservation. Chapter 5A. Protection and Conservation of Wildlife. 4 pp.

United States Department of the Interior, Fish and Wildlife Service. 2013. Pygmy Rabbit Fact Sheet. Pacific Region. Available at; http://www.fws.gov/oregonfwo/Species/Data/PygmyRabbit/. Accessed 4/19/2013.

United States Department of the Interior, Fish and Wildlife Service. 2012. Federally listed, proposed, candidate species and species of concern within Harney County, Oregon. August 11, 2012. 4 pp.

United States Department of the Interior, Fish and Wildlife Service. 2012. Federally listed, proposed, candidate species and species of concern within Crook County, Oregon. August 11, 2012. 3 pp.

United States Department of the Interior, Fish and Wildlife Service. 2012. Federally listed, proposed, candidate species and species of concern within Malheur County, Oregon. August 11, 2012. 4 pp.

United States Department of the Interior, Fish and Wildlife Service. 2012. Federally listed, proposed, candidate species and species of concern within Baker County, Oregon. August 11, 2012. 3 pp.

United States Department of the Interior, Fish and Wildlife Service. 2011. Federal Register. Reissuance of Final Rule to Identify the Northern Rocky Mountain Population of Gray Wolf as a Distinct Population Segment and to Revise the List of Endangered and Threatened Wildlife. Pp. 25590-25592.

United States Department of the Interior, Fish and Wildlife Service. 2009. Federal Register Revised Designation of Critical Habitat for the Contiguous United States Distinct Population Segment of the Canada Lynx. Vol. 74. No 36, 87 pp.

United States Department of the Interior, Fish and Wildlife Service. 2008. Birds of Conservation Concern. Division of Migratory Bird Management, Arlington, Virginia. 93 pp.

United States Department of the Interior, Fish and Wildlife Service. 2007. National Bald Eagle Management Guidelines. United States Fish and Wildlife Service. 23 p.

United States Department of the Interior, Fish and Wildlife Service. 2006. Amendment to the Canada Lynx Conservation Agreement determining occupied lynx habitat. 17 pp.

United States Department of the Interior, Fish and Wildlife Service. 2005. Federal Register 90 Day Finding on a Petition to List the Pygmy Rabbit as Threatened or Endangered. Vol. 70, No. 97. May 20, 2005. 13 pp.

United States Department of the Interior, Fish and Wildlife Service. 2005. Federal Register Final Rule to Identify the Northern Rocky Mountain Population of Gray Wolf as a Distinct Population Segment and to Revise the List of Endangered and Threatened Wildlife. Vol. 74, No. 62, April 2, 2009. 66 pp.

United States Department of the Interior, Fish and Wildlife Service. 2005. Lynx Recovery Outline. Contiguous United States Distinct Population Segment of the Canada Lynx. 21 pp.

United States Department of the Interior, Fish and Wildlife Service. 2005. Lynx Conservation Agreement between the United States Forest Service and United States Fish and Wildlife Service. 9 pp.

United States Department of the Interior, Fish and Wildlife Service. 2003. Endangered and Threatened Wildlife and Plants; Removing the Western Distinct Population Segment of Gray Wolf From the List of Endangered and Threatened Wildlife. Federal Register: April 1, 2003, Volume 68. No. 62.

United States Department of the Interior, Fish and Wildlife Service. 2002. Chapter 1, Introduction. In: Bull Trout (*Salvelinus confluentus*) Draft Recovery Plan. United States Fish and Wildlife Service, Portland, Oregon. 137 pps.

United States Department of the Interior, Fish and Wildlife Service. 1999. Proposed rule: delist bald eagle (Haliaeetus leucocephalus) in the lower 48 states. Federal Register 64:36453-36464.

United States Department of the Interior, Fish and Wildlife Service. 1995. Endangered and Threatened Wildlife and Plants. Reopening of Comment Period on Proposed Rule to Reclassify the Bald Eagle from Endangered to Threatened. Federal Register 50 CFR Part 17. 15280-15281.

United States Department of the Interior, Fish and Wildlife Service. 1987. Northern Rocky Mountain Wolf Recovery Plan. Denver, Colorado. 119 pp.

United States Department of the Interior, Fish and Wildlife Service. 1986. Recovery Plan for the Pacific Bald Eagle. Portland, OR. 160 pp.

United States Department of the Interior, Fish and Wildlife Service. 1981. Bald Eagle Management Guidelines for Oregon and Washington. 10 pp.

United States Department of the Interior, Geological Service. 2013. Daily Flow Statistics. Website: http://waterdata.usgs.gov/usa/nwis/sw

United States Department of the Interior, Geological Survey. 2007. Pygmy Rabbit Surveys on State Lands in Oregon. Open-File Report 2007-1015. Reston, Virginia. 27 pp.

United States Department of the Interior. Fish and Wildlife Service. 2003. Biological Opinion and Letter of Concurrence for Effects to Bald Eagles, Marbled Murrelets, Northern Spotted Owls, Bull Trout, and Designated Critical Habitat for Marbled Murrelets and Northern Spotted Owls. from Olympic National Forest Program of Activities for August 5, 2003 to December 31, 2008. Lacey Washington. 288 pp.

United States Department of the Interior, Fish and Wildlife Service. 2007. Removing the bald eagle in the lower 48 states from the list of endangered and threatened wildlife. Final Rule. Federal Register/Vol. 72, No. 130. July 9, 2007. 28 pp.

United States Environmental Protection Agency, Office of Pesticide Programs. 2005. Imazapyr: Revised HED Chapter of the Reregistration Eligibility Document (RED). December 8, 2005. United States EPA E-Docket EPA-HQ-OPP-2005-0495

United States Environmental Protection Agency, 2005. Pesticide Fact Sheet – Aminopyralid. Office of Prevention, Pesticides Environmental Protection and Toxic Substances Agency (7501C). August 10, 2005. United States Environmental Protection Agency, Office of Pesticide Programs. 2013. Human Health Benchmarks for Pesticides: Updated 2013 Technical Document. http://www.epa.gov/pesticides/hhbp

US P.L. 100-577. Omnibus Oregon Wild and Scenic Rivers Act of 1988.

US P.L. 90-542, 1968. Wild and Scenic Rivers Act.

Utah State University. 2013. The Great Basin and Invasive Weeds. Yellow Starthistle. 1 pp.

Verts, B. J., and L. N. Carraway. 1998. Land Mammals of Oregon. University of California Press, Berkeley, CA. 668 pp.

Wahl, T. R., B. Tweit, and S. G. Mlodinow, editors. 2005. Birds of Washington: status and distribution. Corvallis, OR, United States Oregon State Univ. Press. 436 pp. In Mellen-McLean, Kim 2012d. MIS Information Sheet. Primary Cavity Nesters/Excavators. 29 pp.

Wangemann, S.A. R.A. Kohl, and P.A. Molumeli. 2000. Infiltration and Percolation Influenced by Antecedent Soil Water Content and Air Entrapment. Transactions of the ASAE Vol. 43(6): 1517-1523.

Wardle, D. A., Bardgett, R. D., Klironomos, J. N., Setälä, H., Van der Putten, W. H. and Wall, D. H. 2004. Ecological linkages between aboveground and belowground biota. Science 304: 1629-1633

Warren, A.D. 2005. Lepidoptera of North America 6, Butterflies of Oregon: Their Taxonomy, Distribution, and Biology. Contributions of the C.P. Gillette Museum of Arthropod Diversity. Colorado State University, Fort Collins, Colorado. 405 pp. In United States Department of Agriculture Forest Service 2010b. Species Fact Sheet. Silver-bordered Fritillary (Boloria selene). 3 pp.

Weber, K. T., C. L. Marcum, M. G. Burcham, and L. J. Lyon. 2000. Landscape influences on elk vulnerability to hunting. Intermountain Journal of Science 6:86-94.

Weihe, P. E.; Neely, R. K. 1997. The effects of shading on competition between purple loosestrife and broad-leaved cattail. Aquatic Botany. 59:127-138.

Weiher, E., Wisheu, I.C., Keddy, P.A., and Moore, D.R.J. 1996. Establishment, Persistence, and Management Implications of Experimental Wetland Plant Communities. Wetlands 16(2): p.208-18.

Weiss, N.T. and B.J. Verts. 1984. Habitat and distribution of the pygmy rabbit (*Sylvilagus idahoensis*) in Oregon. Great Basin Naturalist 44: 563-571 – Deschutes NF Weed EIS

Western Bat Working Group. 2005. Species Accounts, Townsend’s big-eared bat. Available at http://www.wbwg.org/speciesinfo/species_accounts/vespertilonidae/coto.pdf. Accessed 9/11/11.

Western Regional Climate Center. 2012. Website: http://www.wrcc.dri.edu/

Western Regional Climate Center. 2013. Website: http://www.wrcc.dri.edu/

Whisenant, S.G. 1990. Changing fire frequencies on Idaho's Snake river plains: ecological and management implications. In: McArthur, E.D.; Romney, E. M.; Smith, S. D.; Tueller, P. T. eds. Proceedings of a Symposium on Cheatgrass Invasion, Shrub Die-off, and Other Aspects of Shrub Biology and Management. United States Forest Service Gen. Tech. Rep. INT-276. Ogden, UT.: Intermountain Forest and Range Experiment Station: 4-10.

Wilde, S.B., T.M. Murphy, C.P. Hope, S.K. Habrun, J. Kempton, A. Birrenkott, F. Wiley, W.W. Bowerman, and A.J. Lewitus. 2005. Avian vacuolar myelinopathy linked to exotic aquatic plants and a novel cyanobacterial species. Environmental Toxicology 20 (3) 348-353.

Williamson, J., and S. Harrison. 2002. Biotic and abiotic limits to the spread of exotic revegetation species. Ecological Applications. 12(1): 40-51

Wisdom, M.J., R.S. Holthausen, B.C. Wales, C.D. Hargis, V.A. Saab, D.C. Lee, W.J. Hann, T.D. Rich, M.M. Rowland, W.J. Murphy and M.R. Earnes. 2000. Source habitats for terrestrial vertebrates of focus in the Interior Columbia Basin: Broad-scale trends and management implications, Volume 2 – Group level results. Gen. Tech. Rep. Threatened and Endangered Species, Sensitive Species and Management Indicator Species and the level of analysis required. PNW-GTR-485. pp. 181-190; 199-208; 219-223; 237-241; 242-248; 258-265; 293-297.

Witmer, G. W., S. K. Martin, and R. D. Sayler. 1998. Forest carnivore conservation and management in the interior Columbia Basin: Issues and environmental correlates. General Technical Report GTR-PNW-420. Portland, OR: United States Department of Agriculture Forest Service, Pacific Northwest Research Station, Portland, OR. 51 pp.

Wolfe, B.E. and J.N. Klironomos. 2005. Breaking new ground: soil communities and exotic plant invasion. Bioscience. 55(6): 477-487

Wood, Tamara. 2001. Herbicide Use in the Management of Roadside Vegetation, Western Oregon, 1999-2000: Effects on the Water Quality of Nearby Streams, USGS, Water Resources Investigations Report 01-4065.

Yu, Y.L., X. Wang, Y.M. Luo, J.F. Yang, J.Q. Yu, and D.F. Fan. 2005. Fungal degradation of metsulfuron-methyl in pure cultures and soil. Chemosphere. 60: 460-466

Zavaleta, E. 2000. Valuing ecosystems services lost to Tamarix invasion in the United States. In: H.A. Mooney, R.J. Hobbs, eds. Invasive species in a changing world. Washington, D.C.: Island Press: 261-300.

Zielinski, W. J., K. M. Slauson, C. R. Carroll, C. J. Kent, and D. G. Kudma. 2001. Status of American martens in coastal forests of the Pacific states. Journal of Mammalogy 82:478-490. In Mellen-McLean, Kim, 2012b. MIS Information Sheet. American Marten (*Martes Americana*). 20 pp.

Zouhar, K. 2004. Cardaria spp. In: Fire Effects Information System, [Online]. United States Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available online at: http://www.fs.fed.us/database/feis/ [2013, June 1].

Zouhar, K., J.K. Smith, S. Sutherland, and M. Brooks. 2008. Wildland fire in ecosystems: fire and non-native invasive plants. Gen. Tech. Rep. RMRS-GTR-42-vol. 6. Ogden, UT: United States Department of Agriculture Forest Service, Rocky Mountain Research Station. 355 p.

Glossary

Active ingredient (a.i.) - In any pesticide product, the component (a chemical or biological substance) that kills or otherwise controls the target pests - Pesticides are regulated primarily on the basis of active ingredients. The remaining ingredients are called “inerts.”

Acute effect **-** An adverse effect on any living organism in which severe symptoms develop rapidly and often subside after the exposure stops.

Acute exposure **-** A single exposure or multiple brief exposures occurring within a short time (e.g., 24 hours or less in humans). The classification of multiple brief exposures as “acute” is dependent on the life span of the organism. (See also, chronic exposure and cumulative exposure.)

Acute toxicity - Any harmful effect produced in an organism through an acute exposure to one or more chemicals.

Additive effect - A situation in which the combined effects of exposure to two chemicals simultaneously is equal to the sum of the effect of exposure to each chemical given alone. The effect most commonly observed when an organism is exposed to two chemicals together is an additive effect.

Adaptive management - A continuing process of action-based planning, monitoring, researching, evaluating, and adjusting with the objective of improving implementation and achieving the goals of the standards and guidelines

Adjuvant(s) - Chemicals that are added to pesticide products to enhance the toxicity of the active ingredient or to make the active ingredient easier to handle or mix.

Adsorption - The tendency of one chemical to adhere to another material such as soil.

Affected Environment - Existing biological, physical, social, and economic conditions of an area subject to change, both directly and indirectly, as the result of a proposed human action.

Agent - Any substance, force, radiation, organism, or influence that affects the body. The effects may be beneficial or injurious.

Agency for Toxic Substances and Disease Registry (ATSDR) - Federal agency within the Public Health Service charged with carrying out the health-related analyses under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Superfund Amendments and Reauthorization Act (SARA).

Alluvial deposits may occur after a heavy rain storm.

Ambient - Usual or surrounding conditions.

Amphibian - Any of a class of cold-blooded vertebrates (including frogs, toads, or salamanders) that are intermediate in many characteristics between fishes and reptiles and having gilled aquatic larvae and air-breathing adults.

Anadromous - Fish that spend their adult life in the sea but swim upriver to fresh water spawning grounds to reproduce.

Anaerobic - Life or process that occurs in, or is not destroyed by, the absence of oxygen. (See also, aerobic.)

Anions - Negatively charged ions in solution e.g., hydroxyl or OH- ion. (See also, cations)

Annual - A plant that endures for not more than a year. A plant that completes its entire life cycle from germinating seedling to seed production and death within a year.

Bacteria - Microscopic living organisms that metabolize organic matter in soil, water, or other environmental media. Some bacteria can also cause human, animal and plant health problems.

Best Management Practices (BMP) - A practice or combination of practices determined by a state or an agency to be the most effective and practical means (technological, economic, and institutional) of controlling point and non-point source pollutants at levels compatible with environmental quality.

Bioaccumulation - The increase in concentration of a substance in living organisms as they take in contaminated air, water, or food because the substance is very slowly metabolized or excreted (often concentrating in the body fat.)

Bioconcentration - The accumulation of a chemical in tissues of a fish or other organism to levels greater than in the surrounding water or environment.

Bioconcentration Factor (BCF) - The concentration of a compound in an aquatic organism divided by the concentration in the ambient water of the organism.

Biological control - The use of natural enemies, including invertebrate parasites and predators (usually insects, mites, and nematodes,) and plant pathogens to reduce populations of non-native, invasive plants.

Biological magnification - The process whereby certain substances such as pesticides or heavy metals increase in concentration as they move up the food chain.

Broadcast application - Herbicide treatment method generally used along roads; boom truck spray is directed at target species. Broadcast methods are used for larger infestations where spot treatments would not be effective.

Bryophytes - Plants of the phylum Bryophyta, including mosses, liverworts, and hornworts; characterized by the lack of true roots, stems, and leaves.

Herbicide Use Buffer - A strip of land near a waterway or other environmentally sensitive area where a particular chemical and method of application is restricted, depending on the herbicide ingredient.

Candidate species - Those plant and animal species that, in the opinion of the Fish and Wildlife Service (FWS) or National Oceanic and Atmospheric Administration (NOAA) Fisheries, may qualify for listing as “endangered” or “threatened.” The FWS recognizes two categories of candidates. Category 1 candidates are taxa for which the FWS has on file sufficient information to support proposals for listing. Category 2 candidates are taxa for which information available to the FWS indicates that proposing to list is possibly appropriate, but for which sufficient data are not currently available to support proposed rules.

Carcinogen - A chemical capable of inducing cancer.

Categorical Exclusion – A category of actions which do not individually or cumulatively have a significant effect on the human environment and which have been found to have no such effect in procedures adopted by a Federal agency in implementation of these regulations (§1507.3) and for which, therefore, neither an environmental assessment nor an environmental impact statement is required. (40 CFR 1508.4)

Cations - Positively charged ions in a solution. (See also, anion.)

Cation Exchange Capacity (CEC) - An indicator for fertility and adsorption of applied herbicides. The Cation Exchange Capacity (CEC) is an index of available sites for solutes/ions to attach to soil particles. A higher CEC represents increased ability to hold and release various chemical elements – a relative higher capacity for holding nutrients

Characteristic Landscape - The naturally established landscape within a scene or scenes being viewed.

Chemical Control - The use of naturally derived or synthetic chemicals called herbicides to eliminate or control the growth of invasive plants.

Chronic exposure - Exposures that extend over the average lifetime or for a significant fraction of the lifetime of the species (for a rat, chronic exposure is typically about two years). Chronic exposure studies are used to evaluate the carcinogenic potential of chemicals and other long-term health effects. (See also, acute and cumulative exposure.)

Chronic Reference Dose (RfD) - An estimate of a lifetime daily exposure level (in mg/kg/day) for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects. Chronic RfDs are specifically developed to be protective for long-term exposure to a compound (seven years to lifetime.)

Chronic toxicity - The ability of a substance or mixture of substances to cause harmful effects over an extended period, usually upon repeated or continuous exposure sometimes lasting for the entire life of the exposed organism.

Code of Federal Regulations (CFR) - Document that codifies all rules of the executive departments and agencies of the federal government. It is divided into fifty volumes, known as titles. Title 40 of the CFR (referenced as 40 CFR) lists all environmental regulations, including regulations for EPA pesticide programs (40 CFR Parts 150-189).

Competitive Seeding – A treatment method that is intended to reduce the potential for invasive plants to become introduced or to reoccupy a site once target populations have been reduced. This method is often combined with other treatment methods.

Common Control Measures – Integrated weed treatment methods used for a given target invasive plant species. The R6 2005 FEIS contains Appendix N, “Common Control Measures,” a compendium of treatment methods for invasive plants known in Oregon and Washington. These methods were updated as a part of development of the Malheur Invasive Plant Treatment EIS.

Congressionally Designated Areas - Areas that require Congressional enactment for their establishment, such as National Parks, Wild and Scenic Rivers, National Recreation Areas, National Monuments, and Wilderness. Also referred to as Congressional Reserves. Includes similar areas established by Executive Order, such as National Monuments.

Connected Actions – An action that would occur at the same time and place, or would be required to occur, in order to implement a proposed action, and therefore would be analyzed in a single NEPA document.

Contaminants - For chemicals, impurities present in a commercial grade chemical. For biological agents, other agents that may be present in a commercial product.

Cultural control - The establishment or maintenance of competitive vegetation, use of fertilizing, mulching, prescribed burning, or grazing animals to control or eliminate invasive plants.

Cumulative Effect (CE) - The impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions—regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time (40 CFR 1508.7).

Cumulative exposure - Exposure resulting from one or more activities that are repeated over a period of time. (See also, acute and chronic exposure.)

Detritus - Loose fragments, particles, or grains formed by the disintegration of organic matter or rocks.

Disturbance - An effect of a planned human management activity, or unplanned native or exotic agent or event that changes the state of a landscape element, landscape pattern, or regional composition.

Dosage/Dose - 1) The actual quantity of a chemical administered to an organism or to which it is exposed. 2) The amount of a substance that reaches a specific tissue (e.g., the liver). 3) The amount of a substance available for interaction with metabolic processes after crossing the outer boundary of an organism.

Dose Response - Changes in toxicological responses of an individual (such as alterations in severity of symptoms) or populations (such as alterations in incidence) that are related to changes in the dose of any given substance.

Drift - The portion of a sprayed chemical that is moved by wind off of a target site.

Early Detection/Rapid Response (EDRR) – Treatment of invasive plants over the life of the project according to the implementation planning process.

Endangered Species - Any species listed in the Federal Register as being in danger of extinction throughout all, or a significant portion, of its range.

Endangered Species Act (ESA) - A law passed in 1973 to conserve species of wildlife and plants, determined by the Director of the U.S. Fish and Wildlife Service or the NOAA Fisheries to be endangered or threatened with extinction in all or a significant portion of its range. Among other measures, ESA requires all federal agencies to conserve these species and consult with the Fish and Wildlife Service or NOAA Fisheries on federal actions that may affect these species or their designated critical habitat.

Endemic - A species or other taxonomic group that is restricted to a particular geographic region due to factors such as isolation or response to soil or climatic conditions. (Compare to “Indigenous” and “Native.”)

Environmental justice - Executive Order 12898 of February 11, 1994 requires federal agencies, to the greatest extent practicable and permitted by law, to make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions, the District of Columbia, the Commonwealth of Puerto Rico, and the commonwealth of the Mariana Islands.

Exposure assessment - The process of estimating the amount of contact with a chemical or biological agent that an individual or a population of organisms will receive from a pesticide application conducted under specific, stated circumstances.

Exotic – Non-native species; introduced from elsewhere, but not completely naturalized. (See also alien and introduced species.)

Federal Insecticide and Rodenticide Act (FIFRA) Pesticide Ingredient - An ingredient of a pesticide that must be registered with EPA under the Federal Insecticide, Fungicide, and Rodenticide Act. Products making pesticide claims must submit required information to EPA to register under FIFRA and may be subject to labeling and use requirements.

Fertilization - Treatment method involving adding of nutrients that could improve the success of desirable species; may be limited, depending on species/soil characteristics.

First-choice Herbicides – First-choice herbicides are those that would be used during the first year of treatment of a given primary target species. It is likely be most effective, given the options associated with a given action alternative. First-choice herbicides are often used in combination with non-herbicide methods.

Flora - Plant life, especially all the plants found in a particular country, region, or time regarded as a group. Also, a systematic set of descriptions of all the plants of a particular place or time.

Forage - Food for animals. In this document, term applies to both availability of plant material for wildlife and domestic livestock.

Formulation - A commercial preparation of a chemical including any inerts and/or contaminants.

Fungi - Molds, mildews, yeasts, mushrooms, and puffballs, a group of organisms that lack chlorophyll and therefore are not photosynthetic. They are usually non-mobile, filamentous, and multi-cellular.

Game fish - Species like trout, salmon, or bass, caught for sport. Many of them show more sensitivity to environmental change than non-game fish.

Geographical Information System (GIS) – Maps and data showing location and attributes for natural resources found within a project area.

Grazing animals - Treatment method which requires matching the invasive species with the appropriate grazer for best success.

Groundwater - The supply of fresh water found beneath the Earth's surface, usually in aquifers, which often supply wells and springs.

Groundwater Loading Effects of Agricultural Management Systems (GLEAMS) - A model that displays herbicide concentrations in streams under a variety of soil, climate, and vegetative conditions.

Habitat - The place where a population (e.g., human, animal, plant, microorganism) lives and its surroundings, both living and non-living.

Half-life - The time required for the concentration of the chemical to decrease by one-half.

Hand/Selective application - Herbicide treatment of individual plants through wicking, wiping, injecting stems, etc., with low likelihood of drift or delivery of herbicides away from treatment sites. This method ensures no herbicide directly contacts soil.

Hand-pulling/Grubbing - Treatment method that is labor-intensive but effective on single plants or on small, low-density infestations.

Hazard Quotient (HQ) - The ratio of the estimated level of exposure to a substance from a specific pesticide application to the RfD for that substance, or to some other index of acceptable exposure or toxicity. A HQ less than or equal to one is presumed to indicate an acceptably low level of risk for that specific application.

Hazard identification - The process of identifying the array of potential effects that an agent may induce in an exposed of humans or other organisms.

Herbaceous - A plant that does not develop persistent woody tissue above the ground (annual, biennial, or perennial.) Herbaceous vegetation includes grasses and grass-like vegetation, and broadleaved forbs.

Herbicide - A chemical preparation designed to kill plants, especially weeds, or to otherwise inhibit their growth. May or may not include an additive (adjuvant) such as a surfactant.

Herbicide Application Rate – The amount of herbicide active ingredient that would be used on a treated acre. The maximum rate is the amount allowed by an herbicide label. Typical rate is the average rate used by the Forest Service for invasive plant treatment projects. Lowest rate (or lowest effective rate) is the least amount of herbicide needed to reach treatment objectives. The lowest effective rate is determined by many variables including formulation, location, target species, and potential for herbicide resistence..

Herbicide Treatment – Any use of herbicide to meet treatment objectives. Herbicide treatments are part of the integrated weed management toolbox. Herbicide treatment may be combined with non-herbicide treatments to meet treatment objectives.

Herbicide Use Buffer – An area adjacent to a stream or other water body where herbicide ingredient or application methods are restricted.

Humus - Organic portion of the soil remaining after prolonged microbial decomposition.

Tribal and Treaty Rights - Native American treaty and other rights or interests recognized by treaties, statutes, laws, executive orders, or other government action, or federal court decisions.

Indian Tribe - Any American Indian or Alaska Native tribe, band, nation, pueblo, community, rancheria, colony, or group meeting the provisions of the Code of Federal Regulations Title 25, Section 83.7 (25 FR 83.7), or those recognized in statutes or treaties with the United States.

Indigenous - An indigenous species is any that were or are native or inherent to an area. (See also, native.)

Inerts - Anything other than the active ingredient in a pesticide product; not having pesticide properties.

Infested area or site - A contiguous area of land occupied by, in this case, invasive plant species. An infested area of land is defined by drawing a line around the actual perimeter of the infestation as defined by the canopy cover of the plants, excluding areas not infested. Generally, the smallest area of infestation mapped will be 1/10th (0.10) of an acre or 0.04 hectares.

Integrated Weed Management (IWM) - An interdisciplinary weed management approach for selecting methods for preventing, containing, and controlling noxious weeds in coordination with other resource management activities to achieve optimum management goals and objectives.

Interdisciplinary Team (IDT) - A group of individuals with varying areas of specialty assembled to solve a problem or perform a task. The team is assembled out of recognition that no one scientific discipline is sufficiently broad enough to adequately analyze the problem and propose action.

Introduced species - An alien or exotic species that has been intentionally or unintentionally released into an area as a result of human activity. (See also exotic, invasive, and noxious.)

Introduction - “The intentional or unintentional escape, release, dissemination, or placement of a species into an ecosystem as a result of human activity” (Executive Order 13122, 2/3/99).

Invasive plant species - An alien plant species whose introduction does or is likely to cause economic or environmental harm or harm to human health (Executive Order 13122, 2/3/99) (See also exotic and introduced species)

Irreversible effect - Effect characterized by the inability of the body to partially or fully repair injury caused by a toxic agent.

Irritant - Non-corrosive material that causes a reversible inflammatory effect on living tissue by chemical action at the site of contact as a function of concentration or duration of exposure.

LC50 (Lethal Concentration50) - A calculated concentration of a chemical in air or water to which exposure for a specific length of time is expected to cause death in 50 percent of a defined experimental animal population.

LD50 (Lethal Dose50) - The dose of a chemical calculated to cause death in 50 percent of a defined experimental animal population over a specified observation period. The observation period is typically 14 days.

Label - All printed material attached to, or part of, the pesticide container.

Land allocation – A management area designated in a Land and Resource Management Plan associated with certain desired conditions, objectives and standards.

Landscape - An area composed of interacting ecosystems that are repeated because of geology, land form, soils, climate, biota, and human influences throughout the area. Landscapes are generally of a size, shape, and pattern that is determined by interacting ecosystems.

Landscape Character - Particular attributes, qualities, and traits of a landscape that give it an image and make it identifiable or unique.

Landscape Setting - The context and environment in which a landscape is set; a landscape backdrop. It is the combination of land use, landform, and vegetation patterns that distinguish an area in appearance and character from other areas.

Leaching - The process by which chemicals on or in soil or other porous media are dissolved and carried away by water, or are moved into a lower layer of soil.

Level of Concern (LOC) - The concentration in media or some other estimate of exposure above which there may be effects.

Lichens - Complex thallophytic plants comprised of an alga and a fungus growing in symbiotic association on a solid surface (such as a rock.)

Littoral zone - 1) That portion of a body of fresh water extending from the shoreline lakeward to the limit of occupancy of rooted plants. 2) The strip of land along the shoreline between the high and low water levels.

Lowest-Observed-Adverse-Effect Level (LOAEL) - The lowest dose of a chemical in a study, or group of studies, that produces statistically or biologically significant increases in frequency or severity of adverse effects between the exposed and control populations.

Manual Control - The use of any non-mechanized approach to control or eliminate invasive plants (e.g., hand-pulling, grubbing)

Material Safety Data Sheet (MSDS) - A compilation of information required under the OSHA Communication Standard on the identity of hazardous chemicals, health and physical hazards, exposure limits, and precautions.

Mechanical Control - The use of any mechanized approach to control or eliminate invasive plants (e.g., mowing, weed whipping).

Microorganisms - A generic term for all organisms consisting only of a single cell, such as bacteria, viruses, protozoa and some fungi.

Minimum tool - Use of a weed treatment alternative that would accomplish management objectives and have the least impact on resources

Modification - A visual quality objective meaning human activities may dominate the characteristic landscape but must, at the same time, utilize naturally established form, line, color, and texture. It should appear as a natural occurrence when viewed in foreground or middleground.

Mollusks - Invertebrate animals (such as slugs, snails, clams, or squids) that have a soft, un-segmented body, usually enclosed in a calcareous shell; representatives found on National Forest System land include snails, slugs, and clams.

Monitoring - A process of collecting information to evaluate if objectives and anticipated or assumed results of a management plan are being realized or if implementation is proceeding as planned.

Morbidity - Rate of disease, injury or illness.

Mowing - Invasive plant treatment method which is limited to level/gently-sloping smooth-surface terrain. Treatment timing is critical, and must be conducted for several consecutive years.

National Environmental Policy Act (NEPA) - An Act passed in 1969 to declare a national policy that encourages productive and enjoyable harmony between humankind and the environment, promotes efforts that prevent or eliminate damage to the environment and biosphere, stimulates the health and welfare of humanity, enriches the understanding of the ecological systems and natural resources important to the nation, and establishes a Council on Environmental Quality.

National Forest Management Act (NFMA) - A law passed in 1976 as an amendment to the Forest and Rangeland Renewable Resources Planning Act, requiring preparation of Forest Plans and the preparation of regulations to guide that development.

National Marine Fisheries Service (NMFS) - The federal agency that is the listing authority for marine mammals and anadromous fish under the ESA.

National Pollutant Discharge Elimination System (NPDES) - As authorized by the Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Point sources are discrete conveyances such as pipes or man-made ditches. Individual homes that are connected to a municipal system, use a septic system, or do not have a surface discharge do not need an NPDES permit; however, industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters.

National Visitor Use Monitoring (NVUM) - A permanent, ongoing sampling system that measures national forest visitor demographics, experiences, preferences, and impressions. A stratified random sample is done for 25 percent of the National Forest System each year according to a national research protocol. NVUM responds to the need to better understand the use and importance of, and satisfaction with, National Forest System recreation opportunities.

National Wilderness Preservation System (NWPS) - The Wilderness Act of 1964 established the national Wilderness Preservation System to ensure that certain federally owned areas in the United States would be preserved and protected in their natural condition. The Act defines a wilderness area, in part, as an area that generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable. Areas included in the system are administered for the use and enjoyment of the American people in such manner as to leave them unimpaired for future use and enjoyment as wilderness.

Native species - With respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem (Executive Order 13122, 2/3/99).

Naturalized - Applied to a species that originally was imported from another country but that now behaves like a native in that it maintains itself without further human intervention and has invaded native populations.

Non-target species - Any plant or animal that is not the intended organism to be controlled by a pesticide treatment.

No-Observed-Adverse-Effect level (NOAEL) - Exposure level at which there are no statistically or biological significant differences in the frequency or severity of any adverse effect in the exposed or control populations

No-Observed-Effect-Level (NOEL) - Exposure level at which there are no statistically or biological significant differences in the frequency or severity of any effect in the exposed or control populations.

Noxious weed - "Any living stage (including but not limited to, seeds and reproductive parts) of any parasitic or other plant of a kind, or subdivision of a kind, which is of foreign origin, is new to or not widely prevalent in the United States, and can directly or indirectly injure crops, other useful plants, livestock, or poultry or other interests of agriculture, including irrigation, or navigation or the fish and wildlife resources of the United States or the public health" (Public Law 93-629, January 3, 1975, Federal Noxious Weed Act of 1974).

Outstandingly Remarkable Value (ORV) - A characteristic of rivers or sections of rivers in the national Wild and Scenic River System. In order for a river to be included in the system, it must possess at least one "outstandingly remarkable" value, such as scenic, recreational, geologic, fish, wildlife, historic, cultural, or other similar features. Outstandingly Remarkable Values are values or opportunities in a river corridor which are directly related to the river and which are rare, unique, or exemplary from a regional or national perspective.

Partial Retention - A visual quality objective where human activities may be evident but must remain subordinate to the characteristic landscape.

Pathogen - A living organism, typically a bacteria or virus that causes adverse effects in another organism.

Percolation - Downward flow or filtering of water through pores or spaces in rock or soil.

Perennial Plant- A plant species having a life span of more than 2 years.

Persistence - Refers to the length of time a compound, once introduced into the environment, stays there.

Personal Protective Equipment (PPE) - Clothing and equipment worn by herbicide mixers, loaders and applicators and re-entry workers worn to reduce their exposure to potentially hazardous chemicals and other pollutants.

Pest - An insect, rodent, nematode, fungus, weed or other form of terrestrial or aquatic plant or animal life that is classified as undesirable because it is injurious to health or the environment.

Pesticide - Any substance used for controlling, preventing, destroying, repelling, or mitigating any pest. Includes fungicides, herbicides, fumigants, insecticides, nematicides, rodenticides, desiccants, defoliants, plant growth regulators, etc.

pH - The negative log of the hydrogen ion concentration. A high pH (greater than 7) is alkaline or basic and a low pH (less than 7) is acidic.

Population - A group of individuals of the same species in an area.

Project "Caps" – Limitations on the acreage that may be treated annually through the life of the project.

Project Design Features (pdf) – Measures that are part of project implementation to ensure that the project is done according to environmental standards and adverse effects are within the scope of those predicted in this Environmental Impact Statement.

Proposed species - Any plant or animal species that is proposed by the Fish and Wildlife Service or NOAA Fisheries in a Federal Register notice to be listed as threatened or endangered.

Recreational Rivers - A classification within the national Wild and Scenic River System. Recreational rivers are those rivers, or sections of rivers, that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

Reference Dose (RfD) - The RfD is a numerical estimate of a daily exposure to the human population, including sensitive subgroups such as children, that is not likely to cause harmful effects during a lifetime. RfDs are generally used for health effects that are thought to have a threshold or minimum dose for producing effects.

Registered Pesticides - Pesticide products that have been approved for the uses listed on the label.

Registration - Formal licensing with EPA of a new pesticide before it can be sold or distributed. Under the Federal Insecticide, Fungicide, and Rodenticide Act, EPA is responsible for registration (pre-market licensing) of pesticides based on data demonstrating no unreasonable adverse effects on human health or the environment when applied according to approved label directions.

Restoration - Ecological restoration is the process of assisting the recovery and management of ecological integrity. Ecological integrity includes a critical range of variability in biodiversity, ecological processes and structures, regional and historical context, and sustainable cultural practices. Restoration may be passive (passing of time to allow for site recovery) or active (in this project, active restoration includes seeding, mulching and planting after invasive plants are removed).

Retention - A visual quality objective where human activities are not evident to the casual forest visitor.

Revegetation - The re-establishment of plants on a site **-** The term does not imply native or non-native; does not imply that the site can ever support any other types of plants or species and is not at all concerned with how the site 'functions' as an ecosystem.

Riparian Area - A geographic area containing an aquatic ecosystem and adjacent upland areas that directly affect it.

Riparian Habitat Areas - Areas along live and intermittent streams, wetlands, ponds, lakes, and unstable and potentially unstable areas where riparian-dependent resources receive primary emphasis. Riparian Habitat Areas are important to the terrestrial ecosystem as well, serving as dispersal habitat for certain terrestrial species.

Risk - The chance of an adverse or undesirable effect, often measured as a percentage.

Risk Assessment - The qualitative and quantitative evaluation performed in an effort to estimate the risk posed to human health and/or the environment by the presence or potential presence and/or use of specific chemical or biological agents.

Scenery Management - The art and science of arranging, planning, and designing landscape attributes relative to the appearance of places and expanses in outdoor settings.

Scenic - Of or relating to landscape scenery; pertaining to natural or natural-appearing scenery; constituting or affording pleasant views of natural landscape attributes or positive cultural elements.

Scenic Rivers - A classification within the national Wild and Scenic River System. Scenic rivers are those rivers, or sections of rivers, that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.

Seen Area - The total landscape area observed based upon landform screening. Seen-areas may be divided into zones of immediate foreground, foreground, middleground, and background. Some landscapes are seldom seen by the public.

Sensitive Species – Sensitive species are identified by a Regional Forester for which population viability is a concern, as evidenced by significant current or predicted downward trends in population numbers or density and habitat capability that would reduce a species' existing distribution (FSM 2670.5). Management of sensitive species "must not result in a loss of species viability or create significant trends toward federal listing" (FSM 2670.32).

Species of Conservation Concern - Threatened, endangered and proposed species; Regional Forester's Sensitive species, management indicator species, and other identified native species.

Species - "A group of organisms, all of which have a high degree of physical and genetic similarity, generally interbreed only among themselves, and show persistent differences from members of allied groups of organisms." (Executive Order 13122, 2/3/99).

Spot application - Herbicide treatment involving use of a backpack sprayer or other means. Application is aimed at specific target species, with methods of prevention (such as barriers,) to control damage to non-target species.

Standards and guidelines - The rules and limits governing actions, as well as the principles specifying the environmental conditions or levels to be achieved and maintained

Sub-chronic exposure - An exposure duration that can last for different periods of time (5 to 90 days), with 90 days being the most common test duration for mammals. The sub-chronic study is usually performed in two species (rat and dog) by the route of intended use or exposure.

Sub-chronic toxicity - The ability of one or more substances to cause effects over periods from about 90 days but substantially less than the lifetime of the exposed organism. Sub-chronic toxicity only applies to relatively long-lived organisms such as mammals.

Surface water - All water naturally open to the atmosphere (rivers, lakes, reservoirs, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other collectors that are directly influenced by surface water.

Surfactant - A surface-active agent; usually an organic compound whose molecules contain a hydrophilic group at one end and a lipophilic group at the other. Promotes solubility of a chemical, or lathering, or reduces surface tension of a solution.

Synergistic effect - Situation in which the combined effects of exposure to two chemicals simultaneously is much greater than the sum of the effect of exposure to each chemical given alone.

Take - "The term 'take' means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." (Title 16, Chapter 35, Section 1532, Endangered Species Act of 1973)

Threatened species - Plant or animal species likely to become endangered throughout all, or a significant portion of, its range within the foreseeable future. A plant or animal identified and defined in accordance with the 1973 Endangered Species Act and published in the Federal Register.

Threshold - The maximum dose or concentration level of a chemical or biological agent that will not cause an effect in the organism.

Tolerances - Permissible residue levels for pesticides in raw agricultural produce and processed foods. Whenever a pesticide is registered for use on a food or a feed crop, a tolerance (or exemption from the tolerance requirement) must be established. EPA establishes the tolerance levels, which are enforced by the Food and Drug Administration and the Department of Agriculture.

Toxicity - The inherent ability of an agent to affect living organisms adversely. Toxicity is the degree to which a substance or mixture of substances can harm humans or animals.

Toxicology - The study of the nature, effects, and detection of poisons in living organisms. Also, substances that are otherwise harmless but prove toxic under particular conditions. The basic assumption of toxicology is that there is a relationship among the dose (amount), the concentration at the affected site, and the resulting effects.

Treatment Objectives: Treatment objectives reflect the desired outcome depending on the extent, distribution and priority for treating a given invasive plant species.

- **Eradicate**: Eliminate an invasive plant species from a site. This objective generally applies to species that are difficult to control and cover small areas. Some occurrences may be on roadsides (Russian knapweed, squarrose knapweed) and others may occur in intact native vegetation (yellow starthistle, small occurrences of thistles or knapweed, new invaders). This is generally our first priority for treatment.
- **Control**: Reduce the size of the infestation over time; some level of infestation may be acceptable. This objective applies to most of the target species (houndstongue, leafy spurge, perennial pepperweed, sulfur cinquefoil, whitetop) and large infestations of thistles and knapweeds. This is generally our second priority for treatment.
- **Contain**: Prevent the spread of the weed beyond the perimeter of patches or infestation areas mapped from current inventories. This objective applies to target species such as common St. Johnswort. This is generally our third priority for treatment.
- **Suppress**: Prevent seed production throughout the target patch and reduce the area coverage. Prevent the invasive species from dominating the vegetation of the area; low levels may be acceptable. This objective applies to target species such as toadflax that would be treated mainly with biocontrol agents. This is generally our fourth priority for treatment.

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

U.S. Fish and Wildlife Service (United States Department of the Interior Fish and Wildlife Service, USDI FWS, USFWS) - The federal agency that is the listing authority for species other than marine mammals and anadromous fish under the Endangered Species Act.

USDA Forest Service (United States Department of Agriculture Forest Service, FS or USFS) - The federal agency responsible for management of the Nation's National Forest System lands

Viability - Ability of a wildlife or plant population to maintain sufficient size to persist over time in spite of normal fluctuations in numbers, usually expressed as a probability of maintaining a specific population for a specified period.

Viable Population - A wildlife or plant population that contains an adequate number of reproductive individuals appropriately distributed on the planning area to ensure the long-term existence of the species.

Viewshed - Total visible area from a single observer position, or the total visible area from multiple observer position. Viewsheds are accumulated seen-areas from highways, trails, campgrounds, towns, cities, or other viewer locations. Examples are corridor, feature, or basin viewsheds.

Visual Quality Objective - A desired level of excellence based on physical and sociological characteristics of an area. Refers to degree of acceptable alteration of the characteristic landscape.

Well-distributed - Distribution sufficient to permit normal biological function and species interactions, considering life history characteristics of the species and the habitats for which it is specifically adapted.

Wetland - An area that is regularly saturated by surface or ground water and subsequently is characterized by a prevalence of vegetation that is adapted for life in saturated soil conditions. Examples include swamps, bogs, fens, marshes, and estuaries.

Wild and Scenic River System - The Wild and Scenic Rivers Act of 1968 established a system of selected rivers in the United States, which possess outstandingly remarkable values, to be preserved in free-flowing condition. Within the national system of rivers, three classifications define the general character of designated rivers: Wild, Scenic, and Recreational. Classifications reflect levels of development and natural conditions along a stretch of river. Classifications are used to help develop management goals for the river.

Wilderness - Areas designated by Congressional action under the 1964 Wilderness Act. Wilderness is defined as undeveloped federal land retaining its primeval character and influence without permanent improvements or human habitation. Wilderness areas are protected and managed to preserve their natural conditions, which generally appear to have been affected primarily by the forces of nature with the imprint of human activity substantially unnoticeable; have outstanding opportunities for solitude or for a primitive and confined type of recreation; include at least 5,000 acres, or are of sufficient size to make practical their preservation, enjoyment, and use in an unimpaired condition; and may contain features of scientific, educational, scenic, or historical value as well as ecological and geologic interest.

Wild Rivers - A classification within the national Wild and Scenic River System. Wild rivers are those rivers, or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted.

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Appendix A – Invasive Plant Inventory Watershed Analysis for the Malheur National Forest

Prepared by Joseph H. Rausch

December 3, 2012

This report presents an analysis of known invasive plants sites by watershed (HUC 5). Also included are other important attributes or concerns about the watersheds that may be associated with the treatment of invasive plants. The analysis is presented in watershed groups of the same basin (HUC 3), sub-basin (HUC4), or portions of sub-basins.

The map below and the corresponding figures on the following pages show the geographic extent of the watershed groups and the levels of infestations, respectively.

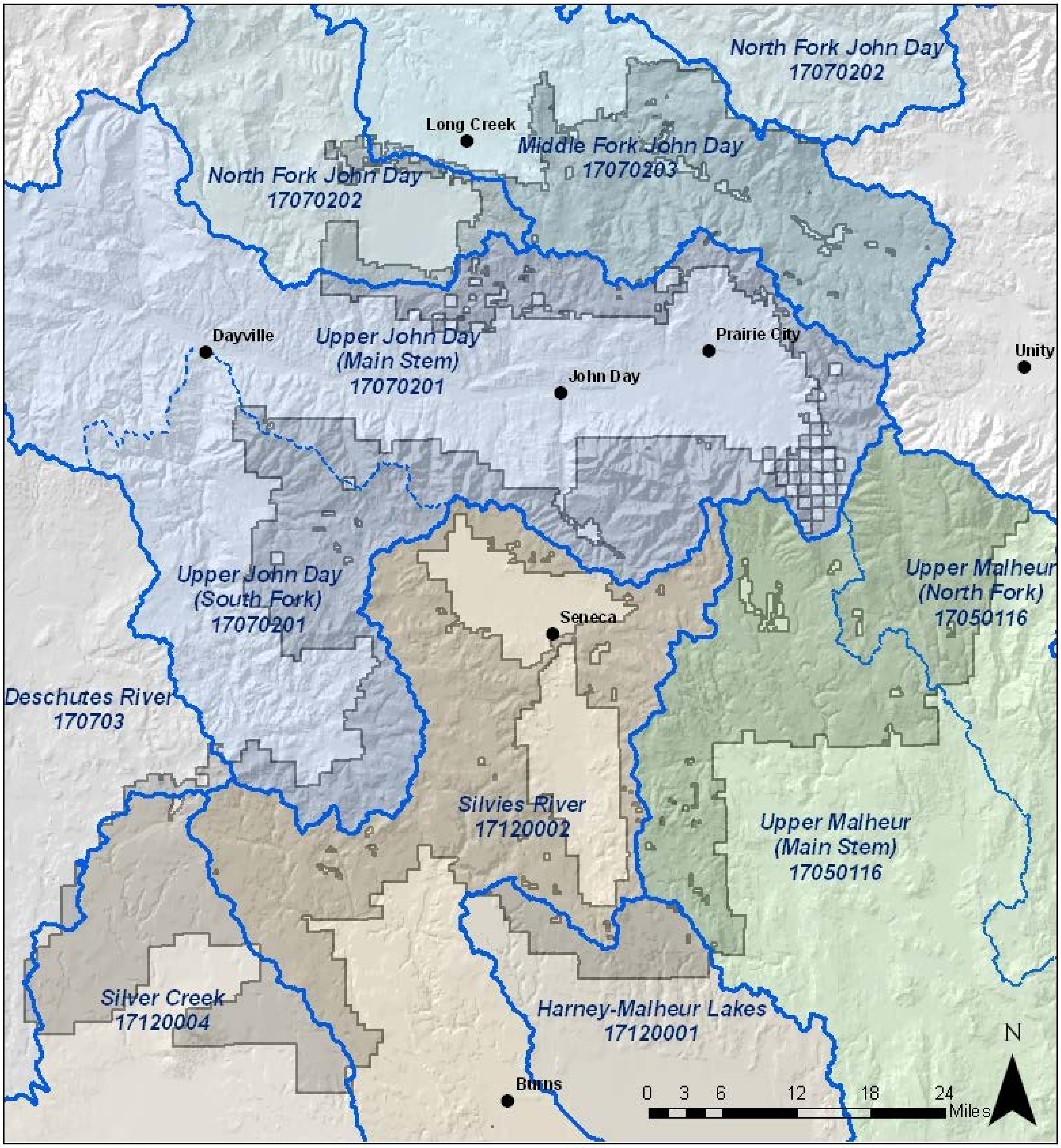


Figure A- 1. Watershed Groups

Summary of Invasive Plant Infestations by Watershed

In figure A- 2 that follows, colors represent the watershed group as presented in figure A- 1 on the previous page; the first column indicates the watershed group (by basin, sub-basin, or a portion thereof), and the second column indicates the 5^{th} field HUC. The individual watershed summaries that follow are generally presented in the order shown above.

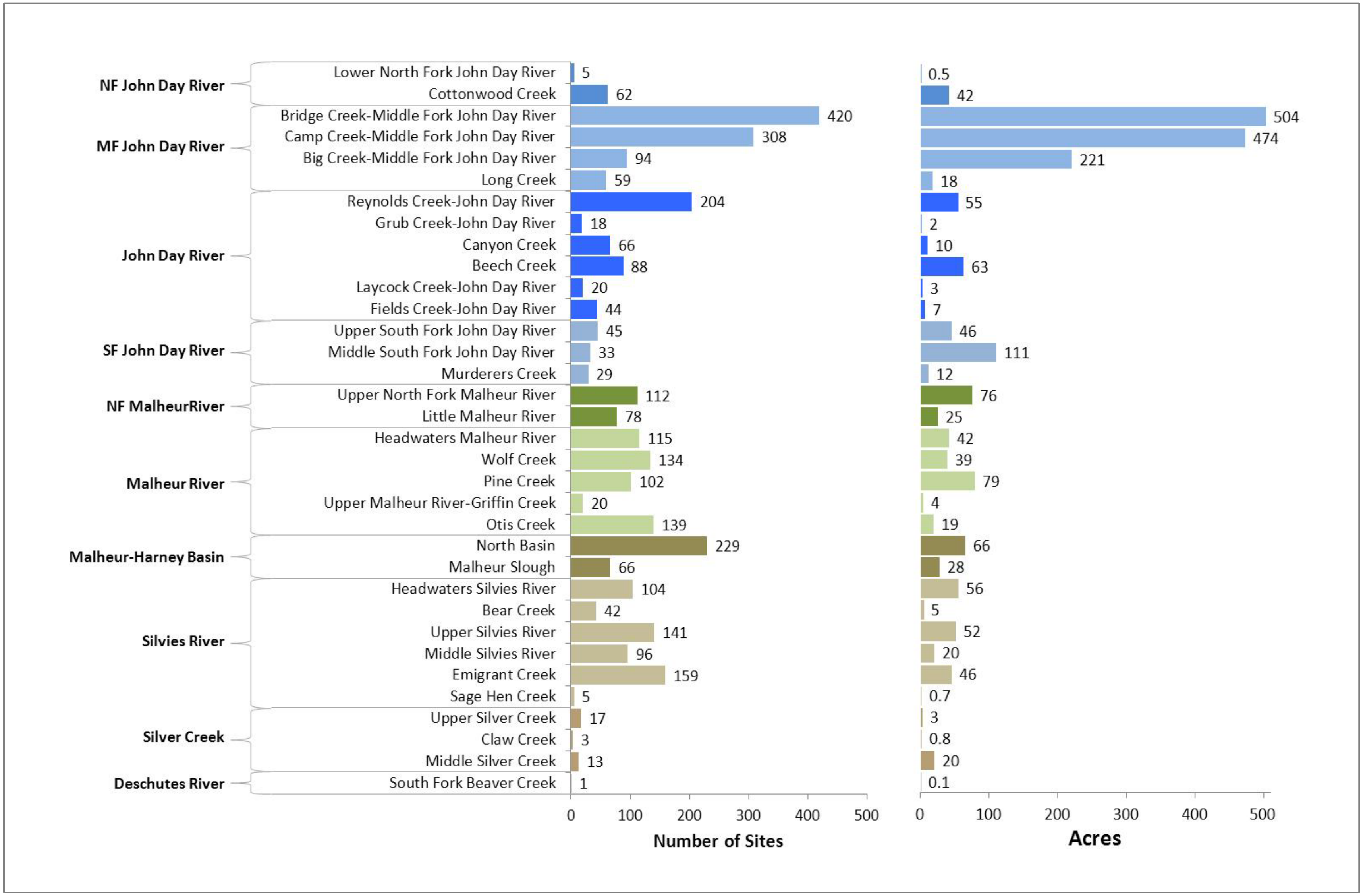


Figure A- 2. Invasive plants infestation summary

North Fork John Day Sub-basin (17070202)

Cottonwood Creek (1707020209)

Lower North Fork John Day River (1707020210)

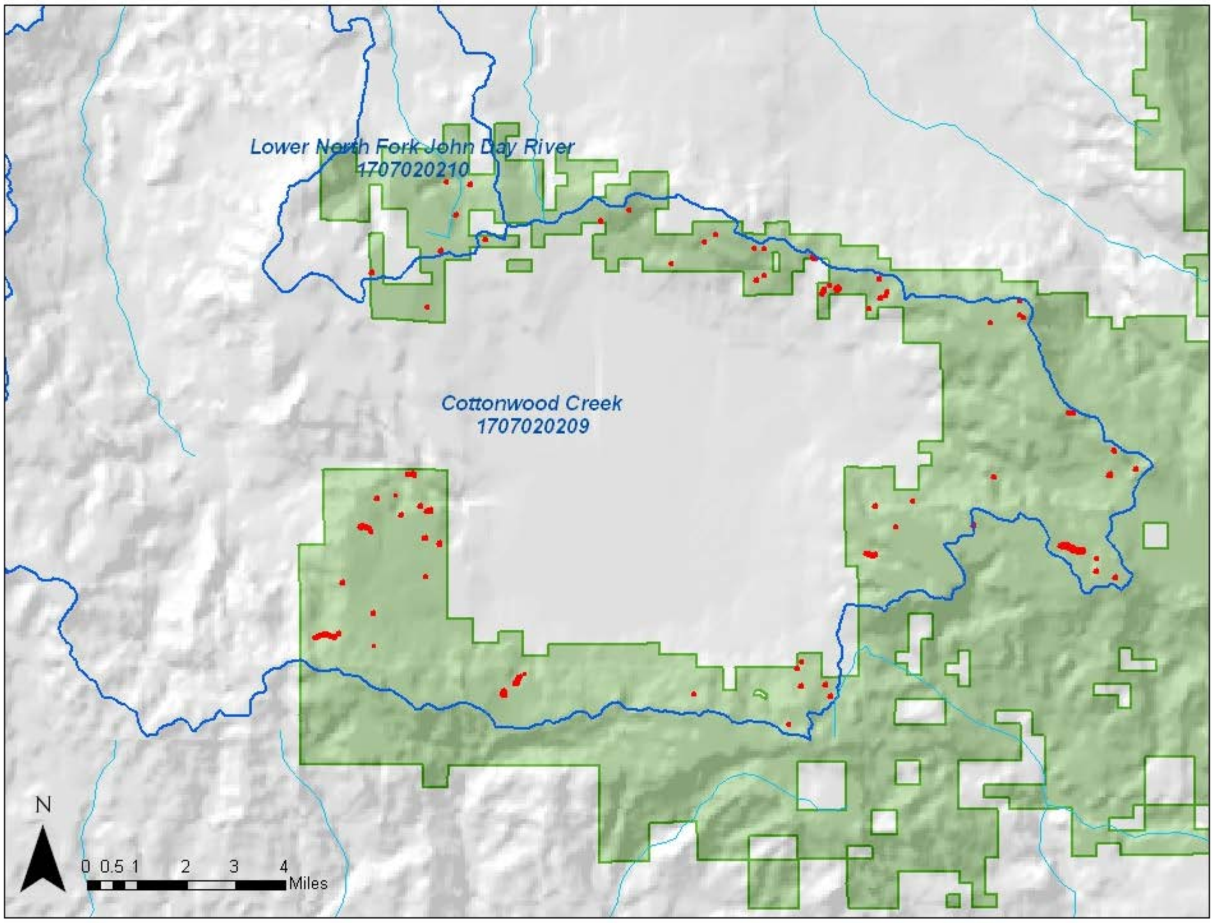
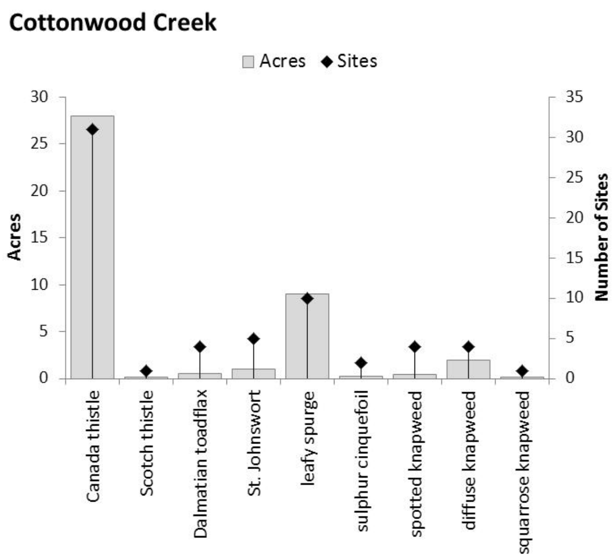


Figure A- 3. North Fork John Day Sub-basin (17070202)

Cottonwood Creek (1707020209)

Ranger district:	Blue Mountain RD
County:	Grant
Total FS acreage:	32,994
Special land uses:	none
Major streams and water bodies:	Fox Creek
Recreation:	dispersed campsites
Grazing allotments:	Fox, Highway, King, Indian Ridge, Donaldson, Beech Creek, Mt. Vernon/John Day, Ferg, Deep Creek
Watershed regional priorities:	within Whole Watershed Restoration Initiative (WWRI) Priority Basin (John Day)
Major roads and/or infested roads:	US-395, 3945, 3940, 3970, 3950
TES species of concern:	steelhead
Comments:	none

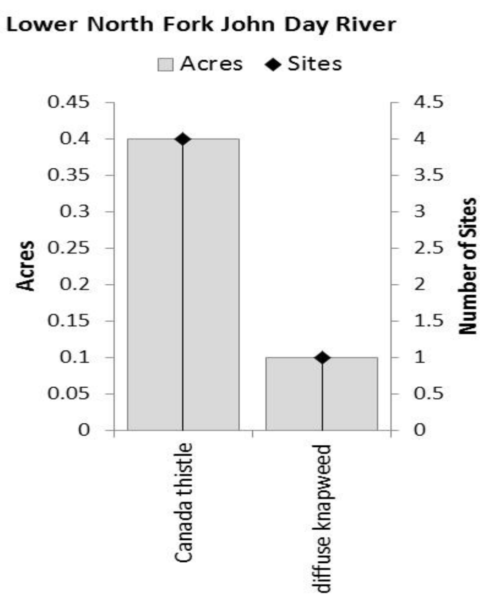


Species	Watershed Total	
	Sites	Acres
Canada thistle	31	28
Scotch thistle	1	0.1
Dalmatian toadflax	4	0.5
St. Johnswort	5	1
leafy spurge	10	9
sulphur cinquefoil	2	0.2
spotted knapweed	4	0.4
diffuse knapweed	4	2
squarrose knapweed	1	0.1
TOTAL	**62**	**41**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	8	4	6	1			
Leafy spurge	2	0.1	1	0.07			
TOTAL	**10**	**4**	**7**	**1**	**0**	**–**	**0**

Lower North Fork John Day River (1707020210)

Ranger district:	Blue Mountain RD
County:	Grant
Total FS acreage:	3,632
Special land uses:	None
Major streams and water bodies:	Deer Creek
Recreation:	Dispersed Campsites
Grazing allotments:	Hamilton, Deep Creek, King
Watershed regional priorities:	Within Whole Watershed Restoration Initiative (WWRI) Priority Basin (John Day)
Major roads and/or infested roads:	None
TES species of concern:	Steelhead
Comments:	None



Species	Watershed Total	
	Sites	Acres
Canada thistle	4	0.4
diffuse knapweed	1	0.1
TOTAL	**5**	**0.5**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	2	0.2	1	0.07			
TOTAL	**2**	**0.2**	**1**	**0.07**	**0**	**–**	**0**

Middle Fork John Day Sub-basin (17070203)

Bridge Creek- Middle Fork John Day River (1707020301)

Camp Creek- Middle Fork John Day River (1707020302)

Big Creek- Middle Fork John Day River (1707020303)

Long Creek (1707020304)

