Chapter 3 Affected Environment and Environmental Consequences

3.1. Introduction

This chapter describes both the existing conditions of the Project Area, and the environmental effects of implementing the alternatives described in Chapter 2. Effects are defined as: •

- Adverse and/or beneficial direct effects occur at the same time and in the same general location as the activity causing the effects.
- Adverse and beneficial indirect effects are those that occur at a different time or location from the activity causing the effects. Both types of effects are described in terms of increase or decreases, intensity, duration, and timing.
- Cumulative Effects result from the incremental impacts of the Proposed Actions/alternatives when added to other past, present, and reasonably foreseeable actions, both on the Forest and Wild and Scenic River corridor as well as other adjacent federal, state, or private lands.

Effects include ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative (40 CFR 1508.7 and 1508.8).

3.1.1 Project Area

The Umatilla National Forest is located in the northern portion of the Blue Mountains in northeastern Oregon and southeastern Washington. There are over 1.5 million acres within the Forest boundary, of which 1.4 million are National Forest system lands. Interstate Highway 84 passes through the Forest dividing it into two halves. The north half extends into Washington and is bordered partially by the Umatilla Indian Reservation on the west and by the Wallowa-Whitman National Forest on the southeast flank. The southern half is bordered on the east by the Wallowa-Whitman National Forest and by the Malheur National Forest on the south (USDA 1990).

The Umatilla National Forest is the home of a collection of diverse landforms and ecotypes. The Forest lies within the headwaters of four large drainage basins: Umatilla, John Day, Walla Walla, and Grande Ronde river basins. The north and south forks of the Umatilla, north and south forks of the Walla Walla, Touchet, Grande Ronde, Wenaha, Tucannon, and North Fork John Day are the local rivers. The waters of the latter are recognized for their high quality anadromous fisheries. There are also a few small lakes and reservoirs greater than five acres in size. The Forest provides timber and other wood products, water, recreation, and supports one of the largest Rocky Mountain elk herds. Elk hunting is a particularly popular activity in the area. There are also three wildernesses covering 304,400 acres, and twenty-two roadless areas total 281,000 acres (USDA 1990).

The Forest most directly influences ten counties: Asotin, Columbia, Garfield, and Walla Walla in Washington; and Grant, Morrow, Umatilla, Union, Wallowa, and Wheeler in Oregon. The local economy and lifestyle tend to revolve around agriculture, ranching, government, and the timber industry. Portions of Umatilla and Morrow counties along the Columbia River in Oregon are more industrialized (USDA 1990).

3.1.2 Basis for Cumulative Effects Analysis

Cumulative effects result from the incremental impacts of the Proposed Actions/alternatives when added to other past, present, and reasonably foreseeable actions, both on National Forest System lands and other adjacent federal, state, or private lands (40 CFR 1508.7). Cumulative effects related to the spread of invasive plants, and cumulative effects related to the risks associated with herbicide or other invasive plant treatments are considered in this Environmental Impact Statement (EIS).

Activities of man and natural processes have led to the introduction, establishment and spread of invasive plants across the Umatilla National Forest. The Umatilla National Forest Plan was amended in October of 2005 to provide management direction aimed at preventing further spread of invasive plants. The cumulative effects analysis assumes that the prevention standards will reduce rates of invasive plant spread within the Project Area, and that treatments will reduce the density and extent of invasive plants further lowering the rates of spread.

Only the land and roads within the National Forest system would be treated in the action alternatives proposed by this EIS. The Forest, however, is intermingled with other federal, state, county, and private ownerships. Management activities and actions on neighboring lands may contribute to spread or containment 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. Coordination would also tend to prevent unwanted effects such as duplication of treatment along a property boundary. The cumulative effects analysis assumes that this cooperative, coordinated effort continues for the life of this project. In addition, the cumulative effects analysis assumes that the release of biological control agents on National Forest system lands and adjacent lands by the Oregon and Washington Departments of Agriculture, as analyzed by Animal Plant Health Inspection Service (APHIS), will continue to reduce the invasive plant infestations in Oregon and also decrease the spread of invasive plants.

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 or Washington. So, accurate accounting of the total acreage of invasive plant treatment for all land ownerships is unavailable. Even the estimates provided are not to be precisely analyzed given the long time span and uncertain implementation schedule for this project.

Although it is difficult to estimate, the Region 6 Invasive Plant FEIS (2005) estimated that invasive plant control occurs on over 1.25 million acres in Oregon and Washington and above 90 percent of this control is through the use of herbicides. Even the highest estimates of herbicide use on National Forest system lands in the two states would amount to less than three percent of the estimated total acres treated with herbicides in Oregon and Washington (R6 FEIS 2005, page 4-1). Regardless, many people express personal concern about their exposure to agricultural and industrial chemicals, and the cumulative effects to human and environmental health from herbicide, pesticide, and other chemical use in our society.

The proposed use of herbicides on and off National Forest system lands could result in additive doses of herbicides to workers, the general public, non-target plant species, aquatic species, and/or wildlife species.

For additive doses to occur, the two exposures would have to occur approximately at the same time, since the herbicides proposed for use are rapidly eliminated from humans and do not significantly bioaccumulate (R6 FEIS 2005). The application rates and extent considered in this EIS are unlikely to result in additive doses beyond those evaluated for chronic and acute exposures in the USDA Forest Service risk assessments, which formed the basis for the effects analysis in the Region 6 Invasive Plant FEIS (2005). The Region 6 Invasive Plant FEIS (2005), in return, served as the basis for the site-specific effects analysis discussed in this EIS.

The risk of adverse effects of invasive plant treatments in all action alternatives have been minimized by the project design features (PDFs). These limit, but not exclude, the possibility of cumulative adverse effects caused by treatment. The use of herbicides within the scope of this project is unlikely to contribute to cumulative effects beyond those described in the Invasive Plant FEIS (2005). Herbicide persistence is managed through PDFs to avoid chemical loading in the soil over time at any one site. Buffers minimize risk of herbicide concentrations of concern near water. Specific PDFs and buffers can be reviewed in Chapter 2.2.3.

Early detection-rapid response is part of all action alternatives, and is considered in the direct, indirect and cumulative effects analysis. Effects of treatments each year under early detection-rapid response, by definition, would not exceed those predicted for the most ambitious conceivable treatment scenario. This is because the Project Design Features do so much to control the potential for adverse effects and because if the most ambitious treatment scenario were implemented, the potential for spread into new areas would be greatly reduced.

Natural events such as drought, weather events, wildfires, and others affect the spread of invasive plants. These events would have implications on where and how treatments would occur; however, natural events do not act cumulatively with the treatment of weeds to multiply possible environmental effects. Potential effects of treatments to contain, controll or eradicate invasive plants are the focus of this analysis.

3.1.3 Life of the Project

This project 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. The effects analysis considers a range of treatments applied to a range of site conditions to accommodate the uncertainty associated with the project implementation schedule.

Many variables affect invasive plant treatment prescriptions, including land management objectives and standards related to a particular site; treatment area priority and treatment strategy (see Chapter 2 for more discussion about treatment areas, priorities and strategy); and landscape scale goals. The relative proportion and timing of integrated treatments including herbicides and other methods; the effectiveness of invasive plant management on neighboring lands; and available funding also affect the treatment that would be implemented.

The treatment scenarios are not intended to be binding treatment prescriptions. Actual annual treatments will adapt to information gathered through inventory and monitoring and make the most of available funding. Newly discovered infestations could be prioritized over existing sites.

The assumption of full funding to treat approximately 4000 acres annually allows the greatest and most intense impacts possible to be evaluated; however, both the positive and negative impacts of the project are likely to be less than predicted for the most ambitious conceivable treatment.

The analysis assumes that the treatment methods would be applied according to Project Design Features for each alternative.

Thus, herbicides, specifically applied by broadcast methods, are assumed to be part of the prescription unless specifically excluded by each alternative's design. In many cases, the implementation planning protocol shown in Appendix B would lead to similar site treatments no matter which alternative was selected. Broadcast methods would not be used in any alternative where conditions do not warrant the risk associated with this application method, and herbicides would not be used if conditions do not warrant the risk associated with using them. However, assuming the most ambitious conceivable treatment scenario clearly highlights the differences between the costs, effectiveness, and adverse effects from different treatment approaches.

Early Detection-Rapid Response

All action alternatives include the ability for Forest Service land managers to approve treatments on currently unknown invasive plant sites assuming Project Design Features would be followed. The effectiveness of future treatments would reflect the ranking of each alternative, because the effectiveness is strongly influenced by the design features.

Assuming the full funding and treatment of approximately 4000 acres annually, early detection/rapid response would be expected to be a very small part of the program initially because the current inventory would be the treatment priority in the early years of the project. Over time, early detection-rapid response would tend to cover a larger part of the program. Even if the acreage treated in one year were to exceed 4000 acres, the effects analysis would still be valid, because the Project Design Features (Chapter 2) and the Implementation Planning Process (Appendix B) ensures that the plausible adverse effects of treating currently unknown infestations would be within the scope of those disclosed here.

3.1.4 Herbicide Risk Assessments

The effects from the use of any herbicide depends 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. The R6 2005 FEIS relied on herbicide risk assessments to evaluate the potential for harm to non-target plants, wildlife, human health, soils and aquatic organisms from the herbicides considered for use on the Umatilla National Forest. Risk assessments were done by Syracuse Environmental Research Associates, Inc using peer-reviewed articles from the open scientific literature and current 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.

Table 14 displays the risk assessments available by chemical; these may be accessed via the Pacific Northwest Region website at http://www.fs.fed.us/r6/invasiveplant-eis/Risk-Assessments/Herbicides-Analyzed-InvPlant-EIS.htm

Table 14 - Risk Assessments for Herbicides Considered in this EIS

Herbicide	Date Final	Risk Assessment Reference
Chlorsulfuron	November 21, 2004	SERA TR 04-43-18-01c
Clopyralid	December 5, 2004	SERA TR 04 43-17-03c
Glyphosate	March 1, 2003	SERA TR 02-43-09-04a
Imazapic	December 23, 2004	SERA TR 04-43-17-04b
Imazapyr	December 18, 2004	SERA TR 04-43-17-05b
Metsulfuron methyl	December 9, 2004	SERA TR 03-43-17-01b
Picloram	June 30, 2003	SERA TR 03-43-16-01b
Sethoxydim	October 31, 2001	SERA TR 01-43-01-01c
Sulfometuron methyl	December 14, 2004	SERA TR 03-43-17-02c
Triclopyr	March 15, 2003	SERA TR 02-43-13-03b
NPE	May 2003	USDA Forest Service, R-5

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

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

The risk assessments considered worst-case scenarios including accidental exposures and application at maximum label rates. The Project Design Features described in Chapter 2 were developed to abate hazards indicated by the assessments. Although the risk assessments have limitations (see R6 2005 FEIS pages 3-95 through 3-97), they represent the best science available. The risk assessment methodologies and detailed analysis is incorporated into references of conclusions about herbicide toxicology in this document.

Herbicide Toxicology Terminology

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

Hazard Quotient (HQ)

The definition of hazard quotient for this analysis 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 one is presumed to indicate an acceptably low level of risk for that specific application.

Exposure Scenario

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

Plausible Effects

The analysis in Chapter 3 focuses on whether effects that are possible based on risk assessments are plausible, given site conditions, life history of organisms in an area, herbicide application methods and other Project Design Features. Project Design Features are often used to minimize or eliminate the plausibility of effects indicated as possible in the risk assessments.

3.2. Botany and Treatment Effectiveness

3.2.1. Introduction

This section focuses on the relative likelihood that the proposed treatment of invasive plants would be effective in reducing threats to desirable, non-target vegetation (addresses issues listed in section 1.9.4) This section discloses the potential risks to non-target vegetation, including SOLI (threatened and endangered species, regional forester sensitive species and other species of local interest to the forest).

3.2.2. Affected Environment

An invasive plant is a non-native plant whose introduction does or is likely to cause economic or environmental harm or harm to human health (Executive Order 13122). Invasive plants are distinguished from other non-native plants in their ability to spread (invade) into native ecosystems. Some species of invasive plants are listed by the Secretary of Agriculture or by the responsible State official as "noxious weeds." This analysis includes all State-listed noxious weeds plus other invasive species that are of concern because of their impacts to ecosystem health. The term "invasive plants" more broadly encompasses all invasive, aggressive, or harmful non-indigenous plant species, whether designated noxious or not.

Invasive plants pose threats to biological diversity of native plant communities by altering ecosystem processes and can completely displace native plant species and cause a decline in overall species richness. Invasive plants are highly adept at capturing available moisture and nutrients, and often spread quickly.

Invasive plants have been detected on approximately 24,649 acres (1.7 percent) of the 1.4 million-acre Umatilla National Forest located in northeast Oregon and southeast Washington. Presently, 24 different invasive plant species are known to occur within the boundaries of the Forest. In the past 13 years, nearly 2,069 invasive plant sites have been mapped covering approximately 24,649 gross acres, and in many cases, a single mapped site may contain one or more species. Additional invasive plant sites likely exist but have not yet been detected by annual inventory and mapping efforts. Some species, such as cheatgrass (Bromus tectorum), North Africa grass (Ventenata dubia) and Russian and Canada thistle (Salsola kali and Cirsium arvense, respectively), occur in such abundance that many sites have either not been mapped or have been dropped from existing databases and vary from district to district. These species are sometimes considered as low priority for treatment due to task force and/or monetary constraints, or species naturalization. Table 15 summarizes the 24 species that are presently documented from inventory efforts and proposed for treatment.

Infestation sites range in size from one plant to numerous plants scattered over large acreages (see Table 16). The majority of inventoried sites (77 percent) are less than 10 acres in size. Infestations located in high-spread areas such as, roadsides, trails, quarries, range structural improvements, developed recreations sites, parking areas represent 50 percent of the total acres infested (12,339 acres). The remaining acres are found throughout forest lands. Table 17 provides a forest wide invasive plant summary by species, priority and acres. It lists the primary target species which has the greatest abundance or highest priority at each particular treatment site and multiple species can and do occur within a primary target species site. Each Ranger District determines invasive species priority ranking based on local circumstances. Priority ranking differences among species can vary based on whether a species is established on a district, rapidly expanding and invading into native plant and wildlife habitats, or whether a species is a new invader that needs to be controlled before it becomes established. Although Table 17 lists current species priority, this ranking can change in the future to adjust to changing environmental conditions or management activities.