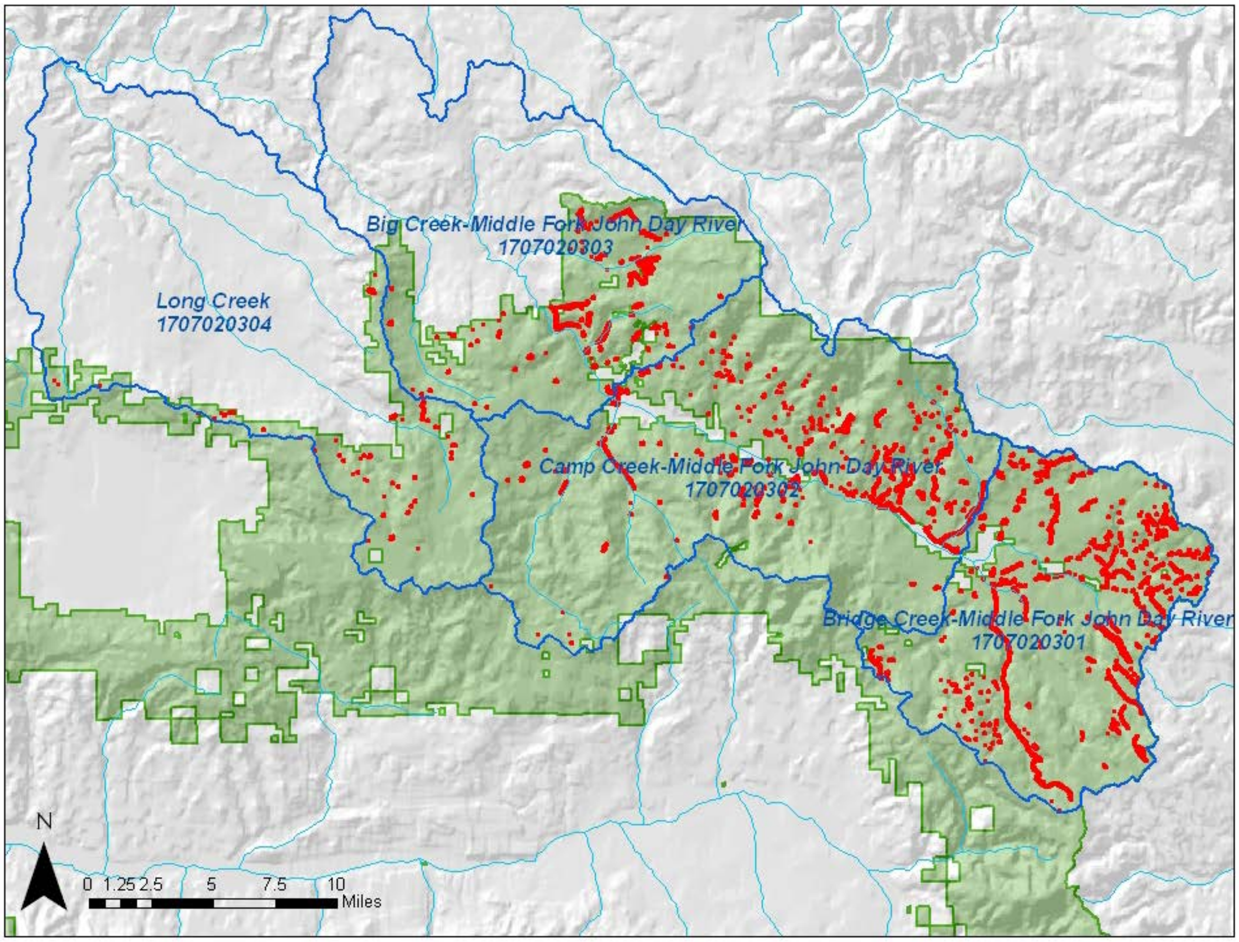
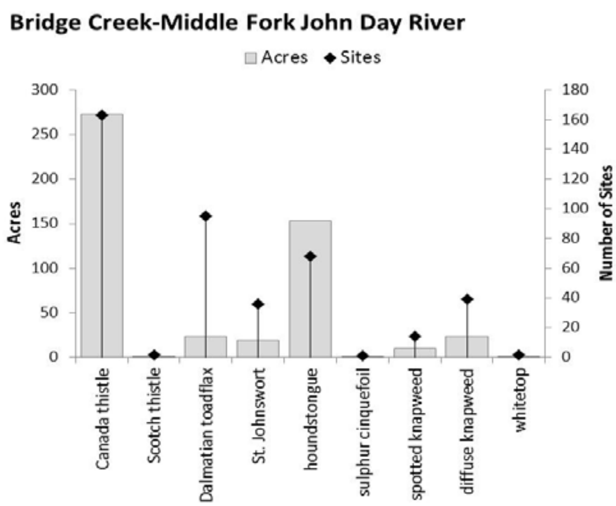


Figure A- 4. Middle Fork John Day Sub-basin (17070203)

Bridge Creek- Middle Fork John Day River (1707020301)

Ranger district:	Blue Mountain RD, Prairie City RD
County:	Grant
Total FS acreage:	75,877
Special land uses:	None
Major streams and water bodies:	Middle Fork John Day River, Crawford Creek, Clear Creek, Lunch Creek, Bridge Creek, Summit Creek, Crawford Creek
Recreation:	Dixie CG, Sumpter Valley Interpretive Site, Dispersed Campsites
Grazing allotments:	Sullens, Blue Mountain, Austin, Upper Middle Fork
Watershed regional priorities:	Within Whole Watershed Restoration Initiative (WWRI) Priority Basin (John Day)
Major roads and/or infested roads:	US-26, OR-7, 2620, 2622, 1940, 1940-275, 1940-220, 1940-281, 1940-552, 2645, 2645-019, 2645-017, 2645-025, 2645-011, 2645-299, 2646, 2646-410, 2646-435, 2646-284, 2640, 2635, 2600-343, 2600-503 (closed)
TES species of concern:	steelhead, bull trout, *Helodium blandowii*
Comments:	A large portion of the Journey Through Time Scenic Byway (US-26, OR-7) traverses this watershed; major grazing allotments in this area are vacant or are in non-use

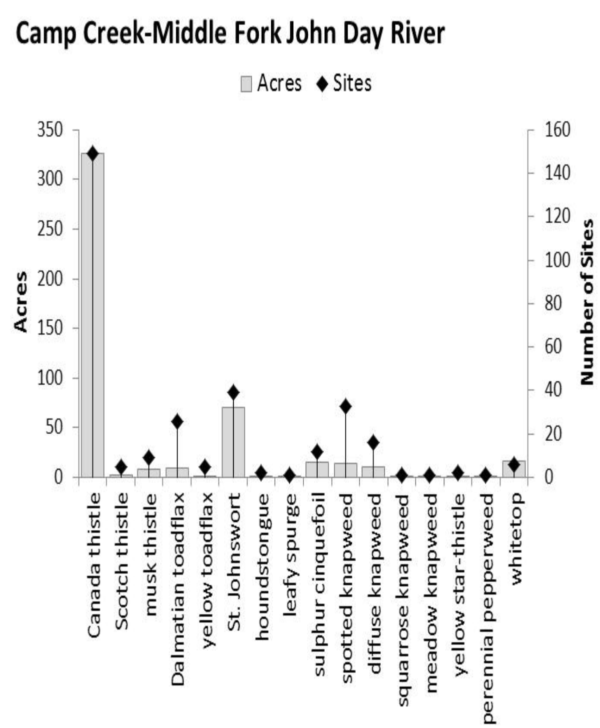


Species	Watershed Total	
	Sites	Acres
Canada thistle	163	273
Scotch thistle	2	0 .3
Dalmatian toadflax	95	24
St. Johnswort	36	19
houndstongue	68	153
sulphur cinquefoil	1	0 .1
spotted knapweed	14	10
diffuse knapweed	39	24
whitetop	2	0 .2
TOTAL	420	504

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	69	66	45	14			
Scotch thistle	1	0 .1	1	0 .007			
Dalmatian toadflax	16	2	9	0 .5			
St. Johnswort	14	3	7	1			
houndstongue	21	12	12	2	1	30 ft.	*Helodium blandowii*
sulphur cinquefoil	1	0 .1	1	0 .03			
spotted knapweed	8	4	3	1			
diffuse knapweed	16	6	11	0.9			
TOTAL	**146**	**94**	**89**	**20**	**1**	**–**	**1**

Camp Creek- Middle Fork John Day River (1707020302)

Ranger district:	Blue Mountain RD
County:	Grant
Total FS acreage:	119,047
Special land uses:	Vinegar Hill-Indian Rock Scenic Area, Dixie Mountain Proposed Research Natural Area
Major streams and water bodies:	Middle Fork John Day River, Vinegar Creek, Vincent Creek, Little Boulder Creek, Granite Boulder Creek, Ruby Creek, Big Boulder Creek, Lick Creek, Camp Creek
Recreation:	Camp Creek CG, Middle Fork CG, Middle Fork Day Use Site, Deerhorn CG, dispersed campsites
Grazing allotments:	Upper Middle Fork, Lower Middle Fork, Long Creek, Slide Creek, Camp Creek, Balance Creek
Watershed regional priorities:	Focus Watershed within Priority Basin (John Day) of the Whole Watershed Restoration Initiative (WWRI)
Major roads and/or infested roads:	County Road-20, 2045, 2050, 2055, 2055-518 (closed), 2055-364 (closed), 2055-432 (closed), 2010, 2614, 2000-120, 2000-139 (closed), 2000-612 (closed), 3600, 3650, 3660, 3670, 3675, 4500, 4550, 4555, 4557, 4559, 4559-283, 4559-284
TES species of concern:	steelhead, bull trout, Phacelia minutissima (no known invasive plants within 100 ft.)
Comments:	None



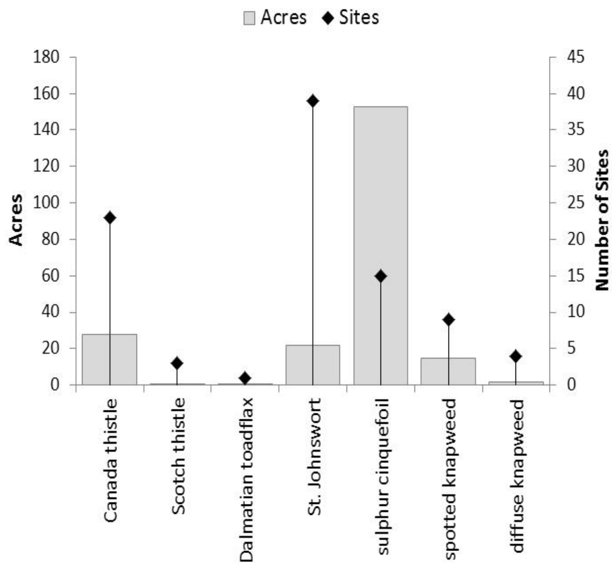
Species	Watershed Total	
	Sites	Acres
Canada thistle	149	326
Scotch thistle	5	2.0
musk thistle	9	8.0
Dalmatian toadflax	26	10.0
yellow toadflax	5	0.5
St. Johnswort	39	70.0
houndstongue	2	0.6
leafy spurge	1	0.1
sulphur cinquefoil	12	15.0
spotted knapweed	33	14.0
diffuse knapweed	16	11.0
squarrose knapweed	1	0.1
meadow knapweed	1	0.1
yellow star-thistle	2	1.0
perennial pepperweed	1	0.1
whitetop	6	16.0
Total	**308**	**475**

Invasive Species	**Within 100 ft. of Stream**		**Within 25 ft. of Stream**		**Within 100 ft. of TES Plant**		
	Sites	**Acres**	**Sites**	**Acres**	**Sites**	**Distance**	**TES Species**
Canada thistle	65	63	42	21			
musk thistle	2	0 .1					
Dalmatian toadflax	11	1	7	0 .3			
yellow toadflax	4	0 .4	1	0 .07			
St. Johnswort	16	15	13	4			
houndstongue	1	0 .05					
sulphur cinquefoil	6	3	3	0 .2			
spotted knapweed	17	5	11	1			
diffuse knapweed	4	1	3	0 .2			
squarrose knapweed	1	0 .07					
meadow knapweed	1	0 .1	1	0 .01			
yellow star-thistle	1	0 .1					
perennial pepperweed	1	0 .03					
whitetop	1	5	1	2			
Total	**133**	**95.0**	**82**	**29**	**0**	**–**	**0**

Big Creek- Middle Fork John Day River (1707020303)

Ranger District:	**Blue Mountain RD**
County:	Grant
Total FS acreage:	45,722
Special land uses:	Vinegar Hill-Indian Rock Scenic Area
Major streams and water bodies:	Middle Fork John Day River, Deep Creek, Big Creek, Slide Creek, Elk Creek, Mud Lake
Recreation:	Dispersed Campsites
Grazing allotments:	Slide Creek, York, Lower Middle Fork, Camp Creek, Bear Creek
Watershed regional priorities:	Within Whole Watershed Restoration Initiative (WWRI) Priority Basin (John Day)
Major roads and/or infested roads:	County Road-20, 2000-893, 2000-621, 2000-893, 2000-978 (closed), 2090, 2090-048, 2090-519, 2090-521 (closed), 3690, 3514, 4500, 4560, 4560-155 (closed), 4560-570 (closed)
TES species of concern:	steelhead, bull trout
Comments:	None

Big Creek-Middle Fork John Day River

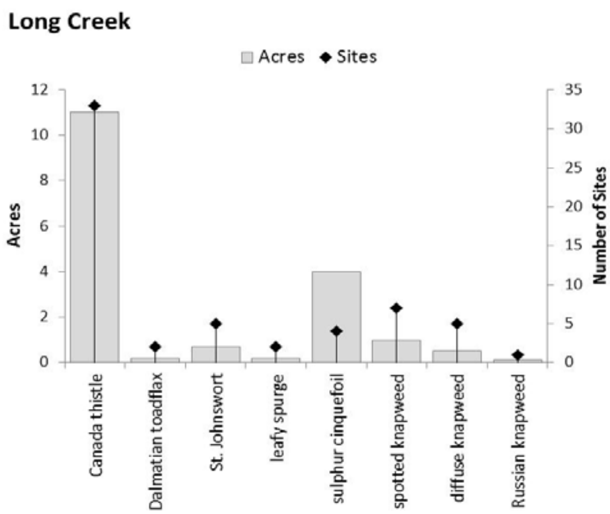


Species	Watershed Total	
	Sites	Acres
Canada thistle	23	28.0
Scotch thistle	3	0.4
Dalmatian toadflax	1	0.2
St. Johnswort	39	22.0
sulphur cinquefoil	15	153.0
spotted knapweed	9	15.0
diffuse knapweed	4	2.0
Total	**94**	**221**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	12	5	9	1			
Dalmatian toadflax	1	0 .2	1	0 .01			
St. Johnswort	18	7	9	1			
sulphur cinquefoil	11	36	10	7			
spotted knapweed	3	2	2	0 .3			
diffuse knapweed	1	0 .1	1	0 .7			
TOTAL	46	50	32	10	0	–	0

Long Creek (1707020304)

Ranger District:	Blue Mountain RD
County:	Grant
Total FS acreage:	29,911
Special land uses:	Long Creek Municipal Water Supply
Major streams and water bodies:	Long Creek
Recreation:	dispersed campsites
Grazing allotments:	Long Creek, War Canyon, Highway, Fox, Keeney Meadows, Mt. Vernon/John Day
Watershed regional priorities:	Within Whole Watershed Restoration Initiative (WWRI) Priority Basin (John Day)
Major roads and/or infested roads:	County Road-18, County Road-35, 3945, 3946
TES species of concern:	Steelhead
Comments:	None



Species	Watershed Total	
	Sites	Acres
Canada thistle	33	11
Dalmatian toadflax	2	0.2
St. Johnswort	5	0.7
leafy spurge	2	0.2
sulphur cinquefoil	4	4
spotted knapweed	7	1
diffuse knapweed	5	0.5
Russian knapweed	1	0.1
Total	**59**	**18**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	6	0.4	1	0.04			
St. Johnswort	1	0.007					
sulphur cinquefoil	1	0.09	1	0.0003			
diffuse knapweed	2	0.1	1	0.04			
Russian knapweed	1	0.07					
Total	11	1	3	0.08	0	–	0

Upper John Day Sub-basin – Main Stem Portion (17070201)

Reynolds Creek-John Day River (1707020105)

Grub Creek-John Day River (1707020106)

Canyon Creek (1707020107)

Beech Creek (1707020108)

Laycock Creek-John Day River (1707020109)

Fields Creek-John Day River (1707020110)

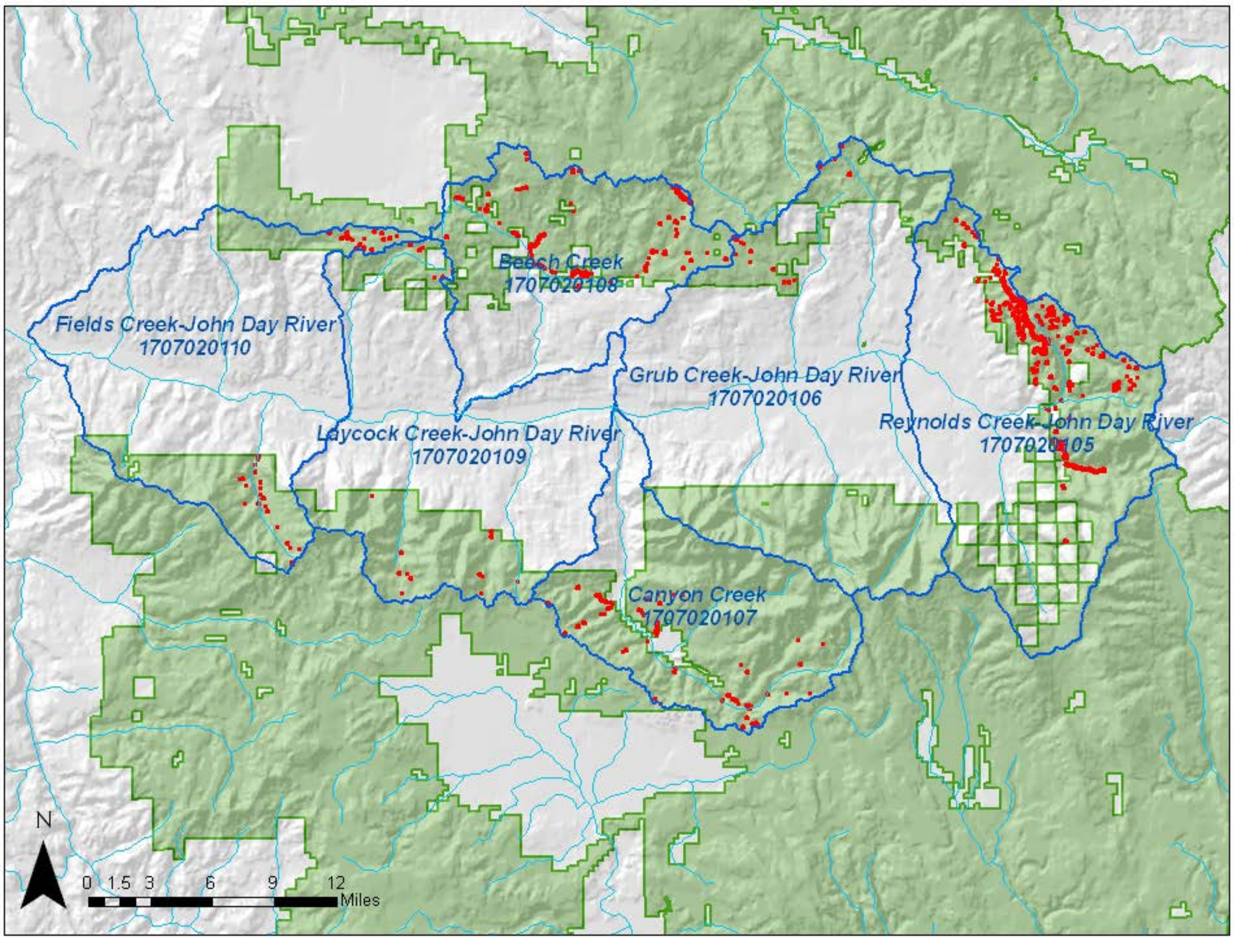
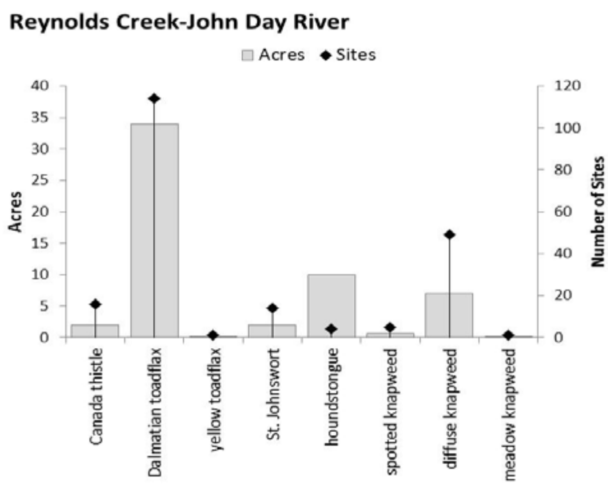


Figure A- 5. Upper John Day Sub-basin – Main Stem Portion (17070201)

Reynolds Creek-John Day River (1707020105)

Ranger district:	Prairie City RD, Blue Mountain RD
County:	Grant
Total FS acreage:	54,573
Special land uses:	Strawberry Mountain Wilderness
Major streams and water bodies:	John Day River, Reynolds Creek, Deardorff Creek, Roberts Creek, Rail Creek, Call Creek
Recreation:	Trout Farm CG, Crescent CG, Sunshine Flat TH, Deardorff TH, Reynold Creek TH, dispersed campsites
Grazing allotments:	Reynolds Creek, Deardorff, Hot Springs, Rail Creek, Dixie
Watershed regional priorities:	Within Whole Watershed Restoration Initiative (WWRI) Priority Basin (John Day)
Major roads and/or infested roads:	US-26, County Road-62, 2600-306, 2600-272 (closed), 2600-390 (closed), 2600-392 (closed), 1300, 1344, 2635, 2635-629
TES species of concern:	Steelhead, Bull Trout
Comments:	None

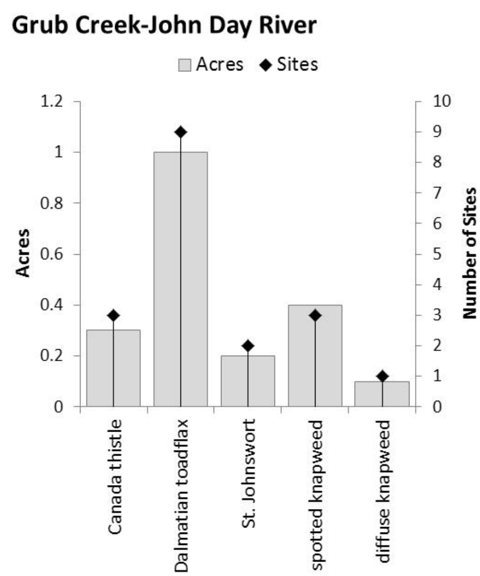


Species	Watershed Total	
	Sites	Acres
Canada thistle	16	2
Dalmatian toadflax	114	34
yellow toadflax	1	0 .1
St. Johnswort	14	2
houndstongue	4	10
spotted knapweed	5	0 .6
diffuse knapweed	49	7
meadow knapweed	1	0 .2
TOTAL	204	56

Invasive Species	Within 100 ft. of Stream			Within 25 ft. of Stream			Within 100 ft. of TES Plant		
	Sites	Acres		Sites	Acres		Sites	Distance	TES Species
Canada thistle	1	0	.05						
Dalmatian toadflax	28	3		17	0	.6			
St. Johnswort	7	0	.6	4	0	.1			
houndstongue	1	0	.5	1	0	.1			
spotted knapweed	1	0	.1	1	0	.06			
diffuse knapweed	10	0	.7	5	0	.1			
meadow knapweed	1	0	.2	1	0	.1			
Total	49	5		29	1		0	–	0

Grub Creek-John Day River (1707020106)

Ranger district:	Blue Mountain RD
County:	Grant
Total FS acreage:	50,089
Special land uses:	Strawberry Mountain Wilderness, Strawberry Mountain Proposed Research Natural Area, Baldy Mountain Proposed Research Natural Area, Dixie Mountain Proposed Research Natural Area
Major streams and water bodies:	Strawberry Creek, Indian Creek, Pine Creek, Dixie Creek, Bear Creek, Grub Creek, Strawberry Lake, Slide Lake, Little Slide Lake
Recreation:	Strawberry Campground, Slide Creek, CG, McNaughton Spring CG, Slide Horse Camp, Slide Creek TH, Onion Creek TH, Strawberry Basin TH, Indian Creek TH, dispersed campsites
Grazing allotments:	Dixie, Roundtop, Indian Creek
Watershed regional priorities:	within Whole Watershed Restoration Initiative (WWRI) Priority Basin (John Day)
Major roads and/or infested roads:	County Road-18, 3670, 5401, 6001
TES species of concern:	steelhead, bull trout, *Thelypodium eucosmum* (no know invasive plants within 100 ft.), *Luina serpentina* (no know invasive plants within 100 ft.)
Comments:	none

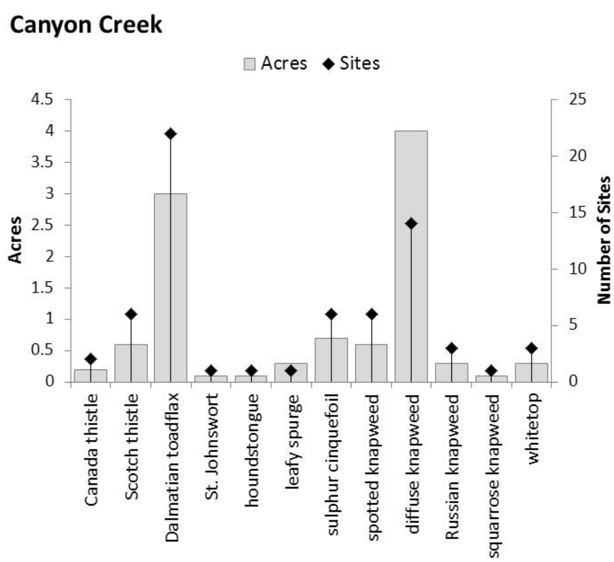


Species	Watershed Total	
	Sites	Acres
Canada thistle	3	0.3
Dalmatian toadflax	9	1
St. Johnswort	2	0.2
spotted knapweed	3	0.4
diffuse knapweed	1	0.1
TOTAL	**18**	**2**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	1	0.006					
Dalmatian toadflax	1	0.2	1	0.1			
spotted knapweed	3	0.3	1	0.07			
TOTAL	**5**	**0.5**	**2**	**0.2**	**0**	**–**	**0**

Canyon Creek (1707020107)

Ranger district:	Blue Mountain RD
County:	Grant
Total FS acreage:	59,583
Special land uses:	Strawberry Mountain Wilderness, Canyon Creek Research Natural Area
Major streams and water bodies:	Canyon Creek, West Fork Canyon Creek, Middle Fork Canyon Creek, Canyon Meadows Reservoir
Recreation:	Wickiup CG, Canyon Meadows CG, dispersed campsites
Grazing allotments:	Seneca, Dark Canyon, Williams Pasture, Joaquin, Fawn Spring
Watershed regional priorities:	Within Whole Watershed Restoration Initiative (WWRI) Priority Basin (John Day)
Major roads and/or infested roads:	US-395, County Road-65, 1500, 6510, 3920, 1516, 1520, 1530
TES species of concern:	**steelhead**, *Thelypodium eucosmum* (no know invasive plants within 100 ft.)
Comments:	none

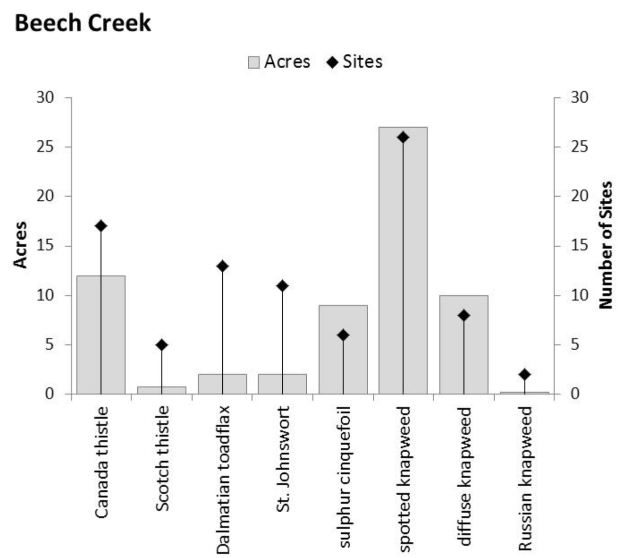


Species	Watershed Total	
	Sites	Acres
Canada thistle	2	0.2
Scotch thistle	6	0.6
Dalmatian toadflax	22	3
St. Johnswort	1	0.1
houndstongue	1	0.1
leafy spurge	1	0.3
sulphur cinquefoil	6	0.7
spotted knapweed	6	0.6
diffuse knapweed	14	4
Russian knapweed	3	0.3
squarrose knapweed	1	0.1
whitetop	3	0.3
TOTAL	**66**	**10**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	2	0 .2	1	0 .06			
Scotch thistle	2	0 .2	1	0 .1			
Dalmatian toadflax	11	0 .04	4	0 .2			
houndstongue	1	0 .04					
sulphur cinquefoil	2	0 .2					
spotted knapweed	2	0 .2	1	0 .04			
diffuse knapweed	5	2	2	0 .4			
Russian knapweed	1	0 .1	1	0 .01			
squarrose knapweed	1	0 .1	1	0 .08			
whitetop	1	0 .02					
TOTAL	28	4	11	1	0	–	0

Beech Creek (1707020108)

Ranger district:	Blue Mountain RD
County:	Grant
Total FS acreage:	40,568
Special land uses:	none
Major streams and water bodies:	Beech Creek, Clear Creek, Lake Creek, Tinker Creek, Magone Lake
Recreation:	Magone Lake Recreation Area, Beech Creek CG, Raddue Forest Camp, dispersed campsites
Grazing allotments:	Fox, Mt. Vernon/John Day, Beech Creek, McCullough, Herberger, Roundtop
Watershed regional priorities:	within Whole Watershed Restoration Initiative (WWRI) Priority Basin (John Day)
Major roads and/or infested roads:	US-395, County Road-32, 3600, 3618, 3620, 3940, 3900-131
TES species of concern:	steelhead
Comments:	none

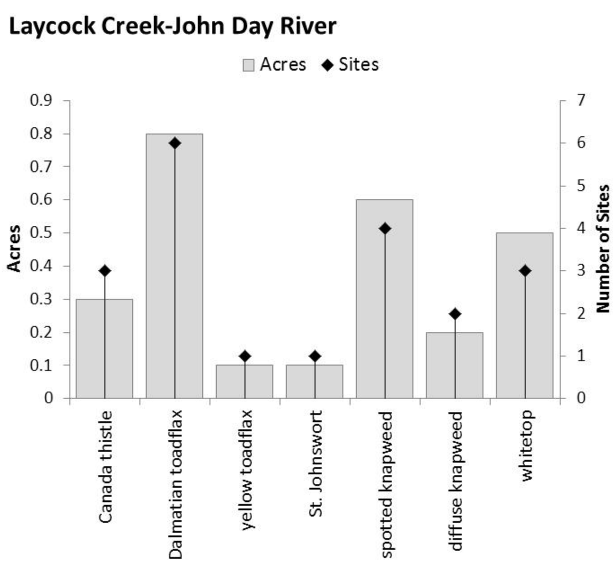


Species	Watershed Total	
	Sites	Acres
Canada thistle	17	12
Scotch thistle	5	0.7
Dalmatian toadflax	13	2
St. Johnswort	11	2
sulphur cinquefoil	6	9
spotted knapweed	26	27
diffuse knapweed	8	10
Russian knapweed	2	0.2
TOTAL	**88**	**63**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	7	0.6	3	0.1			
Scotch thistle	4	0.3	1	0.05			
Dalmatian toadflax	9	1	5	0.3			
St. Johnswort	3	0.6	1	0.1			
sulphur cinquefoil	3	3	3	0.4			
spotted knapweed	15	8	12	2			
diffuse knapweed	6	8	6	3			
Russian knapweed	2	0.2	1	0.01			
TOTAL	49	21	32	6	0	–	0

Laycock Creek-John Day River (1707020109)

Ranger district:	Blue Mountain RD
County:	Grant
Total FS acreage:	30,473
Special land uses:	none
Major streams and water bodies:	Riley Creek, Laycock Creek, Birch Creek
Recreation:	dispersed campsites
Grazing allotments:	Deadhorse, Hanscomb, Seneca, McClellan, Field Peak
Watershed regional priorities:	within Whole Watershed Restoration Initiative (WWRI) Priority Basin (John Day)
Major roads and/or infested roads:	4900, 2190
TES species of concern:	steelhead, *Thelypodium eucosmum* (no know invasive plants within 100 ft.), *Luina serpentina* (no know invasive plants within 100 ft.)
Comments:	none

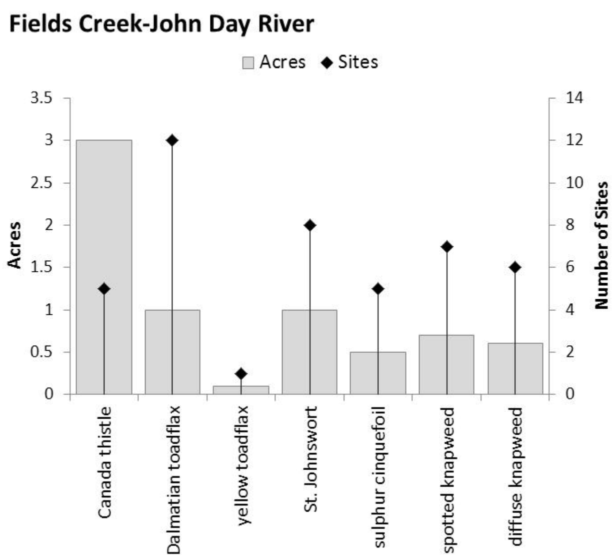


Species	Watershed Total	
	Sites	Acres
Canada thistle	3	0.3
Dalmatian toadflax	6	0.8
yellow toadflax	1	0.1
St. Johnswort	1	0.1
spotted knapweed	4	0.6
diffuse knapweed	2	0.2
whitetop	3	0.5
TOTAL	**20**	**3**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	2	0 .2	1	0 .06			
Dalmatian toadflax	2	0 .2	1	0 .07			
spotted knapweed	1	0 .05					
diffuse knapweed	1	0 .1	1	0 .08			
whitetop	2	0 .3	1	0 .06			
TOTAL	8	1	4	0 .3	0	–	0

Fields Creek-John Day River (1707020110)

Ranger district:	Blue Mountain RD
County:	Grant
Total FS acreage:	25,296
Special land uses:	Cedar Grove Botanical Special Interest Area
Major streams and water bodies:	Fields Creek, Belshaw Creek
Recreation:	Billy Fields CG, Cedar Grove TH, dispersed campsites
Grazing allotments:	Fields Peak, Aldrich
Watershed regional priorities:	within Whole Watershed Restoration Initiative (WWRI) Priority Basin (John Day)
Major roads and/or infested roads:	2100, 2140, 3955, 3955-486, 3955-417
TES species of concern:	steelhead, *Luina serpentina*
Comments:	none



Species	Watershed Total	
	Sites	Acres
Canada thistle	5	3
Dalmatian toadflax	12	1
yellow toadflax	1	0.1
St. Johnswort	8	1
sulphur cinquefoil	5	0.5
spotted knapweed	7	0.7
diffuse knapweed	6	0.6
TOTAL	**44**	**7**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	2	0.2	1	0.08			
Dalmatian toadflax	7	0.5	2	0.1	1	57 ft.	*Luina serpentina*
yellow toadflax	1	0.02					
St. Johnswort	2	0.2	2	0.07			
sulphur cinquefoil	2	0.1					
spotted knapweed	5	0.4	2	0.01	1	51 ft.	*Luina serpentina*
diffuse knapweed	2	0.1					
TOTAL	**21**	**2**	**7**	**0.4**	**2**	**–**	**1**

Upper John Day Sub-basin – South Fork Portion (17070201)

Upper South Fork John Day River (1707020101)

Middle South Fork John Day River (1707020102)

Murderers Creek (1707020103)

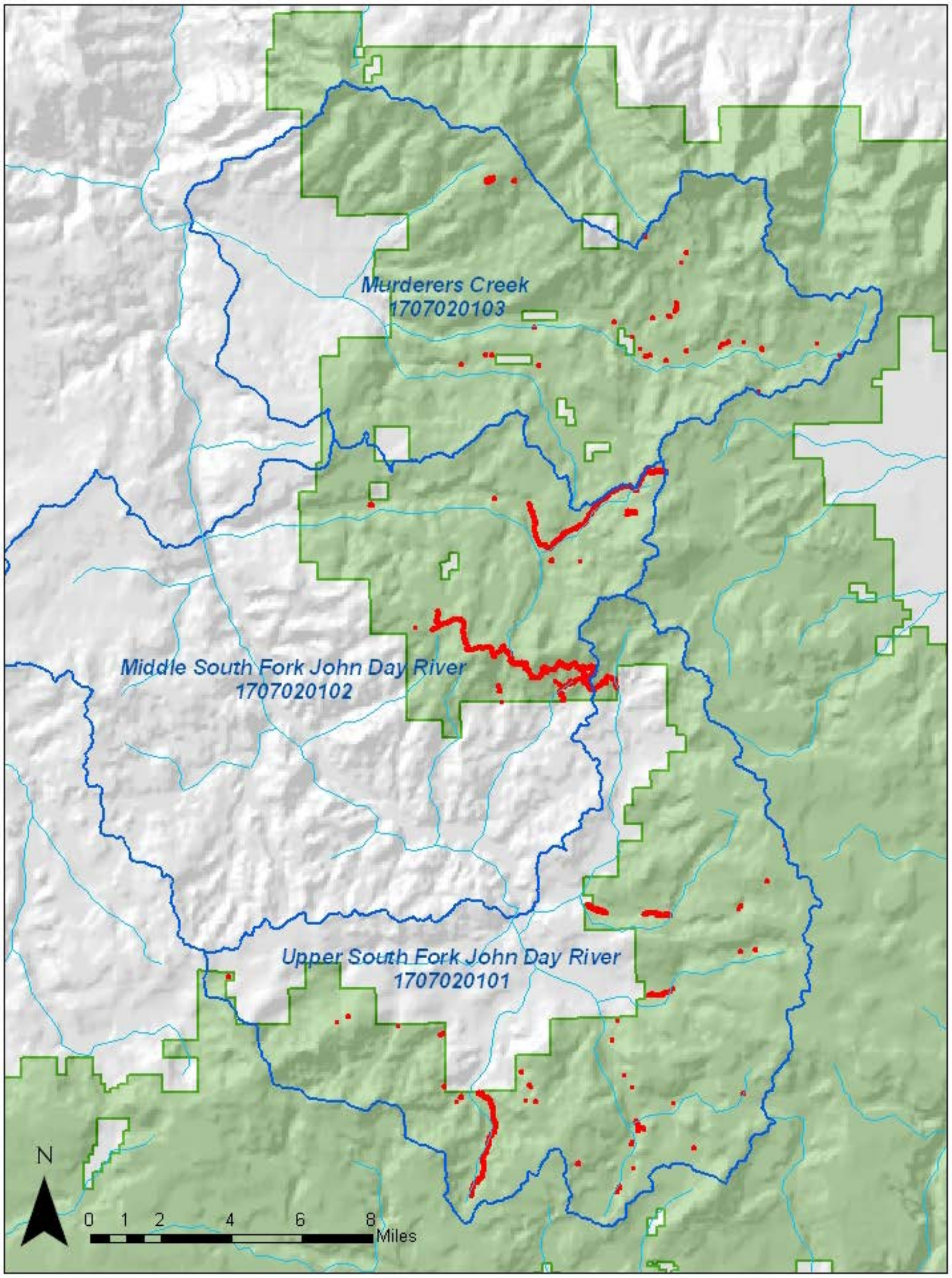
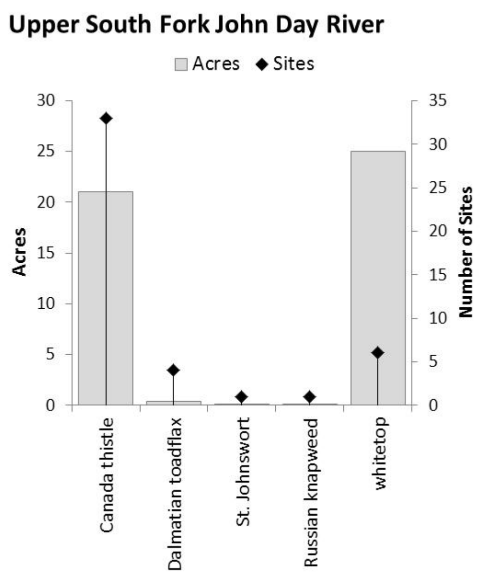


Figure A- 6. Upper John Day Sub-basin - South Fork Portion (17070201)

Upper South Fork John Day River (1707020101)

Ranger district:	Blue Mountain RD, Emigrant Creek RD
County:	Grant, Harney
Total FS acreage:	63,396
Special land uses:	none
Major streams and water bodies:	South Fork John Day River, Bear Creek, Lonesome Creek, Lewis Creek, Spoon Creek
Recreation:	dispersed campsites
Grazing allotments:	Izee, Lonesome, Smoky, Lewis Creek, Snowshoe, Rosebud
Watershed regional priorities:	within Whole Watershed Restoration Initiative (WWRI) Priority Basin (John Day)
Major roads and/or infested roads:	County Road-63, 4700, 3160, 3150, 4785, 6370
TES species of concern:	*Calochortus longibarbatus* var. *peckii* (no know invasive plants within 100 ft.)
Comments:	none

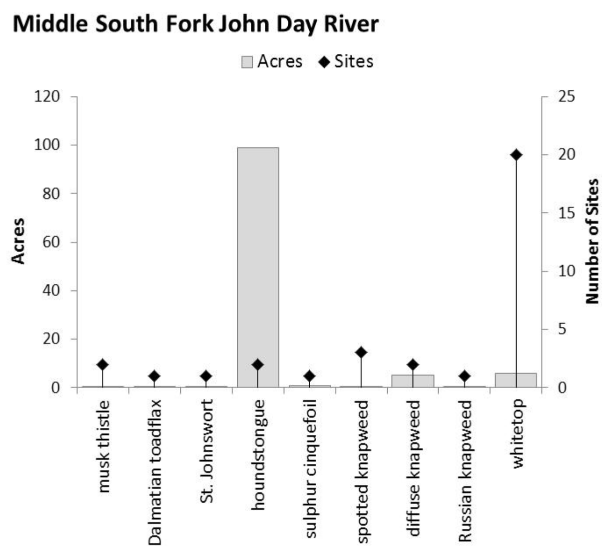


Species	Watershed Total	
	Sites	Acres
Canada thistle	33	21
Dalmatian toadflax	4	0.4
St. Johnswort	1	0.1
Russian knapweed	1	0.1
whitetop	6	25
TOTAL	**45**	**47**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	20	14	13	10			
Dalmatian toadflax	2	0 .2	1	0 .08			
St. Johnswort	1	0 .1	1	0 .08			
Russian knapweed	1	0 .1					
whitetop	3	2	1	0 .2			
TOTAL	27	18	16	11	0	–	0

Middle South Fork John Day River (1707020102)

Ranger district:	Blue Mountain RD
County:	Grant
Total FS acreage:	34,966
Special land uses:	Murderer's Creek Wild Horse Territory
Major streams and water bodies:	Deer Creek, Buck Creek, Corral Creek, Vester Creek
Recreation:	dispersed campsites
Grazing allotments:	Murderer's Creek, Frenchy, Rosebud, Poison
Watershed regional priorities:	within Whole Watershed Restoration Initiative (WWRI) Priority Basin (John Day)
Major roads and/or infested roads:	2400, 2400-338, 6370, 6370-407
TES species of concern:	steelhead
Comments:	none

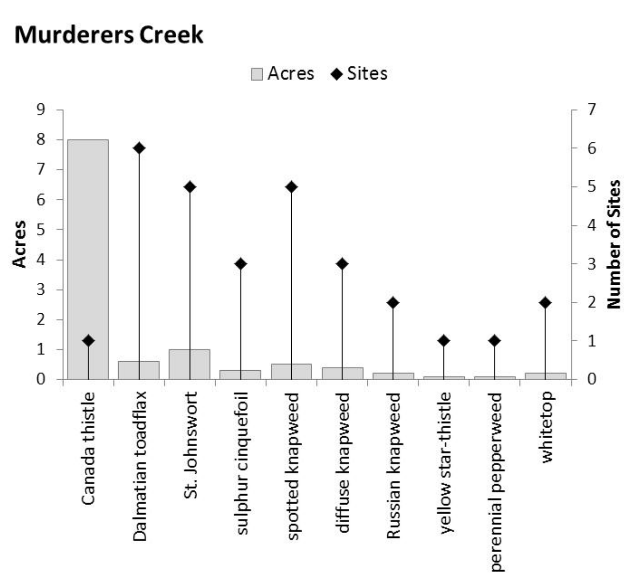


Species	Watershed Total	
	Sites	Acres
musk thistle	2	0.2
Dalmatian toadflax	1	0.1
St. Johnswort	1	0.2
houndstongue	2	99
sulphur cinquefoil	1	0.8
spotted knapweed	3	0.6
diffuse knapweed	2	5
Russian knapweed	1	0.1
whitetop	20	6
TOTAL	**33**	**112**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
musk thistle	1	0.1	1	0.1			
houndstongue	2	23	2	1			
sulphur cinquefoil	1	0.02					
spotted knapweed	1	0.3	1	0.2			
whitetop	11	4	10	2			
TOTAL	16	28	14	3	0	–	0

Murderers Creek (1707020103)

Ranger district:	Blue Mountain RD
County:	Grant
Total FS acreage:	65,101
Special land uses:	Shaketable Research Natural Area, Murderer's Creek Wild Horse Territory
Major streams and water bodies:	Murderer's Creek, Tex Creek, South Fork Murderer's Creek, Thorn Creek
Recreation:	Murderer's Creek GS, Deer Creek GS, dispersed campsites
Grazing allotments:	Murderer's Creek, Fields Peak, Aldrich
Watershed regional priorities:	Priority Terrestrial Restoration and Conservation Watershed (TRACS), within Whole Watershed Restoration Initiative (WWRI) Priority Basin (John Day)
Major roads and/or infested roads:	2100, 2160, 2150, 2170, 2180, 2490, 2480
TES species of concern:	steelhead, Luina serpentina (no know invasive plants within 100 ft.), Phacelia minutissima (no know invasive plants within 100 ft.)
Comments:	none



Species	Watershed Total	
	Sites	Acres
Canada thistle	1	8
Dalmatian toadflax	6	0.6
St. Johnswort	5	1
sulphur cinquefoil	3	0.3
spotted knapweed	5	0.5
diffuse knapweed	3	0.4
Russian knapweed	2	0.2
yellow star-thistle	1	0.1
perennial pepperweed	1	0.1
whitetop	2	0.2
TOTAL	**29**	**11**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Dalmatian toadflax	3	0 .2	2	0 .05			
St. Johnswort	3	0 .2					
spotted knapweed	2	0 .2	2	0 .02			
diffuse knapweed	2	0 .3	2	0 .1			
Russian knapweed	2	0 .1					
yellow star-thistle	1	0 .07					
perennial pepperweed	1	0 .03					
whitetop	1	0 .1	1	0 .03			
TOTAL	15	1	7	0 .2	0	–	0

Upper Malheur Sub-basin – North Fork Portion (17050116)

Upper North Fork Malheur River (1705011611)

Little Malheur River (1705011612)

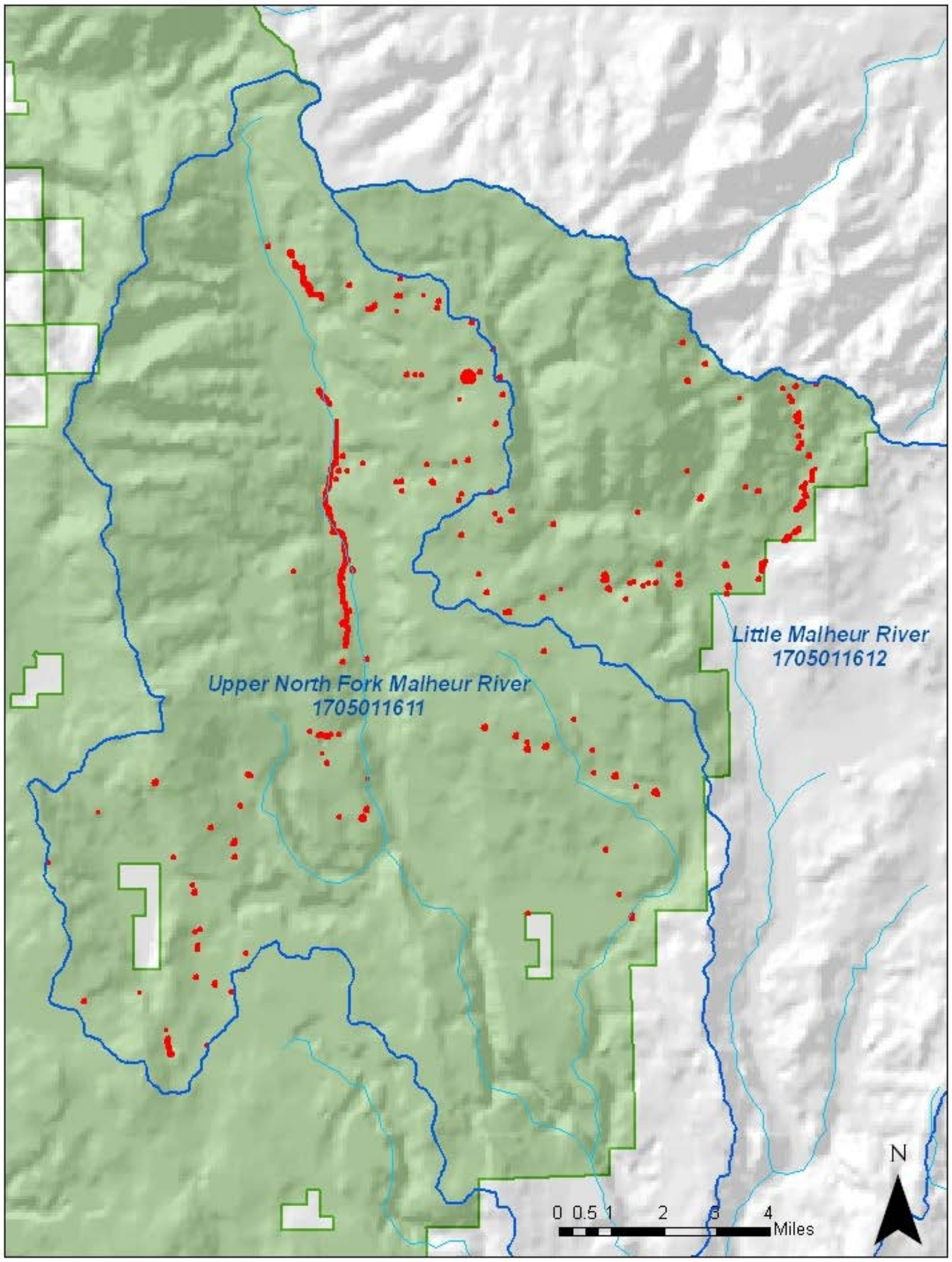
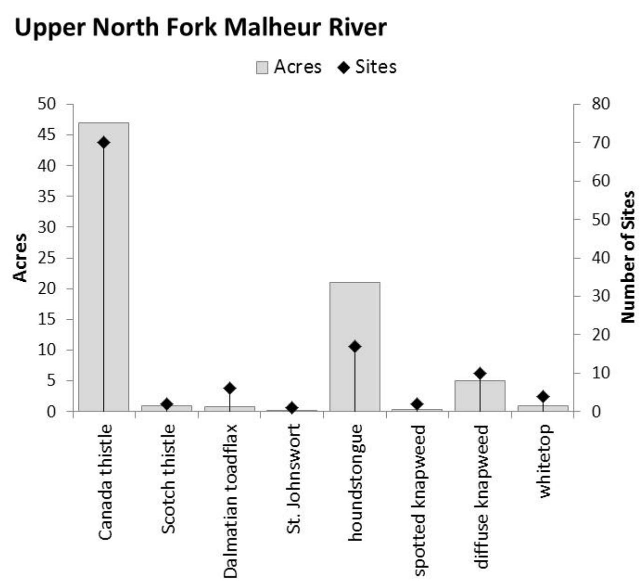


Figure A- 7. Upper Malheur Sub-basin – North Fork Portion (17050116)

Upper North Fork Malheur River (1705011611)

Ranger district:	Prairie City RD
County:	Grant, Baker
Total FS acreage:	96,732
Special land uses:	Monument Rock Wilderness, North Fork Malheur Wild and Scenic River, Dugout Research Natural Area
Major streams and water bodies:	North Fork Malheur River, Crane Creek, Little Crane Creek, Bear Creek, Elk Creek, Flat Creek, Swamp Creek, Spring Creek, Cow Creek, Sheep Creek
Recreation:	Short Creek CG, Elk Creek CG, Little Crane CG, North Fork Malheur CG, Crane Crossing CG, Crane Prairie CG, North Fork TH, Crane Creek TH, Sheep Creek TH, Elf Flat TH, dispersed campsites
Grazing allotments:	Spring Creek, Ott, Flag Prairie, Crane Prairie, North Fork
Watershed regional priorities:	Priority Terrestrial Restoration and Conservation Watershed (TRACS)
Major roads and/or infested roads:	1300, 1400, 1600, 1370, 1675,1665, 1663
TES species of concern:	bull trout
Comments:	Significant groundwater dependent ecosystems throughout watershed

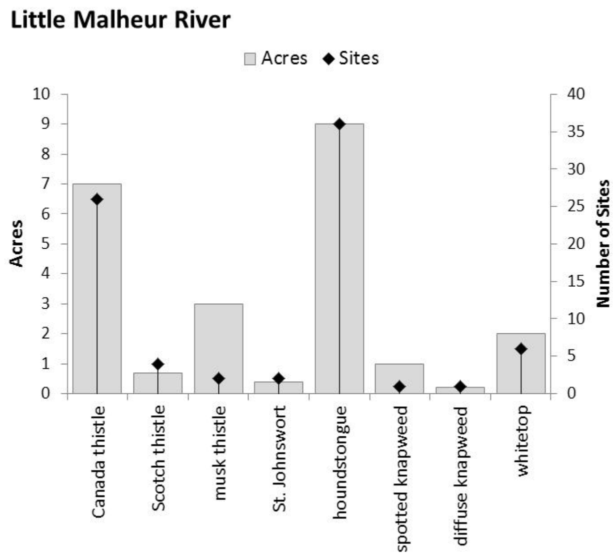


Species	Watershed Total	
	Sites	Acres
Canada thistle	70	47
Scotch thistle	2	1
Dalmatian toadflax	6	0.8
St. Johnswort	1	0.2
houndstongue	17	21
spotted knapweed	2	0.3
diffuse knapweed	10	5
whitetop	4	1
TOTAL	**112**	**76**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	10	4	7	1			
Scotch thistle	1	0 .09					
Dalmatian toadflax	1	0 .01					
houndstongue	7	2	5	0 .5			
spotted knapweed	1	0 .04					
diffuse knapweed	1	0 .2	1	0 .06			
whitetop	2	0 .2	1	0 .01			
TOTAL	23	7	14	2	0	–	0

Little Malheur River (1705011612)

Ranger district:	Prairie City RD
County:	Grant, Baker, Malheur
Total FS acreage:	31,525
Special land uses:	Monument Rock Wilderness
Major streams and water bodies:	Little Malheur River, Camp Creek, Squaw Creek
Recreation:	Elk Flat Spring CG, Little Malheur TH, Horse Creek TH, Table Rock TH, dispersed campsites
Grazing allotments:	Spring Creek, North Fork, Flag Prairie
Watershed regional priorities:	none
Major roads and/or infested roads:	1600, 1672, 1370
TES species of concern:	none
Comments:	none



Species	Watershed Total	
	Sites	Acres
Canada thistle	26	7
Scotch thistle	4	0.7
musk thistle	2	3
St. Johnswort	2	0.4
houndstongue	36	9
spotted knapweed	1	1
diffuse knapweed	1	0.2
whitetop	6	2
TOTAL	**78**	**23**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	6	0.6	1	0.1			
Scotch thistle	1	0.2	1	0.06			
musk thistle	1	2	1	0.6			
St. Johnswort	1	0.2	1	0.1			
houndstongue	11	2	5	0.2			
spotted knapweed	1	0.09					
TOTAL	**21**	**5**	**9**	**1**	**0**	**–**	**0**

Upper Malheur Sub-basin – Main Stem Portion (17050116)

Headwaters Malheur River (1705011601)

Wolf Creek (1705011602)

Pine Creek (1705011603)

Otis Creek (1705011606)

Griffin Creek-Upper Malheur River (1705011605)

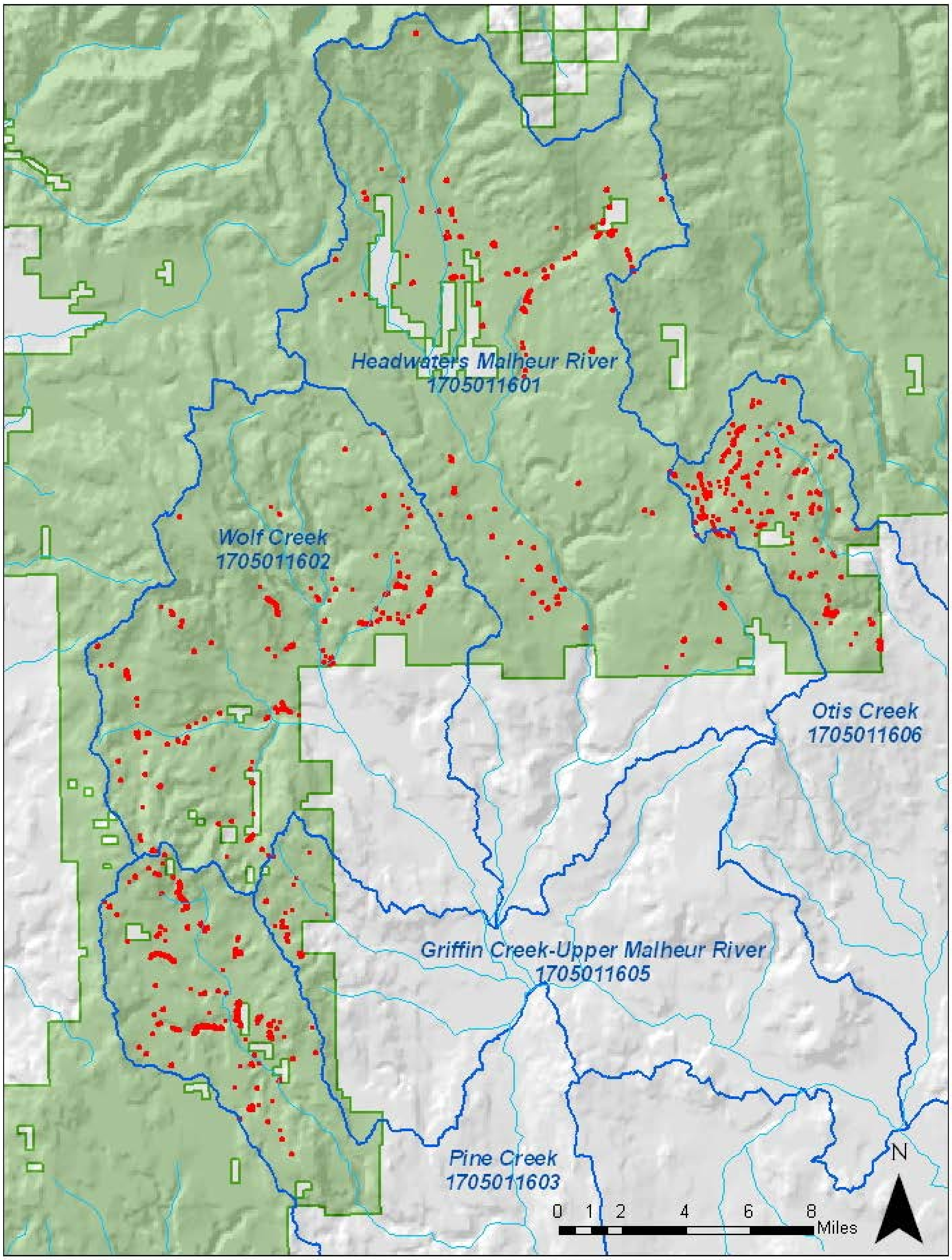
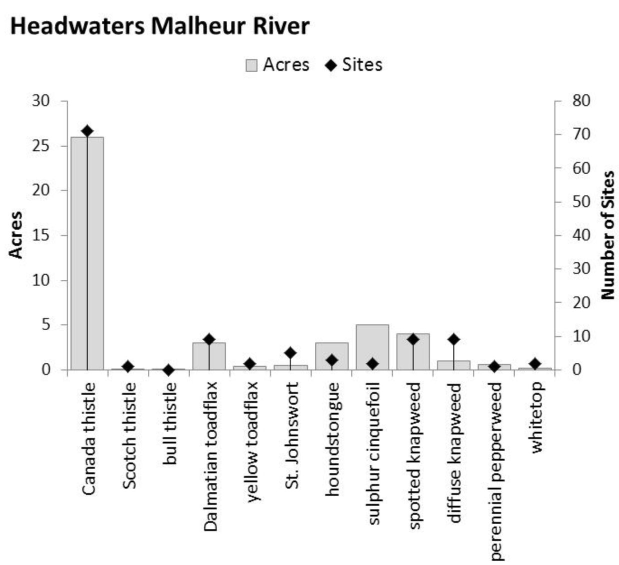