Table 15 - Invasive plant species documented from inventory efforts and the number of sites within each district

Scientific Name	Common Name	Districts No. of sites			
		Heppner	Pomeroy	North Fork John Day	Walla Walla
Articum minus	Lesser burdock	7	1	3	6
Cardaria draba	Whitetop		2	6	1
Carduus nutans	Musk thistle			2	3
Centaurea biebersteinii	Spotted knapweed	1	54	63	98
Centaurea diffusa	Diffuse knapweed	442	151	131	463
Centaurea repens	Russian knapweed				1
Centaurea solstitialis	Yellow starthistle		22	2	18
Chondrilla juncea	Rush skeletonweed				3
Cirsium arvense	Canada thistle	15	48	26	240
Cynoglossum officinale	Houndstongue	10	26	110	154
Cytisus scoparius	Scotch broom	3			2
Daucus carota	Wild carrot				1
Euphorbia esula	Leafy spurge			2	53
(Hieracium pratense 0	Yellow hawkweed				4
Hieracium aurantiacum	Tall hawkweed			1	
Hypericum perforatum	St John's wort	242	36	36	247
Lathyrus latifoliis	Everlasting peavine			1	
Linaria dalmatica	Dalmation toadflax	82	29	7	6
Linaria vulgaris	Butter and eggs	4	1	8	1
Onopordum acanthium	Scotch thistle	6	19	8	6
Phalaris arundinacea	Reed canary grass				1
Potentilla recta	Sulphur cinquefoil		2	88	62
Senecio jacobaea	Tansy ragwort	3	7	11	70
Taeniatherum caput-medusae	Medusahead			4	15
Total (individual species occurrences)		**815**	**398**	**509**	**1455**

Table 16 - Range of invasive plant site sizes

Size of Infestation	# of Invasive Plant Sites	% of Known Sites
Less than 1 acre	531	26
1 to <5 acres	814	39
5 to < 10 acres	247	12
10 to < 50 acres	370	18
50 to < 100 acres	64	3
More than 100 acres	43	2
Total	**2,069**	**100%**

Table 17 – Primary target invasive plant species on the Umatilla National Forest by species priority and acres

Primary Target species	Priority[1]	Number of sites[2]	Acres	Estimate of Total Infested Acres[3]	Other Documented Invasive Plant Species within a priority site (one or all)
Common burdock	3,4	24	184	46	
Whitetop	1,3	15	104	57	diffuse knapweed, hounds tongue, scotch thistle, sulphur cinquefoil
Musk thistle	1	6	42	10	spotted knapweed, diffuse knapweed, tansy ragwort
Spotted knapweed	1,2	327	2,413	603	hounds tongue, yellow hawkweed, dalmation toadflax, yellow toadflax, scotch thistle, sulphur cinquefoil, diffuse knapweed, tansy ragwort
Diffuse knapweed	1,2	1,413	9,968	2,492	tansy ragwort, sulphur cinquefoil, scotch thistle, yellow toadflax, dalmation toadflax, yellow hawkweed, hounds tongue, rush skeletonweed, yellow starthistle
Russian knapweed	2	1	3	1	tansy ragwort
Yellow starthistle	1	36	1,257	314	diffuse knapweed, spotted knapweed, sulphur cinquefoil, tansy ragwort, scotch thistle
Rush skeleton weed	1	2	1	1	
Canadian thistle	4	255	4,482	1,120	diffuse knapweed, spotted knapweed, sulphur cinquefoil, scotch thistle, tansy ragwort
Houndstongue	2	191	2,606	651	sulphur cinquefoil, tall hawkweed, scotch thistle
Scotch broom	1,3	3	6	1	sulphur cinquefoil
Leafy spurge	1	64	35	9	diffuse knapweed
Yellow hawkweed	1	1	1	<1	
St John’s wort	4	191	2,783	695	sulphur cinquefoil, tansy ragwort
Dalmation toadflax	1	51	93	23	yellow toadflax
Yellow toadflax	1	4	19	5	
Scotch thistle	1	11	231	58	sulphur cinquefoil, tansy ragwort
Reed canary grass	4	1	1	<1	
Sulphur cinquefoil	2	92	260	64	diffuse knapweed, tansy ragwort
Tansy ragwort	1	38	100	25	
Medusahead	3,4	8	56	14	
Total		**2,724**	**24,645**	**6,188**	

1 Priority 1 = Generally State Class A or T listed species. Goal is to eradicate new populations and/or control existing populations of these aggressive and harmful species
Priority 2 = Goal is to contain existing populations of aggressive species. Priority 3 = Goal is to eradicate new populations and/or control existing populations of these less aggressive invasive species
Priority 4 = Goal is to contain existing populations of less aggressive invasive species. Species with different priorities vary from district.
2 Individual species can occur on multiple sites, therefore total site numbers are inflated
3. This column is net infested acres, acres that would have 100% ground canopy coverage by invasive species. Ground canopy coverage is estimated to be 55 % for whitetop, and hawkweed and 25 % for all other speces. Net acres are calculated by multiplying gross acres (column 4) by .55 and .25 respectively (L. Dawson 2006).

Native Vegetation

The Umatilla National Forest contains a wide diversity of plant species and communities due to varying elevation and precipitation zones that occur within eastern Oregon. Invasive plants pose threats to biological diversity of native plant communities by altering ecosystem processes and can completely displace native plant species and cause a decline in overall species richness. Invasive plants are highly adept at capturing available moisture and nutrients, and often spread quickly.

The complex geologic history of the area which included floods, volcanic eruptions, landslides and erosion have shaped the landscape of the Umatilla National Forest into a unique combination of landforms and vegetation patterns. The unique combination of geology and topography has produced a distinctive, mosaic pattern of dense, heavily timbered slopes interspersed between open, rugged grasslands. The Forest lies at the extreme eastern edge of the Cascade Range's rain shadow. This high-desert climate is characterized by hot, dry summers (less than 10 inches of precipitation per year) in the lower valleys and moist maritime conditions influenced by the Columbia River at the higher elevations (over 80 inches of precipitation per year). This variety of landform, elevation and climate results in a diversity of plants.

Ecological habitats ranging from low to high elevation include: juniper, sage, grasslands, ponderosa pine, mixed conifer, sub-alpine fir, Engelmann spruce, and alpine plants. Biophysical settings are aggregations of plant associations and represent a combination of temperature and moisture regimes for the Umatilla National Forest (See Table 18). Given this combination of physiography and climate, habitats are highly variable and retain a legacy of botanical diversity.

Plant communities can be classified by a variety of factors such as vegetation structure, site moisture, overstory, and understory. The 2005 R6 FEIS used broad potential vegetation groups (PVGs) to rate the susceptibility of vegetation.

Table 18 provides a summary of the PVGs found in the Project Area, 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.

Table 18 - Potential Vegetation Groups on the Umatilla National Forest's 1.4 million acres and their susceptibility to invasive plants

Potential Vegetation Group	Susceptibility to Invasion[1]	% of Forest	Infested acres (all species)[2]
Cold Forest	Moderate	12	1725
Cold Grassland	Moderate	<1	182
Cold Shrubland	Moderate	<1	46
Dry Upland Forest	Moderate-high	33	7254
Dry Grassland	High	11	3622
Dry Riparian Forest	High	<1	3
Dry Riparian Shrubland	High	<1	1
Dry Shrubland	High	<1	104
Dry Woodland	High-moderate	<1	---
Impounded Water	-----	<1	4
Moist Upland Forest	Moderate-high	29	6897
Moist Grassland	Moderate-high	3	780
Moist Upland Shrubland	Moderate-high	3	332
Moist Upland Woodland	Moderate-high	2	205
Wet Riparian Forest	Moderate	<1	60
Wet Riparian Shrubland	Moderate	<1	7
Riparian Herbland	Moderate	<1	48
Unvegetated Rock	Moderate	<1	45
Unknown	-----	3	3506

1 Susceptibility ratings (derived from R6 FEIS, V. Erickson, and J. Wood): High = high susceptibility to invasion. Invasive plant species invades 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

Since the time of the pioneers, movement of people into the area and the associated establishment of invasive weed spread vectors (highways, railroads, canoes, rafts, and other transportation methods) have continued to alter habitats and vegetation types across the landscape. For example, many areas within the forest have become permanently altered by cheat grass, which has become naturalized. It is highly probable that in the past, this permanent alteration of habitat has affected native vegetation and species of local interest (SOLIs).

Eastside forests are more susceptible to invasive plants than other forests in the region (USDA, 2005b). In general, their grasslands, riparian areas, and relatively dry, open forests are more susceptible to invasion than are dense moist forests and high montane areas (USDA 2005b). The grasslands, riparian areas, and relatively dry, open forests have frequent gaps in the plant cover, which favor invasive plant establishment. 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 (power line) corridors, recreational residences, trails, campgrounds and quarries. These are all places where native vegetation has been removed and disturbance has been created areas for invasive plants to establish.

Botanical Species of Local Interest

SOLI are vascular and nonvascular botanical plant species that are:

- Threatened and/or endangered species (federally listed or proposed for listing under the Endangered Species Act
- Regional Forester Sensitive or Proposed Sensitive Species (Forest Service Manual 2670)
- Plant species endemic to the forest, Oregon and Washington State, and/or Oregon and Washington Natural Heritage Program endangered, threatened, or sensitive species; and
- Species of Local Interest to the Forest

Departmental Regulation 9500-4 – This regulation directs the Forest Service to manage habitats for all existing native and nonnative plants, and fish, and wildlife species on National Forest system lands in order to maintain at least viable populations of such species. Forest Service Manual (FSM) 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.

In FSM 2670.22, the management objective for sensitive species is, in part, to develop and implement management actions to ensure that species do not become threatened or endangered because of Forest Service actions and to maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats throughout their geographic range on National Forest System lands. A viable population is a population that has the estimated numbers and distribution of reproductive individuals to ensure the continued existence of the species throughout its existing range (or range required to meet recovery for listed species) within the planning area.

Prefield Review

A review of available information was completed in order to identify sensitive plant species known or potentially occurring in the project area.

The following sources were consulted for the prefield review:

- Regional Forester's Sensitive Species List (July 2004) modified by J. Wood (July, 2006)
- Oregon Natural Heritage Information Center's (formerly the Oregon Natural Heritage Program) Rare, Threatened and Endangered Species List (May 2004)
- U.S. Forest Service sensitive plant survey GIS layer and associated databases
- USFS personnel (Forest Botanists and Ecologists)
- Literature (see References)

One federally listed species, *Silene spauldingii* (Spaulding's catchfly) is documented on the forest. There are presently 44 SOLI documented or suspected to occur on the Umatilla National Forest (see Table 19). Four bryophytes and six lichen species (non-vasculars) recently suspected of occurring on the forest and considered of local interest are listed in Table 20.

Baseline surveys of prime habitat for the bryophtes and lichen species are nearly complete and no species occurrences are documented.

Table 19 - Sensitive plant species documented (D) or suspected (S) to occur on the Umatilla National Forest

Scientific Name	Common Name	Documented or Suspected	Documented habitat
Allium campanulatum	Sierran onion	D	Dry open areas surrounded by ponderosa pine and juniper wetlands. Usually found growing in clay soils with considerable gravel. Elevation range is 3,000 to 7,400 feet.
Allium diction	Blue mountain onion	D	Openings in subalpine fir stands, Southeast aspects; cobbly shallow soils. Elevation range is 5,200 to 5,500 feet.
Astragalus arthurii	Arthur's milkvetch	D	Moist grasslands, Northerly aspects; shallow, stony soils. Moderate elevations (4,000 feet).
Astragalus cusickii var. cusickii	Cusick's milkvetch	D	Canyon grasslands (Snake and Grande Ronde rivers; loose, fine-textured basalt soils on cliffs, road-cuts and areas of vegetation cover < 50%.
Bolandra oregano	Oregon bolandra	D	Moist rocky seeps, springs, waterfalls, wet road banks. Low to moderate elevations 2,000 to 5,000 feet.
Botrychium crenulatum	Crenulate moonwort	D	Partially shaded or open settings, primarily in sedge/forb communities associated with seeps, small streams, drainages and edges of wet meadows. Englemann spruce and stands of grand fir, Douglas fir and lodgepole pine.
Botrychium hesperium	Windowleaf moonwort	D	Same as above
Botrychium lanceolatum	Lance-leaf grapefern	D	Same as above
Botrychium lunaria	Moonwort grapefern	D	Same as above
Botrychium minganense	Mingan moonwort	D	Same as above
Botrychium montanum	Peculiar moonwort	D	Same as above
Botrychium paradoxum	Northern moonwort	D	Same as above
Botrychium pedunculosum	Stalked moonwort	D	Same as above
Botrychium pinnatum	Northern moonwort	D	Same as above

Scientific Name	Common Name	Documented or Suspected	Documented habitat
Calochortus longebarbatus var. longebarbatus	Long-bearded mariposa lily	D	Seasonally wet meadow and stream margins. Ponderosa, lodgepole pine and juniper forest openings and forest edges of vernally moist grassy meadows, occasionally along seasonal streams.
Calochortus macrocarpus var. maculosus	Nez Perce mariposa lily	D	Pristine grassland on steep slopes, rock outcrops and cliffbands with basaltic soils over a wide elevation range
Calochortus nitidus	Broadfruit mariposa	S	Palouse grasslands, deep soils.
Camissonia pygmaea	Dwarf suncap	S	Sagebrush steppe at 1800' – 2000' elevation
Carex cordillerana	Back's sedge	D	Wet meadows, streams, springs, seeps, moist conifer forest.
Carex hystericina	Porcupine sedge	D	Wet to moist conditions in riparian zones; in or along ditches/canals in prairies and wetlands.
Carex stenophylla (C. eleocharis)		S	Open, dry to moderately moist places, often with grasses, over a wide elevation range.
Cypripedium fasciculatum	Clustered lady slipper	D	Wet forests dominated by grand fir overstory to, more commonly, drier forest types such as ponderosa pine and/or Douglas fir overstory with pinegrass (Calamagrostis rubescens) understory. Found near springs and creeks in moist plant associations, as well as in drier environments in duff and moss under Douglas fir and oceanspray (Holodiscus discolor), and Douglas fir and ninebark (Physocarpus malvaceus). Elevations of 1,600 to 8,000 feet.
Erigeron disparipilus	Snake river daisy	D (only sensitive in OR)	Ridgetops and forest openings at moderate elevations in the Blue Mountains and Snake River regions.
Eleocharis bolanderi1	Bolander's spikerush	D	Intermittent stream channels, edges of wet meadows, and roadside ditches; in dry bunchgrass and scab communities on basaltic substrates
Haplopappus liatriformis		S	Native, undisturbed, prairie grasslands, including shrubland and open forest verges. Elevation ranges generally below 3,000 feet.

Scientific Name	Common Name	Documented or Suspected	Documented habitat
Leptodactylon pungens ssp. hazeliae	Prickly phlox	D	Sheer rock outcrops and talus-covered slopes. Low elevations (below 2,000 feet).
Lomatium cusickii		S	Open slopes with rocky soils in bunchgrass communities, mid to high elevations
Lomatium rollinsii	Rollins' biscuitroot	D	Open slopes in bunchgrass communities of the canyonlands of the Blue Mountain and Snake River ecoregions.
Lomatium salmoniflorum	Salmon-flowered lomatium	S	Open, rock slopes at lower elevations.
Lupinus sabinianus	Sabin's lupine	S	Open grassy slopes in mixed coniferous forest; road-cuts and disturbed soils. Low to moderate elevations (3,300 to 5,500 feet).
Lycopodium complanatum	Ground cedar	S	Coniferous forest with thick duff. Often on rotting wood or in acidic soils. Also in meadows and on open ridgetops. Moderate elevation (4,300 feet).
Mimulus clivicola	Bank monkey-flower	S	Open rocky slopes. Southerly aspects with steep slopes. Shallow soils at low to moderate elevations (2,500 to 5,500 feet)
Montia diffusa	Branching montia	S(sensitive only in WA)	Moist forest with Douglas fir, on disturbed soils over a wide elevation range.
Pellaea bridgesii		D	This small, evergreen fern favors south and east aspects of rocky outcrops and talus slopes of metamorphic and igneous origin. Elevation ranges between 4000 to 9500 feet.
Phacelia minutissima		S	Streambanks in sagebrush communities and in aspen stands. In the Blue Mountains it occurs in association with false hellebore (Veratrum californicum) and white mules ears (Wyethia helianthoides) in vernally moist meadows and small scablands at elevations 5000 to 7000 feet.
Phlox multiflora	Many-flowered phlox	S	Dry, rock areasl; cliffs to ridgetops and open slopes. Wooded, rock areas as well as open sites. Loose substrate at elevations around 3,500 feet.
Ranunculus populago	Mountain buttercup	D	Wet meadows, streamside, and in bogs,and seedps at mid-montane elevations.
Salix farriae	Farr's willow	D	Wet meadows, lakeshores, and streambanks. Elevation range is 7,000 to 8,000 feet.

Scientific Name	Common Name	Documented or Suspected	Documented habitat
Silene spaldingii	Spalding's silene	D	Native, undisturbed, prairie grasslands. Elevation ranges between 1,200 to 4,500 feet.
Spiranthes porrifolia		S	Wet meadows, bogs, streambanks and seepage areas from 60 to 6800 feet in elevation.
Suksdorfia violacea		S	Rock crevices, mossy banks, cliffs, and shaded sandy areas, usually at least vernally wet.
Thelypodium eucosmum	Arrow-leaved thelypody	D	Moist, seepy areas on ashy-clay soils in Grant and Wheeler Counties. Sites include steep drainages along the John Day River.
Trifolium douglasii	Douglas clover	D	Moist to wet meadows and forested wetlands and streambanks, with ponderosa pine, Douglas fir, and lodgepole pine.
Trifolium plumosum var. plumosum	Pussy clover	S	Dry hillsides and forest edges with ponderosa pine, Douglas fir and lodgepole pine.

Table 20 - Non-vascular species of local interest suspected to occur

Bryophytes	Lichens
Rhizomnium nudum (Oregon only)	*Dermatocarpon luridum*
Schistostega pennata	*Leptogium burnetiae* var. *hirsutum*
Scouleria marginata	*Leptogium cyanescens*
Tetraphis geniculata	*Nephroma bellum* (Washington only)
	Peltigera neckeri
	Peltigera pacifica

Field Surveys

Extensive botanical surveys have been conducted on the Umatilla National Forest (J. Wood 2006). Survey routes and documented occurrences and habitats for SOLI are on file at the Umatilla National Forest supervisor's office. Due to the extensive surveys conducted on the forest no additional surveys are proposed for this project. Databases and records from the Umatilla National Forest were used to identify SOLIs within 100 feet of identified treatment areas. Presently, there are 13 plant SOLIs on 44 sites within 100 feet of identified invasive plants proposed for treatment (see Table 21 and Appendix B for a complete listing of sites).