Figure A- 8. Upper Malheur Sub-basin – Main Stem Portion (17050116)

Headwaters Malheur River (1705011601)

Ranger district:	Prairie City RD, Emigrant Creek RD
County:	Grant, Harney
Total FS acreage:	111,947
Special land uses:	Strawberry Mountain Wilderness, Malheur Wild and Scenic River, Fergy Spruce Grove Proposed Botanical Special Interest Area
Major streams and water bodies:	Malheur River, McCoy Creek, Summit Creek, Big Creek, Lake Creek, Crooked Creek, Bosenberg Creek, Mud Lake, Little Mud Lake, High Lake
Recreation:	Big Creek CG, Murray CG, Lake Creek Organizational Camp, Malheur Ford CG, Huddleston SnoPark, Hog Flat TH, Malheur Ford TH, Lake Creek TH, Meadow Fork TH, Big Creek/Snowshoe TH, Skyline TH, Huddleston TH, Starvation TH, dispersed campsites
Grazing allotments:	Summit Prairie, Lake Creek, Logan Valley, McCoy Creek, Dollar Basin, Star Glade, Bluebucket, Central Malheur, Antelope
Watershed regional priorities:	none
Major roads and/or infested roads:	County Road-62, 1600, 1640, 1648, 1649, 1651, 1647, 1643, 1630, 1560, 1400, 1450
TES species of concern:	**bull trout**
Comments:	Significant groundwater dependent ecosystems in Logan Valley

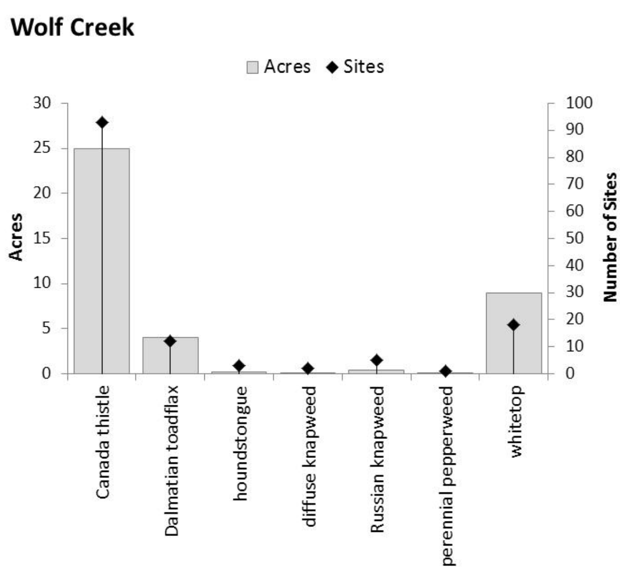


Species	Watershed Total	
	Sites	Acres
Canada thistle	71	26
Scotch thistle	1	0.1
bull thistle	1	0.1
Dalmatian toadflax	9	3
yellow toadflax	2	0.4
St. Johnswort	5	0.5
houndstongue	3	3
sulphur cinquefoil	2	5
spotted knapweed	9	4
diffuse knapweed	9	1
perennial pepperweed	1	0.6
whitetop	2	0.2
TOTAL	**115**	**44**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	14	2	7	0.6			
Dalmatian toadflax	1	0.3	1	0.1			
yellow toadflax	1	0.2	1	0.1			
St. Johnswort	1	0.1	1	0.006			
sulphur cinquefoil	1	2	1	0.6			
spotted knapweed	3	1	2	0.4			
diffuse knapweed	1	0.02					
whitetop	1	0.1	1	0.02			
TOTAL	**23**	**6**	**14**	**2**	**0**	**–**	**0**

Wolf Creek (1705011602)

Ranger district:	Emigrant Creek RD
County:	Grant, Harney
Total FS acreage:	70,865
Special land uses:	none
Major streams and water bodies:	Wolf Creek, Calamity Creek
Recreation:	Rock Springs CG, dispersed campsites
Grazing allotments:	Antelope, Wolf Mountain, West Malheur, Van, Calamity, Muddy
Watershed regional priorities:	none
Major roads and/or infested roads:	1500, 1700, 1630, 1710, 1712, 1705, 1705-378, 1780, 1550-804
TES species of concern:	none
Comments:	none

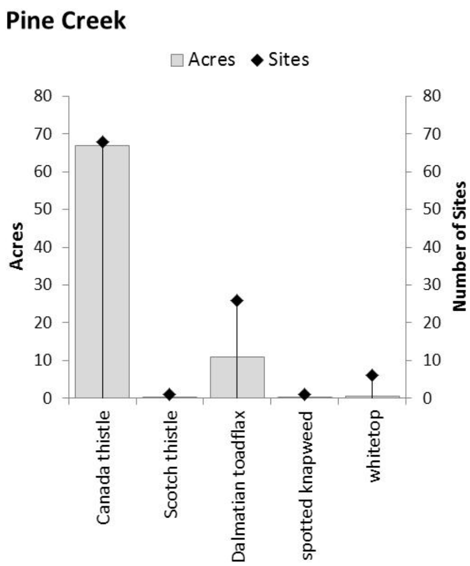


Species	Watershed Total	
	Sites	Acres
Canada thistle	93	25
Dalmatian toadflax	12	4
houndstongue	3	0.2
diffuse knapweed	2	0.1
Russian knapweed	5	0.4
perennial pepperweed	1	0.1
whitetop	18	9
TOTAL	**134**	**39**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	43	8	30	3			
Dalmatian toadflax	6	1	5	0.3			
Russian knapweed	3	0.2	1	0.001			
perennial pepperweed	1	0.009					
whitetop	8	5	6	1			
TOTAL	**61**	**14**	**42**	**4**	**0**	**–**	**0**

Pine Creek (1705011603)

Ranger district:	Emigrant Creek RD
County:	Harney
Total FS acreage:	32,021
Special land uses:	none
Major streams and water bodies:	Pine Creek
Recreation:	dispersed campsites
Grazing allotments:	Calamity, Alkali, Pine Creek
Watershed regional priorities:	none
Major roads and/or infested roads:	2800, 2850, 2855, 2800-189, 2850-262, 2850-951 (closed), 2850-265 (closed), 2800-336 (closed)
TES species of concern:	none
Comments:	none

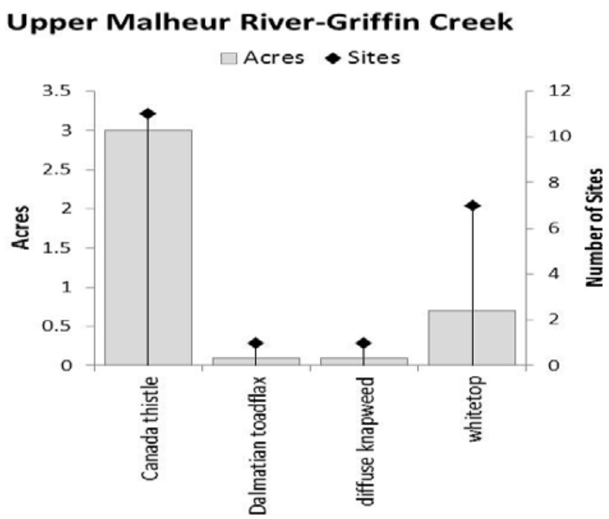


Species	Watershed Total	
	Sites	Acres
Canada thistle	68	67
Scotch thistle	1	0.1
Dalmatian toadflax	26	11
spotted knapweed	1	0.1
whitetop	6	0.6
TOTAL	**102**	**79**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	19	30	9	10			
Dalmatian toadflax	4	0.7	2	0.1			
TOTAL	**23**	**31**	**11**	**10**	**0**	**–**	**0**

Griffin Creek-Upper Malheur River (1705011605)

Ranger district:	Emigrant Creek RD
County:	Harney
Total FS acreage:	7,343
Special land uses:	none
Major streams and water bodies:	Muddy Creek
Recreation:	dispersed campsites
Grazing allotments:	Muddy, Alkali, Pine Creek
Watershed regional priorities:	none
Major roads and/or infested roads:	1705, 2850, 2850-135
TES species of concern:	none
Comments:	none

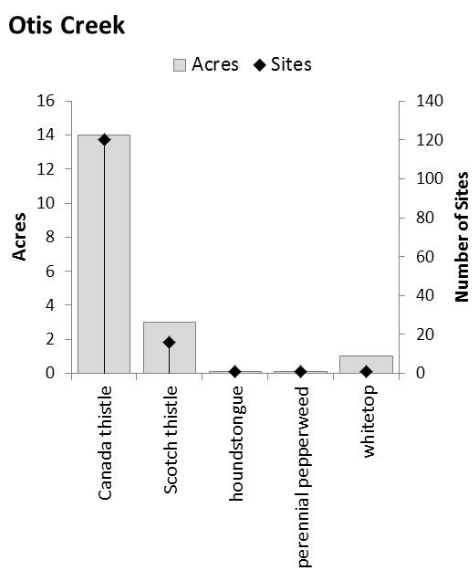


Species	Watershed Total	
	Sites	Acres
Canada thistle	11	3
Dalmatian toadflax	1	0.1
diffuse knapweed	1	0.1
whitetop	7	0.7
TOTAL	**20**	**4**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	3	2	2	0.5			
whitetop	2	0.2	1	0.1			
TOTAL	**5**	**2**	**3**	**0.6**	**0**	**–**	**0**

Otis Creek (1705011606)

Ranger district:	Prairie City RD
County:	Grant, Harney
Total FS acreage:	20,025
Special land uses:	none
Major streams and water bodies:	Cottonwood Creek
Recreation:	dispersed campsites
Grazing allotments:	Ott, Spring Creek
Watershed regional priorities:	none
Major roads and/or infested roads:	1400, 1420, 1663
TES species of concern:	none
Comments:	none



Species	Watershed Total	
	Sites	Acres
Canada thistle	120	14
Scotch thistle	16	3
houndstongue	1	0.1
perennial pepperweed	1	0.1
whitetop	1	1
TOTAL	**139**	**18**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	11	0.7	3	0.1			
Scotch thistle	3	1	2	0.6			
perennial pepperweed	1	0.1	1	0.03			
TOTAL	**15**	**2**	**6**	**0.07**	**0**	**–**	**0**

Silvies River Sub-basin (17120002)

Headwaters Silvies River (1712000201)

Bear Creek (1712000202)

Upper Silvies River (1712000203)

Middle Silvies River (1712000204)

Emigrant Creek (1712000205)

Sage Hen Creek (1712000206)

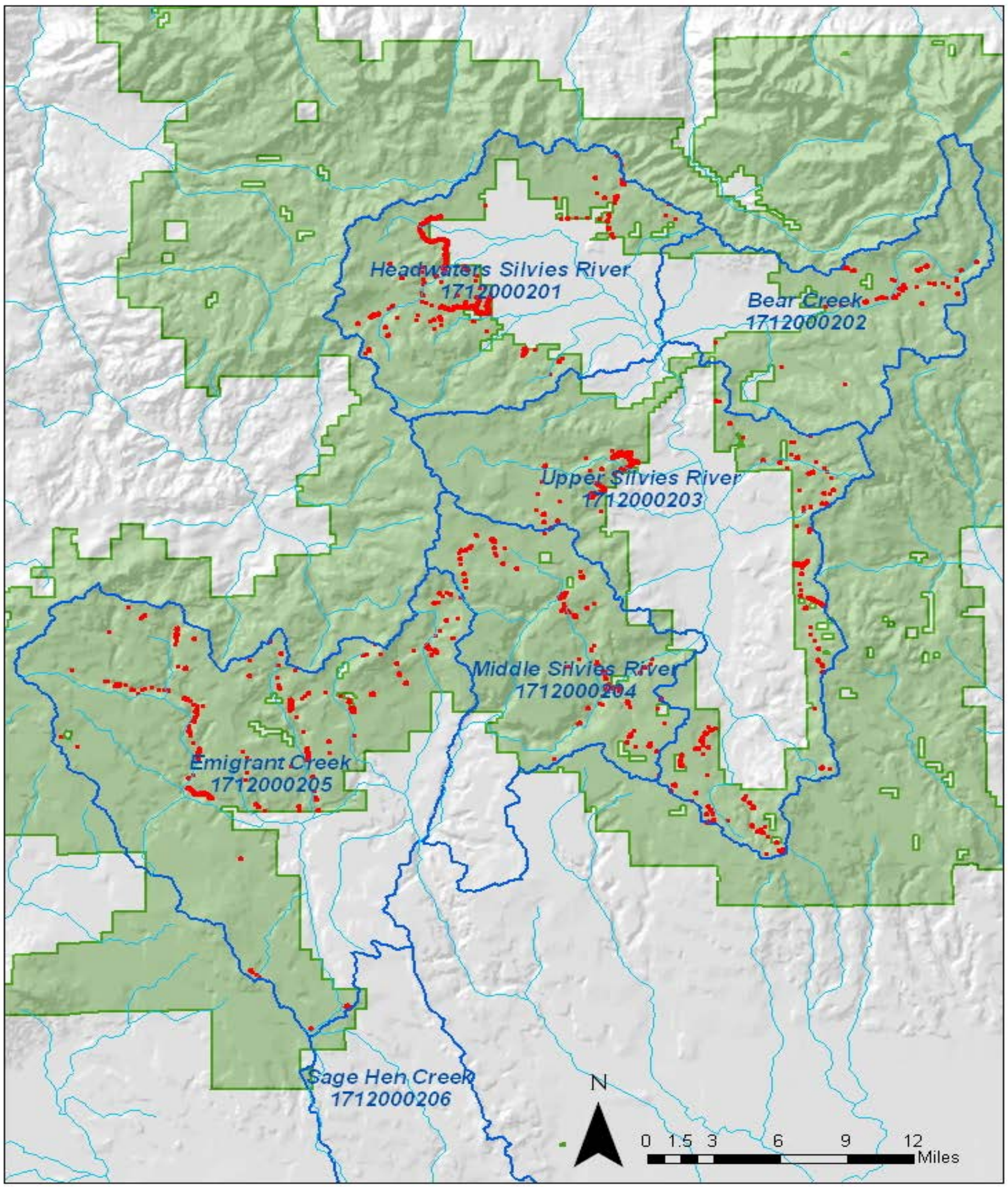
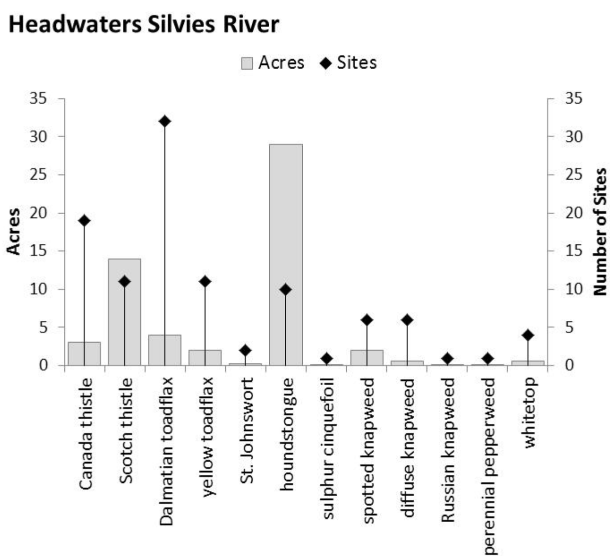


Figure A- 9. Silvies River Sub-basin – 17120002

Headwaters Silvies River (1712000201)

Ranger district:	Blue Mountain RD
County:	Grant
Total FS acreage:	61,343
Special land uses:	none
Major streams and water bodies:	Silvies River, Scotty Creek, Wickiup Creek
Recreation:	Starr Ridge CG, dispersed campsites
Grazing allotments:	Scotty Creek, Jack Creek, Snowshoe, Flagtail, Deadhorse, Hanscomb, Seneca, County Road, Windy Point, Hunter Cabin, Pearson
Watershed regional priorities:	Priority Terrestrial Restoration and Conservation Watershed (TRACS)
Major roads and/or infested roads:	US-395, County Road-63, 2400, 3100, 2100, 4900, 2195, 2400-011, 2400-017, 2400-022, 3780-274, 3780-070 (closed)
TES species of concern:	*Botrychium crenulatum*, *Carex idahoa* (no know invasive plants within 100 ft.)
Comments:	none

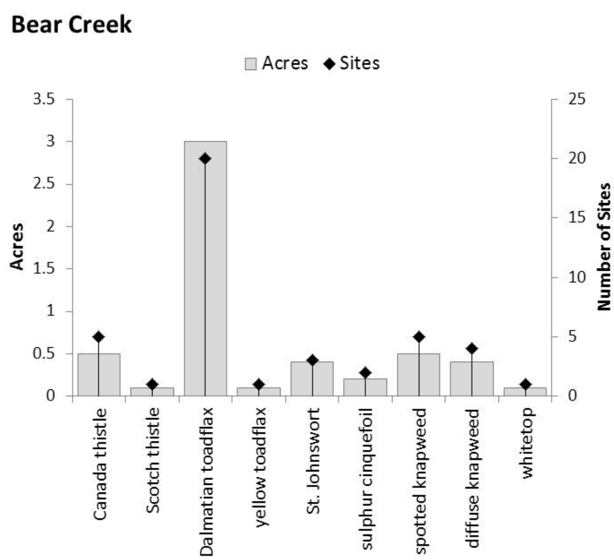


Species	Watershed Total	
	Sites	Acres
Canada thistle	19	3
Scotch thistle	11	14
Dalmatian toadflax	32	4
yellow toadflax	11	2
St. Johnswort	2	0.2
houndstongue	10	29
sulphur cinquefoil	1	0.1
spotted knapweed	6	2
diffuse knapweed	6	0.6
Russian knapweed	1	0.1
perennial pepperweed	1	0.1
whitetop	4	0.6
TOTAL	**104**	**56**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	9	1	6	0.3	1	54 ft.	*Botrychium crenulatum*
Scotch thistle	2	8	1	2			
Dalmatian toadflax	8	0.6	3	0.2			
yellow toadflax	5	0.6	1	0.0005			
houndstongue	4	9	4	2			
spotted knapweed	1	0.1					
perennial pepperweed	1	0.1	1	0.02			
whitetop	3	0.4	2	0.02			
TOTAL	**33**	**20**	**18**	**4**	**1**	**–**	**1**

Bear Creek (1712000202)

Ranger district:	Blue Mountain RD, Emigrant Creek RD
County:	Grant
Total FS acreage:	52,344
Special land uses:	Strawberry Mountain Wilderness
Major streams and water bodies:	Bear Creek, Antelope Creek
Recreation:	Parish Cabin CG, dispersed campsites
Grazing allotments:	Dark Canyon, Antelope, Wolf Mountain, Bridge Creek, Hunter Cabin
Watershed regional priorities:	none
Major roads and/or infested roads:	1600, 1500, 1601,1619, 1710
TES species of concern:	Carex idahoa (no know invasive plants within 100 ft.), Thelypodium eucosmum (no know invasive plants within 100 ft.)
Comments:	none

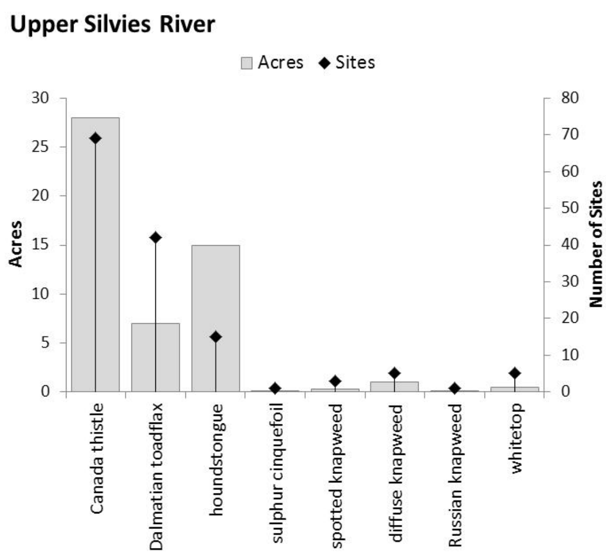


Species	Watershed Total	
	Sites	Acres
Canada thistle	5	0.5
Scotch thistle	1	0.1
Dalmatian toadflax	20	3
yellow toadflax	1	0.1
St. Johnswort	3	0.4
sulphur cinquefoil	2	0.2
spotted knapweed	5	0.5
diffuse knapweed	4	0.4
whitetop	1	0.1
TOTAL	**42**	**5**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	1	0.09					
Dalmatian toadflax	9	0.3	4	0.2			
St. Johnswort	3	0.1	1	0.002			
sulphur cinquefoil	1	0.02	1	0.04			
diffuse knapweed	2	0.2	1	0.08			
TOTAL	**16**	**0.7**	**7**	**0.3**			

Upper Silvies River (1712000203)

Ranger district:	Emigrant Creek RD, Blue Mountain RD
County:	Grant, Harney
Total FS acreage:	80,687
Special land uses:	none
Major streams and water bodies:	Silvies River, Bridge Creek, Camp Creek, Crooked Creek, Trout Creek
Recreation:	Joaquin Miller CG, dispersed campsites
Grazing allotments:	Scotty Creek, Camp Creek, Koehler, Antelope, Bridge Creek, Silvies, Crooked Creek, House Creek, Calamity, Big Sagehen, Alkali, Devine, Pine Creek
Watershed regional priorities:	none
Major roads and/or infested roads:	US-395, 3700, 2800, 2700, 3935, 2800-021, 3700-843, 3700-115, 3700-841, 3700-855, 3765-932, 3765-868, 3765-912
TES species of concern:	*Astragalus tegetarioides*, *Carex idahoa*
Comments:	none

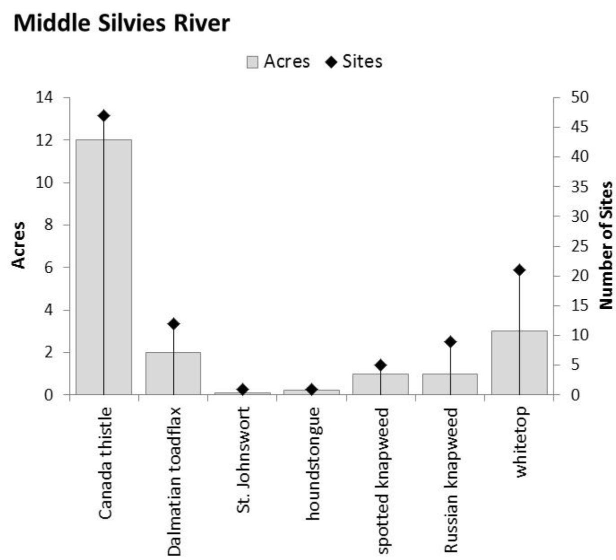


Species	Watershed Total	
	Sites	Acres
Canada thistle	69	28
Dalmatian toadflax	42	7
houndstongue	15	15
sulphur cinquefoil	1	0.1
spotted knapweed	3	0.3
diffuse knapweed	5	1
Russian knapweed	1	0.1
whitetop	5	0.5
TOTAL	**141**	**52**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	30	11	21	2	1	0 ft.	*Carex idahoa*
Dalmatian toadflax	20	2	4	0.4	3	0 ft.	*Astragalus tegetarioides*
houndstongue	5	6	2	0.7	1	0 ft.	*Carex idahoa*
sulphur cinquefoil	1	0.1	1	0.01			
diffuse knapweed	1	0.3	3	0.1			
Russian knapweed	3	0.03					
whitetop	1	0.1					
TOTAL	**62**	**20**	**31**	**3**	**5**	**–**	**2**

Middle Silvies River (1712000204)

Ranger district:	Emigrant Creek RD
County:	Harney, Grant
Total FS acreage:	61,529
Special land uses:	none
Major streams and water bodies:	Silvies River, Myrtle Creek, Sage Hen Creek
Recreation:	West Myrtle TH, dispersed campsites
Grazing allotments:	Myrtle, Scatfield, Big Sagehen, West Myrtle, Scotty Creek, Crooked Creek, Silvies
Watershed regional priorities:	none
Major roads and/or infested roads:	3100, 3700, 3765, 3130, 3125, 3120, 3140
TES species of concern:	Astragalus tegetarioides, Carex idahoa (no know invasive plants within 100 ft.)
Comments:	none

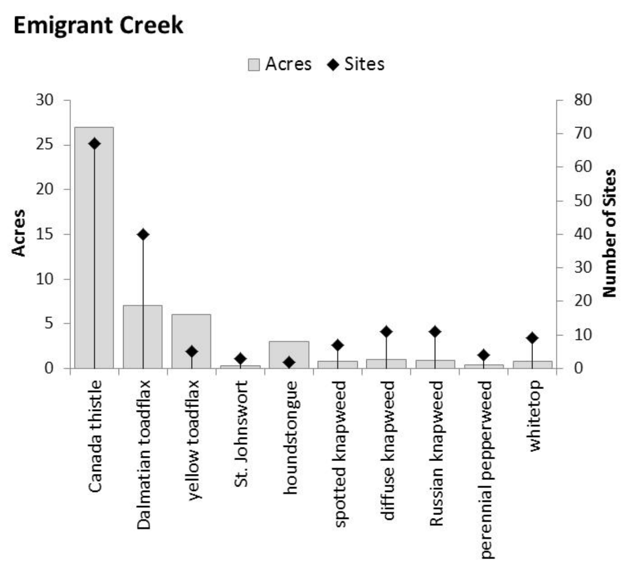


Species	Watershed Total	
	Sites	Acres
Canada thistle	47	12
Dalmatian toadflax	12	2
St. Johnswort	1	0.1
houndstongue	1	0.2
spotted knapweed	5	1
Russian knapweed	9	1
whitetop	21	3
TOTAL	**96**	**19**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	17	3	9	1			
Dalmatian toadflax	4	1	4	0.2			
spotted knapweed	2	0.02	1	0.006	1	0 ft.	*Astragalus tegetarioides*
Russian knapweed	1	0.07					
whitetop	6	0.4	3	0.1	1	79 ft.	*Astragalus tegetarioides*
TOTAL	**30**	**5**	**17**	**1**	**2**	**–**	**2**

Emigrant Creek (1712000205)

Ranger district:	Emigrant Creek RD
County:	Harney, Grant
Total FS acreage:	130,885
Special land uses:	Stinger Creek Proposed Research Natural Area
Major streams and water bodies:	Emigrant Creek, Hay Creek, Yellowjacket Creek, Sawtooth Creek, Whisky Creek, Crowsfoot Creek, Yellowjacket Lake
Recreation:	Yellow Jacket CG, Emigrant CG, Falls CG, Pendleton Spring CG, Alder Springs CG, Donnelly CG, dispersed campsites
Grazing allotments:	Rainbow, West Myrtle, Sawtooth, Blue Creek, Hughet Valley, Snow Mountain, Allison, Donnelly, Green Butte
Watershed regional priorities:	none
Major roads and/or infested roads:	3700, 4700, 4300, 4100, 3746, 3745, 3740, 4780, 4781, 4770, 4357, 4360, 4356, 4370, 4341, 4340, 4334, 4335, 4320, 4332, 4140
TES species of concern:	Calochortus longibarbatus var. peckii
Comments:	none

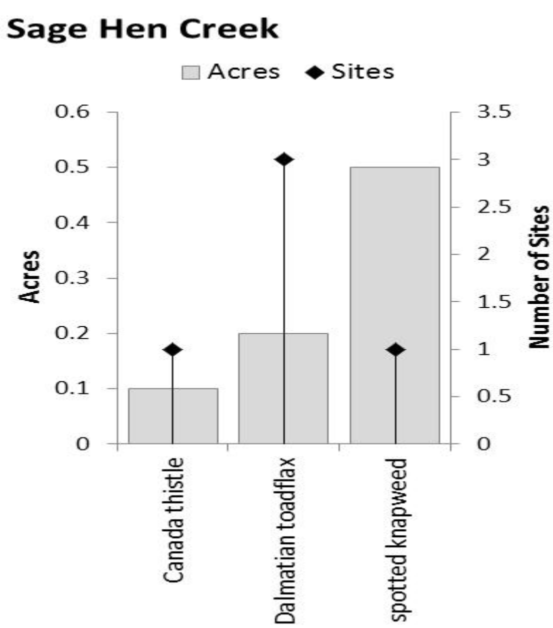


Species	Watershed Total	
	Sites	Acres
Canada thistle	67	27
Dalmatian toadflax	40	7
yellow toadflax	5	6
St. Johnswort	3	0.3
houndstongue	2	3
spotted knapweed	7	0.8
diffuse knapweed	11	1
Russian knapweed	11	0.9
perennial pepperweed	4	0.4
whitetop	9	0.8
TOTAL	**159**	**47**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	28	6	12	0.9			
Dalmatian toadflax	15	0.8	3	0.1			
yellow toadflax	3	2	3	0.6	3	0 ft.	*Calochortus longibarbatus* var. *peckii*
spotted knapweed	3	0.2	2	0.08			
diffuse knapweed	3	0.2	2	0.1			
Russian knapweed	3	0.1	1	0.05			
perennial pepperweed	2	0.06					
whitetop	4	0.3	2	0.1			
TOTAL	**61**	**10**	**25**	**2**	**3**	**–**	**1**

Sage Hen Creek (1712000206)

Ranger district:	Emigrant Creek RD
County:	Harney
Total FS acreage:	2,075
Special land uses:	none
Major streams and water bodies:	none
Recreation:	dispersed campsites
Grazing allotments:	Donnelly
Watershed regional priorities:	none
Major roads and/or infested roads:	County Road-127, 4100
TES species of concern:	none
Comments:	none



Species	Watershed Total	
	Sites	Acres
Canada thistle	1	0.1
Dalmatian toadflax	3	0.2
spotted knapweed	1	0.5
TOTAL	**5**	**1**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
None							
TOTAL	**0**	**0**	**0**	**0**	**0**	**–**	**0**

Silver Creek Sub-basin (17120004)

Claw Creek (1712000401)

Upper Silver Creek (1712000402)

Middle Silver Creek (1712000403)

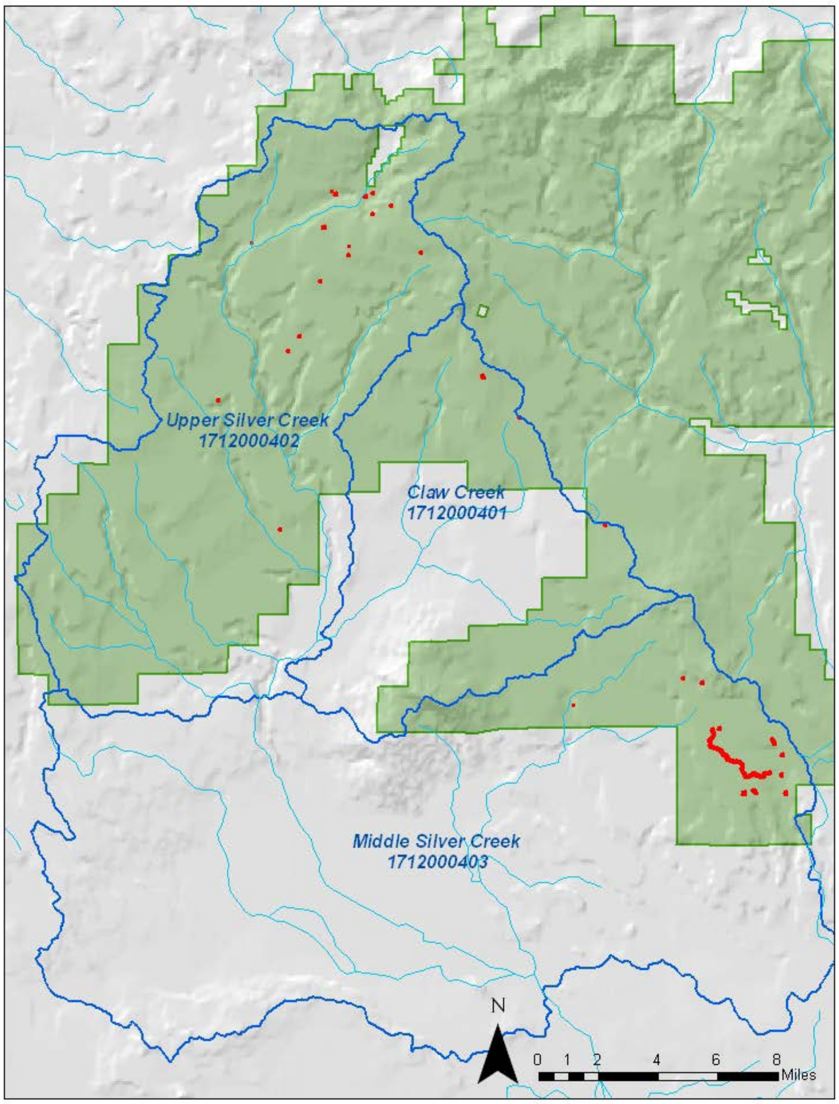
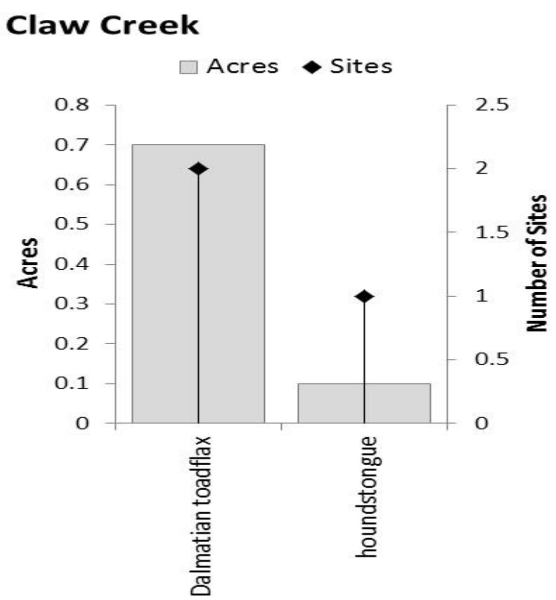


Figure A- 10. Silver Creek Sub-basin (17120004)

Claw Creek (1712000401)

Ranger district:	Emigrant Creek RD
County:	Harney
Total FS acreage:	29,620
Special land uses:	Dry Mountain Research Natural Area
Major streams and water bodies:	Wickiup Creek, Claw Creek
Recreation:	dispersed campsites
Grazing allotments:	Silver Creek, Donnelly, Green Butte
Watershed regional priorities:	none
Major roads and/or infested roads:	4100, 4335, 4130
TES species of concern:	Astragalus tegetarioides (no know invasive plants within 100 ft.)
Comments:	none

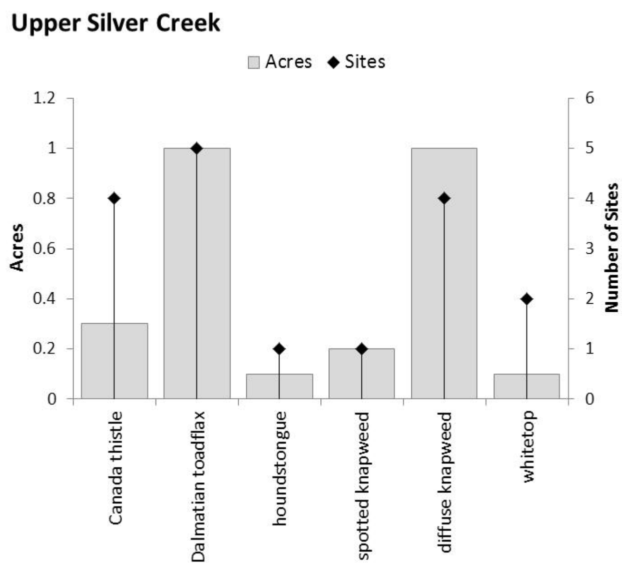


Species	Watershed Total	
	Sites	Acres
Dalmatian toadflax	2	0.7
houndstongue	1	0.1
TOTAL	**3**	**1**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
None							
TOTAL	**0**	**0**	**0**	**0**	**0**	**–**	**0**

Upper Silver Creek (1712000402)

Ranger district:	Emigrant Creek RD
County:	Harney, Crook
Total FS acreage:	96,071
Special land uses:	Silver Creek Proposed Research Natural Area
Major streams and water bodies:	Silver Creek, Sawmill Creek, Nicoll Creek, Delintment Creek, Delintment Lake
Recreation:	Buck Springs CG, Tip Top Spring CG, Delintment Lake CG, dispersed campsites
Grazing allotments:	Allison, Silver Creek, Sawmill, Buck Mountain, Lower Nicoll
Watershed regional priorities:	none
Major roads and/or infested roads:	4100, 4500, 4170, 4160, 4175, 4161, 4545, 4535, 4510, 4525
TES species of concern:	Astragalus tegetarioides (no know invasive plants within 100 ft.), Calochortus longibarbatus var. peckii (no know invasive plants within 100 ft.)
Comments:	none

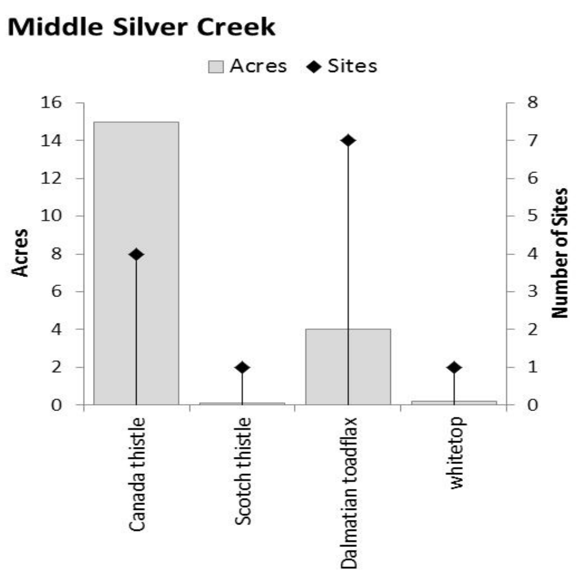


Species	Watershed Total	
	Sites	Acres
Canada thistle	4	0.3
Dalmatian toadflax	5	1
houndstongue	1	0.1
spotted knapweed	1	0.2
diffuse knapweed	4	1
whitetop	2	0.1
TOTAL	**17**	**3**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	1	0.04	1	0.0003			
Dalmatian toadflax	1	.09					
whitetop	1	.04					
TOTAL	**3**	**0.2**	**1**	**0.0003**	**0**	**–**	**0**

Middle Silver Creek (1712000403)

Ranger district:	Emigrant Creek RD
County:	Harney
Total FS acreage:	28,376
Special land uses:	Dry Mountain Research Natural Area
Major streams and water bodies:	none
Recreation:	Pine Springs Overlook, dispersed campsites
Grazing allotments:	Green Butte, Donnelly
Watershed regional priorities:	none
Major roads and/or infested roads:	4100, 4107, 4120, 4126
TES species of concern:	Astragalus tegetarioides (no know invasive plants within 100 ft.)
Comments:	none



Species	Watershed Total	
	Sites	Acres
Canada thistle	4	15
Scotch thistle	1	0.1
Dalmatian toadflax	7	4
whitetop	1	0.2
TOTAL	**13**	**19**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	2	0.2					
Scotch thistle	1	0.1					
Dalmatian toadflax	1	0.2					
TOTAL	**4**	**0.5**	**0**	**0**	**0**	**–**	**0**

Harney-Malheur Lakes Sub-basin (17120001)

North Basin (1712000101)

Malheur Slough (1712000102)

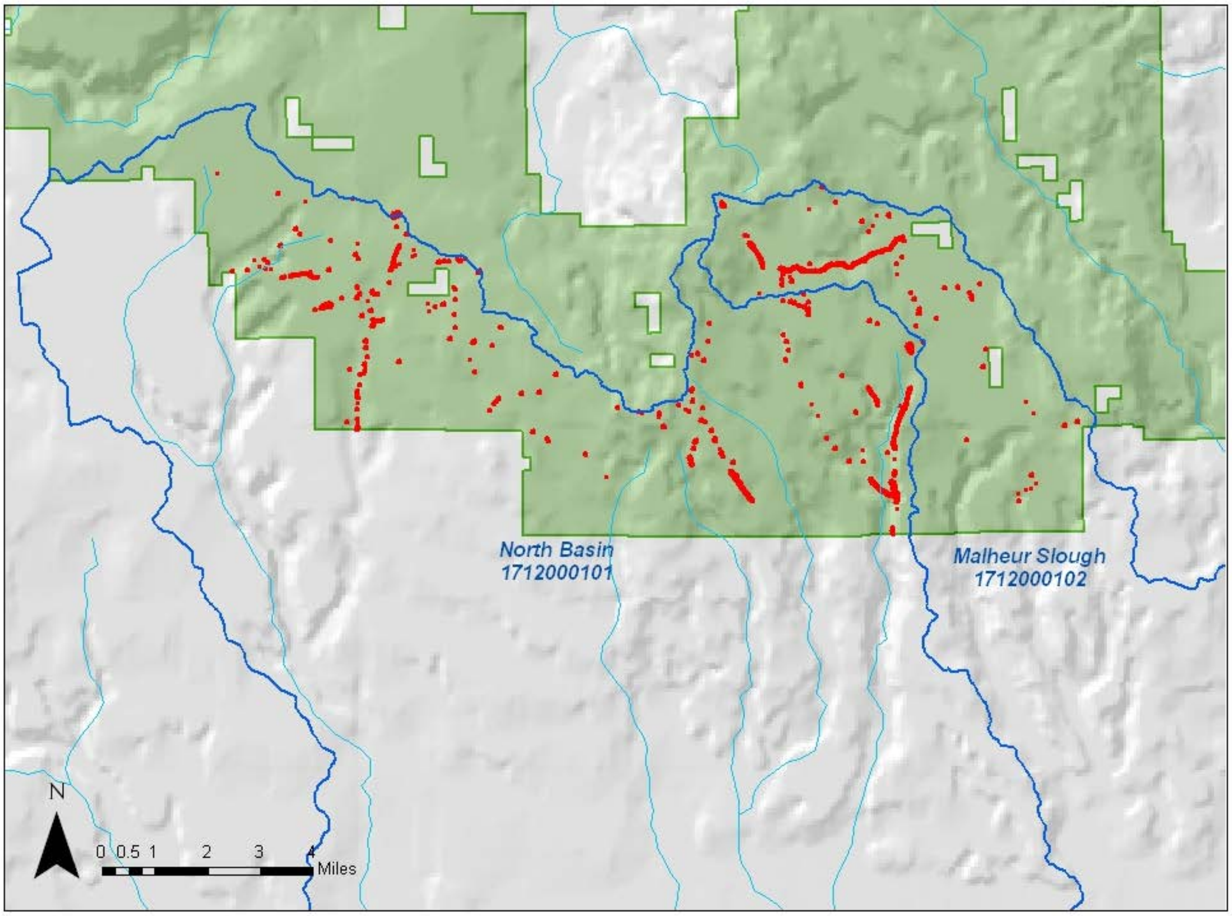
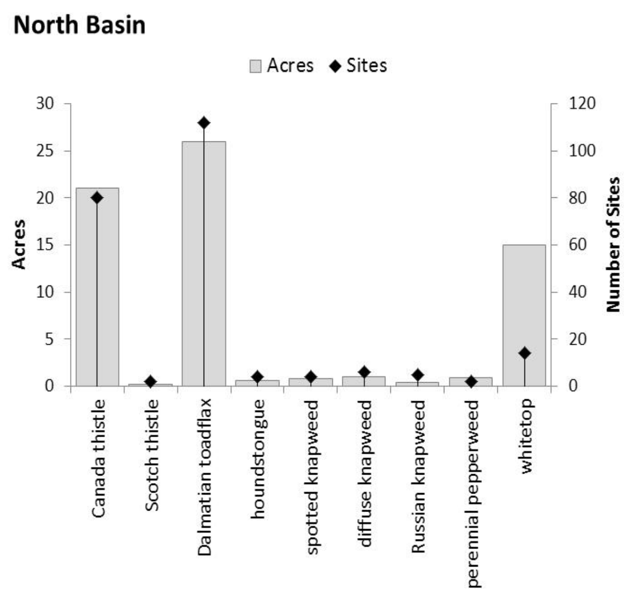


Figure A- 11. Harney-Malheur Lakes Sub-basin (17120001)

North Basin (1712000101)

Ranger district:	Emigrant Creek RD
County:	Harney
Total FS acreage:	32,979
Special land uses:	none
Major streams and water bodies:	Rattlesnake Creek, Poison Creek
Recreation:	Idlewild CG, dispersed campsites
Grazing allotments:	Myrtle, Devine, Pine Creek
Watershed regional priorities:	none
Major roads and/or infested roads:	US-395, 2800, 2800-480, 2810, 2810-478, 2810-482 (closed), 2820, 2820-216, 2820-028, 3935, 3900-958,
TES species of concern:	Astragalus tegetarioides
Comments:	none

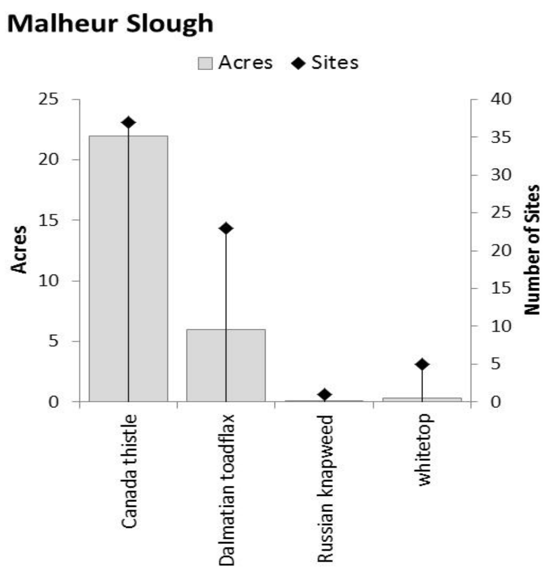


Species	Watershed Total	
	Sites	Acres
Canada thistle	80	21
Scotch thistle	2	0.2
Dalmatian toadflax	112	26
houndstongue	4	0.6
spotted knapweed	4	0.8
diffuse knapweed	6	1
Russian knapweed	5	0.4
perennial pepperweed	2	0.9
whitetop	14	15
TOTAL	**229**	**66**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	14	7	9	2			
Dalmatian toadflax	30	3	14	0.3	1	0 ft.	*Astragalus tegetarioides*
houndstongue	4	0.5	2	0.07			
spotted knapweed	1	0.03	1	0.02			
diffuse knapweed	3	0.2	1	0.02			
Russian knapweed	2	0.2	1	0.03			
whitetop	6	5	3	0.4			
TOTAL	**60**	**16**	**31**	**3**	**1**	**–**	**1**

Malheur Slough (1712000102)

Ranger district:	Emigrant Creek RD
County:	Harney
Total FS acreage:	13,732
Special land uses:	none
Major streams and water bodies:	Cow Creek
Recreation:	Call Meadows SnoPark, dispersed campsites
Grazing allotments:	Pine Creek
Watershed regional priorities:	none
Major roads and/or infested roads:	2800, 2820, 2810, 2850, 2830, 2815, 2820-499, 2815-700
TES species of concern:	none
Comments:	none



Species	Watershed Total	
	Sites	Acres
Canada thistle	37	22
Dalmatian toadflax	23	6
Russian knapweed	1	0.1
whitetop	5	0.3
TOTAL	**66**	**28**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	2	0.2	2	0.04			
TOTAL	**2**	**0.2**	**2**	**0.04**	**0**	**–**	**0**

Deschutes River Basin (170703)

South Fork Beaver Creek (1707030305)

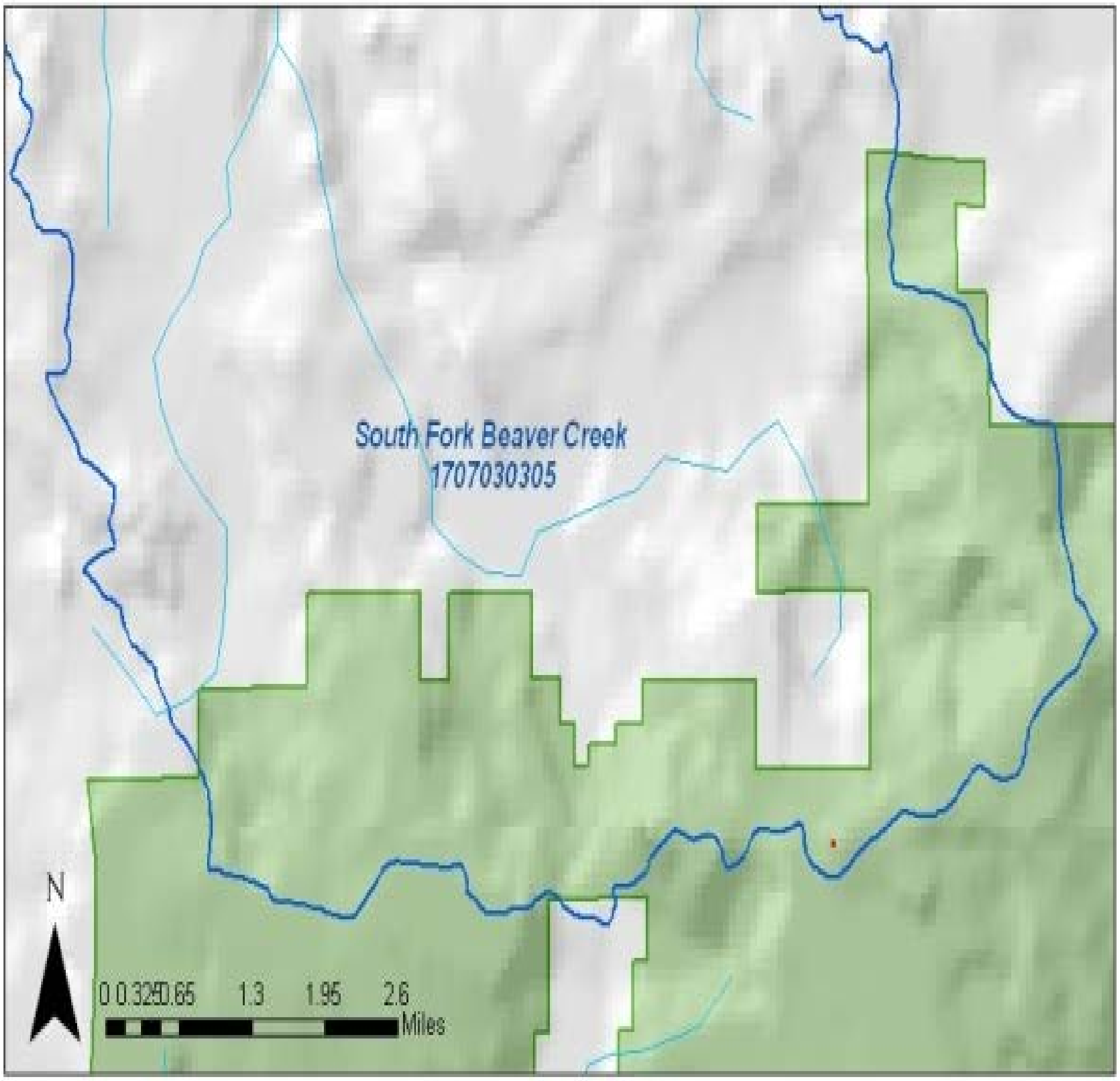
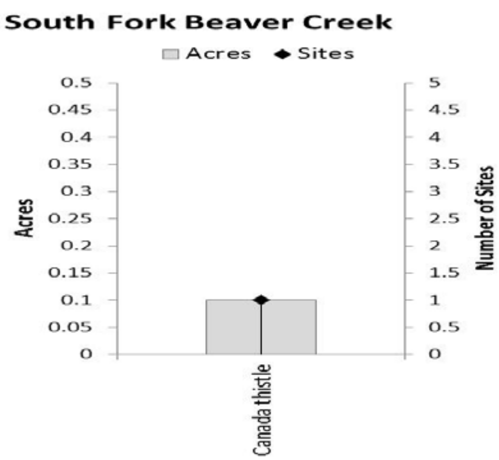


Figure A- 12. Deschutes River Basin (170703), South Fork Beaver Creek (1707030305)

South Fork Beaver Creek (1707030305)

Ranger district:	Emigrant Creek RD
County:	Harney, Grant
Total FS acreage:	7,428
Special land uses:	none
Major streams and water bodies:	Freeman Creek
Recreation:	dispersed campsites
Grazing allotments:	Sawmill, Allison, Little Mowich
Watershed regional priorities:	none
Major roads and/or infested roads:	4100
TES species of concern:	none
Comments:	none



Species	Watershed Total	
	Sites	Acres
Canada thistle	1	0.1
TOTAL	**1**	**0.1**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
None							
TOTAL	**0**	**0**	**0**	**0**	**0**	**–**	**0**

Appendix B - Invasive Species Monitoring Plan

Southern Blues Restoration Coalition CFLRP

Malheur National Forest

1. Introduction

1.1. Background

Invasive plants are non-native species whose introduction does or is likely to cause economic or environmental harm or harm to human health. Invasive plants have the potential to displace native plant communities, increase fire hazards, negatively affect fish and wildlife habitat, degrade rangeland forage, compete with rare and culturally-significant plants, increase soil erosion, and adversely affect scenic beauty and recreational opportunities. Because of their competitive abilities, invasive plants can spread rapidly across the landscape, unconstrained by administrative or ownership boundaries.

Often the terms “invasive plants” and “noxious weeds” are used interchangeably; however, there are subtle differences in meaning. Noxious weeds are invasive or otherwise undesirable plants that have been designated by the State of Oregon as being injurious to public health, agriculture, recreation, wildlife, or any public or private property. Species which are identified as invasive, and which are also designated by the state as being noxious weeds, are the focus of treatment and monitoring on the Malheur National Forest. Here, the terms “invasive plants” and “noxious weeds” are essentially used interchangeably.

1.2. Monitoring Question

What are the trends in the occurrence and distribution of invasive plants/noxious weeds at the project and landscape scales?

1.3. Collaborators

Blue Mountain Forest Partners (BMFP)

Harney County Restoration Collaborative (HCRC)

Malheur National Forest (MNF)

North Fork John Day Watershed Council (NFJDWC)

Rocky Mountain Elk Foundation (RMEF) *

Grant Soil and Water Conservation District (GSWCD) *

Harney County Weed Control (GSWCD) *

Oregon Department of Transportation (ODOT) *

Permittees of MNF livestock grazing allotments *

** Partnerships are currently being developed with these entities*

2. Methods and Protocols

2.1. Types of treatments to be monitored

The occurrence and distribution of invasive plants can be affected by management activities in three major ways: (1) active and deliberate efforts to treat infestations within the CFLRP landscape and project areas (e.g. mechanical, chemical, and biological control efforts), (2) active prevention of invasive species establishment through preventative management practices and revegetation with native plants, and (3) unintentional spread of invasive species due ground-disturbing activities within specific project areas (e.g. spread due vegetation management and restoration efforts). Specific treatments and activities of these two major management activities are discussed below:

Active weed treatments – The purpose of active weed treatment is to control, suppress, and/or eradicate noxious weed infestations at the landscape and project levels. Such activities include manual and mechanical treatments, release of biological control agents[†], cultural control methods (e.g. solarization, livestock use, etc.), and spraying of herbicides†. Monitoring of these efforts will focus on the effectiveness of such treatments in reducing invasive plant infestations.

Preventative revegetation – In many cases, native plant seed is used to preemptively revegetate disturbed sites using native plant seed. The purpose of this is to provide locally adapted, genetically appropriate native plant seed for restoration of disturbed areas prior to invasive plants becoming established at the site. Native plants can provide ground cover at the site and offer a competitive advantage by becoming established before invasive plant gain a foot-hold. Monitoring of these efforts will focus on the effectiveness of such treatments in establishing native vegetation and reducing invasive plant infestations.

Possible unintentional spread – Many of the proposed project-level activities are designed to restore native communities to desired conditions and to provide economically valuable forest products. These often result in ground-disturbing activities that have the potential to unintentionally facilitate the establishment and spread of invasive plant species. Examples of such activities include logging and thinning operations (e.g. skid trails, landings, temporary road construction); pile burning, culvert replacements, stream channel restoration, and road decommissioning. Results of these activities will be monitored to determine if they are inadvertently causing an increase in invasive plant occurrence and distribution.

† These treatment methods are contingent upon successful completion of the Malheur National Forest Site-Specific Invasive Plants Treatment Environmental Impact Statement

2.2. Implementation of monitoring

In most cases monitoring will be accomplished concurrently with invasive species treatments. Monitoring is an inherent process of effectively treating invasive species infestations. Successful control and/or eradication of invasive species populations require numerous multi-year visits to the sites in order to assess the effectiveness of previous treatments and to implement follow-up treatments of residual infestations. Furthermore, it is more efficient and cost-effective to accomplish both implementation and monitoring simultaneously.

Currently, monitoring and data collection will be accomplished by the MNF’s noxious weeds survey and treatment crews, the MNF’s native plant materials restoration staff, and the NFJDWC’s youth crews. Future monitoring efforts may include other interested citizens and groups as partnerships are developed and time and funding permit.

Monitoring will be conducted at three spatial scales: (1) the CFLRP landscape scale, (2) within individual project areas, and (3) at selected treatment areas or disturbed sites.

Monitoring crews will determine the number of invasive plant sites present within and adjacent to the project areas prior to, during, and after project implementation. All known information on existing and historical infestations will be collected and provided prior to the monitoring effort.

2.3. Methods for Data Collection

Invasive plant population data will be collected prior to, during, and following implementation. Data collection will follow the USDA Forest Service invasive species survey protocol; at a minimum, collected data will include the following mandatory information: physical location, which species are present, the size and extent of the infestation, and the density of infestation (percent cover per species). Additional data will include a basic site description, the types of disturbance that may have been historically impacting the site, and what type of vegetation management or restoration activity that will or has occurred. Data will be recorded either on a standardized invasive plant record/treatment data sheet or an electronic field data recorder.

Species which are identified as invasive by the Forest Service, and which are also designated by the state as being noxious weeds, will be the primary focus of the monitoring effort. However, some invasive species that are not designated as noxious, and which are not targets for treatment on the MNF, will also be monitored when necessary. For example, cheatgrass (*Bromus tectorum*) and African wire-grass (*Ventenata dubia*) are not identified as noxious weeds by the state and are not targets of treatment for the MNF, but are species of concern if prevention measures are ineffective and/or management actions are inadvertently causing invasion and spread into new areas.

Additionally, a subset of selected sites will be intensively monitored not only to determine the effectiveness of invasive plant treatments, but also to determine the degree of native species recovery at the site (either through natural recovery or deliberate revegetation efforts). In addition to recording the minimum mandatory information, these intensive monitoring areas will also collect standard ecological data as indicators of biodiversity: native species richness, native species diversity indices, potential natural vegetation, and a description of the ecological “state” as described in published state and transition models.

2.4. Data Management

Data management will be accomplished by the MNF. Monitoring crews shall submit hard copy data sheets or electronic files for any new invasive plant infestations found and updates to any existing infestations. Forest Service personnel will enter all monitoring/treatment data into the Invasive Species Inventory/Treatment GIS module of the Natural Resource Information System (NRIS) and the Forest Activities Tracking System (FACTS); these are the databases of record for all invasive species activities and inventories on national forest lands.

2.5. Data Analysis

Forest Service personnel will analyze all new and old data by site and project area to determine (1) the effectiveness of invasive plant treatments by species, site type, and treatment type, and (2) impacts (if any) of the vegetation management, restoration, and revegetation activities on invasive plant spread, persistence, and density. This will be accomplished by comparing the extent, cover, and species composition of existing sites prior to implementation to new and existing sites during and following implementation.

Additionally, the resulting effect on native biodiversity as a result of invasive plant treatments and subsequent native plant revegetation efforts will be analyzed by comparing measures of native species biodiversity before the treatments to those recoded after implementation of the treatments.

2.6. Indicators and metrics

Project-Level and Landscape Indicators – A number of metrics will be used to determine the trends in the occurrence and distribution of invasive plants/noxious weeds at the project and landscape scales. Data will be collected and reported on a project by project basis. In the future these will be summarized to address the CFLRP area as a whole. Metrics will be compared after implementation to those prior to implementation; these include:

- Total number of infestations (by species)
- Total acres infested (by species)
- Total percent of acres infested (by species).
- Effectiveness of invasive plant treatments by treatment type (e.g. mechanical, manual, herbicide, biological) as measured by percent decrease in invasive plants.
- Effectiveness of preventative native plant seeding treatments as measured by number of new infestations.
- Impact of vegetation management and restoration activities by type of activity (e.g. pile burning, underburning, skidding, decking, culvert replacement, channel restoration, etc.)