Of the 44 sites documented to be within 100 feet of an invasive species documented occurrence:

- 40 percent of the sites are located adjacent to or within 0-10 acres of an invasive species site
- 71 percent of the sites are located adjacent to or within 11-50 acres of an invasive species site
- 21 percent of the sites are located adjacent to or within 51-100 acres of an invasive species site
- 21 percent of the sites are located adjacent to or within 101 or more acres of an invasive species site

In some cases more than one invasive species was documented within 100 feet of a SOLI, the largest reported acreage of infestation was reported in the above stated ranges.

Table 21 - SOLI occurrences within 100 feet of an identified invasive species site

District	Scientific Name	Common Name	Number of occurrences within 100 feet of invasive species	Invasive Species	Previously Treated under "95 EA"
Pomeroy	*Astragalus arthurii*	Arthur's milkvetch	2	Diffuse knapweed, yellow starthistle, scotch thistle	NO
Walla Walla	*Botrychium lanceolatum*	Lance-leaf grapefern	6	Spotted and diffuse knapweed, Canada thistle, tansy ragwort, houndstongue	Yes, hand pulling, chemical on 2 sites for knapweeds
Walla Walla	*Botrychium minganense*	Mingan's moonwort	5	Diffuse knapweed, Canada thistle, tansy ragwort	Yes, 4 sites. 1 site hand pulling for diffuse knapweed and tansy ragwort, 3sites chemical for knapweed
Walla Walla	*Botrychium Montanum*	Mountain Grapefern	1	Diffuse knapweed,	NO
Walla Walla	*Botrychium Pedunculosum*	Stalked moonwort	1	Diffuse knapweed	NO
Walla Walla	*Botrychium pinnatum*	Northern moonwort	6	Diffuse and spotted knapweed, tansy ragwort, Canada thistle	Yes, 4 location, hand pull and chemical for tansy ragwort and knapweeds
Walla Walla	*Carex cordillerana*	Back's sedge	5	Common burdock, diffuse knapweed, sulphur cinquefoil, tansy ragwort	Yes, 2 locations. Hand pulling and chemical for common burdock, knapweed, tansy ragwort
Pomeroy	*Carex hystericina*	Porcupine sedge	1	Scotch thistle	NO

District	Scientific Name	Common Name	Number of occurrences within 100 feet of invasive species	Invasive Species	Previously Treated under "95 EA"
Pomeroy	*Calochortus macrocarpus var. maculosus*	Nez Perce mariposa lily	7	Yellow starthistle, scotch thistle, diffuse knapweed, tansy ragwort	NO
Walla Walla	*Eleocharis bolanderi*	Bolander's spikerush	4		Yes, 1 location, chemical
Pomeroy	*Leptodactylon pungens ssp. hazeliae*	Prickly phlox	1	Diffuse knapweed	NO
Pomeroy and John Day	*Trifolium douglasii*	Douglas clover	4	Diffuse knapweed, houndstongue, St john's wort	NO
District	**Federally Listed Species**	**Common Name**	**Number of occurrences within 1000 feet of invasive species**	**Invasive Species**	**Previously Treated under "95 EA"**
Pomeroy	*Silene spaldingii – Federally listed*	Spaulding's catchfly	1	Yellow starthistle, diffuse knapweed	NO
Total		**13 Species**	**44 Occurrences**	**NA**	**5 species 13 occurrences**

3.2.3 Environmental Consequences

The public has expressed concerns that there is and will continue to be a loss of vegetation diversity within native plant communities from invasive plants. The public has also expressed concern that the application of herbicides has the potential to adversely affect non-target plant species. Determination of effects assumes implementation of all PDFs as listed in Chapter 2.2.3 Table 6, and follows all standards outlined in the Regional FEIS.

Continued loss of vegetation diversity is addressed through the analysis of treatment effectiveness towards the reduction of invasive plants. Treatment effectiveness is measured by the decrease or elimination of the invasive species, and the concomitant recovery of the area with native vegetation. Effectiveness for non-herbicide methods was derived from a thorough review of literature, including technical handbooks such as The Nature Conservancy Weed Control Handbook (Tu et al. 2001), county and state extension service or weed control board publications, and peer reviewed journal articles. A compilation of this review, Common Control Measures for Invasive Plants of the Pacific Northwest Regions (Mazzu 2005) can be found in the project record of this EIS

Concerns related to impacts from treatments to non-target plant species including SOLI were addressed through herbicide risk assessments (FEIS 2005) and a thorough review of the literature including non-herbicidal effects to plants (USDA 2005, Appendix J), risk to pollinators of native plant communities (USDA 2005), and peer reviewed scientific papers.

Risks to non-target species including SOLI were based on the combination of treatment effectiveness between alternatives and direct and indirect effects from invasive plant treatments.

Treatment effects to native plant communities and pollinators associated with these communities is evaluated at a forest wide scale. Effects to individual SOLI are based on individual site occurrences, proposed treatment to nearby invasive species, and overall risk of treatment effectiveness by alternative

3.2.4 Treatment Effectiveness and General Impacts to Native Vegetation Common to All Alternatives

This section describes treatment effectiveness related to each treatment type proposed in this EIS (as tiered to the Regional FEIS). Forestwide, treatment effectiveness typically increases with the number of treatment options available and the percentage of infested lands that may be treated. Early detection, rapid response to newly discovered infestations also increases treatment effectiveness and reduces potential effects of herbicide treatment on non-target vegetation. The effectiveness of an alternative to treat the diverse group of invasive plants depends on the variety of tools available. Thus, alternatives that limit the variety of tools also limit the effectiveness of treatments. Strategies such as integrated weed management, cooperation with private and public landholders, prevention, EDRR and site restoration and revegetation practices apply to all alternatives proposed in this EIS and are described in this section.

Integrated Weed Management

All alternatives strive towards integrated treatments, such as using manual treatment as a follow-up to get plants missed by herbicide spraying, or using a mechanical method, such as weed whacking, on tall stems to reduce biomass and reduce the amount of herbicide used.

Herbicide treatment is often followed up by manual treatment later in the season to get plants that were missed by the herbicide or several years later when invasive plant populations are reduced to the point at which they can be hand-pulled.

Cooperation with Private and Public Landholders as well as Other Agencies

Cooperative treatment of weeds by various land ownerships and neighboring parcels also contributes to optimizing effectiveness of all alternatives. Invasive plants are currently being treated on county and state lands and on some private lands and this work would continue regardless of the alternative that is selected. On-going partnerships will continue, such as the city and county weed boards, Wallowa Resources, Rocky Mountain Elk Foundation, Bureau of Land Management, Oregon Department of Transportation, and North Fork John Day Watershed Council. Efforts such as these are imperative for the promotion of healthy ecosystems by reducing invasive plants and the economic and community benefits that healthy ecosystems provide

Prevention

Prevention practices as outlined by the Regional FEIS and adopted into the Umatilla National Forest Plan suggest that incorporation of these activities will reduce the annual area spread of invasive species to approximately 5 percent compared to the estimated current spread of 8-12 percent (R6 FEIS, 4-22).

Early Detection Rapid Response (EDRR)

Sometimes considered the “second line of defense “after prevention, EDRR is a critical component of any effective invasive species management program. When new invasive species infestations are detected, a prompt treatment to these small occurrences can reduce environmental and economic impacts compared to allowing the infestation to spread and establish, thus warranting a long-term control program.

This action results in lower cost and less resource damage than implementing a long-term control program after the species is established. The no action alternative presently uses manual and mechanical methods to treat new infestations, whereas, the proposed alternatives B, C, and D could treat new or previously undiscovered infestations using the range of methods described in this EIS as directed in the decision tree implementation process and in full accordance with PDFs listed in Chapter 2 of this EIS. EDRR is considered to be one of the four primary elements in the Forest Service National Strategy and implementation for invasive species (USDA 2004) and implementation on any scale would reduce negative impacts to native plant biodiversity. However, treatment effectiveness for control and eradication increases with the more treatment options available.

Site Restoration/Revegetation

Restoration or reclamation of sites infested with invasive species follow treatment restoration standard 13 (USDA-PNW-ROD, 2005a) and incorporate guidelines for revegetation of invasive weed sites and other disturbed areas on National Forests and Grasslands in the Pacific Northwest (Erickson et al. 2003, also Appendix G this document) On degraded sites where reproducing individuals of desirable species are absent or in low abundance, revegetation with well adapted and competitive grasses, forbs and legumes can be used to direct and accelerate plant community recovery and achieve site management objectives in a reasonable timeframe (Sheley et al. 1996 in Erickson et al. 2003).

Restoration and revegetation projects that would include ground disturbing activities such as disking or plowing would require additional NEPA analysis on a site specific level.

In all alternatives, the threat to native plant habitats from invasive plants is considered greater than any effects that would occur from treatments. Specifically, due to concerns about rare plant habitat loss from invasive plant species, sensitive plant populations immediately threatened by invasive plants are a high priority for treatment. All alternatives, including the No Action, approve a range of non-herbicide methods, including biological, manual and mechanical treatments. The variation between alternatives is mostly related to the use of herbicides and treatment methods.

The following treatment types provide specific information related to the effectiveness and impacts to native vegetation common to all alternatives.

Biological Control

Biological control is used where sites are either too large to be sprayed with herbicides, the invasive plant species is so abundant that other methods would not be practical, or the biological control agent is effective on the target plant species and reduces or eliminates the need to use herbicides. For example, bio-control releases on yellow starthistle and diffuse knapweed have shown positive control results on Walla Walla District in the past (J. Mitchell, 2006). Bio-control agents previously released and established in an area will continue to spread to other nearby invasive sites providing a potential long-term control treatment to invasive species with associated bio-control agents.

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 the Forest Service releases 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-targets will spread from neighboring lands to National Forest system lands. There are a few examples of indirect effects on non-target organisms resulting from biological control introductions. Callaway et al. (1999) found the reproductive output of native *Festuca idahoensis* planted with spotted knapweed was lower when the introduced root moth (*Agapeta zoegana)*, had attacked neighboring knapweed. A study of native deer mouse (*Peromyscus maniculatus*) diets found introduced knapweed gall flies were the primary food item for most of the year and over 80 percent of the winter diet (Pearson et al. 2000). These studies illustrate ways that biocontrol agents can indirectly affect their new communities or ways their communities can change agent effectiveness.

Region 6 policy allows redistribution of approved biocontrols without further NEPA decisions. The redistribution of biocontrols may be considered similar to invasive plant prevention practices in NEPA documents.

In compliance with the R6 2005 FEIS, Standard #14 which stipulates to use only APHIS and State-approved biological control agents and agents demonstrated to have direct negative impacts on non-target organisms would not be released, the regional office will annually provide a list of agents that may not be released because they do not meet the standard (Pacific Northwest Region Six White Paper, 2006 (See Appendix B this EIS). This annual list will also add new and approved biological control agents for invasive plants. Additionally, weed practitioners are encouraged to coordinate with the state experts regarding the selection of agents.

Cultural Treatments

No cultural treatment sites are presently identified within the Project Area. Ground disturbing restorative activities such as disking or use of heavy equipment for revegetation will require separate NEPA analysis.

Manual Treatments

Manual treatments proposed by local district personnel in this EIS are mostly on small (less than 2 acres), easily accessible populations of houndstongue, scotch thistle, medusahead and reed canarygrass.

The removal of invasive plants using manual techniques (i.e. hand pulling, digging with hand tools, clipping flower heads with hand tools) could directly affect listed plants in situations where the invasives are co-located with these species. Direct negative effects would be unintentional removal of flowers, fruits, or root systems of these species. Vigor could be reduced in individuals through reduction in photosynthesis or reproduction potential. Solarization coverings may have negative effects on soil microorganisms and non-target species' seed viability and would not selectively allow other plants to grow, as would a selective hand application of an herbicide. Hot water and foaming treatments, shown to be effective on small areas on annual weeds and seedlings, is less effective on underground roots or rhizomes, is restricted to proximity to steam generating equipment (i.e. roadsides), has high risks of applicator burns, and unknown impacts to soil microorganisms and co-located non-target species.

These short-term impacts, if kept to a minimum in relation to population size, would be more than compensated by the long-term positive benefits of removal of aggressive, competitive invasive plants. Manual control crews could also directly impact listed plants through trampling of individuals or creation of erosive conditions within or upslope of populations. These impacts may have a more long term negative impact, but again if minimized, the benefit to the species would be more positive than negative.

Indirect negative impacts from manual control could be attributed to soil disturbance and opening of the canopy (understory, shrub layer or overstory depending on the species).

This could cause shifts in microsite condition such as reduction in soil moisture, disruption of mychorrhizal associations and cause an increase in surface temperatures. All of these indirect effects could lead to a shift in species composition away from the native community upon which listed plants depend. It is possible that one invasive species could be replaced by another invasive through various means of introduction (e.g. windblown seeds, human transport, breaking dormancy of other species seeds). This would likely be at a small scale (scattered 1 acre patches or less). Monitoring treated sites, doing follow-up treatments and taking restorative actions such as seeding desirable species would likely prevent undesirable new invasions.

Positive benefits from the removal of invasive species overshadow indirect negative impacts. Listed plant populations would be affected in a positive way by providing the space for increased growth in population size. One possible scenario is that removal of invasives will encourage native seed dormant in the soil to germinate due to less competitive conditions. Dremann and Shaw (2002) documented the success of converting live oak woodland from 99 percent exotic species cover to 85 percent native plant cover through a strategy of timed manual/mechanical removal that released the native seed bank. No reseeding was necessary.

Mechanical Treatments

Mechanical treatments are not singularly proposed in this EIS, however, could be used in combination with other treatment methods to increase overall treatment effectiveness. Objectives are to reduce biomass which reduces herbicide use, to stimulate new growth making some herbicides more effective, to prepare a site for revegetation, and/or remove and dispose of propagule source (seeds or other vegetative material capable of re-introduction). The majority of mechanical treatments involve using a weed-whackers and mowers.

Herbicide Treatments

The objectives of herbicide treatments are often two fold: 1) to more efficiently reduce the size of moderate to large infestations of invasive plants to a point at which they can be hand-pulled, and, 2) more efficiently treat large expansive areas where invasive plants are continually showing up due to the nature of the site. Different herbicides vary in effectiveness and length of control on different invasive plants, and herbicide techniques can vary in effectiveness, environmental effects, and costs.

Herbicide risks provided the basis for the analysis of effects on non-target plants including SOLIs. Herbicide selectivity, potency, and persistence and ability to move off site were all factors that contribute to risks associated with non-target impacts from herbicides. In general, 1) the more selective an herbicide is, the less impacting it would be on non-target plants, 2) more potent herbicides, which take a very small amount of active ingredient to cause damage, are considered to have higher risk to affect non-target plants if drift occurred, and 3) a persistent herbicide would have the ability to affect non-target plants more than a non-persistent herbicide either directly through off site movement or indirectly through impeding native or desirable seed germination. Summaries of effects to plants by active ingredient are available in Appendix B.

Surfactants

Inerts, Adjuvants and Impurities

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. Adjuvants are compounds added to the formulation to improve its performance. They can either enhance the activity of an herbicide's active ingredient (activator adjuvant) or offset any problems associated with its application (special purpose or utility modifiers). Surfactants are one type of adjuvant that makes the herbicide more effective by increasing absorption into the plant, for example.

Inerts and adjuvants, including surfactants, are not under the same registration guidelines as are pesticides. The EPA classifies these compounds into four lists based on the available toxicity information. If the compounds are not classified as toxic, then all information on them is considered proprietary and the manufacturer need not disclose their identity. Therefore, inerts and adjuvants generally do not have the same amount of research conducted on their effects compared to active ingredients (See Appendix E of this EIS, and the BE for this EIS (available upon request from the Project Record at the Umatilla National Forest in Pendleton, OR) for a detailed discussion of surfactants). Impurities are inadvertent contaminants in the herbicide, usually present as a result of the manufacturing process.

Herbicide Application Methods

Effects to non-target vegetation also vary with the herbicide application method; spot and hand application methods substantially reduce the potential for impacts to non-target vegetation because there is reduced chance for drift. Drift is associated primarily with broadcast treatments and can be mitigated to some extent by the applicator. Drift can also be minimized by equipment (correct nozzle designed for herbicide application), application methods (use of low nozzle pressure), and applying during certain weather conditions (e.g. apply when wind velocity is between two and eight miles per hour and do not spray if precipitation is predicted to occur within 24 hours.). Table 22 summarizes the influences of various factors on spray drift.

Spray nozzle diameter, pressure, the amount of water applied with the herbicide, and herbicide release height are important controllable determinants of drift potential by virtue of their effect on the spectrum of droplet sizes emitted from the nozzles. Meteorological conditions such as wind speed and direction, air mass stability, temperature and humidity and herbicide volatility also affect drift.