Site-Specific Indicators – A subset of selected sites within each project area will be intensively monitored to determine how invasive plant treatments are affecting biological diversity at the sites. Metrics will be compared after implementation to those prior to implementation, these include:

- Native species richness (total number of native species at site)
- Invasive species richness (total number of invasive species at site)
- Native species diversity indices (accounts for the number, abundance, and distribution of species)
- Ecological state (from published state and transition models, when available)

2.7. Plan for data management

Original monitoring data (hard copy and electronic) will be held with the MNF. Most of the data will be stored in the Forest Service's national databases of record for invasive plant inventory and treatments: the Natural Resource Information System (NRIS) and the Forest Activities Tracking System (FACTS). Data that cannot be stored in these databases will be kept in MS Excel or MS Access databases stored on the Forest Service's centralized corporate hard drives (O-Drive).

3. Deliverables

3.1. Reporting of Results

Results of the invasive species monitoring will be presented in an annual summary of monitoring accomplishments. This annual report will focus on expenditures, project areas monitored, number of sites monitored, partnership development, and other basic information.

Detailed reports that analyze and summarize monitoring data will be provided at years three, five, and ten after final initiation of the monitoring program. These reports will focus on (1) the effectiveness of invasive plant treatments, (2) the effectiveness of native plant revegetation at preventing invasion, (3) the degree of unintentional spread due to restoration and vegetation management activities, and (4) the impact of treating invasive plants on the native biodiversity of the sites.

3.2. Responsibility for providing final products.

Malheur National Forest's Invasive Plant Program will be responsible for providing the final reports and products.

4. Adaptive management

4.1. How will the data be used?

Results of the monitoring program will be used to inform the planning and implementation of future proposed activities. Invasive species prevention and control measures will be reassessed and modified, if necessary, depending on the results of the monitoring program.

4.2. At what spatial scale will the results apply and when will they provide meaningful feedback?

Results of the monitoring will be applicable at the site-specific, the general project area, and the CFLRP landscape levels. Results should start providing some meaningful feedback after the first year of implementation. However, long-term results (at years three, five, and ten) will provide much more quality information that can be used in an adaptive management and long-term planning context.

Appendix C - Adjuvant/Surfactant Information

(Excerpted from Analysis of Issues Surrounding the Use of Spray Adjuvants With Herbicides, David Bakke 2002, revised 2007. Please note that this project would not use POEA or NPE based adjuvants.)

Adjuvants are spray solution additives that are mixed with an herbicide solution to improve performance of the spray mixture. Adjuvants can either enhance activity of an herbicide's active ingredient (activator adjuvant) or offset any problems associated with spray application, such as adverse water quality or wind (special purpose or utility modifiers). Activator adjuvants include surfactants, wetting agents, sticker-spreaders, and penetrants. This paper deals mainly with commonly used activator adjuvants used in herbicide applications in forestry.

Adjuvants are not under the same registration guidelines as are pesticides. The U.S. Environmental Protection Agency (U.S. EPA) does not register or approve the labeling of spray adjuvants. All adjuvants are generally field tested by the manufacturer with several different herbicides against many weeds, and under different environments. Surfactants, or surface-acting agents, are a broad category of activator adjuvants that facilitate and enhance the absorbing, emulsifying, dispersing, spreading, sticking, wetting, or penetrating properties of herbicides.

Surfactants, by their very nature, are intended to increase the effect of a pesticide by increasing the amount of pesticide that is in contact with the target (by reducing surface tension). This is not synergism, but more accurately is a reflection of increased dose of the herbicide active ingredient into the plant. Although there is not much data in the technical literature, the references included in Bakke's 2007 hazard assessment indicate a lack of synergistic effects between surfactants and pesticides.

Adjuvant Types

Wetter/Spreaders

Wetter/Spreaders are most often used with herbicides to help it spread over and penetrate the waxy cuticle (outer layer) of a leaf or to penetrate through the small hairs present on the leaf surface. Because of the high surface tension of water, spray mixture droplets can maintain their roundness and sit on the leaf hairs or waxy surface without much of the herbicide actually contacting the leaf. The primary purpose of a wetter/spreader is to reduce the surface tension of the spray solution to allow more intimate contact between the spray droplet and the plant surface. They may also act to change the permeability of the leaf surface.

Most wetter/spreaders used with herbicides are considered non-ionic surfactants. This means that these compounds have no electrical charge and are compatible with most pesticides. There are cationic (positive charge) and anionic (negative charge) surfactants, but they are not as commonly used, with the exception of the cationic surfactant in the Roundup® formulation of glyphosate. Wetter/spreaders have the physical characteristics of both oil and water. Most wetter/spreader molecules contain a water-loving (hydrophilic) head and a long-chain hydrocarbon oil-loving (lipophilic) tail.

There are several different basic chemistries of wetter/spreaders.[29]

Ethoxylated fatty amines (Cationic)

Examples:

- Entry™ II (Monsanto Company)
- POEA - Roundup® has 15 percent POEA

Alkylphenol ethoxylate-based wetter/spreaders (non-ionic)

Examples:

- R-11® Spreader Activator (Wilbur-Ellis Company)
- Activator 90 (Loveland Products)
- X-77® (Loveland Products)
- Pro-Spreader Activator (Target Specialty Products, Inc.)
- Latron AG-98™ (N) (Dow AgroSciences LLC)
- Latron AG-98™ (Dow AgroSciences LLC)

These surfactants usually include an alcohol as a solvent (isopropanol (Pro-Spreader Activator, AG-98™), butanol (R-11®, AG-98™ (N)), glycol (AG-98™ (N), Activator 90)), a silicone defoamer (polydimethylsiloxane), and water.

Examples:

- Alcohol ethoxylate-based wetter/spreaders (non-ionic)
- Activator N.F. (Loveland Products) – may no longer be available
- Silicone-Based wetter/spreaders

Also known as organosilicones, these are increasing in popularity because of their superior spreading ability. This class contains a polysiloxane chain. Some of these are a blend of non-ionic surfactants (NIS) and silicone while others are entirely silicone. The combination of NIS and a silicone surfactant can increase absorption into a plant so that the time between application and rainfall can be shortened. This is known as rainfastness. The surfactants extreme spreading ability may lead to droplet coalescence and subsequent runoff if applied at inappropriately high rates.

Examples:

- Sylgard® 309 (Wilbur-Ellis Company) –silicones
- Freeway® (Loveland Products) –silicone blend
- Dyne-Amic® (Helena Chemical Company) - silicone blend
- Silwet L-77® (Loveland and Helena) – silicones

[29] The use of product names is for illustrative purposes only and is not intended as a recommendation for use or an endorsement of these products by the USDA Forest Service.

- Kinetic (Helena Chemical Company) – silicone blend

Blends normally include an alcohol ethoxylate, a defoamer, and propylene glycol.

Sticker/Spreaders

A sticker can perform three types of functions. It can increase the adhesion or "stickiness" of solid particles that otherwise might be easily dislodged from a leaf surface. It can also reduce evaporation of the pesticide. The third function can be to provide a waterproof coating. Many of the stickers contain surfactants as their principal functioning agent and are sold as spreader-stickers, which give both a sticker action and a wetter-spreader action. These will perform the first two functions quite well. Since the surfactants that provide wetter-spreader action must be somewhat water soluble, they may not provide good protection from rain. This will be provided by products that contain latex (rubber), polyethylene (plastic), resins (rosin), polymenthenes (rosin-like), or other waterproofing agents.

Examples:

- Bond® Spreader Sticker Deposition Aid (Loveland Products)
- Tactic™ Sticker – Organosilicone surfactant – deposition agent (Loveland Products)
- R-56® Spreader Sticker (Wilbur-Ellis Co.)
- Cohere® Nonionic Spreader Sticker (Helena Chemical Co.)

Oils

Adjuvants that are primarily oil-based have been gaining in popularity especially for the control of grassy weeds. Oil additives function to increase herbicide absorption through plant tissues and increase spray retention. They are especially useful in applications of herbicides to woody brush or tree stems to allow for penetration through the bark. Oil adjuvants are made up of either petroleum, vegetable, or methylated vegetable or seed oils plus an emulsifier for dispersion in water.

Vegetable Oils – The methylated seed oils are formed from common seed oils, such as canola, soybean, or cotton. They act to increase penetration of the herbicide. These are comparable in performance to crop oil concentrates. In addition, silicone-seed oil blends are also available that take advantage of the spreading ability of the silicones and the penetrating characteristics of the seed oils.

The U.S. Food and Drug Administration (FDA) considers methyl and ethyl esters of fatty acids produced from edible fats and oils to be food grade additives (CFR 172.225). Because of the lack of exact ingredient statements on these surfactants, it is not always clear whether the oils that are used in them meet the U.S. FDA standard.

Examples:

- MSO® Concentrate Methylated Seed Oil (Loveland Products)
- Hasten® (Wilbur-Ellis Company)
- The surfactant in Pathfinder™ II (a triclopyr formulation)
- Improved JLB Oil Plus (Brewer International)
- Cide-Kick and Cide-Kick II (Brewer International)
- Cygnet Plus Spray Adjuvant (Brewer International)

Blends of vegetable oils and silicone-based surfactants

- Syl-tac™ (Wilbur-Ellis Company)
- Phase™ (Loveland Products)

Crop Oils and Crop Oil Concentrates - These are normally derivatives of paraffin-based petroleum oil. Crop oils are generally 95-98 percent oil with 1-2 percent surfactant/emulsifier. Crop oils also promote the penetration of a pesticide spray. Traditional crop oils are more commonly used in insect and disease control than with herbicides. Crop oil concentrates are a blend of crop oils (80-85 percent) and a nonionic surfactant (15-20 percent). The purpose of the nonionic surfactant in this mixture is to emulsify the oil in the spray solution and lower the surface tension of the overall spray solution.

Examples:

- kerosene (found in the triclopyr formulation Garlon 4),
- Agri-dex® (Helena Chemical Co. or Setre Chemical Co.)
- Red-Top Mor-Act® (Wilbur-Ellis Company)
- Herbimax (Loveland Products)

Fertilizer/Surfactant Mixtures

Nitrogen fertilizers (ammonium sulfate and ammonium nitrate) have been added to adjuvants to increase herbicide activity. These fertilizer solutions have improved the performance consistency on some weeds. Herbicides that appear to benefit from the addition of ammonium are the relatively polar, weak acid herbicides such as glyphosate, the sulfonylureas (Oust, Escort, Telar, etc.), and the imidazolinones (Arsenal, Plateau, Chopper, etc.). Velvetleaf and some grassy annual weeds in particular have been responsive to the addition of nitrogen fertilizer in the spray mix. Some broadleaves and grasses show little or no response with the inclusion of ammonium fertilizer solutions. Ammonium-based fertilizers and, in particular, ammonium sulfate (AMS) are being promoted to reduce potential antagonism with hard water.

Examples:

- First Choice® Exciter Activator (Western Farm Service)
- Magnify Activator – Penetrant (Monterey AgResources)
- Class Act® Next Generation (Agrilliance, LLC)
- Intensify Activator/Penetrant (West Link Ag)

Special Purpose or Utility Adjuvants

The special purpose or utility adjuvants are used to offset or correct certain conditions associated with mixing and application such as impurities in the spray solution, extreme pH levels, and drift. These adjuvants include acidifiers, buffering agents, water conditioners, anti-foaming agents, compatibility agents, and drift control agents.

The pH of most solutions is not high or low enough for important herbicide breakdown in the spray tank. Acidifiers (example LI-700® and Tri-fol®) are sometimes recommended for use with herbicides because of greater absorption of weak acid type herbicides when the spray solution is acidic.

Examples:

- LI-700® Surfactant Penetrant Acidifier (Loveland Products)
- Tri-fol® Acidifier and Buffering Agent (Wilbur Ellis Company)

Drift reduction agents will generally increase the average droplet size to reduce the amount of fine droplets that are especially susceptible to drift.

Examples:

- In-Place® Deposition and Drift Management Agent (Wilbur Ellis Company)
- Sinker Polymer Carrier and Drift Retardant (Helena Chemical Company)

Defoamers are used to reduce the foaming that might occur during agitation of the spray mixture. They typically contain a silicone compound (dimethylpolysiloxane) as their principal active ingredient. Some also include small amounts of silicon. The silicone compound acts to reduce the surface tension of the mixture, so foaming is eliminated or reduced. The silicon particles physically burst air bubbles.

Examples:

- Foaminator™ Dry (Agrilliance, LLC)
- No Foam (Wilbur Ellis Company)
- No Foam Dry (Wilbur Ellis Company)
- No Foam® B (Creative Marketing and Research)

Colorants

Colorants are added to an herbicide mixture prior to application so that the actual treated area can be readily determined. This helps to prevent skips and overlaps. It can also be useful for reducing human exposures to recently treated vegetation.

Examples:

- Hi-Light™ Blue (Becker-Underwood, Inc.)
- Colorfast® Purple (Becker-Underwood, Inc.)

Hazards

Of the adjuvants discussed in this paper, only two carry the Danger signal word 30 (Entry™ II and LI-700®), which is due to the potential effects to the eyes (severely irritating or corrosive). The bulk of the remainder carry the Caution signal word, while several carry the Warning signal word (again because of potential irritant effects to the skin or eyes). None of these adjuvants carry the poison symbol. All of the adjuvants discussed here are no more than slightly toxic when ingested, inhaled, or absorbed through the skin (Acute Toxicity Categories III or IV).

[30] Signal words are required on pesticide and registered adjuvant labels, and provide an overall view of the acute toxicity, or effects to eyes or skin, of the product. There are three signal words used by U.S. EPA, Danger, Warning, and Caution, to signify decreasing levels of this toxicity. In addition, the Danger signal word can be accompanied by the skull and crossbones symbol if the product is an acute poison. Refer to the table on Page 44.

The bulk of these adjuvants do not contain ingredients found on U.S. EPA's inerts list 1 or 2. This is either based on the identified ingredients, or if these ingredients are not sufficiently identified, by information given by the manufacturers. The assessment of hazards for these adjuvants is limited by the proprietary nature of the formulations. Unless the U.S. EPA classifies a compound in the formulation as hazardous, the manufacturer is not required to disclose its identity. At the current time, the disclosure of whether a material is hazardous is based primarily on acute toxicity. There are two products listed that include ingredients on U.S. EPA's inerts list 2 (Herbimax® Petroleum Oil-Surfactant Adjuvant (Loveland Products, Inc.) and In-Place® Deposition and Drift Management Agent (Wilbur-Ellis Co.).

The primary summary statement that can be made is that the more common risk factors for the use of these adjuvants are through skin or eye exposure. These adjuvants all have various levels of irritancy associated with skin or eye exposure. This points up the need for good industrial hygiene practices while utilizing these products, especially when handling the concentrate, such as during mixing. The use of chemical resistant gloves and goggles, especially while mixing, should be observed.

There is little toxicity testing done on these adjuvants. Most of the adjuvants have had some acute toxicity testing, as well as skin and eye irritation studies.

Examples:

- Ethoxylated Fatty Amines
- Entry™ II (POEA)

Danger signal word (Entry™ II); Roundup® (includes POEA) signal word is either Warning or Caution, depending upon the formulation. Skin irritant, may be allergen. Entry™ II is severely irritating to corrosive to eyes (I[31]).

For a comprehensive look at POEA as a surfactant in the Roundup® formulation, refer to SERA 1997a and SERA 2003a. As Entry™ II is the same formulation as the POEA surfactant in Roundup®, these same references can be used.

Entry™ II and POEA both contain ethoxylated ingredients. Ethoxylates are formed by reactions of ethylene oxide. In the manufacturing process, some unreacted ethylene oxide as well as the contaminant 1,4-dioxane can become part of the final formulation. Both of these chemicals are considered likely human carcinogens. For a comprehensive look at the risks of 1,4-dioxane in the POEA surfactant, refer to Borrecco and Neisess 1991. For a comprehensive look at the risks of ethylene oxide in ethoxylated surfactants, refer to USDA, 2003.

Alkylphenol-ethoxylate-based wetter/spreaders

Examples:

- R-11® Spreader Activator (Wilbur-Ellis Co.)

Caution signal word. May cause skin irritation (III). Mildly irritating to the eyes (III).

- Activator 90 and X-77® (Loveland Products, Inc.)

The active ingredient in R-11® Spreader Activator, nonylphenol polyethoxylate, has been linked to estrogenic effects in wildlife, including aquatic species, such as fish and amphibians. For a

[31] The Roman numeral refers to the US EPA toxicity category (I, II, III, or IV) with I representing the category of highest toxicity and IV being the lowest. Refer to 40 CFR 156.62.

comprehensive look at the nonylphenol ethoxylate surfactants, refer to USDA, 2003. Butanol and compounded silicone are both on EPA list 4B. Butanol is slightly more orally acutely toxic than the nonylphenol polyethoxylate. The compounded silicone is practically non-toxic on an acute oral basis (rat LD50 >17 g/kg).

Activator 90 has a Caution signal word while X-77® has a Warning signal word. Based on communications with the manufacturer, both products are fairly similar in formulation, and indeed, they consider the testing data between the two to be bridgeable (S. Baker, Loveland Products, Personal Communication 6/19/02, 8/15/02). Both may cause minor skin irritation (III). Both may cause severe reddening and swelling of the conjunctiva, with possible chemical burns (II). Both did not result in skin sensitization when administered to guinea pigs. It is likely that the signal word for Activator 90 should be changed to Warning, based on its effects to the eyes.

The MSDS describes a toxicity test involving guppies (not further described). Whether this refers to the freshwater aquarium fish *Poecilia reticulata* is not known. In this acute toxicity test, the 96-hour LC50 was determined to be 12.7 mg/L, with a corresponding 96-hour NOEC of 5.8 mg/L. This is comparable to effects of other nonylphenol polyethoxylate-based surfactants on frogs (USDA 2003).

One of the active ingredients, nonylphenol polyethoxylate, has been linked to estrogenic effects in wildlife, including aquatic species, such as fish and amphibians. For a comprehensive look at the nonylphenol ethoxylate surfactants, refer to USDA 2003.

Tall oil fatty acid is a mixture of oleic, linoleic, and rosin acids derived from the hydrolysis of tall oil, a byproduct of wood pulp. Tall oil fatty acid is included in various cosmetics, such as hair dyes and bleaches, shampoos, skin cleansing preparations, and a shaving cream. Tall oil fatty acid is approved for use as an indirect food additive. When fed to rats as 15 percent of the total caloric intake, tall oil fatty acid was nontoxic; however, it had a growth-retarding effect. No treatment-related effects were observed in rats fed diets containing 5 percent and 10 percent tall oil fatty acid over two generations. Liquid soap formulations containing up to 12 percent tall oil fatty acid did not cause dermal irritation, sensitization, or photosensitization in human subjects. One study in rats indicated that this compound had little effect on reproduction. For further information, refer to Anonymous (1989).

The compounded silicone is practically non-toxic on an acute oral basis (rat LD50 >17 g/kg).

Diethylene glycol is practically nontoxic with an acute oral LD50 value in the rat of 12.5 g/kg.

The linear alcohol is not adequately described to say anything definite about its toxicology.

Activator 90 and X-77® contain ethoxylated ingredients. Ethoxylates are formed by reactions of ethylene oxide. In the manufacturing process, some unreacted ethylene oxide as well as the contaminant 1,4-dioxane can become part of the final formulation. Both of these chemicals are considered likely human carcinogens. For a comprehensive look at the risks of 1,4-dioxane in the POEA surfactant, refer to Borrecco and Neisess 1991. For a comprehensive look at the risks of ethylene oxide in ethoxylated surfactants, refer to USDA 2003.

Example:

- Pro-Spreader Activator (Target Specialty Products)

Pro-Spreader Activator has a Caution signal word. It may cause skin irritation (III) and is mildly irritating to the eyes (III).

One of the active ingredients in Pro-Spreader Activator, nonylphenol polyethoxylate, has been linked to estrogenic effects in wildlife, including aquatic species, such as fish and amphibians. For a comprehensive look at the nonylphenol ethoxylate surfactants, refer to the USDA, 2003.

Pro-Spreader Activator contains ethoxylated ingredients. Ethoxylates are formed by reactions of ethylene oxide. In the manufacturing process, some unreacted ethylene oxide as well as the contaminant 1,4-dioxane can become part of the final formulation. Both of these chemicals are considered likely human carcinogens. For a comprehensive look at the risks of 1,4-dioxane in the POEA surfactant, refer to Borrecco and Neisess 1991. For a comprehensive look at the risks of ethylene oxide in ethoxylated surfactants, refer to USDA, 2003.

Example:

- Latron AG-98® (N) and Latron AG-98® (Rohm and Haas)

Both Latron AG-98® (N) and Latron AG-98® have a Warning signal word. Latron AG-98® (N) is considered moderately irritating to the skin, based on the nonylphenol ethoxylate and butanol ingredients. Latron AG-98® is considered severely irritating to skin. Latron AG-98® (N) is severely irritating to the eyes, possibly resulting in conjunctivitis. Latron AG-98® is considered irritating to the eyes.

The active ingredients, nonylphenol polyethoxylate and octylphenol polyethoxylate, have been linked to estrogenic effects in wildlife, including fish and amphibians. For a comprehensive look at the nonylphenol ethoxylate surfactants, refer to USDA, 2003. For purposes of evaluation, the OPE surfactants can be considered equivalent to the NPE surfactants of the same ethoxylate number.

Butanol and compounded silicone (polydimethylsiloxane) are both on EPA list 4B. Butanol is slightly more orally acutely toxic than the nonylphenol polyethoxylate. The compounded silicone is practically non-toxic on an acute oral basis (rat LD50 >17 g/kg).

Latron AG-98® (N) and Latron AG-98® contain ethoxylated ingredients. Ethoxylates are formed by reactions of ethylene oxide. In the manufacturing process, some unreacted ethylene oxide as well as the contaminant 1,4-dioxane can become part of the final formulation. Both of these chemicals are considered likely human carcinogens. For a comprehensive look at the risks of 1,4-dioxane in the POEA surfactant, refer to Borrecco and Neisess 1991. For a comprehensive look at the risks of ethylene oxide in ethoxylated surfactants, refer to USDA 2003.

Alcohol ethoxylate-based wetter/spreader

Example:

- Activator N.F. (Loveland Products)

Activator N.F. has a Caution signal word. This material may irritate the skin, and may cause eye injury. Acute toxicity information was not available for this surfactant.

Activator NF contains an ethoxylated linear alcohol; however, its exact composition is not specified. Several of the articles discussed in the issue questions at the end of this paper concern ethoxylated alcohols.

Compounded silicone (polydimethylsiloxane) is on EPA list 4B. The compounded silicone is practically non-toxic on an acute oral basis (rat LD50 >17 g/kg).

Activator NF contains ethoxylated ingredients. Ethoxylates are formed by reactions of ethylene oxide. In the manufacturing process, some unreacted ethylene oxide as well as the contaminant 1,4-dioxane can become part of the final formulation. Both of these chemicals are considered likely human carcinogens. For a comprehensive look at the risks of 1,4-dioxane in the POEA surfactant, refer to Borrecco and Neisess 1991. For a comprehensive look at the risks of ethylene oxide in ethoxylated surfactants, refer to USDA 2003.

The large percentage of inert ingredients (74.75 percent) in this formulation is troublesome. It is unknown if this is all or mostly water or made up of other ingredients.

Silicone-based wetter/spreaders

Example:

- Sylgard® 309 (Wilbur-Ellis Co.)

Sylgard® 309 has a Warning signal word. It is considered slightly irritating to the skin and is considered severely irritating to the eyes. It is not a skin sensitizer. Besides the acute toxicity data displayed in Table 1, the MSDS describes a 28-day oral dosing study in rats, in which rats were fed doses of 0, 33, 300, or 1,000 mg/kg/day. No significant findings of biological relevance were seen in females, while males showed some effects at highest dose (body weight gain, and changes in food consumption). This would indicate a subchronic NOEL of 300 mg/kg/day.

There has been concern expressed about the toxicity of silicone-based surfactants on terrestrial insects. Refer to issue discussion 2 on page 46.

Example:

- Freeway® (Loveland Products, Inc.)

Freeway® has a Caution signal word. Freeway® is mildly or non-irritating to the skin (Category IV), and is considered slightly irritating to the eyes (Category III).

The exact identity of the silicone-based components of Freeway® is unspecified. Whether it is of the same toxicity as the active ingredient in Sylgard® 309 is unknown, however these silicone based compounds are generally of low acute toxicity.

There has been concern expressed about the toxicity of silicone-based surfactants on terrestrial insects.

Compounded silicone (polydimethylsiloxane) is on EPA list 4B. The compounded silicone is practically non-toxic on an acute oral basis (rat LD50 >17 g/kg).

Propylene glycol is practically nontoxic to mammals, with an acute oral LD50 in rats of 20 g/mg. Propylene glycol is generally regarded as safe (GRAS) by the US Food and Drug Administration, and is an additive in foods and personal care products (21 CFR 184.1666).

Freeway® contains an ethoxylated alcohol; however, its exact composition is unknown. Several of the articles discussed in the issue questions at the end of this paper concern ethoxylated alcohols.

Freeway® contains ethoxylated ingredients. Ethoxylates are formed by reactions of ethylene oxide. In the manufacturing process, some unreacted ethylene oxide as well as the contaminant 1,4-dioxane can become part of the final formulation. Both of these chemicals are considered likely human carcinogens. For a comprehensive look at the risks of 1,4-dioxane in the POEA surfactant, refer to Borrecco and Neisess 1991. For a comprehensive look at the risks of ethylene oxide in ethoxylated surfactants, refer to USDA, 2003.

Example:

- Silwet L-77® (Helena Chemical Co.)

Silwet L-77® has a Warning signal word for both Loveland and Helena Chemical Company formulations. Silwet L-77® may be slightly irritating to the skin, and is not a skin sensitizer. In a repeated skin application study with rats, this material caused moderate skin irritation that resolved during a post-application recovery period. There was no evidence for cumulative or specific organ damage to the skin or other organs, and no effect on male or female reproductive systems. It is a severe eye irritant.

Based on information on one of the MSDSs, this material is not a mutagen, based on the Ames bacterial assay and three separate mammalian assays (Chinese hamster ovary gene mutation assay, a micronucleus cytogenetic assay in mice, and in an in vitro mammalian cytogenetic test).

Findings from a 14-day dietary feeding study with rats (no dosage specified) showed that repeated high doses caused reversible adverse effects on the male and female reproductive tracts. Other effects seen were increased liver weight, altered blood cytology/chemistry, and thyroid enlargement. Evidence of partial or complete recovery was seen over a 28-day recovery period.

In addition to the acute toxicity information in Table 1, the MSDS also lists a 96-hour EC50 (growth) for green algae of 5.5 mg/L, with a corresponding 96-hour NOEC of 1 mg/L.

There has been concern expressed about the toxicity of silicone-based surfactants on terrestrial insects.

Example:

- Kinetic Molecular Zippering Action™ Brand (Helena Chemical Co.)

Kinetic has a Caution signal word. This material may be mildly irritating to the skin and eyes.

Kinetic is a mixture of a silicone-based surfactant and poloxalene.

The exact identity of the silicone-based components of Kinetic is unspecified. Whether it is of the same toxicity as the active ingredient in Sylgard® 309 is unknown, however these silicone based compounds are generally of low acute toxicity. There has been concern expressed about the toxicity of silicone-based surfactants on terrestrial insects.

Poloxalene is of low toxicity on an acute oral basis, with an LD50 value in rats, mice and rabbits exceeding 3 g/kg (III). It is used as an oral veterinary treatment in cattle to cure legume bloat or as a feeding supplement to prevent bloat.

Polyoxypropylene oleate butyl ether is probably a minor component of Kinetic, used as an antifoam agent. It is a product recognized by the US Food and Drug Administration as being generally safe when used as an antifoam agent in food packaging (21 CFR 176.200).

Sticker/Spreaders

Example:

- Bond® Spreader Sticker Deposition Aid (Loveland Products, Inc.)

Bond® has a Caution signal word. This material may be a slight skin irritant but is not a skin sensitizer and is a moderate eye irritant.

In addition to the aquatic toxicity test involving Daphnia, the current MSDS also describes a toxicity test involving guppies (not further described). In communications with the company, this description of a toxicity test involving fish is in error and should be deleted from the MSDS. The only aquatic test with Bond® involves Daphnia.

Bond® is a mixture of synthetic latex and a linear alcohol, along with 45 percent inert ingredients (not otherwise specified). The exact composition of the synthetic latex is not specified; it is likely acrylic latex. The exact composition of the linear alcohol is not specified. Several of the articles discussed in the issue questions at the end of this paper concern ethoxylated linear alcohols.

The large percentage of inert ingredients (45 percent) in this formulation is troublesome. It is unknown if this is all or mostly water or made up of other ingredients.

Example:

- Tactic™ Sticker – Organosilicone surfactant – deposition agent (Loveland Products, Inc.)

Tactic™ has a Caution signal word. It may be a slight skin irritant, but is not a skin sensitizer. Tactic™ is a mild to moderate eye irritant.

Tactic™ is a blend of synthetic latex and a silicone-based wetter/spreader, along with a linear alcohol. The exact composition of the synthetic latex is not specified; it is likely acrylic latex. The exact composition of the linear alcohol is not specified. Several of the articles discussed in the issue questions at the end of this paper concern ethoxylated linear alcohols.

The exact identity of the silicone-based components of Tactic™ is unspecified. Whether it is of the same toxicity as the active ingredient in Sylgard® 309 is unknown, however these silicone based compounds are generally of low acute toxicity. There has been concern expressed about the toxicity of silicone-based surfactants on terrestrial insects. Refer to issue discussion 2 on page 46.

Propylene glycol is practically nontoxic to mammals, with an acute oral LD50 in rats of 20 g/mg. Propylene glycol is generally regarded as safe (GRAS) by the US Food and Drug Administration, and is an additive in foods and personal care products (21 CFR 184.1666).

Tactic™ contains ethoxylated ingredients. Ethoxylates are formed by reactions of ethylene oxide. In the manufacturing process, some unreacted ethylene oxide as well as the contaminant 1,4-dioxane can become part of the final formulation. Both of these chemicals are considered likely human carcinogens. For a comprehensive look at the risks of 1,4-dioxane in the POEA surfactant, refer to Borrecco and Neisess 1991. For a comprehensive look at the risks of ethylene oxide in ethoxylated surfactants, refer to USDA 2003.

Example:

- R-56® Spreader Sticker (Wilbur-Ellis Co.)

R-56® has a Caution signal word. This material may be irritating to the eyes (protective eyewear is required by the label). The MSDS states that ingestion may cause nausea, but that no chronic effects are known. There is little else toxicological information on this product.

R-56® is made up of a nonylphenol polyethoxylate of unknown ethoxylate length and an organic polymer that acts as the sticker. The exact identity of this polymer is not specified.

One of the active ingredients in R-56®, nonylphenol polyethoxylate, has been linked to estrogenic effects in wildlife, including aquatic species, such as fish and amphibians. For a comprehensive look at the nonylphenol ethoxylate surfactants, refer to the USDA, 2003.

R-56® contains ethoxylated ingredients. Ethoxylates are formed by reactions of ethylene oxide. In the manufacturing process, some unreacted ethylene oxide as well as the contaminant 1,4-dioxane can become part of the final formulation. Both of these chemicals are considered likely human carcinogens. For a comprehensive look at the risks of 1,4-dioxane in the POEA surfactant, refer to Borrecco and Neisess 1991. For a comprehensive look at the risks of ethylene oxide in ethoxylated surfactants, refer to USDA 2003.

Example:

- Cohere® Nonionic Spreader Sticker (Helena Chemical Co.)

Cohere® has a Warning signal word. The label states that eye exposure causes substantial but temporary eye injury; protective eyewear is required when handling.

Cohere® is made up of anionic alkanolamine and alkylaryl sulfate surfactants, which are not further identified. The most commonly used alkanolamine forms in surfactants are ethanolamine and triethanolamine, but it is unknown whether Cohere® contains these or another form. The descriptions on the label and MSDS are insufficient to further characterize these ingredients.

Propylene glycol is practically nontoxic to mammals, with an acute oral LD50 in rats of 20 g/mg. Propylene glycol is generally regarded as safe (GRAS) by the US Food and Drug Administration, and is an additive in foods and personal care products (21 CFR 184.1666).

Oils

Example:

- MSO® Concentrate Methylated Seed Oil (Loveland Products, Inc.)

MSO® Concentrate Methylated Seed Oil has a Caution signal word. This material may be slightly irritating to the skin and to the eyes. The product is of low acute oral and dermal toxicity.

MSO® Concentrate Methylated Seed Oil is made up of an esterified vegetable oil and a linear alcohol wetter/spreader. The ethoxylated alcohol is an 11 carbon chain linear alcohol. Several of the articles discussed in the issue questions at the end of this paper concern ethoxylated linear alcohols.

Tall oil fatty acid is a mixture of oleic, linoleic, and rosin acids derived from the hydrolysis of tall oil, a byproduct of wood pulp. Tall oil fatty acid is included in various cosmetics, such as hair dyes and bleaches, shampoos, skin cleansing preparations, and a shaving cream. Tall oil fatty acid is approved for use as an indirect food additive. When fed to rats as 15 percent of the total caloric intake, tall oil fatty acid was nontoxic; however, it had a growth-retarding effect. No treatment-related effects were observed in rats fed diets containing 5 percent and 10 percent tall oil fatty acid over two generations. Liquid soap formulations containing up to 12 percent tall oil fatty acid did not cause dermal irritation, sensitization, or photosensitization in human subjects. One study in rats indicated that this compound had little effect on reproduction. For further information, refer to Anonymous (1989).

MSO® Concentrate Methylated Seed Oil contains ethoxylated ingredients. Ethoxylates are formed by reactions of ethylene oxide. In the manufacturing process, some unreacted ethylene oxide as well as the contaminant 1,4-dioxane can become part of the final formulation. Both of these chemicals are considered likely human carcinogens. For a comprehensive look at the risks of 1,4-dioxane in the POEA surfactant, refer to Borrecco and Neisess 1991. For a comprehensive look at the risks of ethylene oxide in ethoxylated surfactants, refer to USDA, 2003.

Example:

- Hasten® (Wilbur-Ellis Co.)

Hasten® has a Caution signal word. Hasten® may be mildly irritating to the skin and to the eyes. The product is of low acute oral and dermal toxicity.

The main ingredient in Hasten® is identified in Wilbur-Ellis product information as ethylated corn, canola, and soybean oil. This is combined with sorbitan alkylethoxylate ester as a nonionic surfactant.

The polyoxyethylene dialkylester is not sufficiently identified to say anything definite about its composition or toxicity.

Recently the Hasten formulation has been changed to remove the nonylphenol polyethoxylate and replace it with a sorbitan alkylethoxylate ester. This is not further identified.

Hasten® contains ethoxylated ingredients. Ethoxylates are formed by reactions of ethylene oxide. In the manufacturing process, some unreacted ethylene oxide as well as the contaminant 1,4-dioxane can become part of the final formulation. Both of these chemicals are considered likely human carcinogens. For a comprehensive look at the risks of 1,4-dioxane in the POEA surfactant, refer to Borrecco and Neisess 1991. For a comprehensive look at the risks of ethylene oxide in ethoxylated surfactants, refer to USDA, 2003.

Example:

- Pathfinder™ II surfactant (Dow AgroSciences)

Pathfinder™ II herbicide is a ready-to-use material that contains triclopyr herbicide in the butoxyethyl ester formulation combined with oil for use in treating woody plants. The surfactant is not identified except as a ‘naturally occurring non-petroleum diluent’. Based on information from the manufacturer, this diluent is on EPA list 4.

Pathfinder™ II has a Caution signal word. It may cause skin irritation and slight eye irritation. From the MSDS, the 96-hour oral LD50 for rats is 1000 mg/kg (females), while the dermal LD50 for rabbits is >2,000 mg/kg. These values are not appreciably different from those for the butoxyethyl ester form of triclopyr alone. For information on the hazards and risks of using triclopyr herbicide, refer to SERA 2003b as well as U.S. EPA 1998.

Example:

- Improved JLB Oil Plus (Brewer International)

Improved JLB Oil Plus has a Caution signal word. It is a mild skin irritant, but is a severe eye irritant. Considered a mixture of all natural oils, it is made up of natural vegetable oils (unspecified) and limonene (as a penetrant). It is intended to be used in place of diesel or kerosene in stem basal applications. Some information from the manufacturer from the early 1990's indicated the oil as being sunflower seed oil, if this is indeed what is still in the formulation, this would be considered a food-grade additive. Limonene is a derivative of plant oils, particularly lemon, orange, caraway, dill, and bergamot. It is used as a food additive in chewing gum. For a comprehensive look at the use of limonene in surfactants, refer to USDA 1992.

Example:

- Cide-Kick and Cide-Kick® II™ (Brewer International)

These adjuvants contain NPE (nonylphenol ethoxylate) and would not be used on the Malheur National Forest Invasive Plant project.

Example:

- Cygnet Plus Spray Adjuvant for Pesticides (Brewer International)

Vegetable Oils and Silicone Blends

Example:

- Syl-tac™ (Wilbur-Ellis Co.)

Syl-tac™ has a Caution signal word. It may cause slight skin and eye irritation. Syl-tac™ is of low acute oral and dermal toxicity (refer to table 1). Syl-tac™ is a mixture of two other products (Hasten® and Sylgard® 309). Refer to the discussions of those two products.

Example:

- Phase™ (Loveland Products, Inc.)
- Phase™ has a Caution signal word. It may cause skin and eye irritation.

The exact identity of the silicone-based components of Phase™ is unspecified. Whether it is of the same toxicity as the active ingredient in Sylgard® 309 is unknown, however these silicone based compounds are generally of low acute toxicity. There has been concern expressed about the toxicity of silicone-based surfactants on terrestrial insects.

Phase™ contains an ethoxylated linear alcohol; however, its exact composition is not specified. Several of the articles discussed in the issue questions at the end of this paper concern ethoxylated alcohols.

Phase™ contains ethoxylated ingredients. Ethoxylates are formed by reactions of ethylene oxide. In the manufacturing process, some unreacted ethylene oxide as well as the contaminant 1,4-dioxane can become part of the final formulation. Both of these chemicals are considered likely human carcinogens. For a comprehensive look at the risks of 1,4-dioxane in the POEA surfactant, refer to Borrecco and Neisess 1991. For a comprehensive look at the risks of ethylene oxide in ethoxylated surfactants, refer to USDA 2003.

Example:

- Dyne-Amic® (Helena Chemical Co.)

Dyne-Amic® has a Caution signal word. Dyne-Amic® is mildly or non-irritating to the skin (Category IV), and may be slightly irritating to the eyes (Category IV).

Dyne-Amic® is a mixture of a silicone-based surfactant, esterified vegetable oil, and an alkylphenol ethoxylate; however, the exact formulation of these ingredients is unknown. It is likely that the alkylphenol ethoxylate is nonylphenol ethoxylate, but that is not certain.

The exact identity of the silicone-based components of Dyne-Amic® is unspecified. Whether it is of the same toxicity as the active ingredient in Sylgard® 309 is unknown, however these silicone based compounds are generally of low acute toxicity. There has been concern expressed about the toxicity of silicone-based surfactants on terrestrial insects.

Nonylphenol polyethoxylate has been linked to estrogenic effects in wildlife, including fish and amphibians. For a comprehensive look at the nonylphenol ethoxylate surfactants, refer to USDA 2003.

Poloxalene is of low toxicity on an acute oral basis, with an LD50 value in rats, mice and rabbits exceeding 3 g/kg (III). It is used as an oral veterinary treatment in cattle to cure legume bloat or as a feeding supplement to prevent bloat. It could be used here as an anti-foam agent or as a nonionic surfactant.

Polyoxypropylene oleate butyl ether is probably a minor component of Dyne-Amic®, likely used as an antifoam agent. It is a product recognized by the US Food and Drug Administration as being generally safe when used as an antifoam agent in food packaging (21 CFR 176.200).

Dyne-Amic® contains ethoxylated ingredients. Ethoxylates are formed by reactions of ethylene oxide. In the manufacturing process, some unreacted ethylene oxide as well as the contaminant 1,4-dioxane can become part of the final formulation. Both of these chemicals are considered likely human carcinogens. For a comprehensive look at the risks of 1,4-dioxane in the POEA surfactant, refer to Borrecco and Neisess 1991. For a comprehensive look at the risks of ethylene oxide in ethoxylated surfactants, refer to USDA 2003.

Crop Oils and Crop Oil Concentrates

Example:

- Kerosene

Kerosene is included in Garlon 4 formulations of triclopyr. It is on EPA list 3. For a comprehensive look at kerosene, refer to SERA 2003b and USDA 1992.

Example:

- Agri-dex® (Helena Chemical Co.) and Red-Top Mor-Act® Adjuvant (Wilbur-Ellis Co.)
- Agri-dex® and Red-Top Mor-Act® both have a Caution signal word. They may be mildly irritating to the skin and eyes.

Although both materials are from different manufacturers, the identified ingredients are generically similar to discuss together.

The primary ingredient in both products is paraffin base oil. The paraffin base petroleum oil in Agri-dex® (83 percent of the formulation) is described as a solvent refined paraffinic distillate containing a mixture of hydrocarbons having carbon numbers predominantly in the range C20-C50 (heavy paraffinic) or C15-30 (light paraffinic). The light paraffin oil is also identified as horticultural spray oil. It is of low oral and dermal acute toxicity. The paraffin oil mixtures are not on the U.S. EPA inerts list, although other paraffinic oils are on List 2 and List 3. The oil mixture in Red-Top Mor-Act® (83 percent of formulation) is on U.S. EPA list 3. It is also referred to as mineral oil, with low acute oral toxicity (LD50 of 24 g/kg). This oil is also used in many personal care products such as baby oil and cosmetics. The reason why certain paraffinic oils are on the U.S. EPA inerts list and others are not is not apparent (SERA 1997a).

The name polyol fatty acid ester refers to unspecified fatty acid esters of unspecified alcohols. Similarly, the name polyethoxylated polyol fatty acid ester refers to a group of chemicals that consist of unspecified fatty acid esters of unspecified polyethoxylated alcohols (SERA 1997a). Without further identity, no definitive statements can be made concerning the toxicity of these compounds.

Agri-dex® and Red-Top Mor-Act® contain ethoxylated ingredients. Ethoxylates are formed by reactions of ethylene oxide. In the manufacturing process, some unreacted ethylene oxide as well as the contaminant 1,4-dioxane can become part of the final formulation. Both of these chemicals are considered likely human carcinogens. For a comprehensive look at the risks of 1,4-dioxane in the POEA surfactant, refer to Borrecco and Neisess 1991. For a comprehensive look at the risks of ethylene oxide in ethoxylated surfactants, refer to USDA 2003.

Example:

- Herbimax® Petroleum Oil-Surfactant Adjuvant (Loveland Products, Inc.)
- Herbimax® has a Caution signal word. This product may be mildly irritating to the skin and moderately irritating to the eyes.

The primary ingredient in Herbimax® is a light paraffin base oil and an oil-based solvent. The paraffin base petroleum oil in Herbimax® is described as a light paraffinic petroleum distillate. It is of moderate to low toxicity (acute oral LD50 > 5 g/kg, dermal LD50 >2 g/kg). The oil-based solvent is also referred to as light aliphatic solvent naphtha. High levels of acute naphtha exposure can result in central nervous system depression; studies have shown that chronic exposures are no more hazardous than the acute exposures. Naphtha is a flammable material. Both the paraffin oil and the naphtha solvent are on EPA List 2 of potentially toxic inert ingredients.

The label and MSDS identify an alkylphenol ethoxylate as a minor component. This is likely to be a nonylphenol ethoxylate. Nonylphenol polyethoxylate has been linked to estrogenic effects in wildlife, including fish and amphibians. For a comprehensive look at the nonylphenol ethoxylate surfactants, refer to USDA, 2003.

The label and MSDS also identify tall oil fatty acid as a minor component. Tall oil fatty acid is a mixture of oleic, linoleic, and rosin acids derived from the hydrolysis of tall oil, a byproduct of wood pulp. Tall oil fatty acid is included in various cosmetics, such as hair dyes and bleaches, shampoos, skin cleansing preparations, and a shaving cream. Tall oil fatty acid is approved for use as an indirect food additive. When fed to rats as 15 percent of the total caloric intake, tall oil fatty acid was nontoxic; however, it had a growth-retarding effect. No treatment-related effects were observed in rats fed diets containing 5 percent and 10 percent tall oil fatty acid over two generations. Liquid soap formulations containing up to 12 percent tall oil fatty acid did not cause dermal irritation, sensitization, or photosensitization in human subjects. One study in rats indicated that this compound had little effect on reproduction. For further information, refer to Anonymous (1989).

Herbimax® contains ethoxylated ingredients. Ethoxylates are formed by reactions of ethylene oxide. In the manufacturing process, some unreacted ethylene oxide as well as the contaminant 1,4-dioxane can become part of the final formulation. Both of these chemicals are considered likely human carcinogens. For a comprehensive look at the risks of 1,4-dioxane in the POEA surfactant, refer to Borrecco and Neisess 1991. For a comprehensive look at the risks of ethylene oxide in ethoxylated surfactants, refer to USDA, 2003.

Fertilizer/Surfactant Mixtures

Examples:

- First Choice® Exciter Activator – Penetrant (Western Farm Service, Inc.)
- Magnify Activator – Penetrant (Monterey AgResources)
- Class Act® Next Generation (Agrilliance, LLC)
- Intensify Activator/Penetrant (West Link Ag)

All four of these products are sufficiently similar so that they can be discussed together. All four have a Caution signal word. They are considered mildly irritating to the skin and eyes. It is assumed in this review that any toxicity data for the full formulations should be able to be used interchangeably with these four products. Class Act® may be an exception because of the differences with the ammonium compounds.

The wetter/spreader specifically identified in First Choice® is a corn syrup derivative, referred to as alkyl polyglycoside. It is assumed this is the same material used in the other three. This same surfactant product is sold under the trade name of Dow Triton CG-110. According to the MSDS for Dow Triton CG-110, this material is of low acute toxicity (oral LD50 > 5 g/kg, dermal LD50 >5 g/kg), although it is an eye irritant. It is used as a detergent and wetter/spreader in personal care products such as shampoo and skin cream because of its mild skin effects. It is of low aquatic toxicity, with a 48-hour NOEC for Daphnia of 150 mg/L and a 96-hour NOEC for fathead minnow of 125 mg/L.

The Class Act® label specifically identifies corn syrup as a component of the product. The other products list unidentified oligosaccharides, which could be corn syrup, or some other mix of simple sugars. It is unclear of the purpose of these sugars although these are listed as part of the surfactant mixture. Corn syrup is a common ingredient in foods.

The sources of nitrogen in these products are ammonium sulfate (in all four) and ammonium nitrate (found in all but Class Act®). Both chemicals are on EPA List 4B. Both are commonly used fertilizers in commercial garden products.

Ammonium sulfate is a water soluble compound. It is mildly irritating to the skin and eyes. It is of low oral toxicity, with a mouse LD50 of 640 mg/kg (III). In limited testing ammonium sulfate has not been shown to be a mutagen or carcinogen. It is of low aquatic toxicity, with a rainbow trout 96-hour LC50 of 173 mg/L, a 96-hour EC50 for Daphnia of >100 mg/L, and an 18-day EC50 for green algae of 2,700 mg/L. A recent study with three amphibian species showed that ammonium sulfate was more toxic to amphibians than the tested fish, with a 10-day NOEAC of 17 to 83 mg/L ammonium-nitrogen equivalent for the amphibians and 67 to 134 mg/L for fathead minnow (Nebeker and Schuytema 2000).

Ammonium nitrate is also a water soluble compound. In its dilute form as found in these products, it is mildly irritating to the eyes and skin; in its concentrated form, it can cause chemical burns. Ammonium nitrate has gained some notoriety as a component of low cost but dangerous explosive mixtures. It is of low acute toxicity , with an oral (rat) LD50 of >2 g/kg (III) and a dermal LD50 (rabbit) of >5 g/kg (III).

Hazards of oral ingestion include interference with the oxygen carrying capacity of the blood., respiratory irritation, and low blood pressure. It has not been demonstrated as a carcinogen, mutagen, or teratogen. The dilute solution (20 percent) is of low aquatic toxicity with a fish (Chinook salmon, rainbow trout, bluegill) 96-hour LC50 of 420-1,360 mg ammonium-nitrogen equivalent/L. The Daphnia EC50 is 555 mg/L. It can encourage algae growth, which may affect water quality. A recent study with red-legged frog embryos and larvae showed that ammonium nitrate was more toxic to this species of frog than the tested fish, with a 16-day LC50 of 72 mg/L and a 16-day NOEAC of 6.4 mg/L ammonium-nitrogen equivalent (Schuytema and Nebeker 1999).

The large percentage of inert ingredients (about 49 percent) in these products is troublesome. It is unknown if this is all or mostly water or made up of other ingredients.

Acidifiers

Example:

- LI-700® (Loveland Products, Inc.)

LI-700® has a Danger signal word, because of its corrosiveness (toxicity category 1 for both dermal and ocular effects) that is primarily due to the presence of methylacetic acid, also referred to as propionic acid. LI-700® is not exceptionally acutely toxic orally, dermally, or via inhalation. It is commonly used as an acidifier in pesticide mixtures.

The name phosphatidylcholine refers to a group of chemicals that consist of unspecified fatty acid diglycerides linked to the choline ester of phosphoric acid. This group includes the naturally occurring lecithins, which are prominent phospholipids in biological cell membranes. Soya lecithins are used as emulsifiers in a wide variety of food products (SERA 1997a).

The nonionic surfactant contained in LI-700® is identified as alkyl polyoxyethylene ether, which is likely an ethoxylated linear alcohol; however, its exact composition is not specified. Several of the articles discussed in the issue questions at the end of this paper concern ethoxylated alcohols.

LI-700® may contain ethoxylated ingredients. Ethoxylates are formed by reactions of ethylene oxide. In the manufacturing process, some unreacted ethylene oxide as well as the contaminant 1,4-dioxane can become part of the final formulation. Both of these chemicals are considered likely human carcinogens. For a comprehensive look at the risks of 1,4-dioxane in the POEA surfactant, refer to Borrecco and Neisess 1991. For a comprehensive look at the risks of ethylene oxide in ethoxylated surfactants, refer to USDA 2003.

Examples:

- Tri-Fol Acidifier and Buffering Agent (Wilbur-Ellis Co.)
- Tri-Fol has a Caution signal word. It is an eye irritant and a mild skin irritant.

The acidifier in Tri-Fol is citric acid (25 percent of the formulation). Citric acid is of low oral toxicity (mouse LD50 > 3 g/kg (III)). Citric acid is used in many personal care products and is found in foods, although not to the concentration found in Tri-Fol. Citric acid in concentrated form can be severely irritating to the eyes and can cause skin sensitization.

Calcium chloride is of low oral toxicity (LD50 0.9 to 2.1 g/kg (III)). In concentrated liquid forms, it can be very irritating to the skin and eyes, and in its solid form if swallowed can react with water in an exothermic reaction that can cause burns. As a solid, it is not particularly toxic dermally (LD50 >5 g/kg, III). It is of low aquatic toxicity with an LC50 in bluegill of 8,350 – 10.650 mg/L and an LC50 of 759 mg/L with Daphnia. It is used in small amounts in some foods as a substitute for salt, or as part of electrolyte drinks. It is used as a de-icer for roads.

The large percentage of inert ingredients (66 percent) in this product is troublesome. It is unknown if this is all or mostly water or made up of other ingredients.

Drift Reduction Agents

Example:

- In-Place® Deposition and Drift Management Agent (Wilbur-Ellis Co.)

In-Place® has a Caution signal word. It is an eye irritant, and a mild skin irritant. None of the ingredients are sufficiently identified on the label or MSDS to characterize their risk. In older communications with the company, the Forest Service was told that the amine salts of organic acids were on EPA List 3 and were slight skin and eye irritants. The Forest Service was told that the aromatic acid is on EPA List 4 and is on the FDA's list of materials generally recognized as safe.

Recently, the company has informed the Forest Service that the petroleum distillate (Stoddard solvent that is on EPA's List 2) has been replaced by a combination of a modified seed oil and a mineral oil. Both have been identified as being on EPA List 3. Neither is identified sufficiently to characterize their risk.

Example:

- Sinker Polymer Carrier and Drift Retardant (Helena Chemical Co.)

Sinker has a Caution signal word. It is a mild skin and eye irritant. The principal active ingredient cannot be identified exactly from the label or MSDS, however it might be polyacrylamide, which is of low oral toxicity and is used in many personal care products. While the label calls the active ingredient polyacrylamide, the MSDS calls the ingredient a blend of polyacrylamide polymers, so this characterization may not be accurate.

The large percentage of inert ingredients (70 percent) in this product is troublesome. It is unknown if this is all or mostly water or made up of other ingredients.

Defoamers

Example:

- Foaminator™ Dry Antifoaming/Defoaming agent (Agrilliance, LLC)

Foaminator™ has a Warning signal word. It is an eye irritant; the label calls for protective eyewear when handling. The label states that the material is harmful if swallowed, although no acute toxicity figures are available.

Compounded silicone (polydimethylsiloxane) is on EPA list 4B. The compounded silicone is practically non-toxic on an acute oral basis (rat LD50 >17 g/kg).

Polypropylene glycol (PPG) is a generic name for a large class of polymers. The exact size of the polypropylene glycol in Foaminator™ is not specified. PPG is commonly used in personal care products such as shampoo. PPG is of low acute toxicity, with oral LD50 values from 2 to >15 g/kg (III-IV) and acute dermal LD50 values >10 g/kg (III).

Silicon dioxide is identified as part of the active ingredients in Foaminator™, although it is more commonly used as an inert carrier. It does have some insecticidal properties, but this is through physical abrasion of protective oils, causing desiccation rather than through direct insect toxicity. It is of low acute toxicity, with an oral LD50 value of 3 g/kg (III). Silicon dioxide is a processed food additive (an anticaking agent) allowed by US FDA (21 CFR 172.480).

The large percentage of inert ingredients (84.5 percent) in this product is troublesome. As this is a dry formulation, this inert fraction is not water.

Examples:

- No Foam Defoamer (Wilbur-Ellis Co.)
- No Foam Dry Defoamer (Wilbur-Ellis Co.)

These two products contain the same active ingredients so can be discussed together. Both have a Caution signal word. Both are moderate eye irritants

The formulation of compounded silicone (polydimethylsiloxane) found in these two products is on EPA list 4B. The compounded silicone is practically non-toxic on an acute oral basis (rat LD50 >17 g/kg). On the No Foam label, this is identified as "food grade" active silicone.

The large percentage of inert ingredients (90 percent) in these products is troublesome. As No Foam Dry is a dry formulation, this inert fraction is not water. It is identified on the label as an inorganic/organic carrier. The inert in No Foam may be water.

Example:

- No Foam® B (Creative Marketing & Research, Inc.)

No Foam® B has a Caution signal word. No Foam® B is mildly irritating to the skin and eyes; the label requires waterproof gloves when handling. It is of low oral toxicity, with an LD50 value of >5 g/kg (IV).

The primary active ingredient in No Foam® B is the nonionic surfactant nonylphenol polyethoxylate. The older sample labels available on-line identify this as an octylphenol polyethoxylate whereas the newer MSDS identifies it as nonylphenol polyethoxylate. Nonylphenol polyethoxylate has been linked to estrogenic effects in wildlife, including aquatic species, such as fish and amphibians. For a comprehensive look at the nonylphenol ethoxylate surfactants, refer to the USDA 2003.

No Foam® B contains dodecylbenzene sulfonate, otherwise known as dodecylbenzene sulfonic acid. Dodecylbenzene sulfonic acid is probably the compound meant to serve as a buffer in this product. It is of low oral toxicity, with an LD50 value of 650 mg/kg (III). In its concentrated form, being an acid, it is extremely irritating to the eyes and skin, as well as the respiratory tract.

There is an anionic surfactant, ethanolamine, that is identified on the No Foam® B label. It is of low acute oral toxicity with oral LD50 values ranging from 620 to 1720 mg/kg (III) and is moderately toxic dermally with an LD50 value of 1 g/kg (II). It is commonly used as an ingredient in personal care products, such as hand lotions and hair care products. In its concentrated form, it is a strong eye and skin irritant, and is moderately basic (pH of 10). Based on chronic tests, ethanolamine may be a reproductive and developmental toxicant.

Sodium xylene sulfonate is included in No Foam® B as a minor component, probably to help the various ingredients stay dissolved in water. It is of low acute toxicity, with an oral LD50 of >5 g/kg (IV). It is of low aquatic toxicity with minnow and Daphnia acute NOECs of 1,000 mg/L.

No Foam® B contains ethoxylated ingredients. Ethoxylates are formed by reactions of ethylene oxide. In the manufacturing process, some unreacted ethylene oxide as well as the contaminant 1,4-dioxane can become part of the final formulation. Both of these chemicals are considered likely human carcinogens. For a comprehensive look at the risks of 1,4-dioxane in the POEA surfactant, refer to Borrecco and Neisess 1991. For a comprehensive look at the risks of ethylene oxide in ethoxylated surfactants, refer to USDA 2003.

The large percentage of inert ingredients (75 percent) in this product is troublesome. It is unknown if this is all or mostly water or made up of other ingredients.

Colorants

Example:

- Colorfast™ Purple

Colorfast™ Purple dye is not required to be registered, therefore it has no signal word associated with it. It is mildly irritating to the skin, but because of the acetic acid content, can be severely irritating to the eyes, and can cause permanent damage. The label requires the use of acid-resistant gloves and goggles to prevent unnecessary exposures. It would likely be considered a Category 1 material and have a Danger signal word if it carried one.

Acetic acid is the ingredient in household vinegar, although vinegars are normally 4-10 percent acetic acid whereas Colorfast™ Purple contains 23.4 percent by weight. Acetic acid is a very strong eye and skin irritant, and eye exposure can be very hazardous, with permanent damage a possibility.

Gentian Violet is the dye component of Colorfast™ Purple. Gentian Violet is used as an antifungal or antibacterial medication for dermal or mucous membrane infections. Gentian Violet is a suspected carcinogen, based on tests in mice. It is of moderate acute toxicity, with a LD50 value of 96 mg/kg (II).

For a comprehensive look at Colorfast™ Purple dye, including a risk assessment of the suspected carcinogen Gentian Violet, refer to SERA 1997b.

Dipropylene glycol is of low acute and chronic toxicity. It is found in many personal care products. It is minor skin and eye irritant. It is not a carcinogen or a teratogen. The acute oral LD50 is 10.6 g/kg (IV) and the acute dermal LD50 is 20.5 g/kg (IV). At high (multi-gram) chronic doses, effects are seen to the kidney and liver. It is of low aquatic toxicity.

Example:

- Hi-Light® Blue

Hi-Light® Blue dye is not required to be registered as a pesticide; therefore it has no signal word associated with it. It is mildly irritating to the skin and eyes. It would likely be considered a Category III or IV material and have a Caution signal word if it carried one.

Hi-Light® Blue is a water-soluble dye that contains no listed hazardous substances. It is considered virtually non-toxic to humans. Its effect on non-target terrestrial and aquatic species is unknown, however its use has not resulted in any known problems. The dye used in Hi-Light® Blue is commonly used in toilet bowl cleaners and as a colorant for lakes and ponds (SERA 1997b).