Commercial drift reduction agents are available that are designed to reduce drift beyond the capabilities of the determinants previously described. These products create larger and more cohesive droplets that are less apt to break into small particles as they fall through the air. They reduce the percentage of smaller, lighter particles that are the size most apt to drift.

Marrs et al. (1989) in the study, "Assessment of the Effects of Herbicide Spray Drift on a Range of Plant Species of Conservation Interest", examined the distances in which drift affected non-target vascular plants using ground based broadcast treatment methods.

Their observations are consistent with drift-deposition models in which the fallout of herbicide droplets has been measured. Most of the severe impacts (death of the plants and severe growth suppression) were confined to a very short distance (about 2 meters, 6 meters maximum). Symptoms of plant damage and flower suppression were found at slightly greater distances, but most damage occurred near the sprayer. The maximum safe distance at which no lethal effects were found was 20 feet, but for most of the herbicides tested, the distance was 7 feet. In most cases, there was rapid recovery by the end of the growing season. They concluded: "In summary, the effects of severe damage by herbicide-droplet drift from simulation experiments set up to cover a range of high-risk herbicides under realistic application conditions, with standard hydraulic sprayers, suggest that buffer zones surrounding nature reserves and other sensitive vegetation could be quite narrow, in the order of c. 5-10m" (~16-33 feet).

The maximum safe distance at which no impacts are found, obviously is greater with aerial applications due to the distance above the ground at which the herbicide is sprayed, in addition to other factors previously described. All aerial applications of herbicides will comply with EPA label restrictions, in addition to buffer distances described in Project Design Features for the protection of SOLI and stream and riparian areas to meet the direction given in Standards 19 and 20.

Impacts to non-target plants resulting from aerial drift are often studied in conjunction with drift associated with the protection of water quality. To ensure protection to non-target plants (and pollinators), buffer widths are determined by taking into consideration factors such as height of application, weather conditions, nozzle type and orientation and drop size. As with ground broadcast applications, the same factors listed in Table 22 affect aerial drift.

For a complete summary of spray guidelines and current models used to determine buffer distances see Appendix F of this document.

Terrain on the Umatilla National Forest is geared towards using helicopters for access and treatment to proposed and potentially new aerial sites (Pope 2006). Helicopters would be able to apply herbicides at heights of 10 to 20 feet above the ground in most cases. In steep terrain, the pilot would attempt to fly up and down the slope in order to maintain an equal distance of the boom to the ground. Surfactants added to tank mixtures to reduce drift may be added to the herbicide spray to provide additional precaution for off target drift. Surfactants proposed for use in this project and effects analyses have been disclosed in the R6 2005 FEIS (Chapters 4.4, 4.5, 4.7 along with Appendices P and Q).

New applicator technology also exists for more precise application with minimal drift of herbicide to very small areas from helicopters (spray balls). These small applicator tools are lowered via a boom from the helicopter and the pilot applies herbicide (by a trigger mechanism and pump) to approximately a 4 foot radius area two to four feet above the ground (Pope 2006).

Sensitive areas were shown to be fully protected using a 300 foot buffer (no aerial deposition) in a study using three commonly used helicopters, with various nozzle types applying picloram at a rate of 2 gallons/acre (USDA 2006c).

Additionally, helicopter application of clopyralid and picloram to control yellow starthistle in Hells Canyon, Idaho reported application method had greater than 90% percent control and no apparent damage to the native grasslands following treatment (TNC 2006). This application method was reported to be very accurate and negligible drift was observed. Some temporary set-back of some arrowleaf balsamroot (*Balsamorhiza sagittata*) was observed, however most plants recovered.

Table 22 - Summary of the Influence of Various Factors on Spray Drift

Factor	More drift	Less drift
Spray particle size	Smaller	Larger
Release height	Higher	Lower
Wind speed	Higher	Lower
Spray pressure	Higher	Lower
Nozzle size	Smaller	larger
Nozzle orientation (aircraft)	Forward	Backward
Nozzle location (aircraft)	Beyond 2/3 wing span	2/3 or less wing span
Air temperature	Higher	Lower
Relative humidity	Lower	Higher
Nozzle type	Produce small droplets	Produce larger droplets
Air stability	Vertially stable air	Vertical movement of air
Herbicide volatility	volatile	Non-volatile

Glyphosate was ranked as third or fourth choice for most herbicides (i.e., not the preferred option) because it is non-selective (i.e. it will kill any plant that comes into contact with it), and has the potential to leave bare ground potentially ripe for new invasives to establish. Selective herbicides are more desirable for maintaining as much native vegetation on site as possible.

Herbicide Effects on Pollinators

Limited research is available that addresses impacts from invasive plants on mutual relationships between plant pollinators and native plant communities. One study has indicated that exotic plants may compete better for native plant pollinators by producing more desirable nectar and therefore increasing fitness and reproductive ability of the non-native plant (Levine et al. 2003). Presently, little is known about native plant and native plant pollinators in general and efforts in understanding these interactions are just beginning to study basic aspects of plant-pollinator interactions for optimal management decisions to be made for conservation of these interactions in natural systems (Kearns et al. 1998). It is estimated that there may be between 130,000 and 200,000 invertebrate and vertebrate species that regularly visit the flowers of higher plants, which depend on these animals to assure cross-pollination. The majority of flowering plants in the world (88 percent) are pollinated by beetles, followed by wasps (18 percent) and bees (16.6 percent of flowering plants) (Buchman and Nabhan, 1996).

Treatments that reduce invasive plants, positively impact the native plant community when the native plants are restored. Very little information is available on the effect of herbicides on native pollinators. Most information is related to impacts on the non-native honey bee. It is known that pollinators can be directly affected by spray or indirectly when plants needed as food for adults or larvae are eliminated by herbicides (Shepaherd et al., 2003). The only known quantified effects are from direct spray. The herbicides approved for use in the regional FEIS are not expected to have toxic effects when directly sprayed on honeybees at the typical Forest Service application rates.

However, glyphosate and triclopyr, may have some toxic effects if applied at the maximum application rate proposed by the Forest Service (SERA, 2003-glyphosate; SERA, 2003-Triclopyr). Table 23 lists the potential herbicide doses for bees in a direct spray scenario.

Table 23 - Toxicity levels for bees from exposure totypical herbicide application rates

Herbicide	Typical Application Rate	Potential Dose for Bee	Toxic Level for Bee
Chlorsulfuron	0.056 lb/ac	8.98 mg/kg	>25 mg/kg (LD50)
Clopyralid	0.350 lb/ac	56.10 mg/kg	909 mg/kg (no mortality)
Glyphosate	2.000 lb/ac	321.00 mg/kg	540 mg/kg (NOAEC)
Imazapic	0.130 lb/ac	16.00 mg/kg	387 mg/kg (no mortality)
Imazapyr	0.450 lb/ac	72.10 mg/kg	1000 mg/kg (no mortality)
Metsulfuron Methyl	0.030 lb/ac	4.81 mg/kg	270 mg/kg (NOEC)
Picloram	0.350 lb/ac	56.10 mg/kg	1000 mg/kg (no mortality)
Sethoxydim	0.300 lb/ac	60.10 mg/kg	107 mg/kg (NOAEL)
Sulfometuron Methyl	0.045 lb/ac	7.21 mg/kg	1,075 mg/kg (NOEC)
Triclopyr BEE	1.000 lb/ac	160.00 mg/kg	>1,075 mg/kg (LD50)
Triclopyr TEA	1.000 lb/ac	160.00 mg/kg	>1,075 mg/kg (LD50)
NP9E (main generic ingredient in most surfactants)	1.67 lbs/ac	268.00 mg/kg	unknown

Uncertainty exists regarding the effects of herbicides on non-target plant species and pollinators because native species are not the usual test species for EPA toxicity studies. The EPA performs studies predominantly on crop species. Boutin et al. (2004) concluded that it was likely that the current suite of tested species were not representative of the habitats found adjacent to agricultural treatment areas,

and suggested the current suite of tested species might cause an unacceptable bias and underestimated risk. Because of the lack of studies available to fully assess the impacts to native pollinators, it is possible that some short term impacts to pollinators in localized areas could occur from herbicide treatments. Long-term impacts would not be expected because annual herbicide treatments are presently proposed on less than .3 percent of the forest landbase leaving over 99 percent of the forest lands serving as future native pollinator sources after invasive areas are restored or recovered to native vegetative states.

Herbicide Effects on Plant Diversity

Just as changes in plant diversity or species composition can occur due to invasive plants, changes can also occur due to treatments. Short-term changes in species dominance can lead to long-term shifts in plant community composition and structure. Repeated treatments over time could favor tolerant species, which in turn could shift pollinators available to a community.

Some studies cited in this EIS found that species diversity was not affected by herbicide treatment. Species diversity was determined using the number, or richness, of species found on a site. Diversity was then evaluated by comparing the distribution of the number of species by total cover of the plant community using diversity indices. More species distributed across an area equates with higher species diversity.

The number of species on a site may not significantly change, but the composition of these species could change. For example, replacing perennial natives with the same number of non-native annuals may not change species richness, but could change composition enough to affect other components of the ecosystem. Naeem et al. (1999) summarized studies related to biodiversity and ecosystem functioning. Recent theoretical models predict that decreasing plant diversity leads to lower plant productivity. These models also show diversity and composition are equally important determinants of ecosystem functioning.

A completely integrated invasive plant strategy should include multiple herbicides because as DiTomaso (2001) points out, continuous broadcast use of one or a combination of herbicides will often select for tolerant plant species. When broadleaf selective herbicides are used, noxious annual grasses such as medusahead, cheatgrass or barbed goatgrass may become dominant. Population shifts through repeated use of a single herbicide may also reduce plant diversity and cause nutrient changes. For example, legume species are important components of rangelands, pastures, and wildlands, and are nearly as sensitive to clopyralid as yellow starthistle. Therefore, repeated clopyralid use over multiple years may have a long-term detrimental effect on legume populations.

3.2.5 Treatment Effectiveness by Alternative

Effective treatments are defined as those that reduce the extent of invasive plants so that the area can reach its desired condition. Invasive plants are considered to be effectively controlled when acres of plant spread is less than or equal to the annual acres successfully treated (USDA, 2005b). Treatment effectiveness increases with the number of treatment options available and the percentage of infested lands that may be treated. Rapid response to newly discovered infestations also increases treatment effectiveness. Treatment effectiveness is often enhanced by using a combination of treatment methods and prevention activities applied according to IWM principles. A study by Brown et al. (2001) showed that a combination of manual or mechanical and herbicide treatments was more effective than herbicides alone when dealing with persistent species like spotted knapweed. Herbicide treatment alone was found to be most cost effective in the short-term but the combination of treatments maintained better control in the long-term. For example, biological control combined with herbicides could prove more cost effective if insects could establish and maintain long-term control. The regional FEIS (USDA 2005) suggests that with prevention standards implemented in combination with use of chemical treatments are approximately 94-96 percent effective in reducing the rate of invasive species spread (USDA 2005, and Bulkin 2006).

The Umatilla National Forest presently treats invasive weeds according to the *Umatilla National Forest Environmental Assessment for Managing Noxious Weeds* (USDA, 1995). This document incorporated the integrated weed management (IWM) practices emphasizing prevention and non-chemical control strategies prior to the use of herbicides. Under this 1995 EA, 157 sites (1,339 acres) became eligible for biological treatment, 29 sites (41 acres) remained eligible for manual treatment and 587 sites (1,391 acres) were eligible for herbicide treatment using three herbicides, glyphosate, dicamba, and picloram. One additional project (1998 Eden Timber Sale) added 59 additional invasive species sites (383 acres) approved for herbicide treatments.

Presently, with adoption of the 23 regional standards into the forest plan, treatment includes use of two herbicides (dicamba is not approved under the amended forest plan); biocontrol agents on previously specified sites and manual and mechanical treatments are allowed on new infestations.

Alternative A – No Action

Under the No Action Alternative, invasive plant treatments would be limited to areas authorized under the existing "95" EA decision documents. The "95 EA" approved use of herbicides on 587 sites (1,391 acres) on the Umatilla National Forest (USDA 1995). Amendments to this decision added an additional 59 sites (383 acres) approved for chemical treatments (USDA 1998). The total number of sites approved for chemical treatments represents 36 percent of the total number of sites presently mapped. New infestations have been and would continue to be treated with manual and mechanical methods. Methods of treatment for each alternative are summarized in Table 24. Invasive plant sites have continued to increase over the years and, if left untreated, will continue to expand based on projections of spread (Figure 9 below). These expanding, spreading populations would become increasingly more difficult and costly to control in the future and further degrade native plant habitats. Invasive plants would continue to displace native plant species, thereby decreasing vegetative diversity, not to mention serve as additional seed sources for new infestations both on and off federal lands.

Table 24 - Treatment Methods Proposed for Each Alternative

Treatment Methods	Alternative A No Action1	Alternative B Proposed Action	Alternative C No Broadcast in Riparian	Alternative D No Aerial herbicide
Upland Areas	**Acres**			
Manual, mechanical, biological and/or chemical	1,252	14,456	14,456	15,131
Chemical Treatment in Riparian Habitat Conservation Areas [2,3]				
Broadcast	0	3,022	0	3,022
Spot only (including wicking and wiping)	522[1]	2,538	5,560	2,538
All areas				
Bio-Control only	1339	3,917	3,917	3,917
Manual only	41	41	41	41
Aerial only	0	675	675	0
Total Acres Treated	**3,154**	**24,649**	**24,649**	**24,649**

[1]No action alternative includes '95 EA and all amendments to the document. Restrictions on herbicide us under this alternative allows no chemical application within 100' of streams or standing body of water.
[2]Riparian Habitat Conservation Areas (RHCA) as designated under PACFISH, INFISH
[3]Riparian acres are included within the total acres treated.

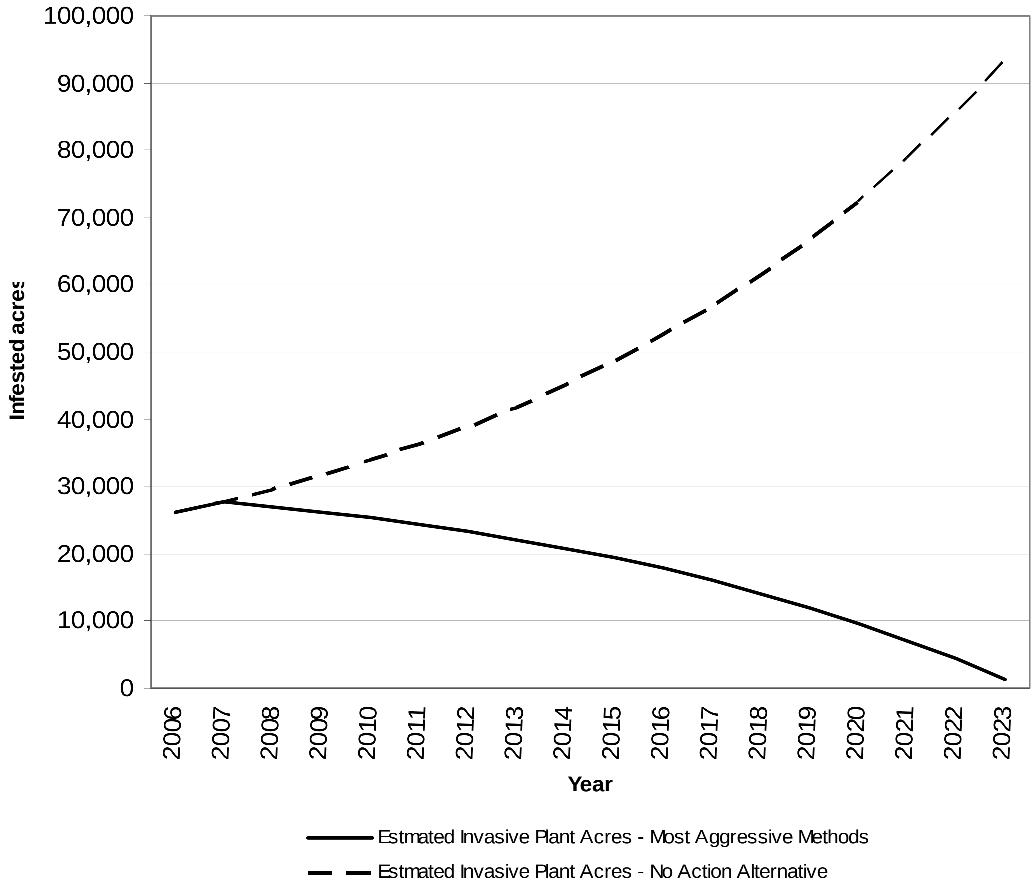


Figure 9 – Estimated invasive species spread for the No Action Alternative and the Proposed Action Alternatives.