Table C- 1. Standard Mammalian Acute Toxicity Testing Results[32]

Name	Oral LD50	Dermal LD50	Inhalation LC50
Ethoxylated fatty amines			
Entry™ II, POEA	1.2 to 14 g/kg (III)	NA	NA
Alkylphenol ethoxylate-based wetter/spreaders			
R-11®	>3.7 g/kg (NPEO) (III)	>2 g/kg (NPEO) (III)	>25 mg/L (est.) (IV)
Activator 90	3.87 to 5.0 g/kg (III)	>2 g/kg (III)	>1.33 mg/L in males (lowest) (III)
X-77®	3.87 to 5.0 g/kg (III)	>2 g/kg (III)	>1.33 mg/L in males (lowest) (III)
Pro-Spreader Activator	>3.3 g/kg (III)	>2 g/kg (III)	NA
Latron AG-98® (N)	>5 g/kg (NPE) (IV) 0.79 g/kg (butanol) (III)	>3 g/kg (NPE) (III) 3.4 g/kg (butamol) (III)	NA
Latron AG-98®	2 g/kg (III)	3 g/kg (III)	NA
Alcohol ethoxylate-based wetter-spreader			
Activator N.F.	NA	NA	NA
Silicone-based wetter/spreaders			
Sylgard® 309	>2 g/kg (III)	>2 g/kg (III)	NA
Freeway®	>2 g/kg (III)	>2 g/kg (III)	NA
Dyne-Amic®	>5.05 g/kg (IV)	>2.02 g/kg (III)	NA
Silwet L-77®	>2.0 g/kg (III)	>2 g/kg (III)	NA
Kinetic	3.3 g/kg (III)	>2 g/kg (III)	NA
Sticker/Spreaders			
Bond®	>5 g/kg (IV)	>2 g/kg (III)	4.73 mg/L (III)
Tactic™	>5 g/kg (IV)	>2 g/kg (III)	>0.19 mg/L (4 hr)
R-56®	NA	NA	NA
Cohere®	NA	NA	NA
Oils			
MSO®	>5 g/kg (IV)	> 4 mg/kg (III)	NA
Hasten®	>5 g/kg (IV)	>5 g/kg (III)	5.79 ml/L (III)

[32] NA indicates data was not available. Roman numerals in parentheses indicate the corresponding toxicity category (refer to page 41)

Name	Oral LD50	Dermal LD50	Inhalation LC50
Improved JLB Oil Plus	>5 g/kg (IV)	>3.16 g/kg (III)	NA
Cide-Kick®	>5 g/kg (IV)	NA	>5.16 mg/L (III)
Cide-Kick® II™	>5 g/kg (IV)	>2 g/kg (III)	>90.04 mg/L (IV)
Cygnet Plus	NA	NA	NA
Blends of vegetable oils and silicone-based surfactants			
Syl-tac™	>5 g/kg (IV)	>5 g/kg (III)	>2.07 ml/L (III)
Phase™	>5 g/kg (IV)	>2 g/kg (III)	>0.19 mg/L
Crop Oils and Crop Oil Concentrates			
Kerosene	28 g/kg (IV)	>2 g/kg (III)	NA
Agri-dex®	>5.01 g/kg (IV)	>2.02 g/kg (III)	NA
Mor-Act®	>5 g/kg (IV)	NA	NA
Herbimax®	>5 g/kg (IV)	>2 g/kg (III)	NA
Fertilizer/Surfactant Mixtures			
First Choice® Exciter	NA	NA	NA
Magnify	NA	NA	NA
Class Act® Next Generation	NA	NA	NA
Intensify	NA	NA	NA
Acidifiers			
LI-700®	>5 g/kg (IV)	>5 g/kg (III)	>6.04 mg/L (III)
Tri-Fol	NA	NA	NA
Drift Reduction Agents			
In-Place®	NA	NA	NA
Sinker	>9.8 g/kg	>9.8 g/kg	NA
Defoamers			
Foaminator™	NA	NA	NA
No Foam	NA	NA	NA
No Foam Dry	NA	NA	NA
No Foam® B	>5 g/kg (IV)	NA	NA

Table C- 2. Standard Acute Aquatic Species Toxicity Testing Results

Name	Rainbow Trout 96-hour LC50	Bluegill 96-hour LC50	Daphnia 48-hour EC50
Ethoxylated fatty amines			
Entry™ II, POEA	4.2 mg/L	1.3 – 2.9 mg/L	2.0 mg/L
Alkylphenol ethoxylate-based wetter/spreaders			
R-11®	3.8 – 6 mg/L NOEC 1 mg/L	4.2 mg/L NOEC 1 mg/L	5.7 - 19 mg/L NOEC (population size) 0.25 mg/L
Activator 90	NA	Guppy (Poecilia reticulata?) 12.7 mg/L, NOEC 5.8 mg/L	5.2 mg/L (24 hour) NOEC 1 mg/L
X-77®	NA	5 mg/L; Guppy (Poecilia reticulata?) 12.7 mg/L, NOEC 5.8 mg/L	5.2 mg/L (24 hour) 2.0 -16.4 mg/L (48 hour) (zero population growth con'c = 13 mg/L)
Pro-Spreader Activator	3.3 mg/L NOEC < 1.0 mg/L	6.0 mg/L NOEC 1.8 mg/L	7.3 mg/L NOEC 3.2 mg/L
Latron AG-98® (N)	NA	NA	NA
Latron AG-98®	10 mg/l	11 mg/l	21 mg/l
Alcohol ethoxylate-based wetter-spreader			
Activator N.F.	NA	NA	NA
Silicone-based wetter/spreaders			
Sylgard® 309	NA	Fathead minnow >4.6 mg/L	22.9 to >41 mg/L (zero population growth con'c = 18 mg/L)
Freeway®	NA	29.7 mg/L	NA
Dyne-Amic®	NA	26.9 mg/L	NA
Silwet L-77®	NA	Zebrafish 2.75 mg/L NOEC 0.56 mg/L	6.2 – 23.4 mg/L (zero population growth con'c = 28 mg/L) NOEC 10 mg/L
Kinetic	NA	19.8 mg/L	111 mg/L (zero population growth con'c = 25 mg/L)
Sticker/Spreaders			
Bond®	NA	NA	614 mg/L (zero population growth con'c = 450 mg/L)
Tactic™	NA	NA	NA
R-56®	NA	NA	NA
Cohere®	NA	NA	NA
Oils			
MSO®	NA	NA	NA
Hasten®	74 mg/L	NA	>50 mg/L
Improved JLB Oil Plus	NA	NA	NA
Cide-Kick®	11 mg/l	10.2 - 18 mg/l	3.9 mg/l
Cide-Kick® II™	NA	NA	NA

Name	Rainbow Trout 96-hour LC50	Bluegill 96-hour LC50	Daphnia 48-hour EC50
Cygnet Plus	NA	30.2 mg/L	NA
Blends of vegetable oils and silicone-based surfactants			
Syl-tac™	>5 mg/L	NA	>5 mg/L
Phase™	NA	NA	NA
Crop Oils and Crop Oil Concentrates			
Kerosene	NA	NA	NA
Agridex®	271 mg/L	>1000 mg/L	>1000 mg/L
Mor-Act®	NA	NA	NA
Herbimax®	NA	NA	NA
Fertilizer/Surfactant Mixtures			
First Choice® Exciter	NA	NA	NA
Magnify	>100 mg/L NOEC 100 mg/L	NA	7.7 mg/L
Class Act® Next Generation	NA	NA	NA
Intensify	NA	NA	NA
Acidifiers			
LI-700®	17 - 130 mg/L	60.8 - 210 mg/L	170-190 mg/L NOEC 100 mg/L
Tri-Fol	NA	NA	NA
Drift Reduction Agents			
In-Place®	NA	NA	NA
Sinker	NA	NA	NA
Defoamers			
Foaminator™	NA	NA	NA
No Foam	NA	NA	NA
No Foam Dry	NA	NA	NA
No Foam® B	NA	NA	NA

Literature Cited In Bakke 2007

Anonymous. 1989. Final report on the safety assessment of tall oil acid. Journal of the American College of Toxicology. 8(4):769-776.

Borrecco, J., Neisess, J. 1991. Risk assessment for the impurities 2-butoxyethanol and 1,4-dioxane found in Garlon 4 and Roundup herbicide formulations. Pacific Southwest Region, Forest Pest Management. Report No. R91-2. 33 pages.

California Department of Fish and Game. 2003. An assessment of the hazard of a mixture of the herbicide Rodeo and the non-ionic surfactant R-11 to aquatic invertebrates and larval amphibians. Office of Spill Prevention and Response. Administrative Report 2003-002, written by Joel Trumbo Staff Environmental Scientist. December 2003. 17 pages.

Carr, K. 2001. Personal Communication. E-mail between Katherine Carr, Environmental Assessment Specialist, Monsanto Company, and Mike Taylor, Forest Botanist, Eldorado National Forest, February 5, 2001.

Haller, W.T., R.K. Stocker. 2003. Toxicity of 19 adjuvants to juvenile Lepomis macrochirus (bluegill sunfish). Environmental Toxicology and Chemistry. 22(3):615-619.

Nebeker, A.V., G.S. Schuytema. 2000. Effects of ammonium sulfate on growth of larval northwestern salamanders, red-legged and Pacific treefrog tadpoles, and juvenile fathead minnows. Bulletin of Environmental Contamination and Toxicology. 64(2):271-278.

Rice, Peter. 2003. Personal Communication. (University of Montana), 10/10/03

Schuytema G.S., A.V. Nebeker. 1999. Effects of ammonium nitrate, sodium nitrate, and urea on red-legged frogs, Pacific treefrogs, and African clawed frogs. Bulletin of Environmental Contamination and Toxicology. 63(3):357-364.

SERA (Syracuse Environmental Research Associates, Inc.). 1997a. Effects of surfactants on the toxicity of glyphosate, with specific reference to Rodeo. February 6, 1997. SERA TR 97-206-1b. 32 pages.

SERA (Syracuse Environmental Research Associates, Inc.). 1997b. Use and assessment of marker dyes used with herbicides. December 21, 1997. SERA TR 96-21-07-03b. 47 pages.

SERA (Syracuse Environmental Research Associates, Inc.) 2003a. Glyphosate – Human Health and Ecological Risk Assessment – Final Report. March 1, 2003. SERA TR 02-43-09-04a. 281 pages.

SERA (Syracuse Environmental Research Associates, Inc.) 2003b. Triclopyr – Revised Human Health and Ecological Risk Assessments – Final Report. March 15, 2003. SERA TR 02-43-13-03b. 264 pages.

Smith, B.C., C.A. Curran, K.W. Brown, J.L. Cabarrus, J.B. Gowan, J.K. McIntyre, E.E., Moreland, V.L. Wong, J.M. Grassley, C.E. Grue. 2004. Toxicity of four surfactants to juvenile rainbow trout: Implications for use over water. Bulletin of Environmental Contamination and Toxicology. 72(3):647-654.

Stark, J.D., W.K. Walthall. 2003. Agricultural adjuvants: Acute mortality and effects on population growth rate of Daphnia pulex after chronic exposure. Environmental Toxicology and Chemistry. 22(12):3056-3061.

United States Department of Agriculture (USDA), Forest Service. 1992. Risk Assessment for Herbicide Use in Forest Service Regions 1, 2, 3, 4, and 10 and on Bonneville Power Administration Sites. September, 1992.

USDA Forest Service, 2003. Human and ecological risk assessment of nonylphenol polyethoxylate-based (NPE) surfactants in Forest Service herbicide applications. Unpublished Report, written by David Bakke, Pacific Southwest Region Pesticide-Use Specialist. May 2003. 182 pages.

Appendix D – Comments on the DEIS and Forest Service Responses

Introduction

This section describes the method used to process and evaluate public comments received at the Malheur National Forest during the 45-day comment period for review of the Malheur National Forest Site-Specific Invasive Plant Treatment Draft Environmental Impact Statement. Table D- 1 lists the commenters that responded to the DEIS in the order received and the comment number. Table D- 2 lists the comment number, comment, and Forest Service response.

Following the tables are the entire letters, in order received, from the United States Department of the Interior, United States Environmental Protection Agency, and Grant Soil and Water Conservation District.

Processing and Evaluating Public Comments

All letters and comments received about the Draft EIS were reviewed in their entirety. Comments were processed using the content analysis method, which consolidates substantive comments by subject, and helps resource specialists (e.g., wildlife biologists, hydrologists) respond to comments in their area of expertise. Substantive comments are those that relate specifically to the proposed project. Only the portions of comments that provided the main points or key issues are included here. Responses to comments are focused on comments raising issues, concerns, or problems. All comment letters are located in the project record.

Table D- 1. List of commenters

ID #	First Name	Last Name	Organization Name	City	State
01	Dick	Artley		Grangeville	ID
02	Dana	Henze		Denver	CO
03	Allison	O’Brien	U.S. Department of Interior	Portland	OR
04	Doug	Heiken	Oregon Wild	Eugene	OR
05	Alese	Colehour		Eugene	OR
06	Peter	Garcia		Eugene	OR
07	Kyle	Miskell		Seattle	WA
08	Karen	Looney			
09	Robert	Marsh	University of Washington	Carnation	WA
10	Maria	Farinacci	Fungi For the People		
11	Christine	Reichgott	U.S. Environmental Protection Agency	Seattle	WA
12	Karen	Coulter	Blue Mountains Biodiversity Project	Fossil	OR
13	Denise	Keenan		Brighton	CO
14	Matt Jason	Wenick Kehrberg	Grant Soil and Water Conservation District	John Day	OR

Comment Response Regulations

This appendix is consistent with NEPA, 40 CFR 1503.4a:

(a) An agency preparing a final environmental impact statement shall assess and consider comments both individually and collectively, and shall respond by one or more of the means listed below, stating its response in the final statement. Possible responses are to:

1. Modify alternatives including the proposed action.
2. Develop and evaluate alternatives not previously given serious consideration by the agency.
3. Supplement, improve, or modify its analyses.
4. Make factual corrections.
5. Explain why the comments do not warrant further agency response, citing the sources, authorities, or reasons that support the agency's position and, if appropriate, indicate those circumstances that would trigger agency reappraisal or further response.

One or more possible response types (1-5 above) are used for each comment in Table D- 2 that follows.

Table D- 2. Commenter ID number, Comment and Forest Service Response

Commenter ID #	Comment	Forest Service Response
General Comments		
07	It is also a large fault that the current plan does not make special consideration for areas containing the most herbicide vulnerable species, such as fish, pronghorn, and pollinators. I still want to be able to see and photograph young red band trout and songbirds when I hike these areas, and not miss them due to the influence of toxic herbicides.	Special consideration for fish and wildlife influenced the selection of herbicides in the R6 2005 Record of Decision and design of the Malheur EIS alternatives. Herbicide-use buffers for the Malheur project are based on the relative toxicity of various herbicides to fish, and project design features (pdfs) that would limit the use of certain herbicides to minimize adverse effects to fish (see pdfs H1 to H11 for Soils, Water, and Aquatic Ecosystems). Additional project design features would minimize impacts on pollinators, pronghorn, and songbirds; for instance, there are rate and spray method restrictions on some herbicides and project caps. A very small part of the Forest would be affected in any given year, and population viability of these species would not be affected by the project. See Chapters 3.3 (pollinators), 3.6 (fish) and 3.7 (pronghorn and songbirds).
12	There is a typo under Alternative B on page 63: (PCBs should be HCB)	Thank you for pointing out this typo, which has been corrected in the FEIS.
08	The health of our public lands must be preserved in order to protect the health of local and global human populations. In order to work toward this goal, we must re-think and limit the use of herbicides in the Malheur National Forest.	This is a general statement of opinion. Limitations on herbicide use have been included in the alternatives to minimize the potential for adverse effects, while still allowing for effective treatment of invasive plant management. The desired condition is for healthy native plant communities to remain diverse and resilient.
05	Land management agencies have a legal mandate to conduct its affairs in an ecologically and socially sustainable manner. Threatened non-human species have a right to protection just as Oregon residents have a right to consume local sources of water, air, plants and animals without fearing risk to their health. Lack of herbicide reporting, limited laboratory testing, and disregard for non-timber forest product consumption is unacceptable.	The project is intended to be conducted in an ecologically and socially sustainable manner. It follows management direction developed with years of public involvement. In the short term, individual, common, non-target plants are likely to be killed or reduced in population size where they are intermixed with invasive plants. However, in the long term, the project is intended to restore desirable native plant communities. Potential risk to public health is very low. Herbicide use is reported annually on National Forests. Laboratory studies have limitations (see DEIS pages 66, 200). However, they constitute best available science. The National Academy of Sciences recently found that "After 30 years of use and refinement, this risk-assessment paradigm has become scientifically credible, transparent, and consistent; can be reliably anticipated by all parties involved in decisions regarding pesticide use; and clearly articulates where scientific judgment is required and the bounds within which such judgment can be applied. The process is used for human health and ecological risk assessments and is used broadly throughout the federal government. Thus, the committee concludes that the … risk assessment … process is singularly appropriate for evaluating risks posed to ecological receptors, such as listed species, by chemical stressors, such as pesticides" (NAS 2013). The risk assessments specifically address forest product consumption. Given the project design features, limited public exposure would be expected. Even if

Commenter ID #	Comment	Forest Service Response
		inadvertent consumption occurred, the amount of herbicide a person may be exposed to would be below the threshold of concern.
05	[The] timber industry in Oregon is not required to report timing, quantity or coverage of aerial spraying. This means area residents have no warning to take precautionary measures if they are concerned about chemical contamination around their homes, schools, and recreation areas. Furthermore, legal limits of herbicide use surpass our neighbors to the north and east, causing further concern for our public's safety (Arkin, 2013). In 2011, the Oregon Health Authority opened an investigation in the Hwy 36 corridor in response to formal complaints from area residents who were concerned when Atrazine, a commonly used herbicide in the timber industry, turned up in their urine The investigation failed to determine the source of the chemical contamination and furthermore, failed to carry out urine testing for other herbicides because there were no laboratories found that can test for these chemicals in human urine (http://public.health.oregon.gov/HealthyEnvironments/TrackingAssessment/EnvironmentalHealthAssessment/Hwy36/Documents/Highway%2036%20PHA%20summary%20FS_final.pdf).	No aerial spraying is proposed. All pesticide use on the Malheur National Forest would be reported. No atrazine use is proposed. The amount of herbicide use for this project is very low compared to agricultural/timber industry use (DEIS pages 76-77). The types of herbicides proposed for use are not those associated with the concerns expressed in the Arkin or Hwy 36 citations. Concerns about legal limits are outside the scope of a Forest Service project. This Malheur National Forest project would follow Land and Resource Management Plan (LRMP) standards and guidelines for herbicide use and pdfs K1 and K2. High use areas, including administrative sites, developed campgrounds, visitor centers, and trailheads would be either posted in advance of herbicide application or closed. Postings would indicate the date of treatments, the herbicide used, and when the areas are expected to be clear of herbicide residue. The public would be notified about upcoming herbicide treatments via the local newspaper or individual notification, fliers, and posting signs. Forest Service and other websites may also be used for public notification. (DEIS page 41).
05	The time has come for land management agencies to listen to the people, who represent critical components to Oregon's ecosystems, and whose health is in danger when decisions are made without sufficient science demonstrating the safety of these chemicals, without access to laboratory testing when accidental ingestion is suspected, and without public knowledge, not to mention consent, of when and where them chemicals are deposited.	Best available scientific information forms the basis for the risk assessment information used in analysis for this project. Although the risk assessments have limitations (see R6 2005 FEIS pages 3-95 through 3-97), they represent the best science available. High use areas, including administrative sites, developed campgrounds, visitor centers, and trailheads would be posted in advance of herbicide application or closed. Postings would indicate the date of treatments, the herbicide used, and when the areas are expected to be clear of herbicide residue. The public would be notified about upcoming herbicide treatments via the local newspaper or individual notification, fliers, and posting signs. Forest Service and other websites may also be used for public notification (pdfs K1 and K2, DEIS page 41).
05	Aerial spraying and clear-cut of old-growth is out of fashion and directly violate federal mandates for ecologically and socially sustainable forestry.	This project does not propose aerial spraying or cutting timber.
02	It is hard to agree with the use of herbicides especially since it would be broadcasted across vast areas, but compared to the harmful effects of invasive species on the natural ecosystem and its inhabitants the proposed treatment is the most cost effective, there has been large amounts of research done while choosing the herbicide that should be used and alternatives to the proposition.	This project does not involve broadcast treatment over vast areas. Most of the treatment sites are small (average size is less than an acre). The DEIS assumed that broadcast spraying would occur in infestations larger than 0.1 acre (DEIS, page 24). Best available scientific information has been used in the analysis.

Commenter ID #	Comment	Forest Service Response
01	As you already know, corporations will do anything for profit, including misrepresenting the safety of a toxic chemical they manufacture.	SERA Risk Assessments use best available scientific information, including independent studies, and are not prepared or paid for by any corporations.
12	Not necessarily do additional restrictions on herbicide use limit ability to effectively manage known and new sites, and besides if they do, these are acceptable trade-offs where protecting human health, water quality, soil productivity, native plant and wildlife viability, fish species, air quality, etc. should trump short or even long term invasive plant control effectiveness.	Treatment effectiveness is influenced by how many choices are available for any given infestation. Page 69 of the DEIS incorporated discussion from the R6 2005 FEIS regarding treatment effectiveness: "In general, alternatives that have the widest variety of herbicides and herbicide families available for use have the greatest potential to result in effective treatments." In contrast, when herbicide use is more restricted, "…fewer acres would likely be achieved at a constant budget, and the years to control increases proportionally" (ibid. page 4-21). This project is designed to protect human health, human health, water quality, soil productivity, native plant and wildlife viability, and fish species. This project does not have any impacts on air quality (see project design features table 10).
12	We greatly appreciate and support this DEIS not including treatment of aquatic invasive plants, or use of aerial spraying, or scarification.	These treatment methods were not considered necessary for cost-effective treatment of invasive plants on the Malheur National Forest.
12	Based on our field experience, many invasive plants have been introduced [by the vectors listed in table 24].	The cumulative effects analysis throughout the DEIS addressed the potential for invasive plants to be spread from these vectors and the interaction between these activities and effects from this project.
12	Re: table 26: It makes sense to focus site-specific/project-specific invasive plant surveys, prevention and monitoring on areas proposed for multiple ground disturbing activities in Silvies River, North Basin, and other areas with 2 or 3 activities and larger acreages of invasive plants. Create and apply adaptive management based on learning in these areas for future projects if funding is not adequate to give all upcoming projects site-specific intensive ground surveys, prevention plans and monitoring.	All of the projects planned by the Forest Service will include prevention measures and consideration of invasive plant spread as per the R6 2005 Record of Decision. "Intensive ground surveys" already occur in areas where invasive plants are most likely to be found. Invasive plant surveys occur each year and are influenced by ground-disturbing activities and events such as wildland fire. Monitoring also will occur, under the auspices of the invasive plant treatment project, with other projects planned throughout the Forest, and as a part of broader scale monitoring programs. The Implementation Planning Process and monitoring sections of the Invasive Plant Treatment DEIS made clear that the project is designed to allow invasive plant managers to adapt to changing conditions on the ground and that the integrated control measures are subject to change based on learning over time. The document also discussed priorities and objectives for invasive plant treatment, which are influenced by a variety of factors, including likelihood of ground disturbance in the area. Monitoring and adaptive management for invasive species will also occur under the auspices of the Collaborative Forest Landscape Restoration Approach (Appendix B).
12	Why should we be put in the position of not trusting the purity of plants, water, bushes, etc. in our cultural, recreational, spiritual, and economy-related food and medicine gathering on public and treaty lands? Where else can we go to gather native edible, medicinal, and cultural plants without fear of toxin	The purpose and need of the project was explained on page 5 of the DEIS; which answers the question of why the Forest Service is proposing to use herbicides as a part of integrated invasive plant treatments. Many project design features are in place to help people avoid areas that have been sprayed. The project meets LRMP standards and guidelines, as well as other relevant management direction. A very

Commenter ID #	Comment	Forest Service Response
	contamination if not public and treaty lands? These areas and periodic flushes can be easily identified and avoided. The statement that people who harvest these plants may be exposed to herbicide deeply offends me. We reject the idea that people should be forced to accept the poison of our public and treaty lands food and medicine.	small portion of the Forest would be affected by chemical use.
12	The EPA is well known to have a revolving door syndrome whereby CEO's and other executives of polluting corporations take shifts of working for the EPA, the fox watching the henhouse.	This comment is beyond the scope of the project. The R6 2005 Record of Decision provided direction for use of herbicides to treat invasive plants as part of an integrated weed management approach.
12	Limiting the use of herbicides and not using herbicides in areas of high human exposure would be more effective than fallible pdfs.	The DEIS discussed how herbicide use has been limited to pose comparatively low risk to people and the environment. Not using herbicides would not meet the need to treat invasive plants using integrated treatment methods in cooperation with our neighbors and in accordance with current management direction, to reduce the extent and impact of invasive plants (DEIS page 5). The R6 2005 Record of Decision (Malheur Forest LRMP) standards require that the Forest Service minimize or eliminate direct or indirect negative effects to non-target plants, terrestrial animals, water quality and aquatic biota (including amphibians) from the application of herbicide… and to use site-specific project design (e.g., application rate and method, timing, wind speed and direction, nozzle type and size, buffers, etc.) to mitigate the potential for adverse disturbance and/or contaminant exposure (DEIS pages 8-9). This is the purpose of the pdfs and herbicide-use buffers. Trade-offs were examined in the DEIS.
12	There should be no transportation of herbicides by watercraft.	Transportation by watercraft could be necessary for locations that are otherwise inaccessible. The pdfs (Group G, H2) provide adequate protection should this be necessary.
12	We never run across a project with a finding that it will contribute to a trend toward federal listing. The "May Impact Individual or habitat (MIIH)" finding in practice is a rubber stamp determination. Rare and listed species are steadily declining to the point of extirpation due to logging, roading, grazing, and other common actions proposed on the Malheur National Forest, like bull trout, Chinook salmon, lynx, wolverine, marten, goshawk, amphibians, rare plants, etc. So the "MIIH" determination clearly understates the potential for cumulative extirpations and uplistings.	There is no indication that this project will lead to ESA listing or extirpation of any species of conservation concern. Determinations under the ESA and sensitive species policy apply to specific projects and are not intended to account for all cumulative impacts. However, projects planned on the Malheur National Forest are designed to minimize impacts to species of conservation concern and restore conditions that are outside the range of natural variability. While not all impacts to individuals can be guaranteed, and thus "may affect" or "may impact" findings and determinations are given to listed or sensitive species, the DEIS found that treatment of invasive plants in the action alternatives for this project would benefit native plant communities and wildlife habitats over the long term. For instance, page 108 of the DEIS stated, "a beneficial indirect effect of proposed treatments is that non-target plants would increase growth and abundance as competition from invasive plants is reduced." Page 118 stated that action alternatives would benefit sensitive plant

Commenter ID #	Comment	Forest Service Response
		species, while no action would have a long-term negative impact to sensitive plants. Page 147, regarding fish, stated, "treatments near the aquatic environment have the potential for short-term adverse impacts. In general, these adverse impacts are very small in comparison to the beneficial impact of the restoration [from effectively removing invasive plants]." Page 208 stated that "successful control of invasive plant infestations provides long-term benefits to wildlife, by restoring native habitats." The DEIS considered whether this project, when combined with other foreseeable or ongoing projects, might have a cumulative effect.
12	We remain unconvinced that notification and signing will not miss people in the area who were not notified or do not see signing.	In addition to notification and signing, colored dye would be used to mark treated areas. However, there is no way to guarantee that no inadvertent herbicide exposure would occur. However, the human health analysis found that there is very low risk of impact to the public because the amount of herbicide a person could be exposed to is predicted to be below the level thought to cause harm. Pdf L2 has been updated in the FEIS to ensure that specific edible/medicinal plant collection areas, along with specific areas of cultural or spiritual value, identified by the public are specifically posted prior to spraying. Postings would indicate the date of treatments, the herbicide used, and when the areas are expected to be clear of herbicide residue.
12	Use of vague, unquantified terms such as "minimal" do not qualify as adequate analysis.	These terms help characterize the extent and magnitude of effects, often along with measurements.
12	It is my understanding that Canada thistle and St. Johnswort are not high priority for eradication (also sulfur cinquefoil). So why use herbicides for these plants in the first place? Especially with slopes with high runoff potential and creeks. Herbicides should not be used near bull trout and other listed fish streams, creeks and rivers.	Herbicides could be used to treat invasive plants as part of a strategy to suppress, contain, control or eradicate various populations of target plants. The pdfs are intended to minimize the adverse effects of using herbicides while still allowing for cost-effective treatments. Project design features and project caps are proposed to minimize the potential for herbicide introduction within the habitat of listed fish species. Model results for areas that both contain listed fish species, and with the highest concentrations of near-stream invasive plants in the project area, indicate that herbicide levels would remain well below levels of concern for all fish species.
12	Page 142-143 says that application within riparian zone would be direct to stems of invasive plants. Why is this only mentioned here?	This statement has been edited in the FEIS because it may have been misleading. Herbicide-use buffers allow foliar treatments within riparian areas.
12	What are the public concerns about aminopyralid?	Aminopyralid is a new and potent herbicide. However, the 2007 risk assessment indicates it poses comparatively less risk to people and the environment than other herbicides approved in the R6 2005 Record of Decision. It may be more effective on broadleaf species; and can be used up to the water's edge, allowing for effective treatments in riparian habitats. Alternative D was developed to show trade-offs associated with adding an herbicide to the list approved in the R6 2005 Record of Decision.
12	What herbicides would not be buffered from streams?	The DEIS described the herbicide-use buffers on page 43. The buffers vary depending on the potential risks to the aquatic environment and other characteristics of each herbicide. Herbicide-specific buffers were developed for this analysis based

Commenter ID #	Comment	Forest Service Response
		on risk assessment results regarding toxicity, persistence, and environmental fate. Herbicides were grouped by characteristics such as mobility and potential effects to fish and other aquatic organisms based on SERA risk assessments. Aminopyralid may be broadcast to the water's edge or through dry stream channels because it poses such low risk to aquatic organisms. Aquatic labeled glyphosate and aquatic labeled imazapyr may be spot sprayed or applied in a hand/selective manner to the water's edge or through dry channels. The intent is to allow for timely, effective treatments while minimizing adverse effects.
11	We are also pleased to note that aerial application of herbicide is not among the alternatives considered.	Aerial application was not considered necessary to meet the needs of this project. Therefore, it was not included.
11	Based on our review, we are rating the DEIS as LO (Lack of Objections).	Thank you for your comments.
13	According to your invasive plant treatment objectives standards 12 and 13, you must identify the future desired conditions of the area before implementing a treatment. Control of the infestation rather than eradication is a viable and ecologically mindful solution.	DEIS table 1 (pages 7-8) described how standards 12 and 13 would be met with this project. The determination of treatment objective (eradicate, control, contain or suppress) is dependent on many factors. DEIS pages 17-18 described the reasoning for the control objectives for target species known on the Malheur National Forest. Passive and active restoration would be used to help restore desirable plant species on treated sites.
11	The EPA supports treating invasive plant infestations in order to maintain or improve the diversity, function and sustainability of desired native plan communities and other natural resources that can be adversely impacted by invasive plant species. In our scoping May 2006 scoping comments, we recommended that the DEIS look across jurisdictional boundaries, include an early detection/rapid response plan, and adopt an Integrated Weed Management approach to addressing invasive plants. We believe the DEIS does an admirable job of incorporating these ideas.	Thank you for this comment.
11	We appreciate the incorporation of "integrated treatment notes" within Table 8 (common control measures), as well as the robust structure of the project design features (pdfs) in Table 9. In particular, it is helpful to have a reference source for each of the project design features.	Thank you for this comment
14	The Directors and Staff of the Grant Soil and Water Conservation District (District) are very pleased to learn the Malheur National Forest (Forest) is moving forward in completing the Environmental Impact Statement to authorize the Forest's use of specific herbicides to treat noxious weeds. The District is confident that through the strategic and responsible application of these herbicide products, the Forest	The DEIS discussed the cost-effectiveness of the alternatives and we concur that cooperative and continuous efforts will be needed to successfully reach control objectives laid out in the DEIS.

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	will experience much greater efficiency and effectiveness associated with their noxious weed control efforts. Upon authorization of the DEIS, the District is looking forward to sharing our expertise and capacity with the Forest to assist in the rapid advancement of their noxious weed control program. Successful containment and long term control of noxious weeds can only be realized through a continuous obligation from both private and public land managers. To that end, the District is very supportive of the Malheur National Forest Site-Specific Invasive Plant Treatment Project and will be looking forward to working cooperatively with the Forest on invasive plant management projects soon.	
14	Implementation of the proposed control measures will provide direct protection to desired native plant communities, reduce noxious weed seed sources that can migrate to neighboring lands, and contribute positively to sustaining essential watershed functions of the Forest.	The DEIS discussed the cost-effectiveness of the alternatives and recognized that unless action is taken, “neighbors would continue to be frustrated in their attempts to enlist the Forest Service to help with partnerships to implement effective integrated treatments within and outside Forest boundaries (DEIS page 20). DEIS page 72 also acknowledged, “Cooperative treatments between neighboring land owners and agencies involved with invasive plant management would increase the effectiveness of alternative B and ensure weed spread between land ownerships is properly abated.”
Prevention		
12	There is not enough site-specific consideration of prevention measures that need to be taken to stop introduction and dispersal of invasive plants on the Malheur.	Prevention will continue to be a high priority regardless of alternative selected. The Malheur National Forest LRMP includes prevention goals, objectives and standards that apply to activities on the Malheur National Forest. The agency puts a high priority on prevention of invasive species. Page 7 of the DEIS outlined prevention measures that are being implemented on the Malheur National Forest.
12	The Forest Service needs to be dealing with the root causes of [invasive plants] in all their aspects and consider the site-specific factors that may be key to preventing invasive plant introduction and dispersal.	
12	Since both roads and streams disperse invasive plant seed, this suggests the need to close significant mileage of roads within 300 feet of streams. This is doable but requires political will and education.	
12	The DEIS fails to ask why invasive plants are concentrated in the Middle Fork John Day drainage and whether the answers to this could suggest site-specific prevention measures.	Reasons that invasive plants are concentrated in the Middle Fork of the John Day drainage include: 1) this area contains lower elevation lands where invasive plants are most prevalent; 2) this area has had a comparatively greater extent and intensity of ground disturbance, including grazing, mining, and logging; 3) this area has numerous private land inholdings, some of which have facilitated spread of invasive plants onto national forest system land; 4) the Forest Service has acquired some of the private land inholdings and their existing invasive plant infestations; 5) the density of roads and relatively high recreation use have resulted in the greater extent of

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		invasive plants; 6) large wildland fires in this area have created habitat for invasive plants; and 7) due to high public interest and use, this area may have had a greater number of invasive plant location reports than lesser used areas. Site-specific prevention measures are included in all projects that could lead to the spread of invasive plants (Invasive Plant Management Standard 1).
04	We share the FS' concern about invasive plants and we urge the FS to take aggressive action (including the use of effective and least-toxic chemicals) to remove them and reduce their spread. We however remain concerned that the increased emphasis on chemical treatment will lead the FS to become complacent about prevention. Avoiding conditions that allow weeds to spread (and minimizing the need for toxic chemical applications) should be the agency's top priority.	Prevention will continue to be a high priority regardless of alternative selected. The Malheur National Forest LRMP includes prevention goals, objectives and standards that apply to activities on the Malheur National Forest. Page 7 of the DEIS outlined prevention measures that are being implemented on the Malheur National Forest. The need for suppression, eradication, control, and containment of invasive plants will still exist regardless of how the prevention standards from the R6 2005 Record of Decision, along with other management direction, are implemented. The R6 2005 FEIS acknowledged that invasive plants will continue to spread, and treatment will continue to be needed; even with prevention measures applied to land uses (R6 2005 FEIS 4.1.3).
04	Better integration of objectives related to forest management and weeds will result in better outcomes.	The R6 2005 Record of Decision (Malheur National Forest LRMP) requires that weed prevention be integrated into all Forest Service activities in the Pacific Northwest Region. Table 24 of the DEIS (page 82) noted the prevention measures related to activities that may lead to the spread of invasive plants.
08	I believe further research and analysis into controlling the root causes of invasive species will turn up more long-term and less toxic methods than herbicides.	This can be done regardless of alternative selected and is outside the scope of this document.
12	So what will be done to reduce livestock introduction and dispersal of invasive plants along with ATV use? If nothing is done with this plan, other project staff will say its outside the scope of their project, passing the buck.	This is outside the scope of this invasive plant treatment project. Potential effects on invasive plants and prevention measures are considered for all projects on the Malheur National Forest.
12	Re: table 24: AMPs and annual operating plans have been inadequate to control livestock vector influence. There is a lot of houndstongue by streams and we think it is due to livestock.	Allotment management plans and annual grazing instructions include prevention measures for invasive plants. Treatment of houndstongue would reduce potential seed source in allotments. Restoration may include keeping cattle away from treated areas until the area has recovered and contains desirable vegetation. Invasive plant treatment would be designed to improve riparian vegetation conditions on the Malheur National Forest. However, there is damage to riparian areas from livestock that would not be addressed by invasive plant treatment alone. Restoration of riparian areas damaged by grazing is outside the scope of the EIS. The FEIS has been edited to note that some portions of allotments, including riparian areas, have been more seriously degraded from cattle and that disturbance from cattle can increase susceptibility to invasive plants. Follow-up seeding and planting of native plants in treated areas would help to reduce the chances of re-infestation of invasive plant species.

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12	Is road maintenance being timed to avoid spreading invasive plants?	Yes, road maintenance activities are coordinated with invasive plant specialists to reduce the spread of weeds caused by road maintenance and rock removal from rock pits. Most road blading is done before or after seed emergence, limiting seed spread. Current blading techniques include depositing ditch material in designated sites to help prevent the spread of weeds to other road systems. Rock pits are inventoried for presence of invasive plants and would be treated before any rock is extracted for use in road maintenance or construction.
12	What is being done through this site-specific plan to reduce and control paved road vectors for invasive plants?	Treatment of invasive plants along paved roads and at designated ditch material disposal sites will help control the spread of invasive plants. Road maintenance activities would also help prevent the spread of invasive plants on roads. Road maintenance activities are coordinated with invasive plant specialists to reduce the spread of weeds caused by road maintenance and rock removal from rock pits. Most road blading is done before or after seed emergence limiting seed spread. Current blading techniques include depositing ditch material in designated sites to help prevent the spread of weeds to other road systems. Rock pits are inventoried for presence of invasive plants and would be treated before any rock is extracted for use in road maintenance or construction.
12	Re: table 24: The prevention considerations for the vector of roads does not deal with vehicles as vectors.	The DEIS discussed vehicle traffic as a vector for invasive plant spread (see page 80).
12	It sounds like Camp Creek HUC 5 roads by streams should be decommissioned to reduce both sediment and road to stream transport of invasive plant seeds. Why is this not considered in the DEIS analysis of prevention? Are there reasons that Camp Creek has such a high percentage of mapped invasive plants that should be considered and remedied?	Decommissioning roads is outside the scope of this project. Future projects planned in the Camp Creek watershed will consider measures to minimize the spread of invasive plants from these projects. Access and travel management planning will consider road closures and decommissioning.
12	Re: table 24: What is the Canada thistle strategy? Why only Canada thistle?	Canada thistle often is introduced after vegetation management treatments, particularly within burn pile scars. The Canada thistle strategy highlights a part of the common control measures (Table 8) that advances soil biologic and physical recovery. Applied mulch leaches nutrients and can advance the succession of diverse soil microbes towards levels prior to burning. The slash amends the soil conditions to support a wider spectrum of vegetation. See discussion on page 81 in the DEIS.
12	Re: table 24: Cleaning equipment before entering the Forest should be not be exempt for emergency situations.	This is a standard from the R6 2005 Record of Decision that is incorporated into the Malheur National Forest LRMP. Changing this standard is outside the scope of this project. However, forests report that equipment cleaning is occurring in wildland fire situations (see Desser 2014 monitoring write-up).
12	What about washing stations and educational signs at national Forest entrances, campgrounds, and administrative sites with pull outs and washing equipment and directions. The problem	These suggestions are outside the scope of an invasive plant treatment project. Washing stations and educational signs could be considered as a part of prevention associated with travel management or other activities.

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	runs deeper than road construction materials.	
12	The effects of prescribed fire in increasing suitable habitat for invasives needs to be addressed.	Burning was included in table 24 (DEIS page 82).
12	Part of invasive plant prevention and native plant restoration on the Malheur needs to be not logging so heavily as to provide ideal habitat for invasive plants, yet this is not discussed or proposed. Likewise, roads should be decommissioned and reforested and we need to get cattle and sheet overgrazing ended, but these are not proposed either. Instead, the Malheur Forest Service is busy escalating the pace of heavy logging across the forest and is not cancelling livestock allotment permits not meeting grazing standards. Why is this Malheur plan not proposing to do more to reduce livestock and logging conditions that encourage invasive plants? Analysis should lead to recommendations for actions to reduce impacts of disturbance that encourage invasive plants.	Prevention will continue to be a high priority regardless of the alternative selected. The Malheur National Forest LRMP includes prevention goals, objectives and standards that apply to activities on the Malheur National Forest. The agency puts a high priority on prevention of invasive species. Page 7 of the DEIS outlined prevention measures that are being implemented on the Malheur National Forest. The need for suppression, eradication, control, and containment of invasive plants will still exist regardless of how the prevention standards from the R6 2005 Record of Decision, along with other management direction, are implemented. The R6 2005 FEIS acknowledged that invasive plants will continue to spread, and treatment will continue to be needed; even with prevention measures applied to land uses (R6 2005 FEIS 4.1.3). Page 15 of the DEIS noted that programs including transportation planning, timber management, and livestock grazing are required to implement prevention actions. Table 24 of the DEIS specifically noted the prevention measures related to activities that may lead to the spread of invasive plants. Page 115 acknowledged that some forest activities could continue to spread weeds, recognizing that current forest management methods have reduced this potential. Prevention measures are included in allotment management plans and annual operating instructions, logging and other vegetation management plans, road construction plans and access and travel management plans. Some recent examples include the Soda Bear thinning project that includes several site-specific invasive plant prevention measures, the Summit Logan Valley Allotment Management Plan that includes prevention measures related to spring development and makes specific reference to reducing soil disturbance, and the Galena vegetation management that considers roads as a vector for invasive plant spread as a key issue for analysis. A review of several other projects found that invasive plant prevention was site-specifically considered.
12	We are concerned that though prevention is identified as important, there is no serious attempt to reduce logging, livestock, ATV and road vector influence on a site-specific basis for spreading invasives.	
12	How will this plan reduce and control logging and temporary road disturbance [that is] introducing and distributing invasive plants on the Malheur? The R6 2005 FEIS does not deal with prevention on a site-specific basis and does not adequately address livestock, roads, ATVs and logging as vectors. All the dumping of herbicides will not stop the problem of invasive plants continuing to be introduced and dispersed. There is a list in this DEIS of upcoming and ongoing timber sales, livestock grazing and road work. Without site-specific prevention measures, these projects will introduce and disperse more invasive plants. EIS analysis is intended by NEPA to suggest and lead to on-the-ground site-specific remedies to ecological damage problems.	
12	Fire suppression and salvage logging as vectors can and should be reduced with this and other plans.	
12	Re: table 25: How will vectors for invasive plant spread from proposed projects be managed to prevent spread of invasive plants? Specifically, blasting associated with decommissioning Bald Butte lookout, logging such as Soda Bear, Elk 16 and Galena, grazing allotment management, plantation thinning,	Page 15 of the DEIS noted that programs including transportation planning, timber management, and livestock grazing are required to implement prevention actions. Prevention measures are included in allotment management plans and annual operating instructions, logging and other vegetation management plans, road construction plans and access and travel management plans. Some recent examples

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	fuel reduction projects. Why are new projects not discussed site-specifically in this [invasive plant treatment] DEIS to build in site-specific prevention plans?	include the Soda Bear thinning project that includes several site-specific invasive plant prevention measures, the Summit Logan Valley Allotment Management Plan that includes prevention measures related to spring development and makes specific reference to reducing soil disturbance, and the Galena vegetation management that considers roads as a vector for invasive plant spread as a key issue for analysis. A review of several other projects found that invasive plant prevention was site-specifically considered.
12	How is the Forest Service going to prevent perpetual propagule pressure from traffic flow that spreads and causes the majority of invasive plant sites. Why is this not addressed on a site-specific basis in this DEIS, despite our lawsuit over this subject in 2002? The R6 prevention measures are not site-specific enough to stop this traffic introduction and dispersal of invasive plants. General road traffic (public traffic) is still an issue. In Figure 8, page 130, roads are found to be the biggest source of ground disturbance. So what is the Forest Service going to do to prevent invasive plant introduction and dispersal via roads with 79% of current invasive plant sites there? This brings us back to our original concern that gave rise to our (successful) 2002 lawsuit. Where is this addressed on a site-specific basis in this DEIS?	
12	Livestock use, logging, road construction and use must be considered in this plan as vectors for introduction and dispersal of invasive plants and addressed sites specifically for planning effective prevention and control methods.	Prevention measures are included in allotment management plans and annual operating instructions, logging and other vegetation management plans, road construction plans and access and travel management plans. Some recent examples include the Soda Bear thinning project that includes several site-specific invasive plant prevention measures, the Summit Logan Valley Allotment Management Plan that includes prevention measures related to spring development and makes specific reference to reducing soil disturbance, and the Galena vegetation management that considers roads as a vector for invasive plant spread as a key issue for analysis. A review of several other projects found that invasive plant prevention was site-specifically considered.
06 / 10	The new [2005] Region 6 Invasive Plant Management Plan includes measures to prevent introduction and dispersal of invasive plants. However the Region 6 plan does not provide adequate site-specific prevention plans to stop the spread of invasive plants through ATVs (all-terrain vehicles), livestock, and roads as vectors, so the Malheur project must consider site-specific entry and dispersal points for invasive exotic plants and stop their introduction and dispersal through these vectors.	The invasive plant treatment DEIS acknowledged that prevention will slow but not stop the spread of invasive plants (page 71). Most of the invasive plants are associated with roads. DEIS page 110 noted that the median distance of mapped invasive plant sites to a road is 4 feet and more than 65 percent of known invasive plant sites are within 25 feet of a road center. The Malheur Access and Travel Management Plan is the appropriate place for this issue to be addressed. Prevention associated with livestock would be addressed in allotment management plans and annual operating plans. Prevention measures are included in allotment management plans and annual operating instructions, logging and other vegetation management plans, road construction plans and access and travel management plans. Some recent examples include the Soda Bear thinning project that includes several site-specific invasive plant prevention measures, the Summit Logan Valley Allotment Management Plan that includes prevention measures related to spring development and makes specific reference to reducing soil disturbance and the Galena vegetation

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		management that considers roads as a vector for invasive plant spread as a key issue for analysis. A review of several other projects found that invasive plant prevention was site-specifically considered.
04	The spread of weeds is often caused by active management that disturbs soil and removes native vegetation, such as logging, roads, grazing, active fire suppression, and OHVs. The FS needs to integrate weed prevention principles into every single activity they conduct. All forest management activities should be adjusted in order to reduce soil disturbance and reduce vegetation disturbance. Undisturbed soil and native vegetation cover should be considered important values to be protected, but the FS too often disturbs soil and native vegetation in the pursuit of other management objectives (e.g. timber production, fuel reduction, livestock grazing) that are not adequately tempered by a concern for avoiding the spread of weeds.	The R6 2005 Record of Decision (Malheur National Forest LRMP) requires that weed prevention be integrated into all Forest Service activities in the Pacific Northwest Region. Page 15 of the DEIS noted that programs including transportation planning, timber management, and livestock grazing are required to implement prevention actions. Table 24 of the Malheur Invasive Plant Treatment DEIS specifically noted the prevention measures related to activities that may lead to the spread of invasive plants. Page 115 acknowledged that some forest activities could continue to spread weeds, recognizing that current forest management methods have reduced this potential. Page 130 noted that most of the existing invasive plants are mapped along road templates (83 percent). Page 131 noted that 6 percent of the [known] invasive plant sites correlate with timber harvest and wildfire events. Prevention measures are included in allotment management plans and annual operating instructions, logging and other vegetation management plans, road construction plans and access and travel management plans. Some recent examples include the Soda Bear thinning project that includes several site-specific invasive plant prevention measures, the Summit Logan Valley Allotment Management Plan that includes prevention measures related to spring development and makes specific reference to reducing soil disturbance and the Galena vegetation management that considers roads as a vector for invasive plant spread as a key issue for analysis. A review of several other projects found that invasive plant prevention was site-specifically considered.
08	Controlling other factors that contribute to the spread of invasives – such as ATVs, roads, and livestock – may have a more long-term impact. Livestock especially act to spread invasive plants, damage riparian areas, and remove grazing from native animals, as they are invasive species themselves.	Prevention is a part of the integrated invasive plant management program but changing land uses is outside the scope of a treatment project. The R6 2005 FEIS, to which this analysis is tiered, addressed the factors that contribute to the spread of invasive plants and resulted in LRMP standards for integrating prevention into all land uses and activities. The Malheur National Forest site-specific DEIS also discussed vectors for the spread of invasive plants, including livestock. Prevention may slow the spread of invasive plants but would not suppress, contain, control or eradicate existing populations or sites detected in the future. Prevention measures are included in allotment management plans and annual operating instructions, logging and other vegetation management plans, road construction plans and access and travel management plans. Some recent examples include the Soda Bear thinning project that includes several site-specific invasive plant prevention measures, the Summit Logan Valley Allotment Management Plan that includes prevention measures related to spring development and makes specific reference to reducing soil disturbance, and the Galena vegetation management that considers roads as a vector for invasive plant spread as a key issue for analysis. A review of several other projects found that invasive plant prevention was site-specifically considered.
Alternatives		

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06 / 10	There is an inadequate range of alternatives in that there is no alternative that would control exotic plants without any herbicide use—since this is seen as not effective enough and has already been tried on the Malheur since 2002.	If alternative A-no action is selected, the Forest Service would not treat invasive plants using herbicides. Alternative A would not approve any treatment, but non-herbicide treatments could continue under categorical exclusions and as actions connected to other projects. Alternative C minimizes use of herbicides and would require non-herbicide methods across the majority of currently infested sites. It includes an annual cap on herbicide use that is much lower than the other action alternatives and addresses many of the suggestions expressed in the scoping and DEIS comment letters. Thus, another alternative strictly limiting herbicide use was not developed for detailed study because of its similarity to alternatives A and C. Use of non-herbicide methods alone have not resulted in eradication, control, or containment of the current infestations. For fish and wildlife habitats, disturbance from non-herbicide methods that require more repeated entries could have greater effects than the herbicide use proposed. Discussion about why the Forest Service did not develop a “no herbicide” alternative for detailed study is in the FEIS.
11	Overall, we .support the proposed alternative (Alternative B). Our comfort with Alternative B is enhanced by the inclusion of herbicide-use buffers and treatment caps. These features will limit the extent, intensity and duration of any potential adverse effects. We also support the inclusion of Figure 4 on page 50 of the DEIS, which lays out a series of questions to help determine whether, where, how, and under what pdfs herbicides should be applied.	Rationale for the selected alternative will be in the Record of Decision.
11	With regard to aminopyralid, we recognize this is a relatively new herbicide, and effective against a broad spectrum of plants. We maintain, however, that the best risk assessment information available (SERA 2007) concludes that: “...Aminopyralid has a favorable human health toxicity profile when compared to the registered alternatives for these use sites and will be applied at a lower rate. Its residual action should alleviate the need for repeat applications, resulting in a reduction in the amount of herbicides applied to the environment for the control of these weeds. Aminopyralid has been determined to be practically non-toxic to non-target animals at the registered application rates, compared to the alternatives, and is less likely to impact both terrestrial and aquatic plants. “ Because the inclusion of aminopyralid within the suite of herbicides available to the Forest would potentially reduce overall herbicide footprint on the Forest, we support the proposed LRMP amendment under Alternative B.	The DEIS compared the trade-offs associated with the LRMP amendment to allow for use of aminopyralid.

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12	Alternative C still has too many acres of herbicide use allowed [over the life of the project].	The annual project caps limit the amount of acres that would be treated each year. Risk of adverse effects from herbicide use would not linger from year to year or accumulate over time given the project design features, herbicide use buffers and herbicide characteristics. This is discussed throughout Chapter 3 of the EIS. The life of the project cap has been removed.
12	Some wildlife habitats need to be avoided with herbicide use such as riparian zone habitats.	The DEIS described limitations on herbicide use in all action alternatives to minimize adverse effects to wildlife habitats. In alternatives B and D, no more than 10 acres of herbicide use would occur per year within 100 feet of streams in any 6th field watershed. In alternative C, no herbicide would be used within 100 feet of any stream. Chapter 3.7 discussed the potential effects on wildlife, concluding that project design features restrict timing or application in sensitive habitats and minimize or eliminate likelihood for any species to receive harmful exposure to herbicide or disturbance. The rationale for selected alternative will be in the Record of Decision.
12	We strongly support Alternative C with some protective modifications (see other comments). The inclusion of alternative C indicates that not using herbicides within 100 feet of water bodies, not using picloram, and not broadcast spraying and using much less herbicide overall constitutes a viable action alternative and the most ecologically benign or preferable alternative. We support alternative C because it would have less risk of herbicide exposure overall.	Trade-offs associated with the action alternatives were disclosed in the DEIS. While alternative C would allow for some herbicide use, it is less cost-effective due to restrictions on treatments near streams. The analysis did not demonstrate that these restrictions are necessary to protect people or the environment or to meet management direction for treating invasive plants.
12	Alternative C does not eliminate human health risks but reduces them greatly.	Trade-offs associated with the action alternatives were disclosed in the DEIS. The restrictions in alternative C reduce the potential extent of herbicide exposure. However, the overall risk to human health is low in all alternatives.
12	Alternative C is not the same as the other alternatives re: drinking water contamination; it is more effective in protecting streams.	Trade-offs associated with the action alternatives were disclosed in the DEIS. All alternatives protect drinking water. In all alternatives, drinking water sources would be buffered (pdf H9 prohibits herbicide use within 100 feet of wells or 200 feet of spring developments). Pdfs and herbicide-use buffers also limit herbicide offsite transport on sites with high runoff potential, restrict herbicide use rates, and buffers minimize potential for herbicide to reach streams in all alternatives. The amount of herbicide that could reach streams would be below a conservative threshold of concern for drinking water in all alternatives. The risk assessments assumed a child drinks water from a stream next to an unbuffered herbicide application. Even under this extreme and implausible scenario, the amount of herbicide that would reach the water was not above a threshold of concern for human health.
12	Alternative C is not the same as the other alternatives; it is especially beneficial to non-target plants and pollinators.	Trade-offs associated with the action alternatives were disclosed in the DEIS. Alternative C is not as effective as the other action alternatives in treating invasive plants (see Chapter 3.1.4).
12	Alternative C is more protective of wildlife than the other	Trade-offs associated with the action alternatives were disclosed in the DEIS.

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	alternatives because it uses less herbicide.	Alternative C is not as effective as the other action alternatives in treating invasive plants. (see Chapter 3.1.4).
12	We support Alternative C with some more protection and prevention modification. Alternative D uses too much herbicide that is highly toxic and persistent in the soil.	The rationale for the selected alternative will be in the Record of Decision. The “modifications” to alternative C suggested by this commenter were considered but not developed for detailed study because they would result in an alternative similar to the no action alternative. See Chapter 2.
12	Riparian zones are the source of highest levels of biodiversity on the forest-toxic poisoning should be prohibited.	Alternative C would not allow any herbicide use within 100 feet of streams or other water bodies. Alternatives B and D would allow some herbicide use in this area (up to 10 acres per year within any 6^{th} field watershed). In alternatives B and D, herbicide-use buffers would not allow broadcast treatments within 50 to 100 feet of the stream, and for some herbicides, spot, selective or hand treatments would not occur within 15 feet of a stream. The trade-offs were discussed throughout the DEIS and alternatives were compared on pages 60 – 63 regarding the issues identified for this project. In addition, action alternatives include limitations (caps) on non-herbicide treatments other than biological control: No more than 50 acres within 100 feet of streams would be treated annually within any 6^{th} field watershed). In alternatives B and D, of the 50 acres, no more than 10 may be treated using herbicide.
12	Re: table 42, low percentages of invasive plant acres by streams indicate alt C is a viable alternative. [We favor] no broadcast spraying and herbicide buffer of 100 feet.	Your comments will be considered in the Record of Decision, along with the analysis in the EIS that compares the trade-offs associated with each alternative.
12	The extra safety and benign environmental effects of alternative C is well worth the extra cost and time to achieve objectives.	The DEIS considered the risks, benefits and trade-offs associated with the alternatives. The rationale for selected alternative will be in the Record of Decision.
13	It is my hope that you will consider Alternative C as your recommended plan of action for control of invasive plant species. Use of bomb spraying techniques as well as the use of Picloram will only disrupt and degrade the forest ecosystem and have negative long term effects. As you review the EIS, I, along with other conservation biologists hope that you decide to utilize Alternative C in your approach to controlling invasive plant species in Malheur Forest. With alternative C, herbicides would not be used at any point within 100 feet of lakes, creeks, ponds or wetlands. This will limit leaching of any toxins into the fresh water systems. This will also limit application of the established 10 herbicides to 30% of the proposed amount in alternative A. Alternative C will also disallow the use of the new herbicide ingredient Picloram. Invasive species are a threat to our national parks and all established ecosystems. The ability to control invasive species is a concern that is ever-present, but use of herbicides in a non-controlled system or bomb spraying will greatly affect the native plant and animal species in a	No “bomb” spraying techniques are proposed in any alternative. The commenter likely is referring to “boom” spraying. Boom, or broadcast spraying, would be done in a controlled manner. Project design features specify how and under what conditions broadcast spraying may occur. Also, alternative A is the no action alternative, the commenter is likely referring to alternative B, which allows for use of picloram (not as a first-choice herbicide but an option should the first choice prove ineffective) and allows for some herbicide use near streams, according to herbicide-use buffers based on the potential mobility and toxicity of each herbicide proposed for use. The DEIS compared and contrasted the trade-offs from not allowing boom (broadcast) spraying and the use of picloram and the rationale for the selected alternative will be in the Record of Decision.

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	negative way. Alternative A is not a safe option for control of invasive plant species, and could alter the ecosystem as a whole in a negative way.	
13	Picloram is a herbicide used to control noxious weeds in intermountain and forest regions. The usual administration is between 1.1-2.2. Kg/ha. The difficulty with this herbicide is that it tends to stay in the soil for long durations, and also is very susceptible to leaching into nearby structures such as neighboring trees, rivers and ponds. A study in Wyoming evaluated concentrations of Picloram were 2.7 and 1.8 mg. /l at distances as far as 10 meters from original point of administration. This represents significant leaching into nearby biota. Contamination of runoff water also persisted for up to 50 days after initial application of Picloram. Alternative C will eliminate Picloram from being used, which will help conserve and preserve native plant, tree and animal species in Malheur Forest.	The DEIS discussed the potential mobility and persistence of picloram along with the other herbicides proposed for use. Project design features and herbicide-use buffers were proposed to ensure that if picloram is used, potential adverse effects would be minimized. Alternative A would not use any herbicide, including picloram. Alternative B does not specify picloram as a first-year, first-choice herbicide. Alternative C would eliminate the use of picloram, and alternative D would include some use of picloram for the first year of treatment. The DEIS discussed the trade-offs between alternatives. The comment did not cite the Wyoming study so it could not be evaluated by the IDT.
13	With widespread herbicide use or bomb spraying techniques, the ecological impact as well as human hazard is not minimized.	No “bomb” spraying techniques are proposed in any alternative. The commenter likely is referring to “boom” spraying. Alternatives B and D include broadcast spraying where it would be the most cost-effective method given the size, density and distribution of target plants. The assumption that all known treatment sites were currently 100 percent infested was used to estimate the amount of broadcast spraying that could be needed. However, most sites are not 100 percent infested and more spot spraying would be likely in alternatives B and D than the boom spraying analyzed in the DEIS. The pdfs and herbicide-use buffers minimize the ecological impact and human hazard of all application methods. The DEIS compared and contrasted the trade-offs from not allowing boom (broadcast) spraying and the rationale for the selected alternative will be in the Record of Decision.
12	We support spot or hand application of herbicides over broadcast spraying and use less herbicide more selectively.	Alternative C does not allow any broadcast application. The rationale for the final selection of alternative will be in the Record of Decision.
06 / 10	Alternative C seems to constitute a large reduction in herbicide use per year based on reserving herbicide use for the most difficult invasive plant species to eradicate or control otherwise that are also high priority for control or eradication. Alt. C is also preferable to the other herbicide use alternatives in that it avoids many herbicide impacts by not allowing broadcast spraying, herbicide use in riparian areas or near water, and not allowing the use of Picloram as a first choice herbicide.	Alternative C is not the preferred alternative because it is the least effective at meeting the purpose and need for action, and is the most expensive due to the need for more treatment entries. The analysis in the DEIS did not show alternative C to provide substantially greater benefits to any resource despite the decreased use of herbicide.
12	The Alternative Comparison table is misleading because aminopyralid is not the only herbicide proposed in alternative B.	The “alternative comparison relative to significant issues” tables in the summary and in chapter 2 have been edited in the FEIS in response to this comment. Other

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		herbicides (than the first-year, first-choice) may be used depending on the site-specific situation at the time of treatment. Over time, integrated treatments may change depending on lessons learned each year. However, the implementation planning process ensures that site-specific treatments follow project design features, herbicide-use buffers, and treatment caps
12	Wouldn't alternative C be more protective to drinking water? This is not clear in issue comparison table.	All alternatives protect drinking water. The additional buffers and restrictions in alternative C would result in less possible herbicide exposure. However, this would not result in a substantial difference to drinking water impacts.
12	We are opposed to alternative D because of the use of picloram, broadcast spraying, and greater use of more toxic herbicides such as chlorsulfuron, metsulfuron methyl, and more use of herbicides in general, instead of prioritizing non-chemical methods.	Alternative D, along with the other action alternatives, would use non-herbicide methods where cost-effective. Alternative D would not require a LRMP amendment approving use of aminopyralid. However, as a result, relatively more picloram may be used.
07	I am also greatly disturbed by your lack of alternative plans that do not rely on toxic herbicide use. While it is true that Alternative C proposes the use of less herbicides, and I am happy that it does not allow spraying in riparian areas, broadcast spraying, and Picloram as first choice, it still plans to spray in areas with plants frequently foraged for by humans.	The no action alternative would not approve any herbicide use on the Malheur National Forest. As stated in the DEIS on pages 17, "Under alternative A-no action, invasive plant treatments would not be authorized as part of a decision on this project-level EIS; projects similar to the current program would likely be authorized under categorical exclusions or connected actions associated with other project decisions." Page 19 stated that under the no action alternative, "categorical exclusions may be completed to authorize manual and limited mechanical treatments in site-specific areas."
12	There should be another alternative besides no action that does not use herbicides. Since non-herbicides methods are in use on the Forest, a true no action alternative would continue their use.	Page 17 of the DEIS noted that under alternative A-no action, invasive plant treatments would not be authorized as part of a decision on this project-level EIS. However, "projects similar to the current program would likely be authorized under categorical exclusions or connected actions associated with other project decisions." All action alternatives would continue to use non-herbicide methods in combination with herbicides. Discussion about why the Forest Service did not develop a "no herbicide" alternative for detailed study is in the FEIS.
08	If herbicides are to be used, there should be a mandatory tapering of their use over time; for example, an 80% reduction of herbicide use at 5 years out, 20% more reduction after 8 years, 90% reduction by 10 years, no herbicide use by 15 years from the beginning of this project's implementation, with full public disclosure of progress and setbacks and public involvement in deciding how to address failures to meet goals.	This idea is not implementable at the project scale due to the uncertainty of funding over time. However, the desired condition is that the need for invasive plant treatment is reduced due to the effectiveness and habitual nature of preventative actions, and the success of restoration efforts. Reduced reliance on herbicides would be expected at effectively treated sites (see section 3.1.4, Treatment Effectiveness). The more effective the integrated treatment, the less need for herbicide in the future. See DEIS page 59.
06 / 10	Members of the public asked for consideration of several alternatives that could have been considered as part of proposed alternatives, yet were eliminated from "detailed study" consideration. These included:	Evaluate effectiveness of invasive plant control by disinterested third party before new control measures are adopted: This alternative was considered but not developed for detailed study because it "is an opinion not supported by law or policy and is outside the scope of the analysis in the

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	--evaluating the effectiveness of past invasive plant control by a disinterested third party before new control measures were adopted. --limitations on herbicide-use rates for all herbicides to avoid the riskiest maximum rates --a mandatory decline of herbicide use over time—e.g. an 80% reduction of herbicide use at 5 years out,, 20% more reduction after 8 years, 90% reduction by 10 years, no herbicide use by 15 years from the beginning of this project's implementation, with full public disclosure of progress and setbacks and public involvement in deciding how to address failures to meet goals. We think this is necessary for accountability. --use of herbicides as the last resort (this was rejected in the Region 6 plan) --use of herbicides for only the highest priority target species (partially met by alt. C) --No herbicide use in a variety of areas—e.g. fish habitat, riparian areas, municipal watersheds, wildlife habitat, areas with edible plants, cultural plant gathering areas, roadless and undeveloped areas, and in developed areas like campsites and along trails. --No early detection/rapid response use of herbicides. While we remain concerned that newly discovered invasive plant sites should be analyzed for site-specific effects from control measures, the Forest Service feels this would prevent timely control of new infestations, when they are most susceptible to eradication. At least some of these public proposals should have been thoroughly analyzed and considered as part of proposed alternatives or as separate alternatives to address concerns.	EIS. It would not address the need for treatment flexibility or rapid response to newly detected infestations. It would not expand the treatment toolbox or bring the program into alignment with Malheur National Forest LRMP guidance." (DEIS page 54). However, the public is welcome to work with us to evaluate effectiveness of invasive plant control. History at treated sites is part of the Implementation Planning Process discussed on pages 48-51 in the DEIS. Limitations on herbicide use rates for all alternatives to avoid the riskiest maximum rates: As explained on page 55 of the DEIS, "Limitations on certain herbicide ingredients, rates, and application methods are already part of the action alternatives to ensure that the adverse impacts of treatments are minimized." The lowest amount of herbicide necessary to meet treatment objectives is part of the design of all action alternatives (pdf F2) and in some cases, rates have been specifically limited to address a specific human health or environmental concern. However, a general limit on application rates was not considered for detailed study because it would not further minimize adverse effects and could impede treatment effectiveness. A mandatory decline in herbicide use over time: This idea is not implementable at the project scale due to the uncertainty of funding over time. However, the desired condition is that the need for invasive plant treatment is reduced due to the effectiveness and habitual nature of preventative actions, and the success of restoration efforts. Reduced reliance on herbicides would be expected at effectively treated sites (see section 3.1.4, Treatment Effectiveness). The more effective the integrated treatment, the less need for herbicide in the future. See DEIS page 59. Full disclosure of setbacks and public involvement in deciding how to address failures: This idea could be integrated into any treatment alternative. We are willing to involve the public in evaluating progress on this project and can provide information by request. The implementation planning process presented in the DEIS considers past treatment history when developing integrated treatment prescriptions (see DEIS page 48). The use of herbicides as a last resort: The Forest Service needs the ability to implement treatment actions to more effectively contain and reduce the extent of invasive plants at existing inventoried sites, and rapidly respond to new or expanded invasive plant sites as they may occur in the future. The purpose and need for the project involves using integrated

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		treatment methods in cooperation with our neighbors and in accordance with current management direction, to reduce the extent and impact of invasive plants. Current management direction does not require the use of herbicides as a last resort. As noted, in the R6 2005 Record of Decision, the Regional Forester considered but rejected this alternative, partially because using herbicides as a tool of last resort would have deviated from integrated weed management principles (R6 2005 Record of Decision page 6, page 27). However, herbicides would only be used where necessary. The DEIS noted (page 49), "If the target invasive species population is not associated with a size, phenology, density or distribution that warrants herbicide use (alone or in combination with other methods), or if herbicide use does not substantially increase treatment efficiency (considering the availability of volunteers if needed), then non-herbicide methods would be favored." No use of herbicides in a variety of areas: Alternative C includes some of these suggestions by eliminating herbicide use near streams and other water bodies. Taken in total, this suggestion would be commensurate with no action, since all of the Forest provides some sort of wildlife habitat. As stated in the DEIS on pages 17, "Under alternative A-no action, invasive plant treatments would not be authorized as part of a decision on this project-level EIS; projects similar to the current program would likely be authorized under categorical exclusions or connected actions associated with other project decisions." Page 19 stated that under the no action alternative, "categorical exclusions may be completed to authorize manual and limited mechanical treatments in site specific areas." However, the current lack of sufficient methods in the toolbox for treating invasive plants is hampering the agency's ability to meet the desired condition for healthy native plant communities. No early detection/rapid response: This idea would not meet the need to effectively treat invasive plants as soon as possible after they are detected. As stated on page 6 of the DEIS, "Invasive plant spread is unpredictable and actual locations of target species may change abruptly over time. Accordingly, the Forest needs the flexibility to adapt to changing conditions, and rapidly respond to invasive plant threats that may currently be unknown. Timeliness of action is an important factor because the cost, difficulty, and potential adverse effects of controlling invasive plants increases with the size and extent of the population. The smaller the population when treated, the more likely the treatment will be effective. The Forest needs a way to effectively treat invasive plants as soon as possible after they are detected."
12	Which is the preferred alternative? This should have been disclosed in the DEIS.	A preferred alternative was not determined by the time the DEIS was published. After reviewing the public and interagency comments, and discussing them with the IDT, the responsible official has determined that alternative B, with some modifications, is

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		the preferred alternative.
12	The conclusion that alternative C would have less beneficial impact than other alternatives is biased, ignoring the potential for non-herbicide controls to reduce or eliminate invasive plants; it would just take a little longer with alternative C.	Alternative C would cost more and take longer to achieve control objectives, and in some cases, objectives would not be able to be met due to restrictions on all herbicide use near streams. The treatment effectiveness section 3.1.4 of the DEIS acknowledged the potential effectiveness of alternative C. Alternative C would be more effective than the no action alternative but less effective than alternatives B or D because it would not allow integrated treatment methods that include herbicides within 100 feet of streams. This would increase the expense as well as the time taken to reach treatment objectives.
12	Even if the differences in impact between alternative C and alternative B are not measurable, it could be a very real impact, as with radiation poisoning, where there is no safe level of radiation exposure.	The toxicity and risk associated with the herbicides used in the action alternatives are not comparable to radiation exposure. Risk assessments are best available science and herbicides proposed for use pose relatively low risk. The scale of the project and the pdfs together make the potential for adverse effects very low to people and the environment.
Common Control Measures/Integrated Invasive Plant Treatment Prescriptions		
12	Prioritize non-herbicide treatment for the thistles…they are easily controlled. Concern about biological controls affecting native thistles is not warranted because they are usually not in the same place as invasive thistles.	Non-herbicide methods would continue to be used in all action alternatives where they would cost-effectively meet treatment objectives. Bull and musk thistles can be effectively hand pulled and this would continue to be done for small infestations. Approved biological controls would be released in all action alternatives. Additional treatments may be necessary in addition to biological controls to eradicate, control or contain infestations that are threatening native plant habitats. The discussion about biological controls affecting native thistles has been edited in the FEIS to acknowledge that an agent found to affect native thistles (*Rhinocyllus conicus*) has been released in Eastern Oregon, but is not currently approved and would not be redistributed on the Malheur National Forest because it would not meet LRMP Invasive Plant Treatment Standard 14. The FEIS contains updated information about which biological controls would be redistributed under the action alternatives.
12	Yellow star thistle – Use biological controls for large infestations	Current infestations of yellow star thistle may not be effectively treated by biological controls because they are small and scattered. If treated effectively, infestations of this invasive species would not become large.
12	Sulphur cinquefoil – Why is metsulfuron methyl preferred? Use glyphosate as first choice herbicide.	County weed managers have found that metsulfuron methyl is the most effective herbicide to treat sulphur cinquefoil. Picloram has also been found to be effective, but would not be the first choice in any alternative (and would not be used at all in alternative C). Scarce information exists about the effectiveness or timing of glyphosate treatments for sulfur cinquefoil. The plant's tendency to grow and develop late in the season suggests that late summer or fall treatments with glyphosate with a good surfactant may be effective.
12	Drop picloram, metsulfuron methyl, Roundup®, clopyralid, try hand pulling first in the establishment year.	The R6 2005 FEIS and the Malheur Site-Specific Invasive Plant Treatment DEIS addressed the risks and benefits of using herbicides as part of the integrated weed

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		treatments. The design features in the FEIS for all action alternatives include a project design feature (F1) that prohibits the use of POEA surfactant, which is an ingredient in Roundup®. Thus, this product would not be used.
12	For knapweeds, drop use of picloram, clopyralid, triclopyr, round up. Use biological agents for large infestations and repeated manual pulling/digging on small infestations.	Aminopyralid is the first-choice herbicide for knapweeds under alternatives B and C and picloram (or aquatic-labeled glyphosate near streams) would be the first choice in alternative D if aminopyralid is not available. Handpulling would be part the integrated treatment prescription, especially for smaller infestations or in combination with herbicides as larger infestations become smaller. The FEIS includes a project design feature (F1) that prohibits the use of POEA surfactant, which is an ingredient in Roundup®. Thus, this product would not be used.
12	For thistles, drop use of clopyralid, chlorsulfuron, picloram.	Aminopyralid is the first-choice herbicide for thistles under alternatives B and C and chlorsulfuron would be the first choice in alternative D if aminopyralid is not available.
12	For Canada thistle – combine methods, use solarization for small infestations, biocontrols for large infestations.	All action alternatives include a combination of treatment methods solarization and biocontrols will be used as part of the integrated treatment prescription where cost-effective to meet treatment objectives.
12	For Bull thistle – no clopyralid, chlorsulfuron, picloram, triclopyr or round up formulation of glyphosate	Aminopyralid is the first-choice herbicide for thistles under alternatives B and C and chlorsulfuron would be the first choice in alternative D if aminopyralid is not available. The FEIS includes a project design feature (F1) that prohibits the use of POEA surfactant, which is an ingredient in Roundup®. Thus, this product would not be used. Glyphosate may be used if other herbicides are found ineffective or if they are not allowed due to pdfs or herbicide-use buffers. However, it is not one of the most effective herbicides for thistles.
12	For leafy spurge – no picloram or round up formulation of glyphosate	Aminopyralid is the first-choice herbicide for leafy spurge under alternatives B and C and picloram (or aquatic labeled glyphosate near streams) would be the first choice in alternative D if aminopyralid is not available. Picloram would not be used in alternative C.
12	For houndstongue – emphasize pulling, cutting, mowing. Drop chlorsulfuron, and metsulfuron methyl.	Chlorsulfuron is the most effective herbicide for this target species. Non-herbicide methods would be used in combination with herbicides in all action alternatives. The R6 2005 FEIS and Malheur DEIS analyzed the impacts of using these herbicides.
12	For toadflaxes – Use biological agents for large infestations, drop use of chlorsulfuron, metsulfuron methyl and picloram	Sulfonylurea herbicides are the most effective for this target species. Biological controls have been effective in containing large infestations and are an important part of the integrated treatment prescription.
12	We need more detailed information comparing the toxicity, mobility and persistence of chlorsulfuron and imazapic and their effectiveness for controlling target invasive species.	The R6 2005 FEIS discussed these herbicides in detail and the Malheur DEIS discussed the site-specific impacts of using these herbicides. Chlorsulfuron is among the lowest risk herbicides to people and wildlife, and poses comparatively moderate risk to aquatic organisms and non-target plants. Imazapic is among the lowest risk herbicides to workers, aquatic organisms and wildlife, and poses comparatively moderate risk to public health and non-target plants. Neither of these herbicides are associated with human health hazard quotients greater than HQ = 1 for any of the

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		conservative exposure scenarios analyzed. Persistence and mobility are discussed in Chapter 3.4.
12	For whitetop and perennial pepperweed – Drop use of chlorsulfuron, metsulfuron methyl and round-up formulation of glyphosate	Sulfonylurea herbicides are the most effective for these target species. The more herbicides available for use, the more likely treatments will effectively eradicate, control and contain infestations. The FEIS includes a project design feature (F1) that prohibits the use of POEA surfactant, which is an ingredient in Roundup®. Thus, this product would not be used.
04	We are concerned that the analysis in this EIS is a bit too generic. The proposed action describes a variety of treatment methods and a DEIS lists a number of locations where treatments may occur, but which treatments and which location is unclear. This is supposed to be a site specific DEIS, so there should be more detailed discussion of the ecological sensitivities at the individual proposed treatment sites. Are they near water, or near sensitive botanical sites or wildlife habitat or recreation areas? How will impacts be limited and mitigated at these sensitive sites? Maybe the FEIS can highlight certain areas of concern where treatments may impact sensitive resource values.	A large spreadsheet (in the project record) describes the proposed actions at each invasive plant treatment location and is available on request. Appendix A summarized the location of invasive plants within each 5th field watershed and provides target species, locations, and lists special land uses, major streams and water bodies, recreation areas, grazing allotments, and threatened/endangered species there. In the DEIS, sensitive sites were addressed site-specifically. Table 29 noted the invasive plant species locations within 100 feet of sensitive plants, table 35 noted infestations and their proximity to drinking water sources, and table 38 described the sites with the greatest potential to impact streams and supplied site-specific model results indicating the low likelihood of herbicide reaching streams for this project. Figure 11 showed these locations on a map. The analysis related to aquatic organisms disclosed the eight 6th-field watersheds where more than one-half of 1 percent of the area within 100 feet of streams or other water bodies is proposed for treatment. The wildlife analysis similarly addressed whether or not invasive plants are within specific wildlife habitats and whether or not the type of treatment could have an impact on each species, (e.g., page 225 stated approximately 79,000 acres of potentially suitable upland sandpiper habitat occurs on the Malheur National Forest and of this, 72 acres are currently known to contain invasive plants. Broadcast application would occur on 50 percent and 25 percent of the sites under alternatives B and D respectively whereas manual/mechanical treatments would occur on 68 percent of the sites under alternative C). The interdisciplinary team noted how the project design features, herbicide-use buffers and treatment caps would minimize impacts to recreation areas and sensitive resource locations.
Off Road Travel for Project		
12	Just require all vehicles to stay on roads, trails and parking areas. No cross country travel.	ATVs may be necessary to provide access to some invasive plant sites. Forest Service policy direction and LRMP management direction would be followed if this is done. Vehicles and equipment (including personal protective clothing) would be cleaned so they do not transport invasive plants (pdf C1).
Restoration		
02	My only concern is once one native species is removed it	The DEIS described the process that would be used to ensure that desirable

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	usually gives rise to a new exotic species that was once being controlled by the previous species, "complete removal of invasives sometimes triggers unanticipated effects, such as spread of previously undetected exotic plants following removal of invasives," (Cristescu et al. 2013). I feel as though the treatment plan doesn't really address this problem except by stating several times that in fact this would happen and the plan would need to be revised or the need for a new plan would need to come into place. It would be helpful the plan had more detail about this issue.	vegetation would occupy treatment sites over time. As much detail as possible was provided based on information known at this time. Page 45 stated, "Recovery of native vegetation after invasive plant treatment cannot be precisely predicted. Restoration would be considered following repeated herbicide and other treatment methods, especially in areas where recovery to native vegetation may not be possible such as campgrounds and other highly disturbed areas. . . Evaluation for site restoration will occur before, during and after herbicide, manual and mechanical treatments. Passive site restoration would be favored in areas having a stable, diverse, native plant community and sufficient organics in the soil to sustain natural revegetation." If the soils lack sufficient organics, mulch and/or soil microbe inoculum from nearby areas could be added. Deep-rooted shrubs may also be seeded or planted to more fully utilize resources from the lower soil profile, especially late in the growing season. Shrubs allow for easier establishment of understory species by increasing water availability and reducing understory temperatures and soil evaporation loss. Restoration was also addressed in the Implementation Planning Process (DEIS pages 48 and 49) and the Treatment Cost Effectiveness section (DEIS page 72, for instance, added $500 per acre to the treatment cost estimate for seeding, mulching or planting on 1,231 acres that are of a size and distribution that could require broadcast spraying and therefore have the greatest potential need for restoration).
12	We are generally supportive of passive and active restoration with native plants. Sterile non-native species should only be used in disturbed sites when necessary.	R6 2005 Record of Decision (Malheur National Forest LRMP) Standard 13 for use of native species for restoration will be followed. This means that native plant materials are the first choice in revegetation for restoration and rehabilitation where timely natural regeneration of the native plant community is not likely to occur. Non-native, non-invasive plant species may be used in any of the following situations: 1) when needed in emergency conditions to protect basic resource values (e.g., soil stability, water quality and to help prevent the establishment of invasive species); 2) as an interim, non-persistent measure designed to aid in the re-establishment of native plants; 3) if native plant materials are not available; or 4) in permanently altered plant communities. Under no circumstances will non-native invasive plant species be used for revegetation.
EDRR		
12	So if the intent of EDRR is to control invasive plants when infestations are small, non-herbicide methods should be used first.	The decision to use herbicide (DEIS, figure 4) described how the Forest Service will determine the need for herbicide use. The intent is to have a range of cost-effective tools for timely treatment.
12	Why would non-first choice herbicides be used on newly detected infestations? We ask that first choice herbicides be used on newly detected infestations for first time herbicide use and only if non-chemical control methods would not be effective.	This section (Chapter 2.3.2) has been edited in the FEIS to clarify herbicides other than those identified as "first-year, first-choice" could be used if the first year's choice is found to be ineffective on existing or new target species found during the life of the project. New target species that are Class A or B listed by the State of Oregon could be treated during the life of the project, according to treatment methods (including

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		herbicides), project design features, and herbicide-use buffers analyzed in the EIS.
Monitoring		
12	We support all monitoring requirements, prior, during and after implementation	Thank you for your comment.
12	Higher risk projects with potential to impact species of conservation concern should necessarily be changed to no longer cause impacts to these species	The term "high risk" project comes from the R6 2005 Record of Decision monitoring framework. It is defined as broadcast spraying near streams and aerial spraying. No high risk projects have been implemented across the region since 2005 (see Desser Monitoring Update 2014). In general, pdfs and herbicide-use buffers avoid higher risks.
12	Monitoring of most or all herbicide use sites should be required.	The DEIS stated on page 49: "Monitoring would occur during implementation to ensure Project Design Features are executed as planned. Post-treatment reviews would occur to determine whether treatments are effective and whether or not passive/active restoration is occurring as expected… post-treatment monitoring would also be used to detect whether pdfs were appropriately applied, and whether non-target vegetation impacts were within tolerable levels."
12	BMPs have usually not been adequately monitored or proven to be effective, so use of BMPs is not protective enough	The Forest Service has emphasized development and monitoring of Best Management Practices (BMPs) listed in the National Best Management Practices for Water Quality Management on National Forest System Lands. Volume 1: National Core BMP Technical Guide (FS-990a) was published April 2012. The draft National Core BMP Monitoring Technical Guide is currently in review and publication is expected in Fiscal Year 2014. The Forest Service is currently testing BMP monitoring protocols, including BMPs for chemical use.
12	By the time unexpected, adverse effects are discovered, the damage is already done. Adverse effects need to be avoided for already severely damaged streams and water quality.	Page 49 of the DEIS stated that monitoring would occur during implementation to ensure pdfs are executed as planned. Post-treatment monitoring would also be used to detect whether pdfs were appropriately applied. Impacts such as some non-target plant damage could occur. However, severe damage to streams and water quality is not likely due to the layers of caution associated with the project.
Treatment Cost Effectiveness		
02	With regards to the alternatives requiring action against the invasive species Alternative D was the most cost effective in regards to the total cost of Most Ambitious Treatment Scenario at $1,270,500 where alternative B was $1,154,000.But alternative B, the proposed alternative, was the most cost effective in cost per acre at $544 per acre than alternative D at $598 per acre. The problem with alternative D is that it excludes the use of aminopyralid but still promotes the notion to broadcast or boom spray the area with more toxic herbicides.	Alternative B is slightly less costly ($1,154,000 is about $120,000 less than $1,270,00) and is why the cost per acre is less. Broadcast spraying would tend to have the best results in both alternatives due to the ability to consistently treat a larger area without skips and gaps associated with spot spraying. Broadcast treatments also tend to go faster. However, no differential in dollars per acre was reflected in the model. The DEIS addressed the differences in alternatives. The use of aminopyralid would increase effectiveness and decrease risk compared to some of the other herbicides. Since alternative D does not use aminopyralid, other herbicides such as glyphosate and picloram would become the first choice.
02	Alternative B the proposed project is the best option, although it	Alternative B is the Forest Service's preferred alternative. The use of aminopyralid as

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	allows broadcasting of herbicides the studies that were done on non-target species and human toxicity showed very low levels of impact.	the first-choice herbicide in most situations would result in low risk to human health. However, table 18 (pages 67-68 of the DEIS) noted that aminopyralid poses moderate risk to non-target plant species.
12	Assumptions [that all infestations would be treated in a single year and all pdfs would be applied] are probably unrealistic.	Project design feature compliance is mandatory and must be assumed. We recognize that all infestations are unlikely to be treated in a single year. This assumption allows for consistent alternative comparison and a way to estimate the cost of an effectively treated acre. DEIS pages 74-75 explained that only a portion of the total acreage would likely be treated each year given funding and workforce limitations.
12	The treatment effectiveness issue component regarding unnecessary restrictions on herbicide use does not consider costs of loss of ecological values, loss of biodiversity, loss of ecological integrity.	The analysis of botany, wildlife, soils, water, and fish discuss how ecological values are affected by the alternatives. The cost-effectiveness issue focuses on the tools that would be available to treat invasive plants and the likelihood that these tools would be effective. Restrictions on tools available, including flexibility in using the most effective herbicide, necessarily increase cost and reduce effectiveness.
12	There is no explanation (quantification, assumptions used) why alternative C is assumed to have only half the control effectiveness of alternative B.	DEIS page 79 explained that the effectiveness of each treatment is influenced by the tools available for use. The more tools available, the greater the potential effectiveness of the treatment. Page 80 explained that alternative C does not approve any broadcast spraying and excludes herbicide use over much of the infested area. Page 80 also noted that broadcast methods accomplish many more acres a day than spot or hand methods. Spot and hand treatments tend to require more labor as applicators must walk from spot to spot and then return to accommodate skips and gaps that are common with this type of treatment. This would increase the number of entries needed and increase the amount of time needed to reach invasive plant control objectives. These are the reasons for the assumption that alternative C would cost more and be less effective in treating invasive plants. No specific information exists on how the restrictions in alternative C would influence the cost or effectiveness of treatment at a given site or in total. The estimates in the DEIS were based on professional judgment of weed management specialists. The FEIS has been edited to clarify the assumptions related to treatment effectiveness.
12	Define unnecessary restrictions on dumping poisons on plants, soils, water, air, wildlife, etc. [re: treatment effectiveness, page 12]	This sentence referred to herbicide-use buffers that are wider than necessary, rate and application method restrictions that are more stringent than necessary, and limitations on herbicide ingredients that go beyond those necessary to minimize adverse effects on people and the environment and meet the R6 2005 Record of Decision (Malheur National Forest LRMP) standards. This issue has been edited in the FEIS for clarity.
Herbicides, Herbicide Impacts, Herbicide Toxicity		
08	I am primarily concerned about the use of toxic herbicides as a method of invasive plant control, as this will likely cause damage to a number of species in the Malheur, as well as	Herbicide toxicity was addressed in the DEIS and will be considered in the final decision for this project. The project is designed to minimize adverse effects on non-target plant species, people, fish, wildlife, soil and water. Impacts to soil, water,

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	impact the water and soil that so many plants and animals are dependent on.	wildlife and aquatic species were addressed in the DEIS.
12	Prohibit herbicide use in the spring which is a time of greater risk of transport of toxic chemicals to streams and a time of greater risk to [wildlife] reproductive success.	The pdfs include seasonal restrictions where needed to protect wildlife. The timing of invasive plant treatment would be based on when it is most effective, in accordance with the pdfs.
08	I would also like there to be no broadcast spraying of herbicides anywhere in this project or future projects, as this allows the herbicides to spread too easily.	Alternative C does not allow broadcast treatment methods. The rationale for selected alternative will be in the Record of Decision.
12	Even though triclopyr does not bioaccumulate “to a great extent” it does bioaccumulate.	Triclopyr would not accumulate in the tissues of animals or magnify up the food chain. It has a bioconcentration factor that is less than 1 (DEIS page 91), meaning that it would be excreted faster than it could be absorbed. Thus, it would not be concentrated from contaminated water into the tissues of fish.
12	It is really disturbing that repeated chemical applications may persist up to 15 years! on the same ground, including repeated spraying with the same year. This makes it imperative to analyze synergistic, cumulative, and chronic effects of repeated herbicide use over a long time period, on site-specific locations. Why is this not analyzed in this DEIS? This is inadequate analysis.	Chronic and cumulative impacts are discussed in the risk assessments and in the DEIS. The pdfs address herbicide impacts and add layers of caution to make sure impacts are limited in extent and duration. There is no evidence that herbicide use would continue on the same acreage each year or persist for 15 years. The analysis in the EIS assumes that the project may be implemented over a 5 to 15 year period; this provides analytical consistency given that levels of funding and treatment effectiveness are highly variable. The project would continue until no more treatments were needed or until conditions otherwise changed sufficiently to warrant the EIS outdated. Herbicide use would be expected to decline each year of treatment as target population is reduced following treatment (see Chapter 3.1.4). The DEIS disclosed that “combinations of chemicals in low doses (less than one tenth of RfD) have rarely demonstrated synergistic effects.”
12	Why are studies that underpin concerns about GMO and round up ready crops not applicable to the proposed project? Who updated the glyphosate risk assessment and based on what new information?	This discussion (DEIS table 7) has been updated in the FEIS. This statement referred to studies that are not applicable to the proposed project because they are based on 1) formulations that are not available in the United States and rates are often much higher than proposed for this project; and 2) the use of glyphosate in this project would be limited to direct application to scattered invasive plants that are not used as crops. The risk assessments focus on the type of herbicide use proposed by the Forest Service, rather than use on edible crops. An independent third party risk assessor updated the glyphosate risk assessment based on information available in the open literature.
08	Herbicide use can cause losses to native biodiversity as well as affect the safety and enjoyment of humans who hike, camp, hunt, and otherwise recreate in the Malheur National Forest.	The DEIS addressed impacts of herbicide use proposed on the Malheur National Forest. The intent is to protect healthy native plant communities. The type and extent of herbicide use proposed is unlikely to adversely affect human health and safety. Effects on recreation were disclosed in the DEIS.
08	I believe herbicides should only be used as a last resort in controlling invasive species and that a thorough analysis of the	The DEIS addressed short- and long-term impacts of the alternatives. Treatment control methods would be developed on a site-specific basis. Current management

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	short-term and long-term effects of any herbicide proposed must be made with respect to the health and biodiversity of the entire forest. If herbicides are used, I would like there to be specific protection plans put in place for species most vulnerable to the herbicides. Invasive plant control measures should be site-specific and strategic so as to cause the least harm.	direction does not require the use of herbicides as a last resort. As noted, in the R6 2005 Record of Decision, the Regional Forester considered but rejected this alternative, partially because using herbicides as a tool of last resort would have deviated from integrated weed management principles (R6 2005 Record of Decision page 6, page 27). However, herbicides would only be used where necessary. The DEIS noted (page 49), "If the target invasive species population is not associated with a size, phenology, density or distribution that warrants herbicide use (alone or in combination with other methods), or if herbicide use does not substantially increase treatment efficiency (considering the availability of volunteers if needed), then non-herbicide methods would be favored."
09	I am writing to voice my opinion that no herbicides be used to reduce invasive species. I am deeply concerned about the routine use of herbicides where it is often the synergistic effect and long term reliance on this mechanism which is poses the greatest unforeseeable risk to both humans and the ecosystems where they are used. For the Malheur project, I am urging that herbicides are phased out over time completely, with full public transparency, that they are used as a last resort after thorough testing, and that they are not used in sensitive areas such as riparian habitat.	This comment is unclear about what synergistic effects are of concern. Synergistic effects were discussed in the SERA risk assessments and the R5 2005 FEIS. Pages 98-99 of the Malheur National Forest Invasive Plants Treatment DEIS discussed synergistic effects, "The R6 2005 FEIS considered the potential for synergistic effects of exposure to two or more chemicals: "Combinations of chemicals in low doses (less than one tenth of RfD) *have rarely demonstrated* [emphasis added] synergistic effects. Review of the scientific literature on toxicological effects and toxicological interactions of agricultural chemicals indicate that exposure to a mixture of pesticides is more likely to lead to additive rather than synergistic effects" (ATSDR, 2004; U.S.EPA/ORD, 2000). Based on the limited data available on chemical combinations involving the twelve herbicides considered in this EIS, it is possible, but unlikely, that synergistic effects could occur as a result of exposure to the herbicides considered in this analysis. Synergistic or additive effects, if any, are expected to be insignificant" (R6 2005 FEIS p. 4-3). Additional information about herbicide use on other land ownerships in Oregon and potential for cumulative effects is in Chapter 3.1.5. The project is not anticipated to have long-term herbicide impacts. The project design features, treatment caps, and the focus on effective integrated treatments and restoration of desirable plant species are intended to minimize need for repeated spraying over a long period of time (see DEIS chapter 3.1.4). Less herbicide would be required at treated sites as target species populations become small enough to treat manually (ibid). It is unclear what full public transparency means. Herbicide risk assessments use best available scientific information and real world studies, considered to be adequately thorough to support findings in the DEIS. Alternative C does not use herbicides in riparian areas, providing a basis for comparison between alternatives.
07	I know that when I am hiking and find a tasty mushroom I want the only poisoning I have to worry about to be from mis-identification on my part, not toxic herbicides sprayed onto it. Herbicides should not be sprayed in these areas.	The risk assessments specifically used best available science to study the acute and chronic risks to people eating contaminated fruits and vegetation. Given the amount of herbicide that would possibly be absorbed and the toxicity of the individual herbicides, no exposures over a threshold of concern were found (DEIS page 93). Also, treatment sites would be posted and marked with dye, so that herbicide use would be known before a person would forage in such an area. Most of the invasive

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		plants known on the Malheur National Forest are directly adjacent to roads. Plants growing in these areas are subject to additional pollutants such as exhaust from vehicles and dust. Morels are the main mushroom species collected on the Malheur National Forest. These fruit in the spring whereas most herbicide treatments would occur in mid to late summer.
12	Drop use of roundup, the surfactant still concerns us, toxic to fish, etc.	The FEIS includes a project design feature (F1) that prohibits the use of POEA surfactant, which is an ingredient in Roundup®. The Roundup® formulation of glyphosate would not be used for this project.
12	We are opposed to the use of picloram and clopyralid due to the threat of HCB to raptor reproduction, as well as other reasons re: picloram.	Picloram and clopyralid were approved in the R6 2005 Record of Decision. Alternative C would prohibit the use of picloram. Alternatives B and D include pdfs and herbicide-use buffers to minimize the potential adverse impact of picloram. Clopyralid is not a first-choice herbicide in any alternative. However, it is among the lowest risk herbicides for worker health and the environment (DEIS table 18). There are no exposure scenarios over a threshold of concern for public health with the use of clopyralid and it contains much less hexachlorobenzene (HCB) than picloram (DEIS page 94).
12	Drop use of metsulfuron methyl.	The DEIS analysis does not indicate that metsulfuron methyl should be omitted from the list of herbicides. It is the first-choice herbicide for about 8 percent of the currently infested acreage (about 186 acres). It is among the lowest risk herbicides relative to human health, aquatic resources and wildlife (DEIS table 18). Restrictions on the use of herbicides approved in the R6 2005 Record of Decision would increase cost and decrease treatment effectiveness.
12	Drop use of triclopyr. High toxicity to applicators, aquatic ecosystems, etc. Not necessary to use.	Triclopyr is not among the first-choice herbicides in any alternative but would be effective on several target species in the project area. Project design features and herbicide-use buffers are in place to ensure that it is used in an appropriate manner that would meet R6 2005 Record of Decision (Malheur National Forest LRMP) standards. Restrictions on the use of herbicides approved in the R6 2005 Record of Decision would increase cost and decrease treatment effectiveness, especially over time if first-choice herbicides are found to be ineffective.
06 / 10	We are asking that the most toxic herbicides not be used at all: triclopyr (which poses the greatest risk to humans) and picloram (which contains carcinogenic hexaclorabenzene, and spreads readily through soils and water). We are also concerned by the first choice proposed use of Chlorsulfuron and Metsulfuron methyl, (both proposed for broadcast spraying) and proposed use of Sulfometuron methyl. These herbicides are acutely toxic and should not be used in broadcast spray applications. We are opposed to the use of the “Roundup” formula of glyphosate as it has a very toxic surfactant and of Clopyralid, as it has a carcinogenic impurity—Hexachlorobenzene.	All of the herbicides mentioned in this comment were approved for use by the R6 2005 Record of Decision. For the Malheur project, the DEIS disclosed the risks of using these herbicides on sites within the Malheur National Forest. Several project design features were developed to respond to risks associated with these herbicides. Triclopyr is not a first-year, first-choice herbicide in any alternative. However, it is an effective herbicide on many target species. It would not be broadcast sprayed as per the R6 2005 Record of Decision (Malheur National Forest LRMP). Alternative C does not allow the use of picloram. Picloram is one of the first-choice

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		herbicides in alternative D. Page 92 of the DEIS noted that “One operational exposure scenario resulted in HCB exposure above the cancer risk threshold: boom broadcast application of picloram at the maximum application rate, treating 112 acres in one day, and not wearing any protective clothing. Required personal protective equipment and pdfs (Group F) would make it unlikely for any workers to actually receive the maximum exposure and thus, use of this herbicide would not result in measurable cancer risks to workers.” The amount of HCB in clopyralid is below a threshold of concern, even given the extreme scenario described. It is unclear what “acutely toxic means” in regards to chlorsulfuron, metsulfuron methyl and sulfometuron methyl. They are among the lowest risk herbicides to people, the aquatic environment and wildlife. The action alternatives have been modified so that POEA surfactant, which is an ingredient in Roundup®, will not be used.
06 / 10	There’s no sufficient reason to use high or moderate risk herbicides when there are safer alternatives available.	DEIS Table 18 listed the comparative risks of herbicides proposed for use in the alternatives (not considering pdfs or site-specific situations on the Malheur National Forest). This table has been edited in the FEIS based on updated risk assessment results. The intent of the proposed action is to use the most effective-least risk herbicide for each target species. None of the comparatively “higher risk” herbicides (considering public health, worker health, non-target plants, aquatic organisms and wildlife) are first-year, first-choices for alternatives B or C. The 10 herbicides analyzed in the R6 2005 FEIS, used in accordance with the R6 2005 standards, pose relatively low risks to people and non-target organisms (R6 2005 Record of Decision p. 8). Aminopyralid compares favorably with the other herbicides considered for use on this project.
06 / 10	We remain concerned by the lack of adequate testing for the effects of herbicide impurities, metabolites, “inert” ingredients, and adjuvants, as well as for the synergistic and chronic effects of multiple ingredients in a single herbicide formula.	The analysis in the DEIS utilized best available scientific information based on herbicide risk assessments written by an independent third party contractor. These risk assessments consider the differences in risk from various formulations of herbicide when possible (including additives). The Forest Service has also prepared risk assessments on surfactants. The comment is unclear as to what would constitute adequate testing. This concern cannot be resolved in a project-level EIS. Additional information on herbicide adjuvants is in the FEIS.
08	Ideally, high and moderate risk herbicides would not be used at all in this project. There are a number of other effective methods of controlling invasive species without the toxicity risk. I especially advocate for the herbicides Triclopyr and Picloram not to be used in this project. Triclopyr poses great risk to humans and carcinogenic Picloram easily spreads and poisons soil and water. Furthermore, the proposed use of Chlorsulfuron	All of the herbicides mentioned in this comment were approved for use by the R6 2005 Record of Decision. For the Malheur project, the DEIS disclosed the risks of using these herbicides on sites within the Malheur National Forest. Several project design features were developed to respond to risks associated with these herbicides. Triclopyr is not a first-year, first-choice herbicide in any alternative. However, it is an effective herbicide on many target species. It would not be broadcast sprayed as per

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	and Metsulfuron methyl, as well as Sulfometuron methyl, seems dangerous given the acute toxicity of these substances. They should not be used in broadcast spraying. Clopyralid, which contains a carcinogenic impurity, and "Roundup" formula glyphosate, which has a highly toxic surfactant, should also not be used in our National Forests. Herbicides should also not be used in any riparian areas, particularly the Long Creek Municipal Watershed, nor in or near sensitive or rare plant species populations or botanical species of conservation concern. Neotropical songbirds, elk, deer, pronghorn, fish, amphibians, raptors, scavengers, and small mammals are all threatened by the use of these herbicides. In order to protect the integrity of our forests, I would like to see the use above listed herbicides dropped altogether.	the R6 2005 Record of Decision (Malheur National Forest LRMP). Alternative C does not allow the use of picloram. Picloram is one of the first-choice herbicides in alternative D. Page 92 of the DEIS noted that "One operational exposure scenario resulted in HCB exposure above the cancer risk threshold: boom broadcast application of picloram at the maximum application rate, treating 112 acres in one day, and not wearing any protective clothing. Required personal protective equipment and pdfs (Group F) would make it unlikely for any workers to actually receive the maximum exposure and thus, use of this herbicide would not result in measurable cancer risks to workers." The amount of HCB in clopyralid is below a threshold of concern, even given the extreme scenario described. It is unclear what "acutely toxic means" in regards to chlorsulfuron, metsulfuron methyl and sulfometuron methyl. They are among the lowest risk herbicides to people, the aquatic environment and wildlife. The action alternatives have been modified so that POEA surfactant, which is an ingredient in Roundup®, is not approved for use (see pdf F1). The analysis in the DEIS displayed the effects of using these herbicides as proposed, and alternative C included restrictions on the use of picloram, along with not broad spraying any herbicide. Chlorsulfuron and metsulfuron methyl are the first-choice herbicides for several target species on the Malheur National Forest. Clopyralid, sulfometuron methyl and triclopyr are not the first-choice herbicide for any of the target species currently found on the Malheur National Forest. However, they are listed as an effective herbicide for several target species and may be used if the first choice proved ineffective. Glyphosate is one of the first-choice herbicides in alternative D. However, only 3 acres in this alternative are likely to require broadcast application. It is an effective herbicide for many target species. The FEIS includes a project design feature (F1) that prohibits the use of POEA surfactant, which is an ingredient in Roundup®. Thus, this product would not be used. Currently, Long Creek Municipal Watershed has 0.1 acre of invasive plants and herbicides are unlikely to be needed to be used for the infestation there (DEIS page 9). The project design features and herbicide-use buffers are intended to respond to

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		specific risks indicated by risk assessments applied to the types of treatments proposed and habitats found on the Malheur National Forest.
07	I feel this plan is faulty is because it so heavily relies on herbicides known to be highly toxic, such as Picloram and the “Roundup” formula of glyphosate, which we know have carcinogenic components, and Triclopyr which creates a health risk for recreationists who come into contact with it. The first choice proposed use of Chlorsulfuron, Metsulfuron methyl, and Sulfometuron methyl are also highly concerning for similar reasons, especially considering that two of these would be broadcast sprayed.	The DEIS acknowledged that a known carcinogen HCB is an industrial by product inherent in the manufacture of picloram and clopyralid (DEIS page 92). This is one reason alternative B proposes to add aminopyralid to the list of herbicides to be used, since it does not contain this contaminant. However, the amount of HCB exposure would be below a threshold of concern given the amount of picloram or clopyralid proposed in any alternative. Project design features restrict the broadcast application rate of picloram that reduces the potential for HCB exposure over a threshold of concern. Glyphosate is not considered a carcinogen (SERA 2011 Glyphosate Risk Assessment, page 61). Risk of cancer from contaminants in the surfactant in “Roundup®” were also quantitatively evaluated in the 2011 glyphosate risk assessment. Results conclude that the upper bound risk is equivalent to a cancer risk of 1 in about 1.5 million, well below the EPA threshold of concern. (ibid, p. 86). Triclopyr is associated with some exposures over a threshold of concern for public health given worst case scenarios that are unlikely to be encountered with this project. The risk assessments for picloram, triclopyr and glyphosate were updated in 2011 and the FEIS has been edited to incorporate findings in these newer assessments. The three sulfonylurea herbicides mentioned (chlorsulfuron, metsulfuron methyl, and sulfometuron methyl) do not pose any human health risks, even given worst-case scenarios that are not plausible for this project.
12	Imazapyr, triclopyr and sulfometuron methyl should not be used.	These herbicides were approved in the R6 2005 Record of Decision. However, none would be first-year, first-choice. The pdfs and herbicide-use buffers minimize the potential adverse impacts of using these herbicides, in accordance with R6 2005 Record of Decision (Malheur Forest LRMP) standards.
12	Drop proposed use of picloram, sulfometuron methyl, clopyralid, chlorsulfuron, and sethoxydim. The most toxic herbicides are generally a problem for multiple receptors, human health, fish, native plants, etc. and should be dropped from use.	None of the herbicide proposed on the Malheur National Forest should be characterized as “the most toxic herbicides.” The R6 2005 Record of Decision approved use of these herbicides because they were of relatively low toxicity compared with many pesticides. Table 18 of the DEIS showed the comparative risks of the herbicides. The risks of using these herbicides on the Malheur National Forest were described throughout the DEIS. The pdfs and herbicide-use buffers minimize the potential adverse impacts of using these herbicides, in accordance with R6 2005 Record of Decision (Malheur Forest LRMP) standards.
12	Don’t use picloram, chlorsulfuron, sulfometuron methyl, or NPE surfactants (rather than limiting rates).	The risks of using these and other chemicals on the Malheur National Forest were described throughout the DEIS. The pdfs and herbicide-use buffers minimize the potential adverse impacts of using these chemicals. In the FEIS, the action alternatives have been modified to prohibit use of nonylphenol ethoxylate-based surfactants (NPE) (pdf F1). Given the design of the alternatives, use of these chemicals would pose minimal risk to people and the environment.
12	Dropping the use of picloram, metsulfuron methyl, sulfometuron	The no action alternative would not allow use of any herbicides. The use of picloram

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	methyl, triclopyr and imazapyr is far more protective of soils and other ecological indicators than reliance on multiple pdfs that may not be implementable or fully effective.	would not be allowed under alternative C. Effects on soils from the alternatives were disclosed in the DEIS. Dropping use of these herbicides in total would reduce the effectiveness of the project. The pdfs are expected to be implementable and effective in reducing risk.
12	Drop use of sulfonylurea herbicides.	Sulfonylurea herbicides are effective on many target species on the Malheur National Forest and were approved in the R6 2005 Record of Decision based on the best available scientific information. The project design features would reduce the risks of using these herbicides.
12	Drop all use of triclopyr.	Triclopyr is not among the first-choice herbicides in any alternative but would be effective on several target species in the project area. Project design features and herbicide-use buffers are in place to ensure that it is used in an appropriate manner that would meet R6 2005 Record of Decision (Malheur National Forest LRMP) standards. Restrictions on the use of herbicides approved in the R6 2005 Record of Decision would increase cost and decrease treatment effectiveness, especially over time if first-choice herbicides are found to be ineffective.
12	Drop chlorsulfuron and metsulfuron methyl from broadcast spraying along with other sulfonylurea herbicides.	Alternative C does not allow any broadcast application. Rate restrictions and herbicide-use buffers minimize adverse effects of broadcast spraying these herbicides in alternatives B and D.
12	Drop use of sulfometuron methyl.	Sulfometuron methyl was approved in the R6 2005 Record of Decision. However, it would not be used first-year, first-choice. The pdfs and herbicide-use buffers minimize the potential adverse impacts of using this herbicide, in accordance with R6 2005 Record of Decision (Malheur Forest LRMP) standards.
12	Drop use of chlorsulfuron. For what invasive plant species is it the first choice?	Chlorsulfuron is the first-choice herbicide for houndstongue, toadflax, whitetop and pepperweed in all action alternatives, and is the first choice for Russian knapweed and bull thistle in alternative D (as a substitute for aminopyralid). The analysis in the DEIS does not indicate that chlorsulfuron should be omitted from the list of herbicides. Unnecessary restrictions on the use of herbicides approved in the R6 2005 Record of Decision would increase cost and decrease treatment effectiveness.
12	Drop the use of clopyralid which contains pentachlorophenol, a dioxin.	Clopyralid does not contain pentachlorophenol. This has been corrected in the FEIS. Technical grade clopyralid contains HCB and pentachlorobenzene as contaminants. Nominal or average concentrations of HCB are less than 2.5 ppm. Nominal or average concentrations of pentachlorobenzene are less than 0.3 ppm (Clopyralid risk assessment page xii.) The U.S. EPA has derived RfDs for both pentachlorobenzene and HCB and a cancer potency factor for HCB. Based on the levels of contamination of technical grade clopyralid with these compounds and the relative potencies of these compounds to clopyralid, this contamination is not significant in terms of potential systemic-toxic effects (ibid, page xiv).
12	Drop use of clopyralid (HCB contaminant).	Clopyralid is not a first-choice herbicide for any of the target species found on the

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		Malheur National Forest. However, it is effective on many of these species and is among the lowest risk herbicides for worker health and the environment (DEIS table 18). There are no exposure scenarios over a threshold of concern for public health with the use of this herbicide and it contains much less HCB than picloram (DEIS page 94). The fewer herbicide choices available for different situations, the less likely treatments will be effective. The analysis in the DEIS does not indicate that clopyralid should be omitted from the list of herbicides. Unnecessary restrictions on the use of herbicides approved in the R6 2005 Record of Decision would increase cost and decrease treatment effectiveness.
01	When dealing with health issues like this that involve the unaware public it's better to be safe than sorry. As the Responsible Official please do not direct your staff to prepare denial or 'it doesn't apply to this project" statements. Most reasonable managers would not take the chance of killing someone even if the probability of it occurring were low. Are you ready to take this risk?	The Responsible Official will carefully consider the risk of using herbicides (including glyphosate, the herbicide of concern mentioned in the comment letter) on the Malheur National Forest in making a decision. No evidence suggests that a person or animal will be killed as a result of any of the proposed alternatives. Much of the material supplied in fact does not apply to this project.
01	The DEIS at page 94 states: "Endocrine disruption and glyphosate was discussed in the updated Glyphosate Risk Assessment (SERA 2011a). SERA 2011 stated that "some recent studies raise concern that glyphosate and some glyphosate formulations may be able to impact endocrine function through the inhibition of hormone synthesis (Richard et al. 2005; Benachour et al.2007a, b), binding to hormone receptors (Gasnier et al. 2009), or the alteration of gene expression (Hokanson et al. 2007)" (all references as cited in SERA 2011). Evaluation of the studies indicates that endocrine disruption effects were indicated for surfactants in the formulations rather than glyphosate itself." All glyphosate containing herbicides contain these harmful surfactants.	DEIS page 95 noted: "The studies that raise the most concern were from formulations not manufactured in the U.S." Page 95 acknowledged, "there is concern that glyphosate formulations may have an impact on these endpoints and that some of these effects could be seen under typical application conditions in the United States. In the absence of comparable studies on U.S. formulations, however, it is not clear whether the studies on glyphosate formulations used outside the United States are applicable to risks posed by U.S. formulations of glyphosate" (SERA 2011). Also, as stated on page 96 of the DEIS, "While the potential for the proposed herbicides to cause endocrine disruption effects is a current data gap, the potential for these effects to actually occur are greatly reduced by measures such as required use of proper protective equipment, public notification, use of licensed applicators, limiting application rates and other relevant pdfs." In addition Page 96 stated, "The potential for these effects to actually occur are evaluated and accounted for by using protective thresholds (or toxicity values). Results of all herbicide risk assessments indicate that there is no evidence to suggest that these types of effects will occur from the proposed herbicide."
01	As your DEIS states at page 94, the EPA is testing herbicides with the potential for causing endocrine disruption. Glyphosate is among the chemicals being tested. The EPA will not complete the testing until 2014, thus the "results are not yet available." No professional, caring public servant would even consider taking the risk of applying a glyphosate-containing herbicide before the results of the EPA testing.	DEIS page 95 noted: "The studies that raise the most concern were from formulations not manufactured in the U.S." Page 95 acknowledged, "there is concern that glyphosate formulations may have an impact on these endpoints and that some of these effects could be seen under typical application conditions in the United States. In the absence of comparable studies on U.S. formulations, however, it is not clear whether the studies on glyphosate formulations used outside the United States are applicable to risks posed by U.S. formulations of glyphosate" (SERA 2011). Also, as stated on page 96 of the DEIS, "While the potential for the proposed herbicides to cause endocrine disruption effects is a current data gap, the potential for these

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		effects to actually occur are greatly reduced by measures such as required use of proper protective equipment, public notification, use of licensed applicators, limiting application rates and other relevant pdfs." In addition Page 96 stated, "The potential for these effects to actually occur are evaluated and accounted for by using protective thresholds (or toxicity values). Results of all herbicide risk assessments indicate that there is no evidence to suggest that these types of effects will occur from the proposed herbicide." The risk assessments account for uncertainty (including risk of endocrine disruption) by using protective (cautious) toxicity values, which are compared to potential operational and accidental exposures. The project design features include additional layers of caution. Glyphosate is not one of the first-choice herbicides in alternatives B or C. It is the first-choice herbicide for approximately 724 acres (3 of these acres are potential broadcast acres) in alternative D.
01	Glyphosate kills aquatic life even if the concentrations of the chemical in water are very low. The fish deaths will occur in the streams in the project area and a few miles downstream. Herbicide mist should never be allowed to contact water … even so-called aquatic-safe herbicides.	The 2011 risk assessment and site-specific modeling do not indicate that fish deaths will occur. Sub-lethal impacts are addressed. The potential exists for very low amounts of herbicide to reach water. However, project-specific modeling (see pages 140-142 in the DEIS) indicates that glyphosate will not enter water at all (one model run suggested 1/1000th of a part per billion, which is orders of magnitude below a concentration that could cause an impact to fish; a non-lethal potential for olfactory interference at 1 ppb). Drift will be managed through herbicide-use buffers that prevent broadcast treatments near streams, and limitations on the weather conditions under which spray would occur.
01	Glyphosate is persistent and remains active for several days after being applied.	Glyphosate is rapidly taken up by an invasive plant and any glyphosate that contacts organic material in the soil is rendered inactive. Page 77 of the DEIS stated, "Glyphosate is quickly taken up by plants or bound up with soils so that it is not mobile in the environment soon after application." Page 77 also stated, "Effects of glyphosate from invasive plant treatments are very limited in time and space to the immediate area of the treatment."
01	[G]lyphosate-containing herbicides are likely to cause bee Colony collapse disorder (CCD) that's currently driving bees extinct [several citations attached].	The attached articles to do not provide scientific information that was not previously reviewed by SERA or the Forest Service. Colony collapse disorder was addressed in the DEIS at page 113, with the conclusion, "implementation of any of the action alternatives would not have adverse effects on honey bees or contribute to the potential cause(s) of CCD." The section on colony collapse disorder has been moved to Chapter 3.7 (Wildlife) in the FEIS.
12	Drop all use of picloram, triclopyr and imazapyr.	Risks associated with herbicide use were discussed in the risk assessments, the R6 2005 FEIS and in the Malheur Invasive Plant Treatment DEIS.
12	Drop the use of NPE due to its potential for endocrine disruption and other harmful effects.	The action alternatives have been modified to prohibit the use of NPE-based surfactants (pdf F1).
12	No broadcast of picloram or sulfometuron methyl.	Sulfometuron methyl would be approved for use (including broadcast) in alternatives B and D, but is not a first-choice herbicide for the target species found on the

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		Malheur National Forest. Picloram is a first-choice herbicide for about 63 acres in alternative D. Of these, about 36 acres are of a size that may require broadcast spraying. Picloram would not be used, nor would any herbicide be broadcast in alternative C. The alternatives were compared throughout the DEIS, and rationale for the decision will be in the Record of Decision for this project.
12	Drop use of picloram, too mobile, too persistent, has HCB	Alternative C would not include use of picloram, and picloram is not a first-choice herbicide in alternative B. It is a first-choice herbicide if aminopyralid is not available. The DEIS did not find that restrictions in alternative C were necessary to meet management direction for herbicide use. Unnecessary restrictions on the use of herbicides approved in the R6 2005 Record of Decision would increase cost and decrease treatment effectiveness.
12	Triclopyr should not be used for many reasons, including toxicity to aquatic organisms and soils.	Triclopyr is not a first-choice herbicide in any alternative. Herbicide-use buffers would avoid use of the more toxic ester formulation of triclopyr near streams. Herbicide application of highly soluble chemicals would be avoided during snowmelt when soils are likely to be saturated (DEIS table 9, pdf H5, H6).
12	We are opposed to any broadcast spraying near streams.	Alternative C does not allow any broadcast application, nor does it allow any herbicide use within 100 feet of streams and other water bodies.
07	[T]here are multiple other areas which I feel would be greatly harmed by the reliance on herbicides in this plan [such as] Long Creek municipal watershed.	Currently, 0.1 acres of invasive plants are mapped within Long Creek Municipal Watershed. Table 2 of the DEIS indicated that herbicides were unlikely to be needed to treat this infestation.
07	There also should be a greater buffer for riparian areas, at least 100 feet from high water table areas, and 300 feet near major streams and rivers	Alternative C would virtually eliminate the potential for herbicides to reach streams and other water bodies. There is no evidence that a large buffer would be necessary. The rationale for selected alternative will be in the Record of Decision.
04	Near water and other sensitive sites, we urge the Forest Service to apply precautions that go above and beyond the minimum requirements on the label.	The project design features and buffers for alternatives B, C and D provide precautions beyond label requirements, based on the potential for herbicides to adversely affect resources of concern. Examples include pdf F2, which limits herbicide application rates below label maximums, pdf F4 that sets strict guidelines for nozzle size to reduce potential for drift, pdf F5 that limits use of sulfonylurea herbicides in certain areas (page 34). Project design feature Group H on pages 35 and 36 and the herbicide-use buffers on page 43 also go beyond label advisories to protect soil and water. Project design feature Group I go beyond the label to protect botanical species of concern (page 36-38). Project design feature Group J goes beyond the label to protect wildlife species of concern (pages 38-40).
08	The use of herbicides could result in myself and people who also pursue edible plants, mushrooms, or animals who consume them to suffer poisoning in treated areas… They [herbicides] should not be used in key areas of human plant consumption, such as in native people's cultural plant gathering sites, berry patches, mushroom foraging areas, or areas with	The herbicide exposure scenarios analyzed in the risk assessments, the R6 2005 FEIS and the Malheur National Forest Site-Specific Invasive Plant Treatment Project DEIS considered the potential impacts on people and animals who may inadvertently consume contaminated vegetation (including mushrooms) and fruit. Given the project design features, the type and extent of herbicide use proposed, and the risk assessment findings, the likelihood of adverse effects to people and wildlife is

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	medicinal herbs.	relatively low. High [public] use areas, including administrative sites, developed campgrounds, visitor centers, and trailheads would be posted in advance of herbicide application or closed (pdf K1, page 41). The DEIS noted that postings would indicate the date of treatments, the herbicide used, and when the areas are expected to be clear of herbicide residue. The public would be notified about upcoming herbicide treatments via the local newspaper or individual notification, fliers, and posting signs. Forest Service and other websites may also be used for public notification (pdf K2, page 41). Project design features L2-L4 have been modified so that forest product gathering areas identified by the public will be prominently posted. Cultural plants in areas identified by tribal members would be buffered similarly to other botanical species of concern (pdf M1, page 41). Taken together, these pdfs provide a high level of protection so that people would not become exposed to herbicides used for the project. The human health analysis found that the threshold of concern for people would not be exceeded even if a person ate contaminated vegetation or fruit, based on relatively extreme exposure scenarios, such as a person consuming a pound of contaminated berries (DEIS page 93). Morels are the main mushroom species collected on the Malheur National Forest. These fruit in the spring, most herbicide treatments will occur in mid- to late-summer.
12	Don't use herbicides in campgrounds, visitor centers, at trailheads or along trails. Many people are chemically sensitive and children and elders are particularly vulnerable.	The human health risk assessment included layers of caution to account for chemical sensitivity. Project design features include public notification and posting of public use areas. Taken together, all of the restrictions suggested in this comment letter would be commensurate to no herbicide use as reflected in the no action alternative.
12	The public has a right to find and use uncontaminated edible and medicinal plants in National Forests. All of these areas [special forest products, cultural plants] should be off-limits to herbicide use, including also known and large flush locations of medicinal plants. Our supporters, staff, and volunteers use medicinal and edible plants gathered from the National Forests. We don't want to be poisoned.	The low extent of herbicide use across the Malheur National Forest indicates that uncontaminated edible and medicinal plants would remain throughout the Forest. Morels are the main mushroom species collected on the Malheur National Forest. These fruit in the spring, most herbicide treatments will occur in mid to late summer. Project design features L2-L4 have been modified so that forest product gathering areas identified by the public will be prominently posted. . Use of dye, posting and notification would be helpful to keep people from inadvertently visiting sprayed areas.
12	Herbicide use should not be allowed close to water. We support the assumption that herbicide use buffer would cover entire infestation if any part is within the buffer distance, but larger buffers should constitute no herbicide zones. No herbicide spraying should be allowed near riparian areas. 100 feet is not a sufficient buffer to avoid spray drift or runoff effects. We are opposed to the use of herbicides to the water's edge or within PACFISH/INFISH buffers.	Alternative C includes restrictions on all herbicide use near water. Buffer distances are based on best available information regarding the persistence, mobility and relative toxicity to the aquatic environment of proposed herbicides. DEIS pages 143-144 discussed studies that were used to develop the buffer distances. PACFISH/INFISH buffers are not based on herbicide information, but on surface disturbance from timber harvest, and thus would not be appropriate to use as herbicide-use buffers. Site-specific model runs are updated in the FEIS. The model runs suggest that the buffers are sufficient to minimize adverse impacts to the aquatic environment. The amount of herbicide that could reach streams in all alternatives is below a threshold

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		of concern for fish.
12	Broadcast spraying should be avoided within 100 feet of streams and water bodies. Or more if botanical species of conservation concern as physical barriers would be insufficient to prevent plant uptake of herbicides through roots or surface run-off.	Alternative C does not allow any broadcast application, nor does it allow any herbicide use within 100 feet of streams and other water bodies. Alternatives B and D do not allow broadcast spraying of most herbicides within 50 to 100 feet of wet streams (except for aminopyralid, which may be broadcast to the waters' edge, and poses very low risk to aquatic resources).
12	We are opposed to herbicide use in Wilderness Areas, Wild and Scenic River Corridors, Inventoried Roadless Area, potential wilderness areas, and areas within 500 meters of developed recreation sites.	This suggestion was considered as an alternative, but was not developed for detailed study. The no action alternative would not approve herbicide use in these areas. Taken together, all of the various suggestions for areas to avoid herbicide use are tantamount to no herbicide use (i.e., no action). Non-herbicide treatment could be done using categorical exclusions or as an action connected to another project. Herbicide use in these areas would follow management direction specific to these areas.
12	Do not use herbicide in wilderness areas. Use handpulling and mechanical if necessary.	Herbicide could be used in wilderness areas in all action alternatives. Herbicide use would have to be approved by the Regional Forester via a pesticide use proposal. A minimum decision analysis would be conducted and documented for treatments other than hand pulling. The intent is to maintain wilderness values that are threatened by invasive plants. Mechanical treatments (motorized and mechanized equipment) are not allowed in wilderness areas. The use of herbicides in wilderness areas may reduce the wilderness experience for some users in the short term, but active treatment provides the best protection of wilderness character and values (DEIS page 257).
08	Herbicides should not be used within 100 feet of streams or areas with high water tables, or within 300 feet of major rivers and creeks.	There is no evidence that a large buffer would be needed to protect water quality or aquatic organisms. The GLEAMS model runs have been updated for the FEIS and include a hypothetical "worst-case" scenario for alternatives B and D assuming that the maximum annual herbicide application occurs (10 acres in a 6th field watershed) without any herbicide use buffer. This same scenario was run for alternative C with a 100 foot buffer imposed. In all alternatives, peak water concentrations were far below any levels of concern for fish.
06 / 10	We are opposed to the use of herbicides in the Long Creek municipal watershed.	Currently, 0.1 acres of invasive plants are mapped within this municipal watershed. Table 2 of the DEIS indicated that herbicides were unlikely to be needed to treat this infestation. Use of herbicides in municipal watersheds would be coordinated with water use managers and would follow pdfs and herbicide-use buffers (see pdf Group H). Drinking water would not be adversely affected.
12	How does pdf H4 manage the persistence of picloram, which can last up to 3 years, yet annual reapplication would still be allowed. This could really raise soil concentrations and keep native plants suppressed. The soil pdfs do not effectively reduce the potential for picloram to build up in the soil and have	Project design feature H3 would avoid use of picloram on bare or compact soils, and inherently poor productivity soils that are highly disturbed. Poor soils include shallow soils less than 20 inch depth that lack topsoil and serpentine soils. As described in Chapter 3.4, herbicide half-life is shortened when soil microbes help break down the herbicide. The action alternatives were modified in the FEIS to limit reapplication of