Assumptions for invasive species growth include: 8-12 percent spread annually, implementation date of 2008, 4,000 acres treated annually, 25 percent and 80 percent effectiveness with No Action Alternative and Proposed Action Alternative, respectively.

Herbicide use is limited to two herbicides approved for this alternative (glyphosate and picloram). Table 25 describes the number of herbicides available for use and treatment effectiveness by alternative.

Table 25 - Herbicide formulations, invasive plant sites, total acres treated and treatment effectiveness for all proposed alternatives

Measuring Factor	Alternative A – No Action	Alternative B – Proposed Action	Alternative C – Restricted Riparian	Alternative D – No Aerial Application of Herbicide
# of herbicide formulations available for use	2[1]	10	10	10
# of invasive plant sites that could be treated	832	2,069	2,069	2,069
# of invasive plant sites that could be treated with herbicides either alone or in combination with other techniques	646	1,812	1,812	1,812
Total acres treated using all methods	3,154[2]	24,646	24,646	24,646
EDRR (including herbicide use)	No	Yes	Yes	Yes
Treatment Effectiveness	Low	Highest	High	High
% of Total Forest Landbase Treated with Chemicals (all identified acres/annually)[3]	Apprx: 0.12%, <0.008% annually	Apprx: 1.5%, 0.3% annually	Apprx: 1.5%, 0.3% annually	Apprx: 1.5%, 0.3% annually

[1]Previous herbicide applications prior to the incorporation of the regional guidelines into the forest plan, glyphosate, dicamba and picloram were approved for use. Dicamba will not be used in sites approved for herbicide under the no action alternative in the future
[2]This acreage represents acres approved under existing NEPA documents; additional new acres are treated using manual and/or mechanical methods. Average annual treatment forest wide is approximately 3,500 acres.
[3] These values based on currently identified infested acres, 3,500 – 4,000 acres treated annually, EDRR estimates not included.

Summary of Treatment Effectiveness for Alternative A – No Action Alternative

Only 8-9 percent of infested acres would be approved for herbicide treatments - With only 8-9 percent of the acres available for herbicide treatment and approximately only 5 percent treated with bio-control methods. All remaining acres (21,536) would need to be treated manually and would likely need multiple years of repeated treatment to control and in some cases may not ever control. This less effective method of control would likely lead to the continued displacement of native plant species and increased spread of invasive species.

Fewer treatment and herbicide options would be available - Only two herbicides are available for use on a limited number of acres. Available herbicides are not as effective on target invasive species as currently approved and proposed herbicides in other alternatives. For instance, the preferred herbicides for some of the most abundant invasive plant species would not be available for use e.g. clopyralid on knapweeds, metsulfuron methyl on houngdtongue and sulfometuron methyl for medusahead. Limited use of herbicides, combined with less effective herbicides for target species would result in additional loss of native plants and habitats. Treatment methods do not include use of aerial herbicide methods which can be an effective and rapid means of controlling or eradicating large infestations of invasive weeds, particularly in areas that have steep slopes, rocky soils, and are difficult or lack access to effectively treat from the ground.

Continued spread of invasive species forest wide - Estimates of present effectiveness of this alternative and projected annual rate of spread would not effectively address public concerns related to continued spread of invasive species (Figure 9 this section).

Alternative B –Proposed Action

Under the Proposed Action alternative all currently mapped invasive species would be treated with the most effective methods to control, contain or eradicate invasive plants, including the 10 newly approved herbicides and surfactants approved in the Regional FEIS. Estimates of annual treatment acres is expected to be approximately 4,000 acres, yet could vary based on funding. EDRR to newly identified infested areas would follow the decision tree matrix for treating invasive weeds and would comply with all PDFs as outlined in Chapter 2.2.3 of this document. As directed by PDFs, the use of all treatment methods combined with prevention and restoration methods amended to the forest plan from the Regional FEIS is expected to decrease existing invasive species populations over time. In addition to the increased effectiveness of treatment options, EDRR will also decrease the potential for continued spread and new establishment of invasive plants on the forest.

Summary of Treatment Effectiveness for Alternative B – Proposed Action Alternative

More sites, acres and more effective methods would be approved for treatment under this alternative compared to the No Action Alternative. Because this alternative also allows the use of all 10 herbicides approved in the Regional FEIS, more effective control of species is expected. Using the decision tree matrix and PDFs also allows the same treatment methods on unknown future sites while still protecting forest resources. Where feasible, this alternative also allows more broadcast spraying of herbicides than Alternative C. This alternative allows aerial application of herbicides on specific identified sites which is not allowed under Alternative A or D.

More acres could be treated more efficiently, therefore increasing overall treatment effectiveness where necessitated by size and density of the invasive plant population. This alternative would allow aerial broadcast spraying of herbicides on sites presently proposed and on potential future sites that fit PDF criteria and application guidelines. Aerial spraying would, more efficiently address large infestations, particularly on steep rocky slopes and soils that otherwise are difficult to access safely.

Expected effectiveness of this alternative combined with projected annual rate of spread would address the public concerns of continued spread of invasive species across the forest (Figure 9 this section).

Alternative C –No Broadcast Herbicide Treatment in Riparian Areas

Under alternative C all currently mapped invasive species would be treated the same as under the Proposed Action. However, no broadcast treatment methods would be allowed in riparian areas. All acres proposed within the riparian areas would be treated using spot herbicide treatments in addition to manual and mechanical methods. Estimates of annual treatment acres would be similar to those reported in the Proposed Action. EDRR to newly identified infested areas would follow the Treatment Decision Tree (Figure 8, Chapter 2) for treating invasive weeds and would comply with all PDFs as outlined in this document. The elimination of broadcast as a method of treatment in riparian areas may reduce the treatment effectiveness because spot treatments often miss small, emerging plants that would likely have been killed by broadcast spraying. With this alternative there is an increased potential for spread in riparian areas that could serve as a source to infest upland sites. This would likely result in more herbicide treatment over time and add cost to the project; however, the effectiveness of this alternative is significantly greater in comparison to the No Action alternative because it authorizes treatment of many more known infestations and allows for herbicide us of EDRR sites prohibited under the no action alternative.

Summary of Treatment Effectiveness for Alternative C – No Broadcast Herbicide Treatment in Riparian Areas

Similar to Alternative B - All herbicide restrictions and buffers as described in the PDFs remain the same as in Alternative B, except no broadcast herbicide treatment would be allowed in riparian areas (3,022 acres). Herbicide methods of treatment that reduce the potential for off site drift such as spot, wiping, or wicking herbicide applications as well non-herbicide methods are possible. The elimination of broadcast treatment as an option in this area would reduce the effectiveness of the treatment especially for species that are widespread and the seedbank or underground vegetative parts capable of re-establishment in future years is large. Effectively controlling species that exhibit this type of growth morphology would require multiple repeated treatments over a period of years.

Expected effectiveness of this alternative in combination with projected annual rate of spread is expected to be much higher than the No Action Alternative and more similar to effectiveness of alternative B because of more sites are approved for a variety of different treatment options in combination with EDRR strategy. Although there is a potential for less effective treatments to be used in the areas where broadcast methods are not possible, these estimates are worst case scenarios and it is likely that not all of these acres could be or would be broadcast treated. This alternative is also expected to effectively address public concerns that the increase of invasive species across the forest would not continue

Alternative D –No Aerial Herbicide Treatment

Under alternative D all currently mapped invasive species would be treated the same as the Proposed Action however, no aerial treatment methods would be allowed on any proposed (675 acres) or future infested acres. All PDFs would be implemented as outlined for riparian areas and PDFs for aerial application would be eliminated. Estimates of annual treatment acres would be similar to those reported in the Proposed Action. EDRR to newly identified infested areas would follow the decision tree matrix for treating invasive weeds and would comply with all PDFs as outlined in this document. The elimination of the aerial treatment method in currently mapped and future sites could reduce the effectiveness of treatment in these areas because some sites may not ever be treated due to safety issues or costs associated with alternative methods of treatment (i.e. hiking in with backpack sprayers). These sites may also be dropped to a lower priority for treatment due to cost factors.

Summary of Treatment Effectiveness for Alternative D – No Aerial Herbicide Treatments

Similar to Alternative B - All herbicide restrictions and buffers as described in the PDFs remain the same as in Alternative B, except no aerial herbicide treatment would be allowed on 675 acres. Herbicide treatment on these acres is still possible using all other methods. However, due to the steepness and remoteness of these proposed aerial sites the use of mechanical equipment such as ATVs for broadcast treatment or mowers is not possible. Therefore, any treatment of these areas would require work crews to hike in and treat the areas and if the terrain is too steep and poses a safety hazard the area will not be treated. The elimination of aerial treatment reduces treatment effectiveness in these areas now or in the future due to the potential inability to treat either from a safety or monetary standpoint. Sites that are presently proposed for aerial herbicide application consist of high priority aggressive invasive species (spotted and diffuse knapweeds and yellow starthistle), if left untreated expected increase in these infested acres is anticipated.

Estimates of effectiveness associated with this alternative in combination with projected annual rate of spread is expected to be much higher than the no action alternative and more similar to effectiveness of Alternative B because of more sites are approved for a variety of different treatment options in combination with EDRR strategy. Although there is a potential for less effective treatments to be used in the areas because the proposed aerial sites would be treated with the most efficient methods, the presently proposed areas would still receive treatment (via backpack sprayers or other methods). Additionally there is a potential for unknown future sites to establish where access issues may be a problem however, EDRR strategies are expected to address these issues in most cases and quickly eradicate areas before they are spread. This alternative is also expected to effectively address public concerns that the increase of invasive species across the forest would continued.

3.2.6 Impacts of Treatments to Native Vegetation including SOLI by Alternative

Alternative A – No Action

Direct and Indirect Effects

Native Vegetation

Current numbers of acres approved for herbicide use would remain the same placing heavy reliance on manual and mechanical treatments for all presently identified sites and all future sites. The removal of invasive plants using manual or mechanical techniques could directly affect native plants and plant communities. Direct negative effects would be unintentional removal, mowing or trampling of flowers, fruits, or root systems of native plants, but should be minimal with properly trained crews. Vigor could be reduced in individuals due to repeated treatments, however; impacts would be short lived, not likely to last a complete growing season. The removal of individuals could also directly affect remaining native plant community components negatively by reducing native seed production (if methods such as mowing are used), creating soil disturbance, and opening the canopy (understory, shrub layer or overstory depending on the species). For instance, hand-pulling trials conducted on spotted knapweed in western Montana and on diffuse knapweed in west-central Montana resulted in an increase in bare ground from 2.7 percent to 13.7 percent during the first year after treatment (Brown et al. 2001). Although these hand-pulling trials were shown to reduce the potential for knapweed seed production by exhibiting 100 percent flower control and 56 percent plant control (Brown et al. 2001) follow-up investigations on resultant vegetation from resident seed banks after treatment were not reported.

Indirect effects from these changes include microsite shifts such as reduction in productivity, reduction in soil moisture, disruption of mychorrhizal connections and increase in surface temperatures. These indirect effects could allow invasive species to reinfest the bare ground because many invasive species are aggressive, opportunistic plants that can thrive in the harsher microsites described above. Invasive plant seed introduction could occur through various means of introduction (windblown seeds, human transport etc.).

Alternatively, native plant communities could be affected positively by providing the space for increased growth in community size. One possible scenario is that removal of invasives will encourage native seed dormant in the soil to germinate due to less competitive conditions.

Dremann and Shaw (2002) documented the success of converting live oak woodland from 99 percent exotic species cover to 85 percent native plant cover through a strategy of timed manual/mechanical removal that released the native seed bank. No reseeding was necessary. Overall effects can vary by species and level of past and present infestation.

No impacts are anticipated from the use of biocontrol agents (see impacts to native vegetation common to all alternatives)

Herbicide use under this alternative would likely cause mortality to some, non-target native plants. Only two herbicides are available under the No Action Alternative for use on seven percent of the currently mapped invasive species sites (less than 0.001% of the forest). These two herbicides do not provide the best options for the variety of invasive plant species and situations that are present within the Forest. For example, the two chemicals available for use (picloram and glyphosate) are not considered to be highly effective on houndstongue, and are considered by weed experts to be herbicides of last choice. For some areas this may require more initial herbicide volume or more repeated applications compared to the same sites treated under Alternative B, C, or D that could use more specific herbicides to target invasive species. Additionally, under Alternative A, approved herbicide treatments rely heavily on picloram to treat a large proportion of sites. Picloram is considered a higher risk herbicide to the environment compared to the other herbicides because it is very mobile and persistent, and because of the levels of hexachlorobenzene (Bautista 2005). This persistent herbicide can readily move to non-target native plants through root translocation or runoff.

The threat of off-site damage to native plants and plant communities around sites presently approved for herbicide use is expected to be higher under under the No Action Alternative compared to alternatives that use more selective herbicides. Overall effects to non-target vegetation from herbicide use would be substantially less compared to Alternatives B, C or D, because less than 10 percent of the acreage approved for treatment under the Proposed Action alternatives is approved under the No Action Alternative. However, on sites approved for treatment under the No Action Alternative, greater negative effects would likely result with this alternative compared to herbicide treatment on the same sites under Alternatives B, C or D. The two approved herbicides available under the No Action alternative are general herbicides that would damage or kill more non-target plants sprayed compared to the more target-specific herbicides approved under the three action alternatives.

SOLI at highest risk (within 100 feet of invasive species)

In the No-Action Alternative, five SOLI with a total of eight occurrences have been treated under the existing EA. Seven of the eight SOLI occurrences (*Botrychium lanceolatum*- three sites, *Botrychium pinnatum*- one site, *Carex cordillerana*- two sites, and *Eleocharis bolanderi*- one site) were previously approved for herbicide treatments. The remaining occurrence was approved for treatment using non-herbicide methods. The invasive species presently being treated chemically near these approved SOLI sites are diffuse knapweed, tansy ragwort and sulphur cinquefoil with either picloram or Glyphosate and possibly dicamba in the past. The remaining seven species and 31 occurrences would only be protected from invasive species using manual or mechanical methods in the future. Table 21 lists the sensitive species, the number of occurrences on the Forest at risk, the invasive species documented nearby and if these specific sites have received invasive plant treatments under the existing EA.

SOLI species near invasive species being treated by manual or mechanical methods could be unintentionally damaged by removal or trampling of flowers, fruit, or root systems. Damage would likely be repeated because these treatments require repetition over many years. Impacts are likely to individual plants but minimal impacts to SOLI populations are expected because crews would be trained to identify and avoid SOLI species. Hand pulling would avoid impacts to individuals. Grubbing invasive plants could cause damage to nearby individual SOLIs by severing roots or corms but they would likely respout if corms are not severely damaged.

Risk to SOLI from herbicide use has previously been evaluated in existing analysis (USDA 1995) and no impacts were anticipated from treatments with existing PDFs. Even with herbicide treatments, monitoring indicates that the five sites treated with herbicide still have invasive species present. This could be attributed to the lower effectiveness of the herbicides used. Even though the herbicide did not impact the SOLI populations and their habitats are expected to continue to be at risk of invasive plant infestation under this alternative.

Lichens, bryophytes, and fungi

Impacts of invasive species to lichens, bryophytes, and fungi is not widely documented in the literature, likely due to taxonomic problems, lack of experts, the small size and intermixing of taxa in the field and the life history and variation of species. It is, however, widely recognized that alteration or loss of habitat resulting from invasive species infestations likely would affect these species. Unknown effects from herbicide treatments are possible. Most of the nonvascular SOLI exist in habitats that don't occur in the disturbed areas often associated with invasive species. Sites presently approved for herbicide use have been evaluated by the forest botanist or proposed to be surveyed prior to treatment if potential habitat of these species occurs. It is likely that if invasive species continue to spread across the forest as predicted with this alternative, habitats for these species would likely be more negatively impacted compared to the treatments proposed in Alternatives B, C and D.

All other SOLI –

The risks to all other SOLI within the forest are similar to risks to native vegetation and habitats in which they thrive. The reduced effectiveness of current treatment options, combined with inability to effectively treat any newly established invasive species near SOLI could threaten these species and their occurrence in the future. Most SOLI are not commonly located in frequently disturbed areas which is commonly where invasive species establish. However, since Alternative A would be less effective at controlling invasives plants, potential spread of invasives into SOLI habitats and associated threats to SOLI population viability would be considerably higher with this alternative compared to the other three alternatives.

Impacts to pollinators

Some impacts to pollinators could occur with the use of highest level of Glyphosate potentially used on sites approved for herbicide use with this alternative (SERA, 2003-glyphosate). There is, however, minimal impact expected to native plant pollinators because only 0.001 percent of the Forest is anticipated to be treated with herbicides, and likely only a portion of that percent would be treated with Glyphosate. If the highest allowable glyphosate application level was used some impacts to pollinators could occur with this alternative (SERA, 2003-glyphosate).

A greater percentage of invasive treatments would be manual or mechanical. Little to no effects to pollinators are expected from manual or mechanical treatments in the long term. Some short-term could occur due to the reduction of flower heads used as food sources for pollinators. Overall, fewer effects would be expected to pollinators under this alternative compared to Alternatives B, C, and D because fewer acres would be treated.

Summary of Effects to Plants for Alternative A-No Action Alternative

Alternative A is the least effective in treating invasive plants and therefore, poses the highest risk to native vegetation including SOLI.

Native vegetation will continue to be impacted by invasive plants - Native plants, and potentially SOLI, would continue to be displaced because this alternative allows less acres of treatment of invasive species and the treatment methods are less effective. A loss of native plant biodiversity, higher risks to SOLI and their habitats would likely result.

Less risk of damage to individual native plants due to less herbicide use - There would be less herbicide use and therefore, less risk of damage to individual non-target native plants. Picloram or glyphosate could be used to treat diffuse knapweed, common burdock, tansy ragwort and sulphur cinquefoil on only eight sites.

Alternative B – Proposed Action

This alternative proposes to treat inventoried invasive plant populations to achieve long-term site objectives using a multitude of treatment methods and herbicides for a more effective method for control, eradication, or containment of invasive weeds. The alternative also includes an EDRR strategy (Figure 8, Treatment Decision Tree, Chapter 2 this EIS) that allows treatment of newly identified or expanding invasive plant infestations with various treatment methods not available in the no action alternative.

The 10 herbicides analyzed and approved for use in the Regional FEIS would be available to more effectively control invasive plant infestations. This suite of herbicides would enhance the ability to choose herbicides that pose a lower risk to non-target plants (in some cases) yet remain effective at controlling target invasive species. Use of these methods and herbicides would follow all PDFs as outlined in Chapter 2 and tiers to the Regional ROD.

Direct and Indirect Effects

Native Vegetation

Impacts from manual and mechanical treatments would be similar to those as described in alternative A. The removal of invasive plants using manual or mechanical techniques could directly affect native plants and plant communities. Direct negative effects would be unintentional removal, mowing or trampling of flowers, fruits, or root systems of native plants, but should be minimal with properly trained crews. These effects could reduce native seed production, create soil disturbance, and open the canopy (understory, shrub layer or overstory depending on the species). However, under this alternative, manual and mechanical methods would typically follow herbicide treatments and seldom used as the primary control method.

Future sites using the Early Detection Rapid Response process may be appropriate for foaming or solarization/mulching techniques for invasive plant control. Such sites would have to be very small patches because both of these methods of treatments are very expensive (TNC 2006). Impacts to non-target vegetation would be limited to small areas. Both of these treatments use heat (plastic mulch in solarization, and steam combined with biodegradable sugar producing foam) to kill target invasives and therefore kill all plants in the treated area. Such treatments would likely be used where there are special resource concerns or where other methods are ineffective.

These sites would likely have higher levels of prioritization and monitoring and likely receive immediate revegetation and restoration methologies. Only short term effects in very limited areas are expected with these treatments.

EDRR sites may also be appropriate for the use of fertilizer/soil amendments and competitive planting as a method of controlling invasive weeds. Some short term, minor effects to community diversity may occur from the establishment of native species that thrive in the modified condition as established by the addition of soil amendments or seeding. No long-term impacts are expected because passive restoration techniques are designed to promote the establishment of desirable plant communities (USDA 2005).

Approximately 1.5 percent of the 1.4 million acres of the Umatilla National Forest are presently proposed for treatment using of herbicides. Proposed annual herbicide treatments would be 0.3 percent of the Forest area or 4,000 acres. Over time herbicide use would be expected to decline as known sites are effectively controlled and EDRR methodologies eradicate new sites.

This alternative has the greatest potential to negatively affect non-target plants. Because it would treat many more acres using herbicides than Alternative A it would cause mortality to more non-target plants. Because Alternative B proposes use of broadcast herbicide spraying in riparian areas it would likely have more negative effects to non-target riparian vegetation than Alternative C. Because Alternative B proposes aerial application of herbicides, it would likely have more negative effects on non-target plants due to chemical drift than Alternative D. However, these effects are considered short term and minor because the Regional prevention and restoration standards adopted by the Forest Plan (USDA 2005), the common control measures and the project design features (PDFs) are considered adequate to protect native plant populations.

The Action Alternatives (B, C, and D) allow the use of several new herbicides, some of which are associated with hazards to non-target vegetation (regional FEIS 4-27- 4-33) and as previously described above. Alternatively, some of these herbicides are more specific to certain plant families which would reduce impacts to native vegetation compared to the two chemicals available in the No Action Alternative. In turn, the reduced impacts to non-target species would aid the recovery of affected native plant communities. For instance alternative A only allows use of picloram and glyphosate. However, Metsulfuron methyl and chlosulfuron are recommend for treating houndstongue compared to other herbicides, clopyralid and chlorsulfuron controls tansy ragwort more effectively than picloram and glyphosate, and imazapic and sulfometuron methyl/chlorsulfuron, sulfumetruon methyl and sethoxydim controls medusa head more effectively than glyphosate. Infestations of houndstongue, tansy ragwort and medusa head are 6,071; 945, and 1,498 acres respectively. Being more effective means reducing the number of applications and volume of herbicide required compared to Alternative A. Risks to non-target vegetation are further reduced by careful implementation of PDFs and common control measure notes and supplemental information provided by local experts. Although some short-term negative effects to native vegetation likely will occur, this alternative would be more effective at accomplishing the projects purpose and need of containing, controlling and eradicating invasive plant infestations. Long term, Alternative B would likely be more effective at allowing native vegetation and plant communities to recover compared to Alternative A.

In summary, there would likely be more risk from herbicide impacts to non-target native vegetation because more acres and sites would be treated compared to Alternative A. The annual forest-wide risk to non-target effects from herbicide use between the no-action and the Proposed Action is less than 0.008 percent and 0.3 percent acres respectively.

Although more acres may be impacted by Alternative B, in the long-term native plant community health will improve because existing and potential future invasive plant sites will be more effectively treated.

SOLI at highest risk (within 100 feet of an invasive species)

Table 26 lists all SOLI site locations within 100 feet of an identified invasive species and the proposed (1st and 2nd choice) treatments for each individual site. For the federally listed species *S. spaldingii* invasive species sites within 1000 feet are listed. Risks to SOLI from each individual herbicide proposed for use are listed in Appendix B. For completed analysis of impacts to federally listed specie *S. spaldingii* see the Botany Report and Biological Assessment for Invasive Plants.

Effects from manual and mechanical methods as primary methods of treatment or as a follow-up treatment after herbicide treatment are expected to be the same as SOLI listed to in the No Action Alternative. Since no cultural methods are proposed close to any SOLI, no impacts are anticipated and, if used in the future, treatments would be directed by the forest botanist.

Risks to SOLI presently determined to be at highest risk from herbicide treatments would be minimized through the application of site specific PDFs. Therefore, no impacts are expected from Alternative B, except for the *Botrychium* species. Though *Botrychium* species depends on symbiotic relationships with soil fungi; the symbiotic and/or other unidentified interrelated multiple relationships are unclear. Triclopyr inhibits growth of some species of mycorrhizal fungi (Cox, 2000). Although triclopyr is not the preferred herbicide for treatment of invasive species identified near the *Botrychium* species, very little is known about impacts of other herbicides to soil fungi and microorganisms (USDA 2005). Therefore approved herbicides could potentially alter the relationship between these two species and associated soil fungi. Five sites proposed for chemical treatment are within 100 feet of a documented *Botrychium* species. Monitoring, required in the PDFs, would track direct impacts and, adjust buffers and treatment options to protect from potential future impacts. Therefore only short-term impacts would be expected from unknown herbicide impacts to inter-related symbiotic or mutualistic relationships. Information derived from monitoring results could be used to further protect any future *Botrychium* sites that could become at risk from invasive weeds.

Table 26 - Determination statements for each sensitive species occurrence within 100 feet of documented invasive species and impacts from alternative B, C, and D

Site no.	SOLI1	Invasive species nearby	Alt A	Alt. B	Alt. C	Alt. D	Proposed Treatment for Alternatives B, C, and D 1st choice, other methods also available
0614000011	*Astragalus arthurii*	diffuse knapweed scotch thistle	MIIH	NI	NI	NI	chem.
6140000073	*Astragalus arthurii*	yellow starthistle diffuse knapweed	MIIH	Ni	NI	NI	biocontrol
0614000200	*Botrychium species B. lanceolatum, B. minganense, B. montanum, B.pedunculosum, B. pinnatum*	spotted knapweed	MIIH	MIIH	MIIH	MIIH	chem.-riparian
0614000210	*Botrychium species B. lanceolatum, B. minganense, B. pinnatum*	diffuse knapweed	MIIH	MIIH	MIIH	MIIH	chem.
0614000212	*Botrychium lanceolatum*	canada thistle	MIIH	NI	NI	NI	biocontrol
0614000242	*Botrychium species B. lanceolatum B. minganense,*	diffuse knapweed tansy ragwort	MIIH	NI	NI	NI	biocontrol
0614000780	*Botrychium species B. lanceolatum, B. minganense, B. pinnatum*	spotted knapweed	MIIH	NI	NI	NI	biocontrol
0614000884	*B. lanceolatum*	diffuse knapweed	MIIH	MIIH	MIIH	MIIH	chem

Site no.	SOLI1	Invasive species nearby	Alt A	Alt. B	Alt. C	Alt. D	Proposed Treatment for Alternatives B, C, and D 1st choice, other methods also available
0614000235	*Botrychium minganense*	diffuse knapweed tansy ragwort	MIIH	NI	NI	NI	biocontrol
0614000198	*Botrychium pinnatum*	diffuse knapweed	MIIH	MIIH	MIIH	MIIH	chem.
0614000199	*Botrychium pinnatum*	tansy ragwort	MIIH	NI	NI	NI	biocontrol
0614000837	*Botrychium pinnatum*	canada thistle	MIIH	MIIH	MIIH	MIIH	chem.
0614000228	*Carex cordillerana*	common burdock	MIIH	NI	MIIH	NI	chem.-riparian
0614000759	*Carex cordillerana*	yellow starthistle	MIIH	NI	NI	NI	biocontrol
0614000841	*Carex cordillerana*	diffuse knapweed sulphur cinquefoil	MIIH	NI	MIIH	NI	chem.-riparian
0614000856	*Carex cordillerana*	diffuse knapweed sulphur cinquefoil	MIIH	NI	MIIH	NI	chem.-riparian
0614000876	*Carex cordillerana*	common burdock	MIIH	NI	MIIH	NI	chem.-riparian
0614000071	*Carex hystericina*	scotch thistle	MIIH	NI	MIIH	NI	chem.-riparian
0614000022	*Calochortus macrocarpus var. maculosus*	yellow starthistle scotch thistle	MIIH	NI	MIIH	NI	chem.-riparian
0614000058	*Calochortus macrocarpus var. maculosus*	yellow starthistle scotchthistle	MIIH	NI	MIIH	NI	chem.-riparian
0614000074	*Calochortus macrocarpus var. maculosus*	yellow starthistle scotch thistle	MIIH	NI	MIIH	NI	chem.-riaprian
0614000075	*Calochortus macrocarpus var. maculosus*	yellow starthistle diffuse knapweed	MIIH	NI	NI	NI	biocontrol
0614000183	*Calochortus macrocarpus var. maculosus*	diffuse knapweed	MIIH	NI	MIIH	NI	chem.-riparian

Site no.	SOLI1	Invasive species nearby	Alt A	Alt. B	Alt. C	Alt. D	Proposed Treatment for Alternatives B, C, and D 1st choice, other methods also available
0614000186	*Calochortus macrocarpus var. maculosus*	diffuse knapweed	MIIH	NI	MIIH	NI	chem.-riparian
0614000187	*Calochortus macrocarpus var. maculosus*	tansy ragwort	MIIH	NI	NI	NI	biocontrol
0614000878	*Eleocharis bolanderi*	houndstongue	MIIH	NI	NI	NI	chem.
0614000881	*Eleocharis bolanderi*	spotted knapweed diffuse knapweed	MIIH	NI	NI	NI	chem.
0614000882	*Eleocharis bolanderi*	spotted knapweed	MIIH	NI	NI	NI	chem.
0614000883	*Eleocharis bolanderi*	houndstongue	MIIH	NI	NI	NI	chem.
0614000757	*Leptodactylon pungens ssp. hazeliae*	diffuse knapweed	MIIH	NI	NI	NI	chem.
061400076	*Silene spaldingii1*	Yellow starthistle, scotch thistle	LAA	NLAA	NLAA	NLAA	chem.
0614000105	*Trifolium douglasii*	diffuse knapweed	MIIH	NI	NI	NI	chem.
0614000314	*Trifolium douglasii*	diffuse knapweed houndstongue	MIIH	NI	NI	NI	chem.
0614000330	*Trifolium douglasii*	St. john's wort	MIIH	NI	MIIH	NI	chem.-riparian
0614000761	*Trifolium douglasii*	diffuse knapweed	MIIH	NI	NI	NI	chem.
Totals for Weed Sites, Species and Occurrences							
35 Weed sites	***13 species 44 occurrences***						

NI = No impact, MIIH= May Impact Individuals or Habitat, But Will Not Likely Contribute to a Trend Towards Federal Listing or Loss of Viability for the Population or Species
Determinations were derived from the combination of treatment effectiveness, risks from herbicides, and species habitat requirements. All PDFs would be implemented.

Lichens, bryophytes, and fungi

Impacts of invasive species to lichens, bryophytes, and fungi is not widely documented in the literature, likely due to taxonomic identification problems, lack of experts, the small size, the life history and variation observed within individual species. Additionally, impacts from herbicides on these taxa have not been widely studied. Because bryophytes and lichens receive their mineral nutrition and water from precipitation, splash water, or directly from the atmosphere, the species listed in Table 26 could be impacted from potential herbicide drift.

As previously stated, triclorpyr inhibits the growth of mycorrhizal fungi, beneficial fungi that increases the ability of plants to uptake nutrients (Cox, 2000). Glyphosate and triclopyr applications in the field and laboratory have also reported reduced diversity and negative impacts to bryophytes and lichens (Newmaster et al. 1999); in some studies, herbicide applications have shown little effect on other species of bryophytes and lichens in field and laboratory conditions (Atkinson et al. 1980; Balcerkiewicz and Rusińska 1987, Bond 1976, Mabb 1989, Pihakaski and Pihahaski 1980, Ronoprawiro 1975, Rudolph and Samland 1985, Stjernquist 1981). Supportive field trials are few. Physiological research is also needed to explain whether herbicides directly alter the physiology of bryophytes and lichens or simply affect their water relations due to loss of associated microhabitats. Bryophytes listed in Table 20 may be impacted by herbicide treatments, but impacts are uncertain and hard to predict. It is expected that the implementation of PDFs that outline effectiveness monitoring will provide much needed information and adjust buffers to protect these species if negative impacts are observed. Short term impacts could be expected. Long-term positive effects to habitats are expected because effective treatment of existing and future invasive plants would restore, protect and maintain habitats these species require.

Impacts to pollinators

Some additional impacts to pollinators from herbicide treatments could occur over and above those listed for alternative A with the addition of triclopyr as a new herbicide. Risk assessments indicate that triclopyr and Glyphosate may have some toxic effects if applied at the maximum application rate proposed by the Forest Service (SERA, 2003-glyphosate; SERA, 2003-Triclopyr). Some shifts in native pollinators due to herbicide treatments may occur at some invasive plant sites that are more than five acres (35 % of sites), highly infested and proposed for broadcast treatment. The level of infestation on these larger sites is unknown. Sites could have a few invasive plants scattered across an area or be heavily infested. In the worst case scenario if all 35 percent of the sites were heavily infested and broadcast sprayed, only 0.003 percent of the forest area where native plant pollinators occur would be impacted. Treatments proposed and standards approved as outlined in the Regional FEIS broadly estimate that the methods would be 80 percent effective thereby it is expected that any impacts to specific sites would be short term and the ability of native pollinators to migrate into potentially impacted area from other nearby areas is highly probable.

Little to no effect to pollinators is expected from manual or mechanical treatments in the long term. Some short-term (year of treatment) effects could occur due to the reduction of flower heads used as food sources for pollinators.