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	impacts on soil organisms, since it has a half-life of 3 years.	picloram to once every two years.
12	We do not agree that the potential for toxic effects to actually occur are accounted for by using very protective thresholds (toxicity values). Especially regarding NPE, which is known to cause endocrine disruption. The more protection is based on multiple pdfs; the more pdfs, the more unreliable the use of pdfs.	The toxicity values (threshold of concern used to determine hazard quotient) are much lower than the rate known to cause human health effects. This helps account for uncertainties. The intent of the design features is to minimize risk to the extent possible, while still allowing for a range of effective treatments over a range of treatment situations. In response to this and other comments, the alternatives were modified in the FEIS to prohibit use of NPE-based surfactants (pdf F1).
12	Vehicles transporting herbicides should not go near drinking water sources or major rivers, creeks and lakes.	There is no realistic way for vehicles not to use roads that cross rivers. However, pdf G requires consideration of herbicide transportation and handling safety. The quantity of herbicides to be transported to treatment sites would be limited to the amounts that are estimated to be needed for any given day. No significant spills or incidents that require reporting at the state or national level have occurred in the region.
07	A plan must be made that relies on herbicides only as a last resort, with proper explanation of why this is so, that includes a mandatory decline in herbicide use, that does not spray in the above mentioned areas of concern, that contains no early detection/rapid response use of herbicides, and that is based behind more adequate testing of herbicides, such as the effects of herbicide impurities, and synergistic effects when multiple herbicide are sprayed in the same areas. Without this, I feel that the Forest Service is putting human health and the health of the forest I love at great risk. Please take these comments into consideration and work to develop a plan that controls invasive plants without poisoning our forest.	Herbicides are proposed as part of an integrated pest management approach. Current management direction does not require the use of herbicides as a last resort. As noted, in the R6 2005 Record of Decision, the Regional Forester considered but rejected this alternative, partially because using herbicides as a tool of last resort would have deviated from integrated weed management principles (R6 2005 Record of Decision page 6, page 27). However, herbicides would only be used where necessary. The DEIS noted (page 49), "If the target invasive species population is not associated with a size, phenology, density or distribution that warrants herbicide use (alone or in combination with other methods), or if herbicide use does not substantially increase treatment efficiency (considering the availability of volunteers if needed), then non-herbicide methods would be favored." A mandatory decline in herbicide use is not implementable at the project scale due to the uncertainty of funding over time. However, the desired condition is that the need for invasive plant treatment is reduced due to the effectiveness and habitual nature of preventative actions, and the success of restoration efforts. Reduced reliance on herbicides would be expected at effectively treated sites (see section 3.1.4, Treatment Effectiveness). The more effective the integrated treatment, the less need for herbicide in the future. See DEIS page 59. Early detection/rapid response using herbicides is needed to allow the Forest Service flexibility to treat invasive plants in a timely and cost-effective manner. While there are data limitations, risk assessments contain the best available scientific information.
12	It doesn't matter that agency herbicide use is low compared to private lands use; agencies should set the tone for promoting alternatives to herbicides.	The low amount of comparative herbicide use is part of the reason why the contribution toward cumulative effects of herbicide use is low with this project. No herbicides have been used on the Malheur National Forest for many years. Categorical exclusions would likely authorize manual and mechanical treatments in the future if the no action alternative is selected.
12	Glyphosate is only one of the top 5 pesticides in use on private and state lands. What other herbicides are in use and how	The effects of herbicides approved for agriculture and other uses off Forest Service land have not been specifically analyzed. Total amount of herbicide use in the river

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	mobile, soluble, and persistent are they?	basins adjacent to the Malheur National Forest is not known. However, as stated in Chapter 3.1.5, the relative scale of this project is so small that it is unlikely to contribute to measurable, detectable herbicide concentrations in downstream waters. Multiple herbicide exposures are unlikely to occur in close enough proximity in time or space with other applications to trigger cumulative effects. The small, scattered nature of the infestations, the relatively low toxicity and potential to cause adverse effects associated with the herbicides proposed for use, the pdfs, herbicide-use buffers and treatment caps that limit the extent, intensity and duration of potential adverse effects, and treating invasive plants cooperatively across administrative boundaries, all serve to minimize the potential for adverse effects to accumulate and amount to a measurable impact on people or the environment.
12	First paragraph (on page 77) glosses over differences in toxicity and mobility of herbicides proposed for use in the project by stating that "most of the herbicides proposed for use would not persist in the environment for more than a few weeks or months, and those that would remain longer have pdfs limiting the frequency of use so that effects do not accumulate at the treatment site."	More discussion about persistence of each herbicide was provided in the DEIS Chapter 3.4. The section referenced in this comment was intended to provide a general introduction and has been edited in the FEIS.
12	Given uncertainties in the risk assessments, and actual combined or chronic levels of exposure and synergistic and chronic herbicide effects, exposure should be limited by greatly restricting herbicide use or keeping herbicide out of areas of high public use, or involving consumption or handling of plants.	Toxicity values are much lower than the rate known to cause human health effects. This helps account for uncertainties. Project design features are intended to further add layers of caution where possible. The R6 2005 Record of Decision (Malheur National Forest LRMP) standard requires that design features minimize risk to the extent possible, while allowing for effective treatments.
12	Is there a pdf requiring that herbicide not be used at maximum rates? If not, there should be.	Maximum herbicide use rates would not be used in general. Project design feature F2 includes the following language: "The least amount of a given herbicide would be applied as necessary to meet control objectives." This applies to all action alternatives. Project design feature F2 also restricts broadcast spraying to typical rates for clopyralid, glyphosate, picloram, sethoxydim, and sulfometuron methyl. The lowest effective rate would be used in any given situation.
12	High run-off potential sites also cover a lot of the ground on the Malheur. This is a good reason not to use maximum herbicide use rates in general and to use herbicides as little as possible.	Project design feature F2 requires that the least amount of a given herbicide would be applied as necessary to meet control objectives. This applies to all action alternatives. Alternatives B and D include broadcasting), however broadcast application of clopyralid, glyphosate, picloram, sethoxydim, or sulfometuron methyl will not exceed typical application rates. Imazapyr has additional rate restrictions in all action alternatives.
12	We are not convinced that the aquatic label herbicides are safe for aquatic life.	Aquatic labeled herbicides pose less risk to the aquatic environment than their terrestrial counterparts. The effects of using these herbicides were discussed throughout the DEIS.
12	All of the notification methods could easily be missed by casual visitors and recreationists hiking, camping in user created	The use of colored dye would be difficult to miss, in addition to the other notification methods. The human health analysis in Chapter 3.2 discussed the low potential for

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	camps, eating berries, etc.	public exposure to herbicide to exceed a threshold of concern, using conservative toxicity values that are far below a level of concern for human health.
12	We are opposed to herbicide use for eradication of native plant species considered noxious such as poison water hemlock.	This project would only authorize treatment of invasive plants.
12	The first question [in the decision to use herbicides figure 4] should have its own broken down decision tree to guide decision-making whether or not to use herbicides. As it is, the answers to the question could be very subjectively based.	Figure 4 was developed to demonstrate the way that herbicide use would be approached as part of the integrated treatment prescription for a given site. Page 49 of the DEIS (paragraph preceding figure 4) stated, “If the target invasive species population is not associated with a size, phenology, density or distribution that warrants herbicide use (alone or in combination with other methods), or if herbicide use does not substantially increase treatment efficiency (considering the availability of volunteers if needed), then non-herbicide methods would be favored.” The factors of target population species, size, phenology, density, and distribution are evaluated together to determine whether herbicide use is warranted. These factors are interdependent and there are no specific go/no thresholds that can be outlined in a decision tree.
12	We are opposed to using cost-effectiveness as a criterion for using herbicides as that will often be used to justify herbicide use as an easier, more convenient method, when most ecological impacts are usually avoided by not using herbicides. Asking whether use of herbicides substantially increase cost-effectiveness biases the decision toward herbicide use and could increase herbicide impacts. Ecological costs should be factored in.	Ecological impacts were factored into the pdfs, herbicide-use buffers, and effects analysis in the DEIS. Cost and effectiveness are important factors in the decision to use herbicides.
12	Couldn’t chlorsulfuron and metsulfuron methyl be replaced by a more ecologically benign herbicide in alternative C? Pro’s and Con’s, what about using glyphosate or imazapic instead or prioritizing non-chemical control methods.	Glyphosate and imazapic are not the best choices for several target species nor are they necessarily “more benign” (see DEIS table 18). All of the herbicides proposed for use (except aminopyralid) were analyzed and approved in R6 2005 Record of Decision. The objective is to use the most effective integrated treatment option available while following pdfs to minimize adverse effects.
12	We are wary of mixing different herbicides as the combined/synergistic effects have not been analyzed.	The R6 2005 Record of Decision Standard 16 requires that the Hazard Index be less than 1 for any tank mixtures to ensure low risks. This precaution accounts for data gaps regarding synergistic effects of different chemicals. In addition, tank mixtures would apply the largest buffer as indicated for any of the herbicides in the mixture (pdf H1). The common control measures do not currently include tank mixtures. However, they may be included in future treatments.
12	Cost effectiveness should not be the primary considering a decision tree: when to use herbicides. [Use of herbicides] should be based on other methods not working.	Cost-effectiveness is an important consideration regarding the decision to use herbicides. The DEIS noted (page 49), “If the target invasive species population is not associated with a size, phenology, density or distribution that warrants herbicide use (alone or in combination with other methods), or if herbicide use does not substantially increase treatment efficiency (considering the availability of volunteers if needed), then non-herbicide methods would be favored.” In the R6 2005 Record of

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		Decision, the Regional Forester considered but rejected an alternative to use herbicides as a "last resort," partially because using herbicides as a tool of last resort would have deviated from integrated weed management principles (R6 2005 Record of Decision page 6, page 27). The pdfs and herbicide-use buffers are intended to allow invasive plant managers the latitude to use the most cost-effective method available while minimizing adverse effects.
01	My uncle lives in Seneca Oregon. He hikes, camps and fishes on the Malheur National Forest with his 2 children. I beg you, please do not approve the application of dangerous herbicides to Malheur National Forest land. Killing fish, birds and mammals (including human visitors to the forest) isn't worth the risk to deal with invasive plants.	Scientific herbicide risk assessments do not indicate that any of the herbicides proposed for use on the Malheur National Forest will kill fish, birds or mammals. The potential for sub-lethal effects to fish and wildlife are discussed in the DEIS (Chapters 3.6 and 3.7). These are not likely to occur given the nature of the project, the type of herbicides proposed for use, and the project design features associated with their use. There are low risks of impacts to human health (Chapter 3.2). Herbicide applicators and the public are not likely to be exposed to herbicide at a level that would cause human health impacts.
05	If Oregon needs more jobs, why not manually remove invasive species?	Manual removal of invasive plants has occurred on the Malheur National Forest for decades and would continue in the proposed alternatives. However, greater reliance on manual treatment is expensive and increases the time necessary to eradicate, control, and/or contain invasive plants (see DEIS Chapter 3.1.4). Some target species cannot be adequately treated using manual methods (see DEIS table 8).
07	My problems with this plan are…centered around the heavy use of toxic herbicides, which would threaten wildlife and human health, damage fragile riparian areas, and which does not stop the spread of invasive plants, through carriers such as ATVs and livestock.	We do not consider the treatment of about 2,000 acres per year within nearly 1.7 million acres of the Malheur National Forest as heavy use. Herbicides are intended to be toxic to the target invasive plants to be eradicated, controlled, contained or suppressed. Threats to wildlife and human health are low. Treated riparian area vegetation would likely experience rapid regrowth, and the majority of near-stream vegetation would not be treated. (DEIS at page 158). The DEIS acknowledged that it would not stop the spread of invasive plants. However, the amount of acreage subject to spread would be reduced with effective treatments (DEIS Chapter 3.1.4.). Vectors for invasive plant spread are acknowledged and discussed in section 3.1.5 and the various cumulative effects sections in the DEIS.
12	Which herbicides had risk assessments after 2004 [when the identity of confidential business information stopped being available to risk assessor]? This raises doubts re: the extent and nature of their full toxic effects.	Risk assessments for glyphosate, imazapyr, picloram and triclopyr were updated in 2011. All available information from the previous risk assessments, along with new information was considered in the DEIS. The risk assessments provide the best available scientific information regarding the use of herbicides on National Forests. The risk assessments, LRMP management direction, and the project design features/herbicide-use buffers all add layers of caution that account for data gaps and uncertainty.
Human Health		
01	Literature authored by independent scientists not connected with Monsanto or the USFS indicates mammals that eat contaminated foliage and humans that might brush against	SERA Risk assessments use best available scientific information, including independent studies. The risk assessments include analysis of impacts from direct contact and vegetation/fruit consumption, along with other exposure scenarios. None

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	contaminated foliage or eat contaminated berries have been known to suffer from the following as a result of glyphosate contact: birth defects, non-Hodgkin's lymphoma, mitochondrial damage, cell asphyxia, miscarriages, attention deficit disorder endocrine disruption, DNA damage, skin tumors, thyroid damage, hairy cell leukemia, Parkinson disease, premature births, decrease in the sperm count, harm to the immune system in fish death of liver cells, severe reproductive system disruptions and chromosomal damage.	of the above effects noted by the commenter are indicated from the analysis of the proposed glyphosate, or other herbicide use.
01	The results of independent, unbiased research on glyphosate-containing herbicides indicate this chemical is causing: birth defects, non-Hodgkin's lymphoma, mitochondrial damage, cell asphyxia, miscarriages, attention deficit disorder, endocrine disruption, DNA damage, skin tumors, thyroid damage, hairy cell leukemia, Parkinson disease, premature births, decrease in the sperm count, harm to the immune system in fish, death of liver cells, severe reproductive system disruptions and chromosomal damage [several web links attached].	All of the websites provided by Respondent #01 were reviewed. Studies linking glyphosate to cancer, neurological diseases, birth defects, and other health concerns generally are for herbicide use rates, formulations, or uses that are dissimilar to this project. Some of the websites refer to cellular level studies that are not applicable to real world exposure risks. Research conducted on whole organisms (e.g., rats, quail, etc.) using plausible exposure routes (e.g., dietary, direct spray) with glyphosate provide the best available science regarding risk from Forest Service applications. Whole organism studies have been conducted, have been reviewed by the EPA, are included in Forest Service risk assessments, and form the basis of our conclusions. The risk assessments and other information in this EIS constitute best available science. The websites cite studies that either are flawed or opinionated reports about scientific studies that were evaluated or included in the Forest Service risk assessments. Disagreement about how herbicides are labeled and the risk assessment process are outside the scope of a project level EIS, which is based on current best available science. Risks associated with the use of glyphosate are addressed in the DEIS and the SERA risk assessment for glyphosate was updated in 2011 to ensure best available scientific information was considered. Several invasive target species are effectively treated with glyphosate. The pdfs and herbicide-use buffers are designed to minimize or eliminate risks of herbicide use, including glyphosate.
12	There is obviously less effect to humans using special forest protects (i.e. native plants) if there is less overall herbicide use and plant gathering areas are not sprayed.	There is very low likelihood that any member of the public would be exposed to harmful levels of herbicide in this project. This is why effects to people are considered the same in all alternatives.
12	Re: the finding that on page 97 that the difference in impact on human health from the restrictions in alternative C are not meaningful or measurable: Let the public determine if the difference in human health impact are measurable or meaningful – after all, we are the ones on the receiving end and with no economic stake biasing us toward using herbicides. The analysis is not accounting for the spiritual and cultural need to	The Forest Service has the responsibility to compare alternatives. An interdisciplinary team comprised of resource professionals made the comparisons. The rationale for the selected alternative will be in the Record of Decision. The human health impacts consider ingestion of sprayed vegetation. However, the pdfs minimize the potential for effects to non-target vegetation.

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	have a source of food and medicine available that has not been contaminated with toxins, and the joy and solace in gathering plants in their natural setting.	The human health analysis does not consider spiritual or cultural needs. Cultural plants identified by tribes would be buffered as botanical species of concern. Individual medicinal and edible plants may be affected by adjacent treatments. However, the vast majority of medicinal and edible plants would not occur in the vicinity of invasive plant treatments.
12	Human health issue should include anything people consume including wildlife and livestock, edible plants, soils.	Effects on the potential for people to consume contaminated vegetation, fruit and fish were addressed in the DEIS Chapter 3.2.
12	Herbicide exposure for people can be indirect as well as direct.	The human health analysis in Chapter 3.2 considered direct and indirect routes of herbicide exposure.
12	See our other comments already submitted for human health on R6 2005 FEIS since you are summarizing analysis for the R6 2005 FEIS.	Comments submitted to the R6 2005 DEIS were addressed in Appendix A of the R6 2005 FEIS. Comments specific to the Malheur National Forest Invasive Plant DEIS are addressed herein.
12	We are very concerned re: human health impacts and disregard for cultural and spiritual values about planned herbicide poisoning of edible and medicinal plants, including indigenous cultural plants like Biscuitroot, Cous, Camus and others.	The EIS has been edited to acknowledge that some people may feel that any herbicide use degrades the spiritual value of plant collection on the Malheur National Forest. No "herbicide poisoning" is "planned" for cultural plants. Cultural plants identified by tribes would be protected as botanical species of concern (pdf M1). Treatment areas would be posted and treated plants would be marked with colored dye. Damage to non-target plants would be obvious soon after spraying. People are unlikely to ingest sprayed vegetation, and if they do, the amount would likely be too low to cause human health impacts.
12	The public may eat contaminated edible plants and use contaminated medicinal plants (e.g. berries, nettles, arnica, Oregon grape, edible mushrooms, arrowleaf balsamroot, lomatiums and others.)	None of the species mentioned in the comment would be intentionally sprayed so any herbicide contact would be incidental. Damage to non-target plants would be avoided to the extent possible. Treatment areas would be posted and treated plants would be marked with colored dye. Treatment areas would be posted and treated plants would be marked with colored dye. Damage to non-target plants would be obvious soon after spraying.
12	We are concerned that workers conscripted from prisons are not fully aware of the risks they are facing from herbicide exposure and not be adequately protected.	All workers would be supervised by a licensed pesticide applicator. Federal, state and county employees and professional contractors are the workers most likely to apply herbicides on the Malheur National Forest.
12	Worker health can best be protected by not using the herbicides with highest human health risks, such as triclopyr, and greatly reducing herbicide use (modified alternative C).	All workers would be supervised by a licensed pesticide applicator and safety measures would be emphasized. Triclopyr is not a first-choice herbicide for any target species in any alternative. However, it would be used in the event that other herbicides were not effective.
12	Worker use of protective clothing and other protective gear should be monitored and enforced.	All herbicide applications in the Pacific Northwest Region of the National Forest System must be supervised by a licensed applicator. Job Hazard Analyses and Safety Plans that are required by Forest Service policy include discussions of personal protective equipment. Forest Service compliance with required safety measures is part of ongoing Environmental Compliance audits. Safety violations have been noted during contract inspections (see Desser 2014 monitoring write-up).

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		OSHA also inspects and monitors worker health and safety.
12	Drop triclopyr due to high HQ values. Drop picloram and clopyralid due to HCB cancer risk. Who decides what is an acceptable risk for cancer? The workers are usually not consulted or these days are desperate for any work and should not be exposed to this risk.	The EPA establishes thresholds for cancer risk. None of the proposed herbicides are associated with a risk of cancer over the EPA threshold. The human health analysis does not indicate significant risks from this project to workers. Risk assessment thresholds of concern are far below levels known to affect human health, the upper bound estimates that indicate risks to workers are unlikely to actually occur, and pdfs appropriately reduce risk. The project would meet R6 2005 Record of Decision (Malheur LRMP) standards.
12	We also do not trust risk assessments to be fully accurate as usually only the active ingredients are tested in isolation, not in combination with other herbicides or with formula-incorporated inert ingredients, metabolites, impurities, etc. Nor are they tested for synergistic or most chronic effects…we do not trust this theoretically “low” risk [of hazard quotient being below 1]. How do we know the Hazard Quotient method of analysis is sufficiently protective?	Risk assessments constitute best available scientific information. While there are limitations on available data, each of the Forest Service risk assessments address inert ingredients, metabolites, impurities and adjuvants, and contain information about chronic exposures to people and the environment. Data regarding synergistic effects is limited and identified as such in the EIS (Incomplete and Unavailable Information). Concerns about risk assessment methods are beyond the scope of a project level analysis. The National Academy of Sciences recently noted, “After 30 years of use and refinement, this risk-assessment paradigm has become scientifically credible, transparent, and consistent; can be reliably anticipated by all parties involved in decisions regarding pesticide use; and clearly articulates where scientific judgment is required and the bounds within which such judgment can be applied. The process is used for human-health and ecological risk assessments and is used broadly throughout the federal government. Thus, the committee concludes that the risk-assessment paradigm reflected in the ecological risk assessment (ERA) process is singularly appropriate for evaluating risks posed to ecological receptors, such as listed species, by chemical stressors, such as pesticides.”(NAS 2013). One benefit of using the formulation of aminopyralid called Milestone™ is that it does not contain inert or added ingredients other than water.
12	Many people (including myself) have been exposed to multiple toxins, increasing overall sensitivity. This is an increasing concern as more people live in cities and industrial areas and our environment becomes more polluted. The Forest Service can better meet Multiple Chemical Sensitivity by greatly reducing herbicide use, not using maximum application rates, and not using herbicides in areas frequented by people, such as campsites, trailheads, and edible/medicinal plant gathering areas). Yet this analysis looks at the effects of herbicide contamination in isolation, not considering cumulative human exposures to toxins and carcinogens.	Multiple chemical sensitivity was addressed in the DEIS on page 94. EPA and Forest Service risk assessments incorporate an uncertainty factor of 10 to account for sensitive individuals when establishing the human health level of concern, which may or may not eliminate risk that an individual may suffer symptoms. However, the uncertainty factor for sensitive individuals addresses variability in tolerances within a normal population. The cumulative exposure to toxins in cities and industrial areas is outside the scope of this project.
12	Why is it assumed that the public will not be directly sprayed? Broadcast spraying could result in public exposure. We are out on the Forest during weekdays.	Workers applying herbicides using ground broadcast, backpack, and selective treatments would be able to avoid directly spraying a person. Direct contact is not likely to result in herbicide exposure to the public over a threshold of concern, given

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		the project design.
12	Analysis of bioaccumulation seems suspect. Explain how HCB carcinogenicity can be characterized as low when bioaccumulation has such a high factor (20,000).	The bio-concentration factor is high but the amount of HCB in picloram and clopyralid is very low. Human exposure to picloram and clopyralid is also very low. HCB is a ubiquitous environmental contaminant, but the contribution from picloram and clopyralid is not significant. Cancer risk due to use of picloram and clopyralid is below the EPA threshold.
12	Surfactants and herbicides associated with endocrine disruption should not be used. Studies are lacking for most herbicides on the potential to bind with estrogen or androgen receptors. Chlorsulfuron and sulfometuron methyl effects on fertility/reproduction in some studies indicate our reasons for concern.	Endocrine disruption is addressed in the Forest Service risk assessments and considered when establishing a level of concern for each herbicide. Endocrine disrupting effects often occur only at doses higher than other more sensitive endpoints used in our analysis, such as weight loss or effects to organs. None of the proposed herbicides pose a risk of endocrine disruption effects from exposures due to Forest Service use of the herbicides.
12	Glyphosate formulas should not be used in areas of high public exposure due to data gaps about surfactants and other ingredients. Hazards have not been identified due to lack of information on surfactants in different glyphosate formulas so they should not be used.	There is quite a large body of data available on risk of glyphosate formulations containing surfactants, relative to other pesticides. The 2011 glyphosate risk assessment quantitatively evaluated the differences in risk from glyphosate formulations versus the active ingredient. No applications will result in high public exposure due to the proposed application methods, public notification, and other pdfs.
12	Additive doses could happen because people could eat contaminated berries, mushrooms, fish and use medicinal plants as a usual or major component of their diet or health care, as with people using herbs repeatedly in doses for an illness or consuming the same food plants until they are gone (e.g. many mushrooms per meal). The net additive effects can be harmful and most risk assessments only study individual ingredients and do not look for synergistic effects.	Chapter 3.2 discussed the potential for additive doses of herbicide. Chronic exposure from the consumption of contaminated fruit, vegetation, and fish were quantitatively evaluated in the risk assessments. There is no evidence that the herbicide use proposed for this project would pose a risk to human health from chronic exposures. Theoretically, additive acute doses from multiple routes could add up to an exposure of concern. However, the amount of fish, vegetation and fruit that would have to be consumed would be implausibly large given the scale of the project. No contamination of food products is expected to occur due to application methods, pdfs and herbicide-use buffers. Synergistic effects are unlikely from chemicals with low acute toxicity (DEIS page 98).
12	Hard to believe that glyphosate would not have greater impacts than disclosed when a boy suffered anaphylactic shock from one glyphosate exposure.	Risk assessments cannot incorporate all allergic or chemical sensitivities. Anaphylaxis is well-documented from many common food items. Reviews of available data do not indicate any likely adverse effects from Forest Service use of glyphosate to control invasive plants.
12	The use of the glyphosate example for adding HQ's does not account for higher HQ's associated with other herbicides.	The FEIS has been modified to provide more information about why additive doses are implausible given the type of herbicide use proposed in this project.
12	It is unfair and a form of discrimination for some minority groups to be disproportionately exposed to herbicides based on their being forest workers, special forest product or subsistence gatherers. BMBP staff, supporters and volunteers are in this minority group. We may be exposed to herbicides over a	No person is likely to be exposed to herbicides over a threshold of concern in this project. Herbicide applicators and those who spend the most time in the Forest would have a greater risk of exposure than the public. However, harmful exposure to herbicide is not likely for workers, assuming they follow typical occupational health and safety practices. For others, the pdfs (Groups K, L and M) require posting,

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	threshold of concern, and in doses greater than casual, one-time visitors who do not use plants or fish from the Forest. The effects of chronic exposures have not been well studied.	notification, information sharing, consultation with tribes, and minimizing herbicide use rates (pdf F2) to reduce potential exposure. Effects of chronic exposure are considered in the herbicide risk assessments, including estimates for people who subsist on fish and vegetation from the forest. There is little potential for the public to be exposed to herbicides over a threshold of concern and there is little potential for this project to create a chronic source of herbicide exposure for any member of the public or any minority group.
Botany		
12	This is more highly biased and unprofessional analysis-approved biological agents COULD weaken or kill a non-target plant, so it can't be concluded that no direct effects could occur to sensitive plant species.	Biological control agents that are currently approved have been rigorously tested for their potential to affect native species. Only those that would not affect native species are currently approved. In the past, some biocontrols were released that were known to affect native thistles (*Rhinocyllus conicus*). This agent is no longer approved for use in Oregon or in Region Six of the National Forest System, and would not be redistributed on the Malheur National Forest.
07	[T]here are multiple other areas which I feel would be greatly harmed by the reliance on herbicides in this plan. These areas contain those with threatened, sensitive, or rare botanical species.	The pdfs in Group I (DEIS pages 36-38) were developed to protect botanical species of conservation concern. Rare plant surveys before project implementation, buffers, and training of implementation personnel would likely prevent impacts to sensitive plant populations and habitats. Most invasive plant infestations are in disturbed areas with very low probability of rare plant occurrence.
12	Avoid herbicide use anywhere near non-vascular sensitive listed plants due to effects uncertainty for these plants.	Sensitive non-vascular plants would be appropriately buffered. Monitoring is intended to address the uncertainty of effects of herbicides on non-vascular plants. Adverse effects on these plants have not been reported from other similar projects.
12	Avoid broadcast spraying within 150 or more feet from sensitive plants due to spray drift and inadequacy of protective barriers to prevent toxicity from soil and water uptake. Don't use herbicides on saturated or wet soils or on plants within 100-150 feet of sensitive plants. There should be no herbicide use on aquatic plants.	No broadcast spraying would occur in alternative C. The pdfs associated with surveying and buffering rare plants are expected to effectively protect them. No evidence of adverse effects on these plants has been reported from other similar projects. Project design feature I8 includes monitoring to ensure that no damage to rare plants is occurring.
12	If the Malheur National Forest has less than one percent of its acreage covered by invasive plants and most sites are along roads, surely invasive plant sites in edible, medicinal and cultural plant gathering areas and in flushes or quantities of these plants could be avoided and protected from herbicide contamination as this area would be a very small subset of the total.	"Edible, medicinal and cultural plant gathering areas" are not mapped on the Malheur National Forest, so it is unknown to what extent there is overlap between these areas and invasive plant treatment sites. The design features for these areas have been changed in the FEIS to make them more implementable and to respond to public concerns about these areas. The new pdfs allow members of the public to identify specific gathering areas to make sure the people know whether these areas might be sprayed and so the areas can be posted prominently. In addition, the colored dye that will be used with the herbicides will act as a warning to people who may be gathering edible or medicinal plants.
12	The botany section appears to involve a lot of rubber stamping rather than adequate detailed analysis on a site-specific level,	Site-specific information included locations of invasive plants and rare plants, discussion about specific risks and benefits of treatment, and comparison of

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	even though this DEIS calls this a site-specific project.	alternatives.
12	We want all sensitive plants fully buffered from any herbicide use. Most of these plant populations are probably mapped but not adequately addressed to determine that there would be no reduction in long-term viability from herbicide use affecting them.	The analysis in the DEIS demonstrated that there is little overlap between rare plants and invasive plants on the Malheur National Forest. Botanical surveys will be conducted to document locations of sensitive plants if suitable habitat is within 100 feet of planned herbicide treatments. Before use of herbicides near known rare plant sites, treatment sites will be assessed to establish adequate buffers.
12	The conclusion [that the project would not result in a trend toward federal listing of any sensitive plant or reduce long-term viability of any plant] is unsubstantiated with no analysis backing it up about how much their populations could be reduced or their range and numbers on the Malheur. There is insufficient information on which to base this optimistic conclusion. Herbicides kill plants are could in fact cause a trend toward listing of sensitive plants. Of course herbicides could lead to a reduction in long-term viability of some the sensitive plants.	The analysis in the DEIS demonstrated that there is little overlap between rare plants and invasive plants on the Malheur National Forest. The project design features were designed to protect rare plants (pdf Group I).
12	Re table 29: Handpull or use other nonchemical cultural control methods that won't uproot, poison, or damage sensitive plants within 100 feet of [invasive plants].	Handpulling would be done if effective under all alternatives. Effectiveness of treatment is an important consideration for the protection of sensitive plants, as discussed in the DEIS in Chapter 3.3.
12	When will sensitive plant surveys be done for areas proposed for invasive species treatment. It is essential prior to implementation.	Surveys would be done prior to implementation. Many of the sites identified in this analysis were visited in the summer of 2013 to better assess the relationships between the locations of the invasive and sensitive plants. This information has been entered into the Forest Service's corporate database (NRM).
12	Will sensitive plant surveys be done prior to implementation in areas that are not considered to have high potential for sensitive plants but which may nonetheless have sensitive plants as yet not documented?	Surveys will be done prior to implementation where there is the potential to harm sensitive plants.
12	Because information about the effects on non-vascular plants is lacking, and because it is not possible to state with 100 percent certainty that all sensitive plants will be detected during surveys, the less herbicide use, the better.	The DEIS considered the tradeoffs between no action and various levels of herbicide use. The project design features are a reasonable response to uncertainty, including monitoring. No losses of sensitive plants have been reported from similar projects across the region.
12	We support restriction of use of herbicides within 100 feet of sensitive plants.	Pdf group I were developed to protect sensitive plants. Pdf I3 states that sensitive plants located within 100 feet of planned ground-based broadcast applications would be covered by protective barrier, or broadcast application would be avoided in these areas (spot or hand herbicide treatment, or non-herbicide methods may be used without covering sensitive plants). Pdf I4 states that when sensitive plants are within 10 feet of saturated or wet soils at the time of herbicide application, only hand methods of herbicide application (wiping, stem injection,) would be used. These measures would protect the viability of sensitive plants.

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12	Because little information is available about how herbicides may affect lichens and bryophytes, and because they occur in wetlands, rock surfaces and in late-successional forest ecosystems, do not use herbicides in these places.	Non-herbicide treatment could be done using categorical exclusions or as an action connected to another project. In the action alternative, would protect vascular and non-vascular plants and other botanical resources.
12	"Immeasurable" effects is an evasion of any quantification and way to seemingly minimize potential negative effects. Pollinators and native plant diversity are far too important to not take a precautionary approach.	Not all risks can be quantified. Professional biologists have used their expertise to make informed judgments about the likelihood of impacts. "Immeasurable" in this context is intended to mean "nearly non-existent. "
12	Canada and bull thistles should not be prioritized for herbicide spraying, they are not high priority for eradication and they attract pollinators. Honeybees will likely use invasive plants such as thistles and be killed or disoriented (indirectly harmed).	Canada and bull thistles are invasive plants and the objective of the project is to eradicate, control, contain or suppress these plants in a cost-effective manner that meets current management direction. The intent is to restore native plant communities in areas infested with invasive plants. Invasive plants threaten native plant diversity. Canada and bull thistle would not be treated while blooming – they would be treated at the rosette stage before any bees would be attracted to them.
06 / 10	We are opposed to using herbicides near botanical species of conservation concern and in or near sensitive or rare plant populations.	The DEIS noted the places where invasive plants are within 100 feet of rare plant populations. Project design features in Group I (page 37-38) protect botanical resources while still allowing for removal of the invasive plants. Monitoring and adaptive management is proposed to ensure that the pdfs adequately protect botanical species of conservation concern (pdfs I6, I7, I8 and I9).
Cultural, Edible, Medicinal Plants		
12	It is very insulting that tribal members can provide input or be notified, but not stop the contamination of cultural revered plants, tainting ancestral gathering areas, and potentially harming those who use the plants! If individual plants of cultural significance will be buffered, why not prohibit herbicide use in the cultural plant gathering areas and other popular plant gathering areas for the rest of the public. This is absurd!	No tribal members have expressed concern about the project. There is no evidence that culturally revered plants will be contaminated, ancestral gathering areas will be tainted, or anyone using cultural plants will be harmed by the project. Cultural plant gathering areas have not been mapped so the overlap between these areas and invasive plants is not known, however cultural plants would be treated similarly to sensitive plants in areas identified by tribal members (pdf M1) Use of blue dye will warn all people where spraying has occurred.
06 / 10 / 12	[In Alternative C], the Forest Service is still planning to use herbicides in key areas of human plant consumption such as where there are edible berries, flushes of medicinal herbs, indigenous people's cultural plant gathering sites, and mushroom gathering areas. We are asking for there to be no herbicide use in these areas. Culturally significant plants and special forest product gathering areas are known by local people and it would be possible to map and protect at least popular, large populations and gathering areas. These should be protected from herbicides. The public has a reasonable expectation that edible and medicinal forest plants and gathering areas will not be poisoned or contaminated by toxic	High [public] use areas, including administrative sites, developed campgrounds, visitor centers, and trailheads would be either posted in advance of herbicide application or closed (pdf K1, page 41). The public would be notified about upcoming herbicide treatments via the local newspaper or individual notification, fliers, and posting signs. Forest Service and other websites may also be used for public notification (pdf K2, page 41). The Forest Service has not mapped culturally significant plants and medicinal/edible plant gathering areas. To respond to concerns about these areas, pdf L2 has been modified in the FEIS to read: "Specific edible/medicinal plant collection areas, along with specific areas of cultural or spiritual value, may be identified by the public. These areas would be specifically posted prior to spraying. Postings would indicate the date of treatments, the herbicide used, and when the areas are expected to be clear of herbicide residue. "In addition, cultural

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	chemicals.	plants in areas identified by American Indian tribal members would be buffered similarly to other botanical species of concern. In addition, blue dye would be used to mark any area sprayed with herbicide (pdf M1). These pdfs would allow people to avoid plant gathering in sprayed areas. The human health analysis found that the threshold of concern for people would not be exceeded even if a person ate contaminated vegetation or fruit, based on relatively extreme exposure scenarios, such as a person consuming a pound of contaminated berries (DEIS page 93).
Pollinators		
12	How do you plan to avoid harming pollinators?	Invasive plants would not likely be treated when pollinators are present, thus they are unlikely to be affected by herbicide use. Page 105 of the DEIS noted, “The North American Pollinator Protection Campaign (2006) determined that invasive plants, left untreated, shift species composition and affect pollinated plants by disrupting the structure and function of ecosystems.” The discussion of colony collapse disorder and pollinators has been moved from section 3.3 to 3.7 in the FEIS.
12	Pollinators may be decimated by herbicide use.	No evidence exists to indicate that pollinators would be decimated by herbicide use from this project, as suggested by the commenter. The timing of treatments, treatment acreage limitations and pdfs that restrict the use of glyphosate and triclopyr, and other pdfs would limit herbicide exposure and minimize any harm to pollinators. Effects of herbicide application on pollinators was discussed in the DEIS on page 105-106, and 112 to 113. The discussion of colony collapse disorder and pollinators has been moved from section 3.3 to 3.7 in the FEIS.
12	As native wild bees do not seem to be affected by colony collapse disorder, it is important to fully protect them as much as possible from herbicides and uncontrolled invasive plants. Exotic honey bees are economically important to protect and have been more exposed to agricultural toxins.	Invasive plants would not likely be treated during the blooming stage when pollinators would be attracted to them, thus they are unlikely to be affected by herbicide use. Implementation of the action alternatives would not have adverse effects on honey bees or contribute to the potential causes of CCD (DEIS p 113). The discussion of colony collapse disorder and pollinators has been moved from section 3.3 to 3.7 in the FEIS.
12	Direct herbicide application to plants [using any rate or method] could easily expose bees who crawl into blossoms.	
12	The optimistic and biased conclusion that the action alternatives would not have adverse effects on bees or colony collapse disorder is not supported by the evidence presented in the DEIS.	The comment is unclear about what evidence in the DEIS does not support our conclusions. The discussion of colony collapse disorder and pollinators has been moved from section 3.3 to 3.7 in the FEIS.
Soil, Water, Sediment		
12	Riparian sedges and shrubs may also provide significant shade, especially in drier forest types [thus it is not true that lack of impact on large woody shrubs would protect shade].	Invasive plants do not provide significant shade and no impact to water temperature would be predicted.
12	Fueling of machines with tanks smaller than 5 gallons should also be restricted to not within 150 feet of surface waters.	This design feature would apply to chain saws and mowers that are commonly used on the Malheur National Forest. Adverse effects to riparian areas would not be likely

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		from refueling small tanks.
12	Why is the amount of sediment produced in alternative so low that there would be no potential for cumulative effects to sediment delivery?	DEIS page 145 discussed WEPP model results indicating the amount of sediment that could be produced from grubbing (which would be the most ground disturbing of the activities proposed). The amount of sediment that could be produced is low and inconsequential considering ongoing sediment inputs from natural processes, roads, and other Forest activities. The alternatives have been modified in the FEIS to cap the amount of manual grubbing that may occur within 100 feet of a stream to less than 50 acres per year.
12	Page 166: [For Upper Middle Fork John Day River, because there would be more treatment concentrated in a localized area, and sediment/turbidity could be of greater magnitude than other areas (low-moderate)] why is there no attempt made in this DEIS to quantify sediment impacts to these streams and analyze the impacts of this to fish?	DEIS page 145 concluded, “There is the potential for increase in sediment delivered to streams because of manual treatment within the [stream] buffers. However, this level of activity is well below current delivery rates and likely not at measurable levels in streams which contain known aquatic resources.” This conclusion was based on WEPP modeling and a manual grubbing scenario. WEPP modeling estimated that grubbing could generate about 2 pounds of sediment per acre. This is a very low amount compared to existing sediment delivery from natural processes and human activities. A 50-acre cap on the amount of grubbing that would be approved within 100 feet of streams has been added to all alternatives. This would prevent potential adverse effects from sediment generated from this project.
12	pdf H7 sounds incredibly inadequate to protect lake and pond quality and ecosystems. We are concerned by uncertainty re: herbicide risks to reptiles and amphibians. Pdf H8 is inadequate to protect wetlands. We are strongly opposed to any herbicide use in wetlands and lake, pond, river, and stream buffers. There is no guarantee that leaving some untreated areas will protect organisms	The need to protect reptiles and amphibians from treatment was recognized and a number of project design features are in place to reduce risks. As described on page 228 of the DEIS, project design features F2, H1, H2, H5, H9, and H10 reduce the likelihood that for herbicides to be delivered to waterways in concentrations of concern. Herbicide restrictions on certain soil types (H3 and H6) reduce potential for runoff and leaching, and restrictions on extent of treatment on a given site (H4, H5, H7 and H8) ensure that herbicides would not be delivered in amounts greater than the SERA risk assessment and that unsprayed areas will be retained to provide refugia. Collectively these pdfs in combination with use of low risk first-year, first-choice herbicides reduce the likelihood that adverse effects from herbicide exposure would occur to reptiles or amphibians. The GLEAMS model was run on four sites within the project area that had the greatest potential for herbicide delivery to water near fish habitat. Results indicate that herbicide concentrations in the water would be very low and less than levels of concern for fish, amphibians and aquatic invertebrates (chapter 3.5.3).
12	There is ongoing heavy extensive logging on the Malheur, creating even more areas of disturbed soils (there are a lot already), so runoff is a big concern. Therefore there should be at least 100 foot buffers protecting streams and other surface waters from herbicides as in alternative C.	The GLEAMS modeling displayed on pages 140 and 144 of the DEIS considered site-specific conditions, including disturbed soils. This modeling was redone to increase the number of weather years included to better characterize the effects of a large storm after treatment, and to better characterize the differences between alternatives. The results of the modeling indicate that 100 foot buffers would reduce the potential for herbicide to reach the stream. Alternative C may require more extensive manual treatment in already disturbed areas, however a limitation on non-

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		herbicide treatments within 100 feet of streams would minimize the potential for sediment delivery. Project design feature H5 limits runoff in all alternatives by applying herbicide during the dry season with the lowest soil moisture conditions, where greater than 50 percent groundcover exists (greater than 70 percent groundcover on steep slope sites), and/or at reduced rates. This pdf is intended to reduce potential offsite runoff transport of herbicides. Additional project design features, herbicide use buffers in all alternatives, and project caps would reduce the potential for herbicide to reach streams.
12	How were the buffers determined for wells? Was surface run-off, erosion, leaching, and heavy rain on snow events taken into consideration?	There is currently no state restriction in effect for the use of herbicides within a specified distance of public water wells. The distance of 200 feet is precautionary considering the potential for herbicides to enter ground water.
12	Avoid planning any control measures that could introduce herbicides into surface water tables.	The analysis in the DEIS discussed the potential for herbicide to enter water. The project design features and herbicide-use buffers were developed to minimize herbicide concentrations in surface waters. Site-specific model runs and past monitoring studies indicate that alternative C would keep herbicide from reaching surface waters. Table 39 has been updated in the FEIS to remove picloram from the list of herbicides since it would be prohibited in this alternative.
12	RE: DEIS page 76: What studies demonstrate that herbicide use similar to the type proposed in this project will not result in harmful concentrations of herbicides in water?	This statement on page 76 referred to the National Water Quality Assessment Program and Clackamas River studies discussed further in this section of the DEIS. Additional information on water quality monitoring was discussed on page 143 (Berg 2004 and Bakke 2001). The risk assessments also refer to multiple studies to determine the level of herbicide in water that could cause harm to people and the environment, and the potential amount estimated to be delivered to streams.
12	[Re: statement on page 144 that pdfs largely preclude cumulative effects from multiple treatments at a single site]: Define “largely” in quantitative terms and with regard to aquatic impact consequences.	“Largely precluded” means that the likelihood of cumulative effects is very low and not measurable.
12	[Re: statement on page 144 that adverse effects would be minimal]: Define “minimal” in quantitative terms, what are the effects to water quality and aquatic life of such minimal adverse effects?	“Minimal” means that likelihood of impacts is very low and has been mitigated to the extent practical via pdfs and herbicide-use buffers. In alternatives that allow some herbicide use within 100 feet of streams, no more than 10 acres within 100 feet of any water body in a 6th field watershed would be treated with herbicide in a single year.
12	The cumulative effects brief discussion does not consider the contribution of logging, livestock, and road building to increasing invasive plant sites over time.	This was discussed in the introduction to cumulative effects on (DEIS Chapter 3.1.5). The project caps, pdfs, and herbicide-use buffers ensure that no additional impacts to water quality would be expected even if invasive plants spread over time. Prevention measures would slow the spread of invasive plants associated with forest activities.
12	303d listed streams for temperature and those suspected of having water temperatures above standards should not be put at risk of losing existing shade.	Invasive plants rarely reach a height that would provide shade to streams and taller native vegetation that provides shade would not be treated. In addition, the amount of riparian area that would be treated is a fraction of total riparian vegetation. Thus,

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		existing shade is not likely to be adversely affected and the project would not contribute to increasing water temperatures. The project would have a beneficial impact to the extent that invasive plants are competing with shade-producing vegetation.
12	How is it determined that [water quality would be maintained]? Alternatives B and D would definitely introduce toxic chemicals into surface waters through application of herbicides to the waters' edge, surface run-off transporting herbicides within 100 feet of surface water to the water, and broadcast spray and drift in riparian areas. This would violate standards. Just saying [it would comply with standards] does not make it true or substantiate these claims.	This comment was made to the introductory paragraph of the water quality section of the DEIS. The chapter discussed the potential for herbicide and sediment delivery in supporting the conclusion that beneficial uses of water would be maintained.
12	Would 303d listed streams have broadcast spraying within 100 feet of the stream or up to the water's edge with alternatives B and D? Is there herbicide spraying with 100 feet of any category 5A streams proposed? Is there herbicide use proposed within 100 feet of any streams or rivers [that have insufficient information for the 303d list]? If so, this would be another legal violation, as this would…result in…toxic chemicals entering the stream and degrading water quality.	None of the predicted peak concentrations in water would exceed drinking water standards as defined by the State of Oregon (State of Oregon 2004) (DEIS page 142). Peak water concentrations predicted are far below the levels of concern for fish by several orders of magnitude. Riparian application [of herbicides] is not of the extent to affect riparian vegetation that shades water and maintains water temperatures (ibid). None of the streams on the Malheur National Forest have been 303d listed for chemical contamination.
12	Don't use herbicides in municipal watersheds.	Approximately 0.1 infested acres are mapped in the Long Creek Municipal Watershed Management Area. As noted on page 9, "The low level of current infestation likely will not require any use of herbicides." All drinking water sources would be appropriately buffered from herbicide use.
12	We are strongly opposed to the use of herbicides within 100 feet of streams and other water bodies. In some cases 150-300 feet from waterways and water bodies may be needed. Use PACFISH/INFISH Buffers.	As noted on DEIS page 42, "herbicide-use buffers …were developed based on label advisories, SERA risk assessments, and various studies of drift and runoff to streams such as Berg 2004." Alternative C would prohibit herbicide use within 100 feet of streams. No more than 10 acres within 100 feet of any water body in a 6th field watershed would be treated with herbicide in a single year in alternatives B and D. No evidence exists that larger buffers are necessary to keep herbicide out of water bodies. PACFISH/INFISH buffers are larger than necessary to keep herbicide out of water bodies.
12	We are concerned also by proposed herbicide use for dry stream channels since subsequent precipitation events or soil movement (e.g. landslides or bank trampling) could move herbicide contamination into contact with surface water and vulnerable aquatic plants, insects, amphibians, and fish. Applying herbicide to run-off ditches should also be avoided due to surface run-off hydrological connections to streams or saturated wetlands.	Herbicide-use buffers are included for dry streams to limit use/application method for herbicides with moderate-high risk to fisheries. (DEIS table 11). These apply to roadsides approaching stream crossings. In addition the herbicide use buffer table (see alternative B description) was updated to include buffers on hydrologically connected ditches when surface water is present in the ditch.

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12	[The result of the Berg review of BMPs] provides good reason not to broadcast spray in riparian areas, as with alternative C, and not allow herbicide spraying in road ditches hydrologically connected to streams.	The herbicide-use buffers in alternatives B and D limit most broadcast spraying within 100 feet of streams. Aquatic labeled herbicides and herbicides that pose lower risk to fish may be broadcast as close as 50 feet from streams. Aminopyralid poses very low risk to aquatic resources, thus broadcast spraying is allowed to the water's edge. Treatments along roadsides would comply with these buffers. The alternatives have been modified to add hydrologically connected ditches to the list of places where herbicide-use buffers would apply when surface water is present in the ditch (see herbicide use buffers for alternative B).
12	How will the Forest Service act to prevent herbicides being transported by road runoff and hydrological connected ditches into streams? Why is this not addressed in the DEIS and given site-specific consideration?	DEIS page 137 noted, "Roadside treatments pose the greatest risk to water contamination from herbicide spraying because roadsides are more compacted and promote more runoff and roadside ditches may have direct connection to a stream channel. In these circumstances ditches may effectively circumvent streamside buffers." Page 139 noted, "road segments that cross streams or penetrate into stream buffers provide routes for contaminants to reach streams, whether from rutted running surface, roadside ditches or runoff projected onto natural slopes an inadequate distance from the channel for proper buffering... Results from modeling are shown in table 38 and include a treatment along roads. These results agree well with monitoring results from applications on roads in Oregon's Willamette Valley by the Oregon Department of Transportation (Berg 2004)." Page 160 noted, "The most likely routes for herbicide delivery to water are potential runoff from a large rain storm soon after application, especially from treated roadside ditches. The FEIS clarifies that herbicide-use buffers apply to hydrologically connected ditches that carry surface water at the time of spraying (see herbicide use buffers for alternative B).
12	Does modeling that indicates the amount of herbicides that could reach streams is below a level of concern [relative to fisheries impact in issue comparison table] account for herbicides traveling through soils, and surface runoff or along hydrologically- connected roads?	Yes, the site-specific modeling and risk assessment findings consider soil conditions, leaching and run off. Hydrologically connected roadside ditches would be buffered to mitigate potential herbicide delivery to streams.
12	Herbicide should not be used in road ditches or on road segments that cross streams or penetrate into stream buffers. This does not seem to be included in pdfs and should be.	DEIS page 137 noted, "Roadside treatments pose the greatest risk to water contamination from herbicide spraying because roadsides are more compacted and promote more runoff and roadside ditches may have direct connection to a stream channel. In these circumstances ditches may effectively circumvent streamside buffers." Page 139 noted, "road segments that cross streams or penetrate into stream buffers provide routes for contaminants to reach streams, whether from rutted running surface, roadside ditches or runoff projected onto natural slopes an inadequate distance from the channel for proper buffering... Results from modeling are shown in table 38 and include a treatment along roads. These results agree well with monitoring results from applications on roads in Oregon's Willamette Valley by the Oregon Department of Transportation (Berg 2004)." Page 160 noted, "The most likely routes for herbicide delivery to water are potential runoff from a large rain storm soon after application, especially from treated roadside ditches The FEIS clarifies that

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		herbicide-use buffers apply to hydrologically connected ditches that carry surface water at the time of spraying.
12	There is a trend in this DEIS of identifying vectors and vulnerable times when herbicides are more likely to be transported then not follow through in analysis with prevention measure ideas and pdfs…We support pdfs [that safeguard against spraying under conditions of active infiltration or obvious saturated conditions]. But what about very persistent herbicides applied prior to snow remaining to be transported through snowmelt runoff, e.g. picloram, imazapyr?	The herbicide-use buffers, along with pdfs, manage the persistence, mobility and toxicity of herbicide ingredients. The analysis in DEIS Chapter 3 indicated that levels of herbicide that may reach streams would be below a threshold of concern for fish and drinking water.
06 / 10	We are strongly opposed to the use of herbicides within 100 feet (or within 300 feet for major creeks and rivers) of streams and areas with high water tables such as bogs, springs, fens, wet meadows, and marshes, and in roadside ditches that funnel water to these areas.	Alternative C would virtually eliminate the potential for herbicides to reach streams and other water bodies. There is no evidence that a large buffer would be needed to protect water quality or aquatic organisms. The FEIS included GLEAMS modeling showing a treatment scenario of 10 acres with maximum application rates for all herbicides and compared this to a scenario where the same treatment occurred with a 100 foot buffer. This shows that the 100 foot buffer effectively reduces the potential for herbicides to enter a stream. The results of even the unbuffered scenario showed that impacts on the aquatic environment would be limited to possible effects on aquatic plants from use of sulfonylurea herbicides. However, this modeled example did not consider the herbicide use buffers, nor did it consider broadcast and other rate restrictions associated with the alternatives. In addition, the modeled example includes 10 contiguous riparian acres treated with herbicide and currently none of the streamside infestations are that large. The alternatives have also been modified to include herbicide-use buffers for hydrologically connected roadside ditches when surface water is present.
12	We are opposed to creating sediment/turbidity impacts that would be likely to adversely affect federally listed fish and their designated critical habitat. How is it assumed that these impacts would not cause a trend toward federal listing or a loss of viability for MIS and aquatic sensitive species?	The triggers for findings under the Endangered Species Act are very conservative. The amount of sediment that would be produced is expected to be very low. However, we are engaging in formal consultation with the regulatory agencies because sediment effects cannot be completely discounted. Compared to natural background levels, sediment produced from invasive plant treatments would not be measurable and recovery would be rapid. Herbicide treatments in combination with manual treatments would reduce the sediment production compared to manual treatments alone. The greatest amount of sediment would come from digging up invasive plants near streams. DEIS page 145 quantified the amount of sediment that could be produced from the most ground disturbing activity proposed in the project (grubbing). The action alternatives have been modified to include a limitation on non-herbicide treatments within 6th field watersheds (with the exception of biological controls). The FEIS has been modified to include a treatment cap all non-herbicide treatment methods except biological agents. The FEIS states that no more than 50 acres within 100 feet of any water body in a 6th field watershed would be treated in a single year.

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12	Pdfs should mitigate potential for sediment impacts under EDRR.	Passive and active restoration is included in all alternatives to ensure that desirable vegetation reoccupies treated sites (pages 44-45 in the DEIS). The action alternatives have been modified to include a limitation on non-herbicide treatments within 6th field watersheds (with the exception of biological controls). The FEIS states that no more than 50 acres within 100 feet of any water body in a 6th field watershed would be treated in a single year.
12	[Increased sediment due to reliance on non-herbicide methods near streams in alternative C] could be mitigated so that little or no sediment enters water.	Herbicide treatments in combination with manual treatments would reduce the sediment production compared to manual treatments alone. The action alternatives have been modified to include a limitation on non-herbicide treatments within 6th field watersheds (with the exception of biological controls. The FEIS has been modified to include a treatment cap on all non-herbicide treatment methods except biological agents. The FEIS states that no more than 50 acres within 100 feet of any water body in a 6th field watershed would be treated in a single year. This applies to all action alternatives.
12	[In table 47], "low quantity" of project-related sediment needs to be quantified and analyzed re: potential impacts to fish and other aquatic life.	DEIS page 145 quantified the amount of sediment that could be produced from the most ground disturbing activity proposed in the project (grubbing). The action alternatives have been modified to include a limitation on non-herbicide treatments within 6th field watersheds (with the exception of biological controls). No more than 50 acres within 100 feet of any water body in a 6th field watershed would be treated in a single year. In alternatives B and D no more than 10 of these acres would consist of herbicide use. Project acreage caps would therefore limit maximum annual sediment production to approximately 80 to 100 pounds per year within any 6th field watershed. However, this limitation is based on an area that currently has a comparatively high concentration of invasive plants near streams. The amount of sediment that would likely be generated in any 6th field watershed in any given year is likely much lower than this maximum and would not be detectable compared to background levels.
12	Herbicide impacts to soils should be an issue.	Page 14 of the DEIS discussed why impacts to soils were not considered a significant issue. "Impacts to soils have been resolved through adherence to the R6 2005 Record of Decision standards and additional project design features. None of the alternatives pose significant threats to soils given the nature of the types of treatments proposed. The approach to soils in this document is to analyze how herbicides are filtered through various soil types and their eventual environmental fate, with the main issue ultimately being potential effects on fish [which is a significant issue]. Impacts on soils are discussed in Chapter 3.4 and otherwise addressed throughout the DEIS.
12	We are very concerned about herbicide persistence in soils of: aminopyralid, imazapyr, picloram, chlorsulfuron, imazapic, glyphosate and sulfometuron methyl. Use of imazapyr and picloram should be stopped. We are very concerned about herbicide persistence in water of: aminopyralid, chlorsulfuron,	The pdfs and herbicide-use buffers in the action alternatives minimize adverse impacts of herbicide use. Toxicity, mobility and persistence were all considered in the analysis and development of the project design. Formulations of glyphosate containing POEA surfactants would not be used.

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	clopyralid, sethoxydim and glyphosate. The use of chlorsulfuron, the round up version of glyphosate, clopyralid and sethoxydim should be discontinued for many reasons, including persistence in water. The same herbicides keep coming up as posing the most problems through toxicity and persistence. These herbicides should not be used: triclopyr, imazapyr and picloram, and to a lesser extent, glyphosate, which has conflating factors.	
12	In reference to impacts on soils having been resolved by adherence to standards/pdfs: This is all very optimistic but seems unlikely…impacts to soils also includes native plants taking up herbicides through their root system, killing or contaminating the plants, with secondary indirect impacts to insects, amphibians, and other wildlife species and humans.	Direct impact on soil productivity is not a significant issue and effects on soil productivity do not vary between alternatives. Effects on non-target plants from uptake through the soil are considered, as is the potential for herbicides to move offsite through the soils. Impacts to soils may result in impacts to other resources such as native plants, which is discussed in the botany section of the DEIS (Chapter 3.3).
12	This [the conditions covered by pdf H3, including bare, compact soils, and poor productivity soils that are highly disturbed] covers most soil conditions on the Malheur, so don't use picloram or metsulfuron methyl. Persistence is another good reason not to use these herbicides.	The R6 2005 Record of Decision standards require that the use of these herbicides be done in a manner that minimizes adverse effects. This is why pdfs are associated with the project that go beyond the label. Soil conditions would be considered in the implementation planning process. We do not agree that these conditions would preclude all use of these herbicides according to this pdf. Picloram would not be used in alternative C.
12	There are a lot of clay soils on the Malheur, drop proposed use of picloram, imazapyr, and sulfonylurea herbicides because runoff on clay soils could damage non-target plants downslope.	The pdfs were developed to reduce the potential for adverse effects from off-site movement of herbicides in clay soils.
12	Residual soil activity is a reason to limit use of certain herbicides, including aminopyralid and not use picloram, imazapyr, and imazapic. It is not clear that pdfs would eliminate the potential for herbicide persistence in the soils to have long-term effects on native plant communities.	Herbicide persistence in the soils was addressed in the DEIS and the pdfs would limit herbicide build up that could have long-term effects on native plant communities. Over the long term, herbicide treatment would help reduce invasive plants that threaten native plant communities.
12	Drop the use of picloram because risk assessments found typical rates could inhibit soil microbial activity.	Picloram is not a first-choice herbicide in the preferred alternative B. It would only be used if first-year, first-choice herbicides were found to be ineffective. Picloram is effective on knapweeds, yellow star thistle and leafy spurge and would be used for these species if aminopyralid was not available (as in alternative D) or if it was found to be ineffective. If alternative D were selected, picloram would be the first-year, first-choice for about 63 acres. The amount of land that would be affected is small and the impact on soils would not lead to long-term adverse effects., Picloram would not be used at all in alternative C, which would reduce the potential effectiveness of this alternative. Several pdfs (H group) are proposed to reduce the potential impact of picloram on soil organisms.
12	There could be triclopyr induced changes to fungal growth at predicted soil concentrations for the Malheur (0.5 ppm	DEIS pages 126-127 discussed the potential for triclopyr to affect fungal strains in a lab setting. However, this was not found in the field. Based on best available scientific

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	predicted) only 0.1 ppm needed or changes in some fungal strains.	information, spot spraying of triclopyr at typical rates "has very low potential for slowing fungal growth."
12	The conclusion that there is little potential for this project to adversely affect soils or contribute to meaningful cumulative effects is not well substantiated as long as picloram, triclopyr, chlorsulfuron, metsulfuron methyl, sulfometuron methyl, and imazapyr are proposed for use-especially with repeat applications!	The soils analysis considered the impacts of each of the herbicides proposed for use. The more effective the initial treatment, the less herbicide would need to be used for repeat applications (DEIS Chapter 3.1.4). All of these herbicides are effective on target species found on the Malheur National Forest.
12	The conclusions on page 129 do not acknowledge long half-lives of picloram and aminopyralid and repeated applications and long persistence in poor soils…picloram has a half-life up to 3 years, not just 90 days.	The FEIS has been edited for consistency. Half-lives of individual herbicides vary widely depending on soil and weather conditions.
12	Re: metsulfuron methyl: how long does the impact have to last to seriously degrade or destroy soil fertility and native plant growth? A 100 day half-life could be long enough to do this.	As discussed in the DEIS on page 127, "For metsulfuron methyl, findings from one study showed slight growth reduction of common soil bacterium above 5 ppm soil concentrations (SERA 2004c). Modeled metsulfuron soil concentrations are 0.06 ppm." Page 129 noted, "the project limits use of metsulfuron methyl to once a year to minimize soil buildup (pdf H4). Since soil conditions determine the buildup potential – a lack of soil microbes equates to lack of decomposition – the use of metsulfuron methyl … would be avoided on sites with poor soil conditions (pdf H3) where restoration to native vegetation is desired." Thus, the use of metsulfuron methyl would not degrade or destroy soil fertility or native plant growth.
12	The soils cumulative effects analysis is inadequate. Why wouldn't activities under this project be likely to add to the impacts of other activities creating bare soils, such as logging and grazing.	The amount of soil disturbance from removal of invasive plants by all methods is likely to be small and would not measurably add to other activities that disturb soils (see Soils Cumulative Effects). The invasive plant treatments on areas of the productive land base would comply with LRMP minimum groundcover requirements to avoid erosion (USDA 1990, p. IV-40). Adequate groundcover not only stabilizes the site but promotes the microbial activity that decomposes residual herbicide residue.
12	The statement that soil organisms would not be harmed is not consistent with previous analysis.	Page 126 of the DEIS explained that most of the 10 herbicides approved in the R6 2005 Record of Decision were not found to pose deleterious effects to soils. Picloram and sulfometuron methyl had potential to affect soil microbes in laboratory tests but not in field studies. These risks were reduced in the project by limiting frequency and rate of application of these herbicides. The project proposes use of sulfometuron methyl at rates half that analyzed in the SERA risk assessment. Picloram use in alternatives B and D has specific design criteria to avoid use on inherently poor soils and limit repeat application (pdfs H3 and H4).
12	Changes to plant cover by roads should be considered adverse effects as bare ground will encourage invasive plants to re-establish.	Passive and active restoration would occur on roadsides to help establish desirable vegetation and discourage re-establishment of invasive plants (see DEIS Chapter 2). Roadsides are managed as administrative areas and not for productive purposes. Road management stabilizes road bases using plant cover during reconstruction or

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		construction (Road 3, USDA 2012). The plant cover provides some level of resistance to weed invasion. Road management limits the disturbance that can further open up bare surfaces for weeds to establish by blading and cleaning ditches only when necessary to insure adequate drainage for storm flow (Road 4, USDA 2012). However, roadsides may always be prone to weed invasion due to the unnatural gravel surface that favors colonization by opportunistic plant species.
12	The paragraphs under figure 8 seem contradictory.	This section of the EIS has been edited for clarity.
12	Dust as a means of offsite transport is another reason not to use sulfonylurea herbicides (chlorsulfuron, sulfometuron methyl and metsulfuron methyl). This is of concern because the invasive plant sites are along roads and susceptible to offsite transport by dust. The pdf that these herbicides be applied during moist conditions will lead to offsite transport by water.	Off-site transport by water would not necessarily occur during “moist” conditions. A pdf (H11) limits herbicide use when rainfall is predicted. Herbicide-use buffers apply to hydrologically connected roadside ditches when water is present.
12	Effects on soil microbes provide more reasons not to use picloram or sulfometuron methyl. A lot of the Malheur has poor soils.	As explained in the DEIS, these risks were reduced by limiting frequency and rate of application. The project proposes use of sulfometuron methyl at rates half that analyzed in the SERA risk assessment. Picloram use in alternatives B and D has specific design criteria to avoid use on inherently poor soils and limit repeat application (pdf H3 and H4).
12	Drop use of imazapyr also. Soil fertility is important and imazapyr poses other concerns also.	Imazapyr would not pose risks to soil fertility. Page 126 noted that soil impacts would be short-term and associated with high use rates, which are not proposed in this project. Project design feature F2 limits the rate of imazapyr to 0.7 pounds per acre. Imazapyr is not a first-year, first-choice herbicide in any alternative.
Fish and Aquatic Organisms		
12	This is disturbing that there is no info on toxicity to aquatic organisms for imazapic. Therefore it should not be used near streams, lakes, ponds, and rivers.	Information about impact to aquatic organisms is available and included in the FEIS. Based upon risk assessment information and R6 2005 FEIS, imazapic poses low risk to the aquatic environment (table 18). Herbicide-use buffers in alternatives B and D would not allow broadcast spraying with imazapic to within 100 feet of wet streams or 50 feet of dry streams. The buffers would not allow spot or selective use of imazapic within 15 feet of wet or dry streams.
12	Why are the project BA and Biological Evaluation for listed and sensitive aquatic species not included in the DEIS?	The BA is based on the preferred alternative, which had not been designated prior to receiving public comment. The Biological Evaluation was summarized in the DEIS.
12	There is no guarantee that adverse herbicide impacts to biodiverse aquatic environments would not outweigh benefits. An accidental spill near a creek or the extirpation of a rare plant or amphibian would be disastrous.	The DEIS discussed the risks and benefits of invasive plant treatments. The nature of the project, pdfs, and herbicide-use buffers minimize the potential for adverse effects, which is why we believe herbicide impacts would not outweigh benefits. Accidental spills of a type that would extirpate an amphibian or rare plant have not occurred for any Forest Service invasive plant project. A damaging spill would be prevented by the herbicide transportation and handling plan and other pdfs.
12	There is no analysis really supporting the conclusion that	The finding that herbicide impacts would be short-term is based on the type and

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	herbicide adverse impacts would only be short term for aquatic environments, as herbicides can kill invertebrates (fish prey), pollinators, native and rare plants, and amphibians.	extent of herbicide use and the pdfs and herbicide-use buffers associated with the project. While herbicides can affect elements of the aquatic environment, this depends on how much herbicide exposure occurs. Toxicity tables showing adverse effects levels for invertebrates, algae and aquatic plants are added to the FEIS. The amount of herbicide exposure has been minimized to the point where impacts are expected to be minor, with rapid recovery. The magnitude of any potential impacts is expected to be very low given the project design, caps, and buffers. Lethal effects on aquatic organisms are not expected, and potential sub-lethal effects are expected to be infrequent or non-existent.
12	We are particularly concerned by low dose levels causing acute effects and fish death for use of picloram, glyphosate, sethoxydim and triclopyr (see table 43).	The amount of herbicide that would reach streams (based on risk assessment and site-specific modeling) does not indicate that the concentrations in streams would kill any fish. The herbicide-use buffers restrict application methods near streams for these herbicides (except aquatic glyphosate, which is less toxic to fish than the terrestrial formulations). The pdfs provide additional layers of caution to minimize risk of herbicides reaching streams in concentrations beyond the threshold of concern for fish.
12	Isn’t it dangerous to assume that toxicity testing for fish would be adequately protective for little or no testing on amphibians or invertebrates?	Data gaps were discussed in the DEIS and the R6 2005 FEIS. The R6 2005 FEIS noted, “Toxicity data and exposure scenarios for fish provide a reasonable surrogate for effects on amphibians because several studies have found that amphibians are less sensitive, or about as sensitive, as fish to some herbicides (Berrill et al. 1994; Berrill et al. 1997; Perkins et al. 2000).” Comparison of toxicity values for fish and amphibians for the herbicides analyzed indicate similar sensitivities (see Forest Service/SERA risk assessments). The R6 2005 FEIS also noted, “Limitations notwithstanding, a substantial amount of scientific data on the toxicity of these herbicides to birds and mammals, and some amphibians and invertebrates exist. The data are generated by manufacturers to meet EPA regulations before an herbicide may be registered for use, and by independent researchers that have published findings in peer-reviewed literature. This data is then analyzed according to standard risk assessment methodology to reach a characterization of risk for each herbicide.” Site-specific modeling was conducted on four sites within the project area that had the greatest potential for herbicide delivery to water near fish habitat. Results indicate that herbicide concentrations in the water are at least 3 orders of magnitude less than levels of concern for fish, amphibians and aquatic invertebrates (page 157 and table 38, chapter 3.5.3).
12	Our primary concerns to fish from herbicide use include runoff after a storm, and accidental spills as discussed on page 160.	Effects to fish and the aquatic environment were addressed in the DEIS. The risk assessment and site-specific GLEAMS model results estimate effects from run off. The effect of an accidental spill would be minimized by pdfs that do not allow large amounts of herbicide to be transported and for herbicide mixing to be done away from streams (pdf Group G). The herbicide-use buffers, pdfs and project caps together minimize the potential for adverse impacts to the aquatic environment or fish.

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12	We are concerned by implicit potential for water bodies to have detectable effects from herbicide use [as shown in table 45]. We are concerned by proposed use of herbicides near these creeks and rivers, especially as most of them have multiple federally and state listed fish. Sublethal effects, decimation of fish prey, synergistic effects with other stressors, and decimating accidental chemical spills are still possible with proposed herbicide use-especially with proposed repeated herbicide use on the same ground. We are also concerned by adding any potential toxicity impacts to already greatly diminished remaining fish runs. Any project impacts could have cumulative effects with [several other stressors on fish], why is this not discussed?	DEIS page 169-170 addressed cumulative effects on fish. The DEIS noted that several other stressors on fish exist, including hydropower development, habitat degradation from human activities, direct harvest of fish, and competition from hatchery fish (USDA Forest Service 2008b). These are part of the existing condition for aquatic organisms and this project will not worsen these conditions. At any given site, direct or indirect adverse effects to aquatic organisms under all alternatives would be low magnitude, localized, and short-term. These short-term, low-magnitude effects are not of a type or extent that would combine with ongoing human activities or foreseeable projects on the Malheur National Forest and produce long-term, cumulative impacts, even considering the vectors of invasive plant spread described in chapter 3.1.5 The threshold of concern for wildlife and fish is set particularly low (a no effect or no adverse effect level, or a fraction of the lethal dose). This accounts for uncertainties about how herbicides affect wildlife and fish given cumulative stressors. The amount of herbicide that might reach streams over the life of the project is very low. There is no evidence that this project would contribute to chronic effects to fish from herbicide use.
12	We are concerned by the potential cumulative contamination of waters with toxic chemicals through repeated herbicide use and by synergistic or combined chronic effects to fish already stressed by high water temperatures, and high sediment loadings and lack of adequate prey species and refugia from effects of grazing, logging, roading, mining, other human impacts to local rivers, streams, and creeks. Also takes by dams and fishing.	
12	More reasons for our concerns re: less predictable herbicide loss of native plants near streams (especially as herbicide can travel through water and soils) and sedimentation effects [as described on pages 164-166]. What steps would be taken to reduce sediment contribution to these areas?	The integrated treatments proposed are not likely to lead to substantial losses of non-target vegetation. On projects across the region, minimal losses of non-target vegetation have been reported (Desser 2014). Sediment would be low for all treatment methods. Integrated treatment methods that include herbicides are less likely to disturb ground than manual or mechanical treatments alone. The action alternatives have been modified to include a limitation on non-herbicide treatments within 6th field watersheds (with the exception of biological controls). No more than 50 acres within 100 feet of any water body in a 6th field watershed would be treated in a single year, and in alternatives B and D of these, no more than 10 acres would consist of herbicide use.
12	We want access [to more site-specific information that will be developed at the 6th field watershed scale] through the ongoing ESA Section 7 consultation process.	The Biological Assessment will be part of the public record and available on request before the FEIS is published. The Biological Opinion from the National Marine Fisheries Service and Fish and Wildlife Service will be available before the Record of Decision is published.
12	Do peak concentrations in water exceed the toxicity thresholds for fish, aquatic invertebrates or amphibians?	Toxicity indices for aquatic invertebrates, macrophytes, and aquatic plants have been added to the FEIS with discussion about how herbicides may influence these components of the aquatic environment. Fish are used as a surrogate for amphibians as discussed in the DEIS on page 200: “Data suggest that amphibians may be as sensitive to herbicides as fish (Berrill et al. 1994; Berrill et al. 1997; Perkins et al.

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		2000).” Model results indicate that toxicity thresholds would not be exceeded (or closely approached) for fishes, amphibians, and aquatic macroinvertebrates.
12	Aquatic species of concern need macro-invertebrate prey that could be killed by herbicide use near surface waters.	The analysis in the DEIS considered the impacts of treatments on the aquatic environment. Effects on aquatic macro-invertebrates were considered in the analysis. The aquatic risk rankings in table 18 considered these effects. The pdfs and herbicide-use buffers minimize adverse impacts. Model results indicate that toxicity thresholds would not be exceeded (or closely approached) for fishes, amphibians, or aquatic macroinvertebrates.
12	Not acceptable for badly threatened fisheries to be further destroyed by toxic herbicide use.	Effects on fisheries were discussed in Chapter 3.5. There is no evidence that the herbicide use proposed would destroy fisheries. The analysis concluded that any impacts to fishes would be short-term and of low-magnitude (e.g., sub-lethal).
12	How would herbicide use within RHCAs and riparian zones meet PACFISH and INFISH RMO’s? Obviously herbicide use in riparian areas would remove native plant cover, likely reduce native plant diversity, and could remove native plants contributing shading or stream bank stability, as well as contaminate water used by fish or indirectly contaminate water or increase water temperature downstream.	DEIS page 158 noted that the PACFISH –INFISH habitat indicators are pool frequency, water temperature, amount of large woody debris, lower bank angle of the creek, and width to depth ratio. Treatment of invasive plants on the Malheur National Forest is not likely to measurably affect any of these indicators. These indicators were further discussed on pages 158-162. The project is intended to restore native plant communities; invasive plants are more likely to threaten native plant diversity than treatments. DEIS page 105 noted: “invasive plants have the ability to deplete available resources to lower levels than native vegetation can tolerate, they can quickly dominate disturbed sites and displace native vegetation. When invasive plants dominate native plant communities, native plant species diversity is decreased.” DEIS page 160 noted: the small percentage near-stream areas needing treatment would not be capable of changing solar radiation to a degree that would measurably affect stream temperature. Effects from chemical contamination are expected to be negligible in all project watersheds (ibid).
Wildlife		
04	Birds appear to be more sensitive to aminopyralid than mammals. The FS should take this into consideration. Birds might be more exposed to this chemical in a wildland/forest setting than in a farm setting.	The potential effect of herbicide exposure on birds was considered and is summarized on pages 203-207 of the DEIS. Table 58 displayed the herbicide toxicity indices used to determine the threshold of concern (amounts below this rate would not be expected to result in adverse effects, including non-lethal effects) whereas table 60 displayed the herbicide exposure scenarios for wildlife considered in the risk assessments developed specifically for the Forest Service. The exposure scenarios included consumption of contaminated vegetation, insects, fish, and other prey. Based on the best available information, none of these scenarios would result in birds being exposed to aminopyralid at levels over the threshold of concern. The likelihood of exposure on forest habitats was also considered. Aminopyralid is one of the herbicides that would “not pose a risk” to birds or mammals. As shown in table 61, one percent or less of wildlife habitats would be treated and infested sites are small and scattered. As a result, large areas of unaffected nesting and foraging habitat would be available, reducing the likelihood of herbicide exposure. Alternative

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		D would not include the use of aminopyralid. Page 211 notes that alternative D could increase treatment risks compared to alternative B, and it could be less effective in reducing invasive plants and promoting the long-term maintenance of wildlife habitat. Information presented in the DEIS utilizes the best information available (SERA 2007) related to the toxicity of aminopyralid to birds and wildlife. As described, aminopyralid has a favorable human health toxicity profile when compared to the registered alternatives for these use sites and will be applied at a lower rate. Its residual action should alleviate the need for repeat applications, resulting in a reduction in the amount of herbicides applied to the environment for the control of these weeds. Aminopyralid has been determined to be practically non-toxic to non-target animals at the registered application rates, compared to the alternatives, and is less likely to affect both terrestrial and aquatic plants. The EPA commented that aminopyralid would potentially reduce overall herbicide footprint on the Malheur National Forest. Finally, EPA cited the SERA 2007 risk assessment that "aminopyralid has been determined to be practically non-toxic to non-target animals at the registered application rates."
06 / 10	The Forest Service needs to plan specific protection measures for species most vulnerable to herbicides, including pollinators, Neotropical songbirds, amphibians, fish, invertebrates, native ungulates (elk, deer, and pronghorn), scavengers, raptors, and small mammals.	The DEIS incorporated the R6 2005 FEIS and SERA risk assessments, using best available scientific information about potential effects of herbicides on wildlife. Project design features (DEIS table 9) provide specific protection measures for wildlife species of conservation concern and restrict herbicide use to reduce effects to terrestrial and aquatic species. The analysis in the DEIS does not indicate that additional protection measures are warranted.
12	Highly questionable that herbicides proposed for use pose no risk to terrestrial wildlife species.	Risk from herbicide exposure was determined using data and methods outlined in the SERA risk assessments, and exposure scenarios for wildlife were described on pages 203 to 207 of the DEIS. The findings in the DEIS considered a variety of exposure scenarios, and risks from herbicide exposure on wildlife varies. With implementation of the pdfs, use of herbicides in the action alternatives would not result in herbicides exposures over a threshold of concern. None of the first choice herbicides in alternatives B and C would pose any risk to wildlife. Pdfs limit the rate that moderate or higher risk herbicides may be used in all action alternatives. Herbicide use caps limit the extent of treatment.
12	PDFs J2a and b do not address impacts to bald eagles by herbicide contamination of prey species or indirect reduction of prey species from herbicide food chain impacts.	As described on page 220 of the DEIS, potential effects to bald eagle from prey contamination were evaluated. The results of exposure scenarios indicate that no herbicide or surfactant proposed for use poses a plausible risk to birds from eating contaminated fish. All expected doses to fish-eating birds are well below any known no-observable-adverse-effect-level (NOAEL). Consequently, at proposed application rates and methods, no adverse effects for herbicide exposure to the bald eagle are anticipated (DEIS p. 221).
12	Re: PDF J3a - Protection for only 2 weeks post-fledgling does not protect peregrine falcons from herbicide impacts to	Pdfs restrict herbicide use near active nests and ensure that herbicides would be applied at rates that would not cause adverse effects to peregrine falcons. This

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	reproductive fledgling success from herbicide reduction of insects and birds and bioaccumulation of toxins in the parent falcons. Disturbance is not the only or main negative effect to raptors from herbicide use.	project design feature has been implemented on similar projects across the region and the commenter provides no evidence that proposed restrictions are not adequate to protect nesting birds from disturbance. As described on page 221 of the DEIS, potential effects to nesting birds and fledglings from herbicide application were evaluated using both a fish and small mammal scenario. Potential effects are reduced with implementation of project design features that restrict the use of herbicides and surfactants (J3e, F2) and Malheur LRMP standard restricting the broadcast application of triclopyr. Also as described, because the herbicides proposed for use are rapidly excreted from prey and do not bioaccumulate, no adverse effects from herbicide exposure to nesting birds or their young are anticipated.
12	Re: PDF J3b - Some herbicides are persistent in soils for over a year, leading to effects into the nesting season even from spraying that was done outside the nesting season.	
12	Re: PDF J3e – Eliminate use of picloram and clopyralid due to threats to raptor reproduction and other reasons.	There are no known peregrine falcon, goshawk or bald eagle nests near proposed treatment sites. Project design features would protect these and other raptor nests, should treatment be proposed near nest sites in the future. Thus, exposure to herbicides is unlikely and no adverse effects to raptor reproduction are anticipated. Pages 221-222 of the DEIS discussed the reasons why HCB in picloram and triclopyr are unlikely to affect peregrine falcons and there is no evidence that use of picloram and clopyralid, as proposed, would threaten raptor reproduction.
12	Don't use herbicides in active Greater Sage Grouse habitat. Herbicides can kill plants and insects needed by sage grouse young. Sage grouse are endangered and have lost most of their suitable habitat and populations. Re: PDF J4e: Effects of herbicide use to plant species composition and insects used by sage grouse would persist past the reproductive season.	With implementation of project design features that restrict herbicide application and treatment in breeding/foraging habitat, no adverse effects from herbicide exposure are anticipated (DEIS p. 223-224). As discussed on DEIS page 223, no effects to breeding birds or reproduction are expected due to the marginal nature of breeding habitat on the Malheur National Forest and implementation of protective pdfs. Page 224 noted, "While exposure from these herbicides/surfactants are possible, when you consider that; 1) NPE would not be used (pdf F1), 2) pdf F2 restricts broadcast application of clopyralid, glyphosate, picloram, sethoxydim and sulfometuron methyl to typical application rates, 3) The Malheur National Forest LRMP prevents broadcast application of triclopyr, 4) Only 79 acres of invasive plant treatment are proposed in suitable habitat and sites are small and scattered across 20 watersheds, and 5) the use of the project area by sage grouse is scattered and incidental, it is unlikely that birds would consume 100 percent of their diet from contaminated insects/vegetation for 90 days and receive a chronic dose of concern. As a result, there are no adverse effects from herbicide exposure anticipated under any alternative."
12	There should be no herbicide impacts allowed to affect greater sage grouse.	
12	Sage grouse are also very vulnerable to herbicide use. Based on the effects analysis, we have concerns about herbicide impacts to sage grouse. Drop all use of triclopyr and NPE surfactants and maximum rates of glyphosate. Drop herbicide use in 79 acres of suitable sage grouse habitat!	
12	Re: PDF J5a: Drop all use of glyphosate with POEA surfactant, sulfometuron methyl, and NPE surfactants and all use of herbicides in or near wetlands, streams, lakes, ponds, etc.	Potential effects to amphibians and aquatic-dependent species from herbicide application were recognized and a number of pdfs and herbicide-use buffers near streams were proposed to minimize risks. Taken together, these restrictions and buffers minimize risks to aquatic-dependent species such as the Columbia frog. Herbicide use buffers for wet streams have been modified to include protection for hydrologically connected ditches. The action alternatives have been modified to

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		prohibit use of POEA and NPE-based surfactants (pdf F1). The need to protect reptiles and amphibians from treatment was recognized and a number of project design features are in place to reduce risks. As described on page 228 of the DEIS, project design features F2, H1, H2, H5, H9, and H10 reduce the likelihood that for herbicides to be delivered to waterways in concentrations of concern. Herbicide restrictions on certain soil types (H3 and H6) reduce potential for runoff and leaching, restrictions on extent of treatment on a given site (H4, H5, H7 and H8) ensure that herbicides would not be delivered in amounts greater than the SERA risk assessment and that unsprayed areas will be retained to provide refugia. Collectively these pdfs in combination with use of low risk first-year, first-choice herbicides reduce the likelihood that adverse effects from herbicide exposure would occur to reptiles or amphibians. Finally, The GLEAMS model was run on four sites within the project area that had the greatest potential for herbicide delivery to water near fish habitat. Results indicate that herbicide concentrations in the water are below levels of concern for fish, amphibians and aquatic invertebrates.
12	There should be no herbicide impacts allowed to affect Columbia spotted frog.	Effects of herbicide application to the Columbia spotted frog are discussed on pages 227-228 of the DEIS. Potential adverse effects are greatly reduced with implementation of pdfs and herbicide-use buffers. Refugia would be retained near breeding habitat. Finally, if occupied habitat is proposed for treatment, the site would be reviewed by a local biologist and treatment methods modified if necessary to avoid adverse impacts. Collectively, these pdfs in combination with the use of low risk first-year, first-choice herbicides reduces the likelihood that the Columbia spotted frog would be adversely affected by herbicides.
12	Don't use herbicides in known or potential and actual Columbia Clubtail habitat.	Under no action, herbicide use would not be approved in these areas. Non-herbicide treatment could be done using categorical exclusions or as an action connected to another project.
12	Re: PDF J6b: What are the ester formulations of herbicide and what are their impacts?	This pdf refers to the ester formulation of triclopyr (BEE) which is the more toxic terrestrial formulation. The impacts of triclopyr BEE were discussed throughout the DEIS. The wildlife section of the FEIS has been edited to better describe why this pdf would reduce impacts to the silver-bordered fritillary.
12	Columbia spotted frogs could be directly and indirectly affected by herbicide use within 300 feet of surface water and in rock pits.	Pdf J5-a on page 39 of the DEIS was specifically included to protect the frogs. Other pdfs and the herbicide-use buffers provide additional protection. DEIS page 216 noted, "Project design features restrict treatment in suitable breeding habitat and make herbicide exposure unlikely." Thus, suitable breeding habitat would be maintained, and proposed herbicide use within 300 feet of surface water or in rock pits would not have effects on the frogs beyond what is described in the DEIS.
12	Drop all use of herbicides within known or suspected habitat for the silver bordered fritillary. Drop all use of NPE based	Effects to the silver-bordered fritillary are discussed on pages 230 to 231 of the DEIS. This species is dependent on wet meadow habitat and currently invasive plants are known to occur on 34 acres of suitable habitat. Also, these sites are scattered across

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	surfactants in general.	45 watersheds. Although data on herbicide exposure to butterflies is limited (SERA 2007, Bramble 1997, USDA Forest Service 2005a), impacts on butterflies are not expected to occur on this project considering 1) the small scattered nature of habitat proposed for treatment, 2) that herbicides would be applied with spot application on 20 of the 34 acres proposed, 3) that preferred herbicides under alternatives B and C (aminopyralid, chlorsulfuron and metsulfuron methyl) are not likely to result in toxic levels to this species, 4) that use of ester formulations of herbicide in known silver-bordered fritillary habitat would be prohibited (J6b), and 5) that pdf J6a will protect host/nectar plant species, it is unlikely this species or its habitat would be adversely affected by proposed herbicides, and 6) NPE-based surfactants would not be used in any alternative (pdf F1). Potential effects are further reduced when you consider that pdf J6-b also requires that treatment in occupied habitat would be coordinated with a biologist, so that the type or timing of treatment can be modified if necessary to reduce potential impacts. Additional information on herbicide effects has been added to the FEIS.
12	Don't use herbicide in 34 acres [of silver bordered fritillary habitat] or on wet meadow habitat in general.	Under no action, herbicide use would not be approved in these areas. Non-herbicide treatment could be done using categorical exclusions or as an action connected to another project.
12	Don't use any herbicides within known occupied or suspected habitat for pygmy rabbit, upland sandpiper, grasshopper sparrow, or other rare birds and Harney Basin Duskysnail, and other rare mollusks.	Adverse effects on these species have been minimized while still allowing for effective treatment of invasive plants, as per the R6 2005 Record of Decision (Malheur National Forest LRMP) standards. In addition, the following species-specific design features would be implemented: 1) avoid treatment in on sites where grasshopper sparrows have been documented (J9-a), 2) protection of burrows and treatment methods, timing and location would be coordinated with a wildlife biologist in suspected pygmy rabbit habitat (J7-a), 3) modifying or avoiding treatment in sites with historic or recent documentation of upland sandpipers (J8-a), and 4) coordination of treatment timing, methods and buffers with a wildlife biologist in sites where the Harney basin duskysnail has been documented (J10-a). With implementation of these pdfs and treatment restrictions, and considering sites proposed for treatment would be reviewed by a biologist prior to treatment, no adverse effects from herbicide exposure to these or other rare species are anticipated.
12	Don't use herbicides in potential and actual Harney Basin Duskysnail habitat.	Under no action, herbicide use would not be approved in these areas. Non-herbicide treatment could be done using categorical exclusions or as an action connected to another project.
12	Re: PDF J12 – How would big game species be protected from toxic herbicide contamination from grazing and from bioaccumulation of herbicide toxins. These PDFs are typical human disturbance PDFS, mostly without adequate analysis or remedies to protect herbicide exposure and toxic	Effects of herbicide exposure on big game are discussed on pages 232 to 233 of the DEIS. As described, while glyphosate and picloram, could result adverse effects at or above the typical application rate, with implementation of pdfs, these herbicides would not be applied at levels that would result in acute or chronic doses of concern. Effects of exposure are further reduced when you consider that elk forage over large

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	contamination.	areas and are not likely to consume an entire day's diet of contaminated vegetation (acute exposure) or forage exclusively on vegetation for 90 days (chronic exposure). As a result and considering that 88 percent of the proposed treatments occur close to open roads, which are less likely to be used by elk (Thomas 1979), it is unlikely that elk would be adversely affected by herbicide exposure. In addition, NPE-based surfactants have been prohibited from use in the project (pdf F1).
12	Wildlife considerations for herbicide use/selection should not be limited to just seasonal restrictions designed to control/reduce human disturbance. Likewise, not just fish species of conservation concern should be considered, but also their prey species.	We agree that seasonal restrictions alone may not adequately reduce potential effects from herbicide exposure. That is why many of the pdfs proposed for implementation limit application and place restrictions on higher risk herbicides/surfactants (pdfs F1-F5, LRMP standards, and pdfs J3-e, J4-a, J5-a, and J6-b). Implementation of these pdfs/standards reduce effects to conservation species of concern, as well as other terrestrial and aquatic species and require coordination with a wildlife biologist to modify the treatment type, timing and buffers, or avoid treatment if necessary to reduce potential effects (pdfs J5-a, J6-b, J7-a, J8-a, J9-a and J10a). Collectively these pdfs, as well as other considerations described in the DEIS (e.g., foraging behavior of wildlife and the small and scattered nature of treatment sites) reduce the likelihood of herbicide exposure to terrestrial and aquatic species.
12	Clopyralid contains HCB, so alternative C does not eliminate all risk of HCB contamination to raptors.	The FEIS has been corrected to indicate that alternative C reduces risk of HCB contamination due to use of picloram, but does not eliminate all risk due to allowing use of clopyralid. Clopyralid is not a first-choice herbicide in any of the alternatives. In all alternatives, the pdfs reduce the potential for peregrine falcons to be exposed to HCBs.
12	Poisoning is more harmful to wildlife than disturbance.	The DEIS analysis disclosed both risks from herbicide use and general disturbance to wildlife habitat from all treatments. In many cases, herbicide use would not affect a given wildlife species whereas disturbance would. See Chapter 3.7 for more information.
12	What analysis supports the statement [DEIS page 76] that there would be "no possibility for this project to result in exposures that could cause a cumulative effect in animals."	The DEIS page 76 noted that the risk assessments evaluated chronic exposures to herbicides and found that cumulative effects are unlikely because the herbicides would be more rapidly excreted than they would be absorbed from predicted levels of exposure. Pages 214-215 of the DEIS provided further reasoning for why the potential for exposure to cause a cumulative or chronic exposure is implausible. The FEIS has been edited for clarity.
12	Because data for amphibians is more limited than mammals and birds, and data is limited regarding effects of herbicides on mollusks, and because data was insufficient to assess risk of chronic exposures for some surfactants and herbicides, and other relevant data limitations, less herbicide should be used overall, and the most toxic or persistent herbicides should not be used, and herbicides should not be used near riparian areas.	This comment is noted and the risks, data limitations and uncertainty of herbicide treatment to wildlife were recognized throughout the DEIS. In fact, it is these risks and data limitations that led to the development of project design features (see table 9) and herbicide-use buffers. These design features/buffers not only reduce potential impacts to species of concern, but also limit use of higher risk herbicides/surfactants and reduce treatment effects to all terrestrial and aquatic species. Alternative C provides a basis for comparison for eliminating all herbicide use within 100 feet of wet

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		and dry streams. In alternatives B and D, while herbicide may be used within 100 feet of streams, herbicide-use buffers restrict methods of application near stream for some of the herbicides and a cap of 10 acres per year within 100 feet of a stream in any 6th field watershed would minimize riparian impacts from herbicides. Additional pdfs restrict rates and methods of application to reduce potential for adverse effects.
12	[re: statement that small mammals would likely not be directly sprayed then consumed by other animals because they are generally nocturnal] is not true of squirrels, etc.	We recognize that not all small mammals are nocturnal. However, many mammals are nocturnal and this behavior, combined with the fact that many preferred habitats (e.g., burrows, and trees) would not be treated, reduces the likelihood of direct spray. The risk assessments consider the effects of consumption of prey that has been exposed to herbicides. Acute and chronic herbicide exposure over a long period of time would be far below the “no effect” level. The fact that many small mammals are nocturnal and therefore would not be exposed to herbicide during operations adds another layer of caution.
12	We are concerned about herbicide impacts to wildlife because herbicides can cause malformation or mortality to amphibians.	Effects to amphibians are discussed on pages 227-228 of the DEIS and potential impacts are minimized with implementation pdfs and herbicide-use buffers. Potential effects to amphibians and aquatic-dependent species from herbicide application were recognized and a number of pdfs and herbicide-use buffers near streams were proposed to minimize risks. Taken together, these restrictions and buffers minimize risks to aquatic-dependent species such as the Columbia frog. Further protection for hydrologically connected ditches has been added. The action alternatives have been modified to prohibit use of POEA and NPE-based surfactants (pdf F1). The need to protect reptiles and amphibians from treatment was recognized and a number of project design features are in place to reduce risks. As described on page 228 of the DEIS, project design features F2, H1, H2, H5, H9, and H10 reduce the likelihood that for herbicides to be delivered to waterways in concentrations of concern. Herbicide restrictions on certain soil types (H3 and H6) reduce potential for runoff and leaching, and restrictions on extent of treatment on a given site (H4, H5, H7 and H8) ensure that herbicides would not be delivered in amounts greater than the SERA risk assessment and that unsprayed areas will be retained to provide refugia. Collectively these pdfs in combination with use of low risk first-year, first-choice herbicides reduce the likelihood that adverse effects from herbicide exposure would occur to reptiles or amphibians. Finally, The GLEAMS model was run on four sites within the project area that had the greatest potential for herbicide delivery to water near fish habitat. Results indicate that herbicide concentrations in the water are less than levels of concern for fish, amphibians and aquatic invertebrates.).
12	Table 60 illustrates additional reasons (wildlife impacts) to completely stop the use of triclopyr, NPE surfactant, picloram, sulfometuron methyl, and not to use maximum rates of glyphosate and sethoxydim.	Potential effects to wildlife from herbicide application are discussed in section 3.73 of the DEIS. The analysis concluded that adherence to invasive plant treatment standards and pdfs, actual animal behavior and feeding strategies, and/or seasonal presence/absence within treatment areas would reduce risks. As a result and considering the limited spatial extent of infestation (over 80 percent of sites are 0.25 acres or less), the DEIS concluded that wildlife is not likely to be exposed to harmful

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		levels of herbicides or surfactants under the action alternatives. NPE-based surfactants have been prohibited from use in the project (pdf F1).
12	Drop the use of herbicides in the 8 acres of lynx foraging and denning habitat. We have seen lynx (good sightings) on the Ochoco NF and near the Umatilla NF in about 2003 and 2010.	The no action alternative would not approve herbicide use in these areas. Non-herbicide treatment could be done using categorical exclusions or as an action connected to another project. Potential effects to lynx are discussed on page 215 of the DEIS. As described, lynx are not expected to be adversely affected because of their infrequent occurrence and small amount of habitat proposed for treatment (8 acres).
12	Drop the < 1 acre of herbicide use and disturbance to wolverine denning habitat.	The no action alternative would not approve herbicide use in these areas. Non-herbicide treatment could be done using categorical exclusions or as an action connected to another project. Potential effects to wolverine were discussed on page 215 of the DEIS. As described, wolverine are not expected to be adversely affected because of their infrequent occurrence, small amount of habitat proposed for treatment, and considering they prefer remote areas that are less likely to be affected by invasive plants or treatment.
12	Drop the use of triclopyr and NPE based surfactants to help protect gray wolves (and bears, cougars, coyote, foxes, lynx, bobcats, etc.). Drop all herbicide use in preferred wolf habitat.	The DEIS acknowledged risks associated with triclopyr and NPE surfactants (the alternatives have been modified to prohibit use of NPE-based surfactants)(pdf F1). Potential effects to wolves are discussed on page 217-218 of the DEIS. As described, wolves are not likely to be affected because pdfs would protect den or rendezvous sites; and at proposed application rates and with implementation of pdfs, no adverse effects from herbicide exposure are anticipated.
12	Drop use of NPE surfactants and picloram to help protect bat species. Keep glyphosate below maximum rates.	Effects to bats are discussed on page 219 of the DEIS. As described, no roost sites would be affected, pdfs restrict herbicide use, and bat foraging behavior makes it unlikely they would be adversely affected by proposed herbicides. As a result, no adverse effects from herbicide exposure are anticipated. NPE-based surfactants would not be used (pdf F1).
12	This cumulative effects discussion [about bats] fails to consider the effects of white nose syndrome and human disturbance	To date, white nose syndrome has not been documented northwest of Oklahoma (Butchkowski 2013). While it is possible, it could be documented at some point in the future, this is speculative and it is unlikely to occur on the Malheur National Forest during the analysis period. Also, the Pacific Northwest Region is actively engaged with prevention methods and public awareness efforts identified by the Fish and Wildlife Service http://www.fs.usda.gov/detail/r6/forest-grasslandhealth/invasivespecies/?cid=stelprdb5302193 and Western Bat Working Group recommendations (WBWG 2010).
12	Drop the use of NPE surfactants, picloram and clopyralid (re: HCB) to reduce herbicide risks to peregrine falcons, bald eagles, northern goshawk and other raptors.	The DEIS analysis concluded that the pdfs sufficiently minimize risks to falcons, eagles, and goshawk in all action alternatives. NPE-based surfactants would not be used (pdf F1).
12	[Discussion about peregrine falcon] provide more reasons for our concerns re: risks to peregrine falcons and other birds of	The DEIS analysis concluded that no peregrine falcon nest sites are known on the Malheur National Forest and that implementation of project design features would

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	prey.	ensure that any future nesting peregrine falcons would be not be adversely affected by treatments or be exposed to toxic levels of herbicide. The DEIS also found that the likelihood for HCB contamination is remote and discountable.
12	No use of NPE surfactants, triclopyr, picloram, clopyralid, nor high rates of glyphosate also helps neotropical songbirds.	Effects to birds of conservation concern, including many neotropical songbirds, were discussed on pages 238 to 241 of the DEIS. Considering the small amount of habitat proposed for treatment, reduced risk due to foraging behavior, and pdfs, no adverse effects from herbicide exposure to songbirds are anticipated. The action alternatives have been modified to prohibit use of NPE-based surfactants (pdf F1).
12	Inadequate cumulative effects analysis re: effects of livestock combined with potential herbicide effects, etc. to sage grouse.	Grazing was considered as a cumulative effect under the action alternatives in the DEIS (page 211-215), as well as under the analysis for sage grouse (page 224). It was recognized that continued grazing could promote the spread of invasive plants and reduce wildlife cover and forage conditions, particularly in dry forest and shrub steppe habitats. Because grazing use is not expected to change, and with implementation of allotment management plan and allowable use standards, it is expected that existing habitat would be relatively unchanged. While it was recognized that continued grazing could adversely affect sage grouse habitat by promoting invasive weeds, because proposed treatments (including EDRR) are expected to control future expansion of invasive plants, proposed actions would help to maintain sage grouse habitat. Herbicide exposure was also considered in the cumulative effect analysis and is described on page 214. Due to the small amount of habitat proposed for treatment, treatment restrictions within breeding habitat, and reduced risk of herbicide exposure, none of the alternatives would measurably contribute to any other past, ongoing or future activity and result in consequential effects to sage grouse
12	[The statement that sage grouse would not be exposed to toxic levels of herbicide] is not certain given the data gaps noted previously.	While some data are lacking as explained on page 224 of the DEIS, the conclusion that sage grouse would not be exposed to toxic levels of herbicide was made for a number of reasons including: 1) NPE will not be used 2) pdf F2 restricts broadcast application of clopyralid, glyphosate, picloram, sethoxydim and sulfometuron methyl to typical application rates, 3) The Malheur National Forest LRMP prevents broadcast application of triclopyr, 4) Only 79 acres of invasive plant treatment are proposed in suitable habitat and sites are small and scattered across 20 watersheds, and 5) the use of the project area by sage grouse is scattered and incidental, thus it is unlikely that birds would consume 100 percent of their diet from contaminated insects/vegetation for 90 days and receive a chronic dose of concern. The effect determination that sage grouse are not likely to be exposed to toxic levels of herbicide is based collectively on these considerations.
12	Drop herbicide use on upland sandpiper habitat.	The analysis in the EIS does not indicate that herbicides would adversely affect upland sandpiper habitat.
12	Don’t use herbicides in deer and elk fawning and calving habitat.	The analysis in the EIS does not indicate that herbicides would adversely affect deer and elk fawning and calving habitat. Most herbicide treatments would occur later in

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		the summer than when calving occurs.
12	Statements about invasive plants in goshawk habitat are contradictory (567 acres of nesting/foraging habitat, and 18 acres within post-fledgling habitat are proposed for treatment, versus the statement that northern goshawk prefers closed canopy mature forest so its habitat is not at risk from invasive plants.)	Goshawk prefer closed canopy forest for nesting, thus nesting habitat is generally not at risk from invasive plants. However, as described in the DEIS, post-fledgling and foraging can occur in non-forest and more open forests areas where some invasive plants can be found. Suitable goshawk habitat would be maintained and any effects from treatment would be minor and short-term.
12	Don't use herbicides within goshawk nesting and foraging habitat including PFAs that are declining from cumulative FS management impacts. Timber sales are routinely degrading PDFAs on the Malheur and are rending them as unsuitable for PFA habitat, so there are cumulative reproductive effects to consider. What about cumulative effects to raptor eggs?	Anticipated cumulative effects, including timber harvest were displayed in DEIS table 62. Invasive plant treatment would occur on approximately 519 acres that would also be harvested. As described on page 235, while ongoing and future activities would modify goshawk nesting and foraging habitat, existing LRMP standards would protect nest sites and PFA areas. As a result, none of the alternatives would measurably contribute to any other past, current or foreseeable activity and there are no consequential cumulative effects anticipated.
Range		
12	Ungulates can bioaccumulate herbicides. There should be no herbicide use within 100 feet of stock tanks.	The herbicides proposed for use would not bioaccumulate in grazing animals. Using spot or selective methods of herbicide application would provide an additional layer of caution to protect water sources for grazing animals.
12	Re: PDF group N: Avoid use of bioaccumulating toxic herbicide ingredients and formulas listed on herbicide labels as having potential to contaminate ungulate milk or meat.	Label guidance related to grazing animals would be followed in all alternatives as described in the DEIS range section. The herbicides approved for use do not bioaccumulate in the bodies of mammals. Hexaclorabenzene, a contaminant in clopyralid and picloram, does bioaccumulate. However, the amount that would be used is very small. Hexaclorabenzene is ubiquitous in the environment. Milk and meat would not be contaminated.
12	Discussion about clopyralid, chlorsulfuron, metsulfuron methyl, picloram, surfactants, and triclopyr provide reasons for concerns about cattle. Wouldn't altered liver and kidney weights constitute pathological effects to specific organs from use of picloram? The use of triclopyr should be discontinued as it is highly toxic to large mammals.	This information reflects general hazards associated with the herbicides and additives but does not consider the exposure scenarios that would be plausible for this project. Given the limited extent of herbicide use and the pdfs, impacts to grazing animals are not expected. Triclopyr would be used infrequently in this project. It is not one of the first-choice herbicides in any alternative for any target species. The grazing section has been updated to focus on plausible risks to grazing animals.
Cumulative Effects		
04	The rate of active forest management seems likely to increase in the coming years to address a legacy of past high-grading, fire suppression, and livestock grazing abuses. We are concerned that this EIS may not fully consider the cumulative effects of long-term widespread chemical treatments, especially in light of the possibility that some of these treatments could be avoided with less intensive and/or less extensive active management.	The cumulative effects analysis in the DEIS specifically addressed the ongoing and foreseeable future projects and the cumulative impact of treatment, in light of the potential to spread invasive plants. The pdf limitations and treatment caps are intended to ensure that the adverse effects of chemical treatments are minimized so they will not add up to additional cumulative effects. As discussed in the previous comment, most of the invasive plants on the Malheur National Forest are along roads, rather than being related specifically to forest practices or fire suppression.

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12	Cumulative effects analysis is not adequate. What are the consequences of multiple stressors plus herbicide poisoning on fish, amphibians, pollinators, Neo-tropical songbirds, raptors, ungulates, etc.	Cumulative effects were addressed in the DEIS for all resources and the analyses have been augmented in the FEIS. Because the scale of the project is so small compared to the amount of habitat available, and because impacts from the project have been minimized, the project would not add stress to wildlife or fish species or contribute to cumulative effects. Stressors on species are described and accounted for in the analysis.
12	Additive effects are by definition cumulative effects.	Additive effects were considered in the DEIS.
12	Terms such as “unlikely to be measurable or detectable” remain unsupported by analysis and unquantified. This does not account for the combined or synergistic effects of multiple herbicide applications (potentially of different herbicides) repeated on the same sites over time.	The herbicide risk assessments and site-specific analysis provide analysis measures as available. As discussed on pages 98-99 of the DEIS, the R6 2005 FEIS noted, “combinations of chemicals in low doses have rarely demonstrated synergistic effects…. synergistic or additive effects, if any, are expected to be insignificant.” DEIS Chapter 3.1.4 explained how each treatment entry would reduce invasive plant density, and thus, less herbicide would be needed over time on any given site. The pdfs, herbicide-use buffers and annual caps also limit the amount of herbicide used overall.
12	The cumulative effects analysis does not adequately address additive, synergistic, and chronic effects regarding overlapping combined effects of repeated herbicide applications and combined effects of various projects; veg, livestock grazing near roads, livestock grazing in timber sale areas, ATV use introducing invasive plants, then logging creating suitable habitat for them, etc.	The cumulative effects analysis throughout the DEIS addressed the potential for invasive plants to be spread from land use activities and the interaction between these activities and effects from this project.
12	[Re: statement that median logging acreage is 8,000 acres per year for the last ten years]: Now the acreage logged on the Malheur is much more than 8,000 acres and has been for a few years.	All vegetation management projects include prevention measures to address the potential for invasive plants to spread from ground disturbing activity.
12	We find it very hard to believe that only 2 percent of the invasive plant sites correlate with livestock grazing and only 6 percent with logging and wildfire based on our experience on the Malheur. It’s hardly only a moderate risk of invasive plant dispersal from livestock grazing. May the Forest Service is not seeing a lot of what we’re seeing because we spend most of our time away from the roads in timber sale units. Livestock and logging as invasive plant introduction and dispersal vectors should have been addressed in depth by this DEIS regarding site –specific information that could help determine effective site-specific prevention. Keep livestock out of riparian areas and areas of concentrated ground disturbance where water acts to further disperse invasive plants and enables their establishment. Check gate entrance areas to determine which	Tables 68 and 69 displayed invasive plant acreage within allotments on the Malheur National Forest. Invasive plants are mapped on about 1/10th of 1 percent of active allotment acreages. Allotment management plans consider conditions within the allotments and include prevention measures to prevent the spread of invasive plants there. Cattle may be kept away from treated areas until the area has recovered and contains desirable vegetation as a part of post-treatment site restoration. For instance, the Summit Logan Valley Allotment Management Plan includes prevention measures related to spring development and makes specific reference to reducing soil disturbance. Invasive plant treatment would be designed to improve riparian vegetation conditions on the Malheur National Forest. However, there is damage to riparian areas from livestock that would not be addressed by invasive plant treatment alone. Restoration of riparian areas damaged by grazing is outside the scope of the EIS. The FEIS has been edited to note that some portions of allotments, including riparian areas, have been more seriously degraded from cattle and that disturbance

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	herds are bringing in invasives. Which allotments have more invasive plants? Keep cattle out of existing infestations.	from cattle can increase susceptibility to invasive plants. Follow-up seeding and planting of native plants in treated areas would help to reduce the chances of re-infestation of invasive plant species.
12	Table 34 illustrates the cumulative impacts already degrading habitat conditions and water quality in major rivers and creeks on the Malheur. These streams are already severely degraded by livestock use, logging, roading and in some cases, mining. All in ways detrimental to fish. Adding herbicide contamination is a cumulative effect that could threaten fish viability. Already reduced fish runs of listed species…cannot take more degradation of streams and river conditions without it affecting their viability.	The project design features and herbicide-use buffers for this project minimize the likelihood that herbicide would affect streams and degrade fisheries. Given all of the project design features, herbicide-use buffers, and annual treatment caps, no degradation of streams or river conditions would likely occur.
12	First paragraph of cumulative effects section on page 144 does not acknowledge persistent herbicides like picloram and imazapyr.	The soil cumulative effects analysis discussed persistence of herbicides noting that "herbicide half-life period and pdfs that limit re-treatments of more persistent herbicides largely preclude cumulative effects from multiple treatments at a single site." Herbicides have variable rates of decay primarily depending on the soil capacity for microbial decomposition and secondarily due to solubility, and exposure to sunlight. Laboratory studies cited in the SERA risk assessments address sensitive types of bacteria and fungi to herbicide concentrations. One type of microbial sensitivity does not translate to overall microbial sensitivity with concomitant adverse effects to soil fertility. To expand the layers of caution against herbicide buildup, the timeframe for reapplication of herbicides was increased to once every two years for picloram, imazapyr and metsulfuron methyl. The time frame for reapplication of aminopyralid has been limited to once a year because of its relatively long half-life. Please note that aminopyralid has high decay rates in sunlight.
12	How many streams, river reaches in the John Day River has enough pesticides in it to give me toxic symptoms. How many streams have actually been tested for chemical contamination?	This is unknown. None of the streams within the project area have been 303d listed for chemical contamination, based on monitoring conducted by the Oregon State Department of Environmental Quality.
12	Re previous studies (discussed on page 77): Aren't these Western Cascades studies, i.e. areas with more water flow? There's a lot of nuances being lost here.	No local studies exist. However, site-specific modeling done for highest risk situations on the Malheur National Forest using small streams (about 2 cubic feet per second) found that the amount of herbicide that would reach streams would be below a threshold of concern for fish (DEIS table 38). Lower flow streams would show greater effect (higher concentration) than higher flow streams.
12	Re NWQAP Pesticide Study: Conclusion [of the study] indicates lack of dilution and degradation of pesticides or the degradation constituents in streams, contrary to prior DEIS assurances that herbicides in streams would be diluted and unlikely to cause impacts.	The risk assessments discussed the potential for the herbicides proposed for use in this project to reach streams. Site-specific modeling indicated that the amount of herbicide that would reach streams would be below a threshold of concern. Parameters for climate and stream flow used in model runs were derived from local sources and reasonable estimates based on knowledge of local conditions and channel size.

Commenter ID #	Comment	Forest Service Response
12	Re; page 78: Vector/pathways for pesticide transport [runoff, leaching] are operational on the Malheur. Why are these not discussed?	This comment was made in reference to a study quoted on page 78 in the introduction to cumulative effects, which was not specific to this project or the Malheur National Forest. Runoff and leaching in relation to this project was specifically discussed on DEIS pages 93, 125-126, 128, 136-137, and 139-143.
12	[Study on page 78 talks about human health benchmarks]. Yet human health is not the only or main concern with stream contamination. What about benchmarks for effects to invertebrates, fish or amphibians? It's is a lower threshold of concern for fish, amphibians, and aquatic invertebrates than for humans, much lower.	Benchmarks (toxicity indices, thresholds of concern) were discussed in the DEIS for fish and wildlife. The risk assessments and R6 2005 FEIS contain additional information. The Malheur National Forest Invasive Plant Treatment FEIS includes additional information about the toxicity indices for aquatic invertebrates, aquatic plants and algae.
12	[The Clackamas River Study] fails to convince me that the Forest Service should go ahead and add more herbicide to the National Forest because there are less herbicides there than industrial and agricultural studies.	This information was provided for context. Herbicide use for this project would be very low in comparison to total herbicide use off National Forest land. There is no indication that the herbicide use proposed would measurably add to herbicide use downstream.
12	The description of allotment conditions is biased and deceptive. Disturbance is artificially diluted by averaging it across the allotment. Actually, livestock have been creating bare soils and denuded stream banks in riparian areas, with severe soil and native plant damage, setting up perfect conditions for invasive plant establishment. There are a lot of invasive plants in riparian corridors damaged by livestock on the Malheur, based on our field experience.	Invasive plant treatment would be designed to improve riparian vegetation conditions on the Malheur National Forest. However, there is damage to riparian areas from livestock that would not be addressed by invasive plant treatment alone. Restoration of riparian areas damaged by grazing is outside the scope of the EIS. The FEIS has been edited to note that some portions of allotments, including riparian areas, have been more seriously degraded from cattle and that disturbance from cattle can increase susceptibility to invasive plants. Follow-up seeding and planting of native plants in treated areas would help to reduce the chances of re-infestation of invasive plant species.

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
620 SW Main Street, Suite 201
Portland, Oregon 97205-3026

9043.1
IN REPLY REFER TO
ER13/708

Electronically Filed

December 19, 2013

Teresa Raaf
Forest Supervisor
431 Patterson Bridge Road
John Day, OR 97845

Dear Ms. Raaf:

The Department of the Interior has reviewed the Draft Environmental Impact Statement for the Malheur National Forest Site-Specific Invasive Plants Treatment Project. The Department does not have any comments to offer.

We appreciate the opportunity to comment.

Sincerely,

Allison O'Brien

Allison O'Brien
Regional Environmental Officer

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue, Suite 900
Seattle, WA 98101-3140

OFFICE OF
ECOSYSTEMS,
TRIBAL AND PUBLIC
AFFAIRS

December 23, 2013

Teresa Raaf
Forest Supervisor
431 Petterson Bridge Road
John Day, Oregon 97845

Re: U.S. Environmental Protection Agency comments on the Malheur National Forest Site-Specific Invasive Plants Treatment Project Draft Environmental Impact Statement.
EPA Region 10 Project Number: 06-017-AFS.

Dear Ms. Raaf:

The U.S. Environmental Protection Agency has reviewed the Draft Environmental Impact Statement for Malheur National Forest Site-Specific Invasive Plants Treatment Project within Grant, Baker, Harney, Malheur, and Crook Counties, Oregon. Our review was conducted in accordance with the EPA responsibilities under the National Environmental Policy Act and Section 309 of the Clean Air Act.

The DEIS analyzes the Forest Service's proposal to use integrated methods to treat invasive plants to reduce their extent and impact. The project area encompasses the Malheur National Forest and a portion of the Ochoco National forest (together nearly 1.7 million acres). Approximately 2,124 acres of invasive plants need to be suppressed, contained, controlled or eradicated within the project area. Three action alternatives and a no action alternative are considered in the DEIS. Alternative B, the proposed action, would authorize several herbicide and other integrated treatment methods to be implemented on the Forest over the next 5 to 15 years. Alternative B would include one amendment to the Malheur National Forest Land and Resource Management Plan to allow for the use of aminopyralid. Alternative C is would restrict herbicide use to a greater extent than Alternative B, and Alternative D would not allow for the use of aminopyralid.

The EPA supports treating invasive plant infestations in order to maintain or improve the diversity, function and sustainability of desired native plan communities and other natural resources that can be adversely impacted by invasive plant species. In our scoping May 2006 scoping comments, we recommended that the DEIS look across jurisdictional boundaries, include an early detection/rapid response plan, and adopt an Integrated Weed Management approach to addressing invasive plants. We believe the DEIS does an admirable job of incorporating these ideas.

We appreciate the incorporation of "integrated treatment notes" within Table 8 (common control measures), as well as the robust structure of the project design features (pdfs) in Table 9. In particular, it is helpful to have a reference source for each of the project design features. Overall, we support the proposed alternative (Alternative B). Our comfort with Alternative B is enhanced by the inclusion of herbicide-use buffers and treatment caps. These features will limit the extent, intensity and duration of any potential adverse effects. We also support the inclusion of Figure 4 on page 50 of the DEIS, which lays out a series of questions to help determine whether, where, how, and under what pdfs herbicides should be applied. We are also pleased to note that aerial application of herbicide is not among the alternatives considered.

With regard to aminopyralid, we recognize this is a relatively new herbicide, and effective against a broad spectrum of plants. We maintain, however, that the best risk assessment information available (SERA 2007[1]) concludes that:

> *"...Aminopyralid has a favorable human health toxicity profile when compared to the registered alternatives for these use sites and will be applied at a lower rate. Its residual action should alleviate the need for repeat applications, resulting in a reduction in the amount of herbicides applied to the environment for the control of these weeds. Aminopyralid has been determined to be practically non-toxic to non-target animals at the registered application rates, compared to the alternatives, and is less likely to impact both terrestrial and aquatic plants."*

Because the inclusion of aminopyralid within the suite of herbicides available to the Forest would potentially reduce overall herbicide footprint on the Forest, we support the proposed LRMP amendment under Alternative B.

Based on our review, we are rating the DEIS as LO (Lack of Objections). We appreciate the opportunity to review and comment on the DEIS. If you have any questions about our review, please contact me at (206) 553-1601, or by electronic mail at reichgott.christine@epa.gov. Or you may contact Teresa Kubo of my staff at (503) 326-2859 or by electronic mail at kubo.teresa@epa.gov.

Sincerely,

Christine B. Reichgott, Manager
Environmental Review and Sediment Management Unit

[1] Syracuse Environmental Research Associates (SERA), Inc. 2007. Aminopyralid Human health and Ecological Risk Assessment. Fayetteville, New York. Jun. 28, 2007

U.S. Environmental Protection Agency Rating System for Draft Environmental Impact Statements Definitions and Follow-Up Action*

Environmental Impact of the Action

LO – Lack of Objections

The U.S. Environmental Protection Agency (EPA) review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

EC – Environmental Concerns

EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce these impacts.

EO – Environmental Objections

EPA review has identified significant environmental impacts that should be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no-action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU – Environmentally Unsatisfactory

EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potential unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the Council on Environmental Quality (CEQ).

Adequacy of the Impact Statement

Category 1 – Adequate

EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis of data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2 – Insufficient Information

The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses or discussion should be included in the final EIS.

Category 3 – Inadequate

EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the National Environmental Policy Act and or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

* From EPA Manual 1640 Policy and Procedures for the Review of Federal Actions Impacting the Environment. February, 1987.

Grant Soil and Water Conservation District
721 S. Canyon Blvd. - John Day, OR 97845 - Phone (541) 575-0135 - FAX (541) 575-0646

SKB
Joe Rausch

December 24, 2013

Teresa Raaf, Forest Supervisor
Malheur National Forest
431 Patterson Bridge Road
John Day, OR 97845

Subject: Letter of support in regards to the Malheur National Forest Site-Specific Invasive Plants Treatment Project Draft Environmental Impact Statement (DEIS).

Dear Ms. Raaf:

The Directors and Staff of the Grant Soil and Water Conservation District (District) are very pleased to learn the Malheur National Forest (Forest) is moving forward in completing the Environmental Impact Statement to authorize the Forest's use of specific herbicides to treat noxious weeds. The District is confident that through the strategic and responsible application of these herbicide products, the Forest will experience much greater efficiency and effectiveness associated with their noxious weed control efforts.

Initiated in 1987 through an agreement with the Grant County Court, the District has been charged with the coordination of the County's Noxious Weed Control Program. Acting in this leadership role the District has successfully networked with private landowners, conservation organizations, neighboring counties, as well as state and federal agencies to implement integrated on the ground and educational labors that have been truly effective in controlling noxious weeds on a landscape scale within the County. Upon authorization of the DEIS, the District is looking forward to sharing our expertise and capacity with the Forest to assist in the rapid advancement of their noxious weed control program.

The DEIS the Forest proposes to establish compliments the ongoing weed control efforts the District and local citizens have put forth. By reinstating the use of herbicides, the Forest is clearly demonstrating their pledge to actively join the local commitment to battle invasive plant populations. Implementation of the proposed control measures will provide direct protection to desired native plant communities, reduce noxious weed seed sources that can migrate to neighboring lands, and contribute positively to sustaining essential watershed functions of the Forest.

Successful containment and long term control of noxious weeds can only be realized through a continuous obligation from both private and public land managers. To that end, the District is very supportive of the Malheur National Forest Site-Specific Invasive Plant Treatment Project and will be looking forward to working cooperatively with the Forest on invasive plant management projects soon.

Sincerely,

Matt Wenick, Weed Control Coordinator
Grant Soil & Water Conservation District
721 S. Canyon Blvd.
John Day, OR 97845
541-575-1554

Sincerely,

Jason Kehrberg, District Manager
Grant Soil & Water Conservation District
721 S. Canyon Blvd.
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CONSERVATION - DEVELOPMENT - SELF GOVERNMENT