All other SOLI

The risks to all other SOLI within the forest are similar to risks to native vegetation. Most SOLI are commonly located in undisturbed areas and not in disturbed areas where invasive species are commonly established. Many other SOLI exist on the Forest, and are not presently considered to be at highest risk from invasive species infestation. Invasive sites with high potential for spread that are near, but more than 100 feet from identified SOLI, would likely receive high priority for treatment to fully protect SOLI and their habitats. PDFs requiring surveys of potential habitats, adherence to the project decision tree, and incorporation of all PDFs should protect SOLI discovered in the future. Increased levels of treatment effectiveness combined with EDRR strategies will further protect future SOLI sites and habitats that might otherwise be impacted from invasive species establishment.

Summary of Effects to Plants for Alternative B—Proposed Action Alternative

Currently inventoried invasive sites will be treated as prioritized by each district and as funding allows. Over time currently impacted native plant communities and habitats will likely recover with implementation of PDFs, prevention and restoration standards and EDRR strategies.

Risks to SOLI within 100 feet of an invasive site would be minimized through the application of site specific PDF - No impacts to SOLI (at highest risk) or their associated habitats is expected except for Botrychium species and Cypripedium fasciculatum where project activities may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or loss of viability for the population or species. This conclusion of risk was based on specific herbicide characteristics and best available information related to individual SOLI habitat requirements.

Risks to all other SOLI forest wide would be reduced - More effective invasive plant treatment and herbicide options would be available (compard to Alternative A) thereby reducing the present risk of invasive spread into other SOLI areas. Additionally, EDRR strategies in conjunction with PDFs provide for adequate protection of SOLI sites if invasive plant species pose a risk in the future.

Impacts to bryophytes and lichens and fungi are not presently known - Project Design Features would require surveys for these species as well as post treatment monitoring and adaptive management that could adjust buffers, if needed, to further protect these species from unknown effects.

Risks to pollinators may increase - The addition of triclopyr to the list of available herbicides could increase the risk to pollinators (compared to Alternative A). Glyphosate and triclopyr, may have some toxic effects if applied at the maximum application rate proposed by the Forest Service (SERA, 2003-glyphosate; SERA, 2003-Triclopyr).

Alternative C – Restricted Riparian

This alternative is very similar to alternative B except broadcast methods (hand broadcast and boom mounted sprayers on vehicles) would not be allowed in riparian areas. This alternative addresses concerns about risk of herbicide delivery to water and potential impacts to fish. Based on GIS mapping and stream buffers an estimated 3,022 acres would not be broadcast treated.

Direct and Indirect Effects

Native Vegetation and SOLI at highest risk (within 100 feet of an invasive species)

This alternative reduces the potential for non-target plant impacts by reducing the risks of drift from broadcast applications. However, spot treating individual invasive plants would likely be less effective and more costly than broadcast treatments, and repeated treatments within the same site may be required for species with a long-lived seed bank.

Broadcast treatments spray herbicides over a wide swath of vegetation and bare soil if present, and can be effective at killing emerging invasive seedlings due to the persistent nature in the soil of some herbicides.

Lichens, bryophytes, and fungi

As stated previously, impacts from invasive species and from herbicides to lichens, bryophytes, and fungi are not widely documented. This alternative would reduce the impacts associated with drift and broadcast application in riparian areas. It is possible that this could be of importance since many of these species thrive in these wetter environments; however, at this point in time it is difficult to predict. Future surveys, monitoring and adaptive management techniques outlined in PDFs will provide additional information.

All other SOLI

Impacts to all other SOLI are similar to those discussed in the Proposed Action. There could be a slight increase in risk to SOLI in the future because broadcast methods could not be used nearby (within 300 feet) to more effectively treat a newly established invasive species. It is expected that EDRR strategies would reduce and eliminate the potential of this risk. Little to no measureable impacts to habitat would be expected should chemical use be needed.

Impacts to pollinators

Impacts to pollinators are expected to be similar to those described in the Proposed Action; however, the potential for direct spray to pollinators (from drift) in the riparian areas where broadcast treatments are limited would be greatly reduced.

In summary the effects from the implementation of Alternative C are similar to those described in the Proposed Action. There would be a reduction of impacts to non-target plants, pollinators, and SOLI (including lichens, bryophytes and fungi) from drift associated with broadcast treatments in riparian areas (potentially 3,022 acres). Without broadcast methods treatment effectiveness could be less, potential for invasive species spread could increase, and potential degradation of habitat could last longer. This could result in a longer, more expensive control period using spot, manual and mechanical methods.

Alternative D – No Aerial Herbicide Application

This alternative is similar to Alternative B except it does not allow aerial herbicide application on currently proposed (675 acres) sites. This alternative addresses concerns about risk of herbicide drift, impacts to non-target plants, herbicide delivery to water and potential impacts to fish.

Table 27 - Proposed aerial sites on the Umatilla National Forest. All sites are located on the Pomeroy Ranger District

Site no.	Invasive species	Proposed treatment	Acres
06140400051	yellow starthistle	chem-riparian	3
06140400059	diffuse knapweed	chem	211
06140400061	diffuse knapweed	chem	3
06140400063	yellow starthistle	chem	8
06140400067	diffuse knapweed	chem-riparian	2
06140400082	diffuse knapweed	chem	1
06140400086	diffuse knapweed	chem	7
06140400188	diffuse knapweed	chem-riparian	3
06140400191	yellow starthistle	chem	134
06140400287	yellow starthistle	chem	286
06140400292	diffuse knapweed	chem	4
06140400495	spotted and diffuse knapweed	chem-riparian	5
06140400498	yellow starthistle and diffuse knapweed	chem	3
06140400499	yellow starthistle	chem	6
Total			**675**

Direct and Indirect Effects

Native Vegetation

This alternative reduces the potential for impacts to non-target plants because it reduces the risks of drift associated with aerial broadcast applications. Currently, 675 acres are proposed for aerial treatment application in Alternative B. Sites proposed for aerial herbicide application often have very limited access; costs for ground based methods of treatment in these areas are high, and worker safety is a concern due to steep slopes. Where worker safety is not a concern, the potential for treatment using backpack sprayers is still a viable alternative, but may have a lower priority because of time and cost constraints. Since such sites may not be as effectively treated as they could be using aerial application methods, the potential for weeds spreading in remote areas is greater, and greater long term impacts to native vegetation are probable.

SOLI at highest risk (within 100 feet of an invasive species)

Presently there are no SOLI located near proposed aerial sites, therefore no impacts are expected. Follow PDF's for newly identified invasive species.

Lichens, bryophytes, and fungi

As stated previously, impacts from invasive species and from herbicides to lichens, bryophytes, and fungi are not widely documented. This alternative would reduce the impacts associated with drift and aerial broadcast application. At this point in time, due to lack of scientific studies effects are difficult to predict.

Impacts to pollinators:

Impacts to pollinators are expected to be similar to those described in the Proposed Action; however, the potential for herbicide contact to pollinators from drift during aerial broadcast treatments would be eliminated.

In conclusion, numerous factors need to be considered in the assessment of direct and indirect effects of this project. Treatment effectiveness is important when measuring effects. That is, if the invasive species still persist, then effect on non-target species will also persist. However, other effects and impacts may be equally important but not always as easily determined, mostly due to the lack of scientific knowledge to conclusively support determinations. Table 28 lists risk factors related to botanical resources for this project. Each factor is classified into low, medium and high risk. Risk factors are not considered to be equal in weight to other risk factors**.**

Table 28 - Risk factor comparison summary table for all alternatives

Risk Factor	Alt A – No Action	Alt B Proposed Action	Alt C. Restricted Riparian	Alt D. No Aerial Broadcast Treatment
Loss of native plant communities and plant bio-diversity from invasive species infestation	high	low	medium	medium
Risks to non-target plants from herbicide use	lowest	high	medium	medium
Impact to SOLI at highest risk from invasive plants	high	low	medium	medium
Impacts to other forest SOLI from invasive plant establishment and infestation	high	low	medium	medium
Impacts to forest bryophytes, lichens and fungi	unknown	unknown	unknown	unknown
Impacts to plant pollinators (honey bees and native pollinators)	low	high	medium	medium

1 Insufficient data on impacts from invasive species invasion and physiological herbicide to species - Prevention and restoration standards from Regional FEIS expected to further protect for Alternative A, PDF's and prevention and restoration standards from Regional FEIS expected to further protect apply to Alternatives B, C, and D.
2 Comparison evaluation included treatment effectiveness in combination with direct and indirect effects and included future potential EDRR sites

Cumulative Effects

Past, present and foreseeable future actions include natural events, forest uses and management activities on the Forest in combination with the conservative approach to controlling invasive weeds has resulted in the current increase in infested acres existent on the Forest today. Events, uses and activities on the Forest and adjacent ownerships include:

- Recreational use
- Other ground disturbing activities such as construction or maintenance of recreation sites
- Road use
- Fire and its associated management activities
- Logging
- Agricultural crop production
- Grazing
- Wind and other weather conditions
- Climatic events such as drought are all documented to contribute to the spread of invasive species

Present and reasonably foreseeable future actions will continue to provide opportunities for invasive species to establish. Roads will continue to be a major conduit for invasive plants. Forest Service projections suggest that recreation uses of National Forests will continue to increase. Other land management and use activities such as grazing, vegetation management, fuels management (Healthy Forest Initiative), wildfire, and fire suppression will continue to cause ground disturbances that can contribute to the introduction, spread and establishment of invasive plants on National Forest system lands (USDA, 2005).

Many of these same natural events, uses and activities have, and will continue to also happen on lands adjacent to or in the vicinity of Umatilla National Forest lands.

Alternative A - Cumulative Effects

The 1995 EA/DN found that the currently approved treatments (The No Action Alternative) would have no significant impact on non-target vegetation, including SOLI. However, based on the past effectiveness of treatments combined with past natural events, forest uses and management activities, negative cumulative impacts are evident because invasive species continue to spread. No change in this trend would be expected in the foreseeable future. Therefore, continued negative impacts to native vegetation including SOLI and their habitat are expected under this alternative. Future spread of invasive species on National Forest system lands increases the likelihood of weeds spreading to private, tribal, state and other ownerships, and may increase the challenge of controlling weeds on those land ownerships, thereby increasing the use of herbicides.

Herbicide treatment of invasive species is common on lands near or adjacent to the Umatilla National Forest for agricultural crop production, range improvement, landscape improvement and other reasons. If other land owners and managers do not control weeds on their lands, the challenge of controlling weeds increases for Umatilla National Forest managers.

Potential effects of herbicide treatment to non-target vegetation, including SOLI, on National Forest system land is relatively small as reported in the direct/indirect effects section above. The cumumlative effects of herbicide treatments on all land ownerships in and near the Umatilla National Forest are somewhat unknown. Uncertainty exists because a comprehensive reporting system of treatment activities across all land ownerships does not exist. County weed boards report treatment accomplishments from cooperators that participate with their program; however, other treatments of unknown extent using unknown chemicals most likely exist. For known treatments, herbicide treatment likely impacts individual non-target plants sprayed. While PDFs add a measure of protection for SOLI on National Forest system lands, SOLI may be more vulnerable on other ownerships where protective measures are unknown. Overall, potential impacts are considered minor and short term for two reasons: 1.) The great majority of area proposed for treatment on National Forest system land is known, and chemicals used, application rates and methods will follow labeled requirements. 2.) The overall positive effect of killing target invasive infestations is a far greater long term benefit to non-target plant communities, including SOLI, than the temporary damage that may occur to individual non-target plants.

There is likely some damage to individual non-target plants from manual and mechanical treatments. The temporary and incidental effects are also considered minor because affected plants would likely resprout. The benefit of invasive plant removal or reduced seed production due to treatment is considered a greater benefit to non-target plants than the minor damage that could occur to non-target individuals.

While crews treating weeds on National Forest system lands would be trained to identify and avoid damage to SOLI, the effect on SOLI of manual/mechanical treatements could vary on other ownerships.

The cumulative effects analysis assumes that the release of biological control agents on National Forest system lands and adjacent lands by the Oregon and Washington Departments of Agriculture, as analyzed by Animal Plant Health Inspection Service (APHIS), will continue to reduce the invasive plant infestations and decrease the spread of invasive plants. It is recognized that biocontrol agents will likely cross land ownership boundaries. Though biocontrol agents could occasionally affect non-target plants, that would be considered rare and minor compared to the benefits of reducing the area and spread of weeds.

No comprehensive scientific evidence exists to the cumulative impacts to pollinators. However, based on professional opinion native pollinators are expected to be impacted in some heavily infested areas due to loss of native forbs and other plants pollinators use.

In summary, while some herbicide treatments in the vicinity of the National Forest are unknown, most treatments are known. Overall the known potential negative effects of past, present and foreseeable future treatments are considered minor and short term, especially compared to the benefits of reducing the negative influence invasive plants have on non-target plant communities.

The cumulative effects of Alternative A combined with the past, present and foreseeable future actions listed above will likely continue the present trends on native plant communities. Namely:

- Some reduction of invasive plant infestations where authorized treatments on the Umatilla National Forest and other lands have occurred and would probably occur in the future;
- Some minor, short-term loss of native plants due to treatment of invasive plants now and throughout the life of this project;
- Continued growth in the number of invasive plant species and the acres infested on the Umatilla National Forest and adjacent lands due to the natural and man-caused activities (listed above) that can favor invasive plants,
- The effect of weather and climate can have a profound impact positively or negatively on invasive plants even though local conditions happen to all plant communities equally. For example, a drought, though causing stress to many plant species, tends to favor the spread of weeds because, in general, they tend to tolerate drought better than native species. Also natural events such as wildfires effect invasive plant infestations and native plant communities. While weather, climate and natural events will predictably occur; where, when and the impact they will have is prophetically unpredictable.

Alternative B - Cumulative Effects

The effectiveness of the proposed invasive plants treatment project would be increased if coordination with adjacent landowners treats invasive plants infestations across land ownerships. The cumulative effects analysis assumes that this cooperative, coordinated effort continues for the life of this project. Alternative B would more effectively control invasive infestations on the Forest. The likely result of this would be improved weed control effectiveness on adjacent land ownerships. That is, because aggressive treatment expects to reduce invasive infestations on the National Forest, there would be less weed seed and invasive plants to spread onto neighboring lands. Herbicide treatment of invasive species on lands near or adjacent to the Forest would likely continue.

However, as the future spread of invasive species on National Forest system lands decreased, the likelihood of weeds spreading onto private, tribal, state and other ownerships would also decrease. Over time, this could reduce herbicide use on National Forest and adjacent land ownerships.

The land uses and management activities listed at the beginning of this cumulative effects section would continue on National Forest and other lands. The uses and activities would partially compromise treatment effectiveness by spreading weeds. Because many of these activities spread weed seed, an effective treatment program requires vigilance to successfully treat weeds over the long term. The EDRR component of this alternative allows for treatment of newly discovered, future infestations on Forest lands. Other landowners may or may not have the flexibility, funds or manpower to address new infestations whenever and wherever they are found. Because the extent of future treatment programs on other lands is unknown, the effect this will have on weeds migrating onto national forest lands is also unknown. The effects of natural events, weather and climate would be similar to that listed in Alternative A.

The cumulative effects of Alternative B combined with past, present, and foreseeable future actions listed above are expected to have a mixed combination of effects on the native plant communities of the Umatilla National Forest. These effects include temporary loss of non-target native and desirable non-native plants from damage and mortality caused by proposed invasive plant treatments. The damage on each treatment site would be similar to those described for Alternative A; however, Alternative B proposes to treat many more acres, therefore more non-target plant damage and mortality is expected, especially from chemical spraying. Still, because treatments would be a very small percentage of the Forest's total area, and because the losses are likely to be temporary, they are considered acceptably minor. In the long-term, vegetation management will favor re-establishment of native plant communities across ownership boundaries, especially where coordinated treatments have occurred.

There are 42 invasive weed sites (approximately 3,600 acres) adjacent to other land ownerships proposed for treatment on the forest. Identified invasive sites likely infest these other land ownerships. Drift associated with herbicide treatments from or onto adjacent lands is possible which could have effects on non-target plants. Potential effects of drift from forest lands would likely be minor and temporary due to PDF's developed to significanlty reduce impacts of all herbicides proposed. Potential effects from herbicide drift from adjacent landowner application to non-target plants on forest lands may have slighly higher impacts to non-target plants because adjacent land owners are not restricted to regional standards, herbicides approved for use and forest PDF's. Overall, coordinated treatment of invasive plants with adjacent landowners to restore native vegetation (see PDF B.1 in section 2.2.3) is essential to effectively control weeds on both sides of the boundary.

Manual, mechanical and biological control cumulative effects would be similar to those described for Alternative A.

Alternative C and D – Cumulative Effects

Alternatives C and D would predictably have very similar cumulative effects as Alternative B. It is acknowledged that invasive treatments are somewhat different among these three alternatives. However those differences become miniscule when considered in the context of all cumulative effect factors that have, can and will influence invasive plant infestations and native plant communities.

It is acknowledged that the combination of past, present and foreseeable future actions have a combination of effects both positively and negatively influencing the purpose and need of containing, controlling and eradicating invasive species. It is also understood that some of the Umatilla National Forest programs that deliver goods and services to the American people can have both positive and negative influences on the establishment and spread of invasive species. This invasive plants treatment project is conscientiously specific to containing, controlling and eradicating invasive plants. This project in no way attempts to diminish or modify other Umatilla National Forest programs. Each Forest program is responsible to manage activities in ways that will minimize the potential for invasives plants to become established and spread.

With this understanding it is our firm belief that the result of this project acting in the context of past, present and foreseeable future actions will reduce the influence of invasive species and thereby improve native plant communities and their ecologic functions.

3.3 Terrestrial Wildlife

3.3.1 Introduction

Invasive plant species have become established and continue to spread, causing a loss of wildlife habitat and posing a risk of injury to wildlife, so the Umatilla National Forest has proposed to conduct invasive plant treatment projects within its administrative boundaries. Methods used to treat invasive plants also have the potential to adversely affect individual animals as well as wildlife habitat. This section will summarize the effects on wildlife from invasive plants and the methods used to control invasive plants.

3.3.2 Affected Environment

Invasive Plants and Wildlife Resources

Invasive plants have adversely impacted habitat for native wildlife (Washington Dept. of Fish and Wildlife 2003). Any species of wildlife that depends upon native understory vegetation for food, shelter, or breeding, is or can be adversely affected by invasive plants. Species restricted to very specific habitats, for example pond-dwelling amphibians, are more susceptible to adverse effects of invasive plants.

Although it is rare, some wildlife species can utilize invasive plants for food or cover. For example, American goldfinch (*Carduelis tristis*), and red-winged blackbird (*Agelaius phoeniceus*) utilize purple loosestrife (Kiviat 1996; Thompson, Stuckey, and Thompson 1987), and native bighorn sheep will utilize 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). These are not preferred plants for any of these species. The few uses that an invasive plant may provide do not outweigh the adverse impacts to an entire ecosystem (Zavaleta 2000).

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 Olsen 1991; Risser, 1988 as cited in Johnson et al. 1994). 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 (Brotherson and Field 1987; Dudley 2000; Horton 1977), reducing available forage quantity or quality (Bedunah and Carpenter 1989; Rice et al. 1997; Trammell and Butler 1996); 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; and documented in photos by Clay Grove, USFS, and Rosa Wilson, NPS). Invasive plants that grow large and densely (e.g., giant reed, Himalayan blackberry) can act as physical barriers to water sources and essential habitat (Bautista, S., personal observation).

Invasive plants can act as a population sink by attracting a species and then exposing them to increased mortality or failed reproduction (Chew 1981). For example, 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 used much less, by native and rare wildlife species. Washington Department of Fish and Wildlife (2003) identified noxious weeds, such as yellow starthistle and knapweed, as threats to 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 and are adversely affecting the animal's distribution 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 mammals, reptiles, and amphibians (Jakle and Gatz 1985; Olson 1999). Invasion by purple loosestrife makes habitat unsuitable for numerous birds, reptiles and mammals (Kiviat 1996; Lor 1999; Rawinski 1982; Thompson, Stuckey, and Thompson 1987; Weihe and Neely 1997; Weiher et al. 1996).

Of the federally listed species that occur on Umatilla National Forest system land, none are known to be adversely affected by invasive plants within the Project Area.

In summary, invasive plants are known or suspected of causing the following effects to wildlife:

- 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
- Change to effective population 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, perhaps due to altered nutrient cycling
- Source-sink population demography, with more demographic sinks than sources

- Lack of proper forage quantity or nutritional value at critical life periods

Threatened, Endangered, Sensitive (TES) Species

Federally Listed Species

Two species listed as “threatened” and one species listed as “endangered” under the Endangered Species Act (ESA) of 1973, as amended, have habitat in the project area. The bald eagle *(Haliaeetus leucocehpalus*), which is currently listed as threatened, is the only listed species confirmed to currently occupy habitat on the Forest.

Canada lynx (*Lynx canadensis*), which is listed as threatened, has limited potential habitat on the Forest. Although unconfirmed sightings are occasionally reported, only limited historical evidence suggests lynx once occupied this area. The Forest is considered to contain “unoccupied habitat” by the U.S. Fish and Wildlife Service (FWS). Gray wolf (*Canis lupus*), is currently listed as endangered by FWS. The Forest contains habitat for the gray wolf, however no confirmed sightings have occurred for over five years. Government officials continue to investigate reported sightings. No den or rendezvous sites have been found so no resident populations are known to occur on the Umatilla National Forest or in the Blue Mountains. Listed species and one candidate species found, or with potential habitat in the Project Area are included in Table 29. A brief overview of the bald eagle, Canada lynx, and gray wolf regarding their presence in the Project Area is discussed below. The Columbia spotted frog (*Rana luteiventris*) is a FWS candidate species and on the Regional Forester’s Sensitive Species List. It is discussed in the “Forest Service Sensitive Species” section. All species life history, threats, and generally recognized species protection measures are discussed in the sections of the Terrestrial Wildlife Specialist Report/Biological Assessment prepared for this document in Appendix C. The complete report is available upon request from the Project Record at the Umatilla National Forest Supervisor’s Office in Pendleton, Oregon. Additional detailed accounts can be found in the Biological Assessment prepared for the Regional Invasive Plant Program (USDA Forest Service 2005). This Biological Assessment is incorporated by reference.

The FWS maintains a list of “candidate” species. Candidate species are those taxa which the FWS has sufficient information on biological vulnerability and threats to support issuance of a proposal to list, but issuance of a proposed rule is currently precluded by higher priority listing actions (U.S. Fish and Wildlife Service 1996).

Table 29 - Federally listed or candidate species known to occur on the Umatilla NF

Species	Scientific Name	Status	Critical Habitat	Presence
Bald eagle	*Haliaeetus leucocephalus*	Threatened	None	Yes
Canada lynx	*Lynx canadensis*	Threatened	None	No
Gray wolf	*Canis lupus*	Endangered	None	No
Columbia spotted frog	*Rana luteiventris*	Candidate	None	Yes

Bald Eagle

The bald eagle ranges throughout much of North America, nesting on both coasts and north into Alaska, and wintering as far south as Baja California. The largest breeding populations in the contiguous United States occur in the Pacific Northwest states, the Great Lakes states, Chesapeake Bay, and Florida. Oregon and Washington are important for wintering bald eagles, however the Umatilla National Forest provides only limited wintering habitat for migratory eagles as well as residents.

Bald eagle populations have made substantial recoveries in recent years. Formerly listed as endangered in 1978, the bald eagle was down-listed to threatened status in the lower-48 states in 1995. In March 1999, FWS proposed to delist the bald eagle throughout its entire range (Federal Register 1999). A final rule on the delisting proposal has not yet been issued, and the species remains protected under the ESA.

Bald eagle numbers vary by season and include breeding, migration and wintering populations. The breeding season begins in late February or March, with juveniles fledging between mid-July and early September. They generally leave the nest area between late August and late September. Migration generally peaks during March-April in the spring, and October-November in the fall.

Bald eagles first breed at five to six years of age. Egg-laying can start as early as February and continue until April, and both sexes incubate one to three eggs for 31 to 35 days. Eggs hatch from March to May, and the nestling period lasts 11 to 14 weeks. Some breeding birds remain near nesting territories throughout the winter months (USDI 1986).

Nesting territories are normally associated with lakes, reservoirs, rivers, or large streams (U.S. Fish and Wildlife Service, 1986). In the Pacific Northwest recovery area (for more information see the Bald Eagle Recovery Plan, U.S. Fish and Wildlife Service, 1986) , preferred nesting habitat for bald eagles is predominately uneven-aged, mature coniferous (ponderosa pine, Douglas-fir) stands or large black cottonwood trees along a riparian corridor (NatureServe 2006 and USDI 1986). Eagles usually nest in mature conifers with gnarled limbs that provide ideal platforms for nests. Trees selected for nesting are characteristically one of the largest in the stand or at least codominant with the overstory. Nest trees usually provide an unobstructed view of the associated water body and are often prominently located on the topography. They also tend to be found in relatively remote areas that are free of disturbance. Snags, trees with exposed lateral limbs, or trees with dead tops are often present in nesting territories and are used for perching or as points of access to and from the nest. The size and shape of a defended breeding territory varies widely (1.6 to 13 square miles) depending upon the terrain, vegetation, food availability, and population density of an area (USDI 1986). 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, 1999).

The most common food sources for bald eagle in this region are fish, waterfowl, rabbits, and various types of carrion (NatureServe Explorer 2006 and USDI 1986). The main food source for bald eagles during the breeding season is fish; therefore, habitat of most importance during this period consists of areas near large bodies of water and major river systems (U.S. Fish and Wildlife Service, 1995).

During the critical incubation (March) and brooding (late April/early May) phases, human disturbance can result in nest failure with the risk reduced as the nesting cycle progresses towards fledgling at the end of July. Some habituation of eagles to human activity has been observed, varying according to type and proximity to the bald eagle. Individual birds vary widely in their response to human disturbance (USDI 1986).

The Umatilla National Forest has one known bald eagle nest site, which was discovered in 1994. The Dry Creek bald eagle nest is located on the Heppner Ranger District, west of Dry Creek and is approximately three air miles north of the North Fork of the John Day River. The nest has had variable success over the years in fledging young, but the majority of the time has successfully fledged 1 to 2 young each year. The nest site is surveyed each spring to determine nest success. A site-specific management plan was developed and reviewed by the FWS and Frank Isaacs (bald eagle specialist form Oregon State University) for the Dry Creek bald eagle nest site in 1999. The plan developed both a Bald Eagle Consideration Area (BECA) boundary and a Bald Eagle Management Area (BEMA boundary. The BECA includes both private and Bureau of Land Management (BLM) land, while the BEMA is entirely within National Forest system lands. It is presumed that the eagles occupying this nest stay in the area year-round.

The nest is on a north-facing slope in a canyon that contains mixed conifer with dry/juniper/pine on the south-facing slope. Several age classes of trees exist within the area, including several older, large diameter trees. An unimproved dirt road runs up the canyon bottom near the nest. The area is grazed by livestock early in the season (early spring and summer). Motorized travel is limited and is mostly used for livestock operations. The BEMA is within critical elk winter range. The road in close proximity to the nest is within a seasonal road closure for elk, which happens to coincide with when the birds nest. The eagles have become accustomed to some degree to human disturbance. There are no identified invasive plants sites within the BEMA, however there are several small sites on National Forest system lands within the BECA. They are well over a mile from the nest and are currently not large enough to impact eagle prey foraging habitat.

At this time the Forest has no established winter roost sights; however bald eagles do roost on the Forest during winter months. Winter bird count surveys occur along the North Fork of the John Day River and the Umatilla River each year. Bald eagle numbers appear to be fairly small and both the roost and perch sites seem to vary somewhat from year to year. The majority of the bald eagle migration and winter sightings are in areas along the Mecham and Umatilla creeks as well as the Grande Ronde and Tucannon Rivers. Currently, there are no invasive plants adversely affecting bald eagles on the Forest.

Canada Lynx

Lynx occur in mesic coniferous forest that have cold, snowy winters and provide a prey base of snowshoe hare (Lepus americanus) (Ruediger et al. 2000). Both snow conditions and vegetation types are important factors in defining lynx habitat. Crusting or compaction of snow may reduce the competitive advantage that lynx have in deep, soft snow. Primary vegetation that contributes to lynx habitat is subalpine fir types where lodgepole pine is a major seral species, generally between 4,100-6,600 feet (Ruediger et al. 2000, Ruggiero et al. 1999, and Verts and Carraway 1998). Moist grand fir and Douglas-fir types intermixed with subalpine types constitute secondary vegetation that may also serve as foraging habitat when characterized by a dense, multi-layered understory that maximizes hare browse at ground level and at varying snow depths (Ruediger et al. 2000 and Ruggiero et al.1999). Hares comprise 33-100 percent of the lynx' diet and a hare density of greater than or equal to 0.5 hares/hectare is likely required for lynx persistence (Ruggiero et al. 2000). Riparian areas, aspen stands, and high-elevation willow communities are also important lynx prey habitats.

Large, course woody debris is a common element of natal den sites. Hollow logs and root wads provide protection and thermal cover for kittens.

Denning habitat must be in or adjacent to foraging habitat to be functional (Ruediger et al. 2000). Lynx seem to prefer to move through continuous forest, and frequently use ridges, saddles, and riparian areas. Home range sizes for lynx can be variable, but it appears that at least 6,400 acres of primary vegetation should be present to support survival and reproduction.

Canada lynx are thought to occur in Oregon as dispersers that have never maintained resident populations. They are considered an infrequent and casual visitor by the state of Oregon (Ruediger et al. 2000, pp. 4-7). The Umatilla NF has not had a verified lynx observation, therefore the Forest is considered “unoccupied” habitat. To be considered “occupied” habitat, the Forest would have to have at least two verified lynx observations or records within the past five years, or evidence of lynx reproduction.

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 the survey effort. It is unknown whether lynx are currently present on the Forest, but there are no verified records of lynx, and there is no evidence of occupation or reproduction that would indicate colonization or sustained use by lynx.

Lynx habitat on the Umatilla National Forest 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 southeast Washington. 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 Forest. Potential lynx habitat generally occurs in an elongated cluster in the northern portion of the Umatilla National Forest with another habitat cluster in the Blue Mountains on the southern end. However, the Lynx Conservation Agreement (May 2006), states that the LCAS does not apply to forests that are considered as having unoccupied habitat. Table 30 describes the size and type of potential lynx habitat as defined in the LCAS and acres of known invasive plant sites that exists within the Forest.

Table 30 – Descriptions of Potential Lynx Habitat

Potential Lynx Denning	Potential Lynx Forage	Currently Unsuitable	Total Potential Lynx Habitat	Acres of Invasive Plants Within Potential Habitat
81,485	**154,761**	**121,716**	**357,962**	**3,486 (<1%)**

Gray Wolf

Habitat preference for the gray wolf appears to be more prey dependent than cover dependent. The wolf is more of a habitat generalist inhabiting a variety of plant communities, typically containing a mix of forested and open areas with a variety of topographic features including grasslands, sagebrush steppe, and coniferous, mixed, and alpine forests (NatureServe 2006, Verts and Carraway 1998, and Witmer et al. 1998).

Wolves prefer fairly large tracts of roadless country; generally avoiding areas with an open road density greater than one mile per square mile (Witmer et al. 1998). The basic social unit in wolf populations is the pack. A pack can consist of 2 to 20 wolves (average of 10).

Wolves prey primarily on large ungulates such as elk and deer (NatureServe Explorer 2006, Verts and Carraway 1998, and Witmer et al. 1998). Their alternate prey base typically consists of smaller mammals and birds, such as, beaver, ground squirrels, rabbits, and grouse (NatureServe Explorer 2006 and Witmer et al. 1998). It is not uncommon to observe wolves "mousing" in grassy meadows much like coyotes and red fox. Individuals may take livestock as secondary prey when ungulates are less vulnerable or available (Witmer et al. 1998).

Gray wolves have extensive home ranges but specific habitat requirements for denning, rearing young, and foraging. Dens are usually located on moderately steep slopes with southerly aspects within close proximity to surface water. Rendezvous sites, used for resting and gathering, are complexes of meadows that have adjacent hillside timber with nearby surface water (Kaminski and Hansen 1984). Both denning and rendezvous sites are often characterized by having nearby forested cover, remote from human disturbance (NatureServe Explorer 2006). Wolves are strongly territorial; defending an area of 75-150 square miles, and are threatened by negative interactions with humans. There are currently no known denning or rendezvous sites on or near the Forest, but potential habitat for denning or rendezvous does exists. Several inventoried roadless areas and wilderness areas offer secluded places that would be logical for wolves to inhabit.

While occasional wolf sightings are reported in the Blue Mountains, there are no known established wolf packs or territories (e.g. observations of reproduction, den sites, or rendezvous sites) on the Forest. Wolf sighting information seems to indicate transient or lone individuals that are not part of a resident pack. Government officials have not yet confirmed a wolf pair near a tributary of the Minam River, just south of the Umatilla National Forest (on the north-end of the Wallowa-Whitman National Forest); however, there have been numerous reported sightings and some evidence to indicate their existence in this area. During the summer of 2006 government officials surveyed the area but were not able to confirm the pair. Investigations of wolf sightings are on-going. One investigation took place in late January 2007, in response to reported sightings in the vicinity of Saddle and Tryon Creeks near the Minam, however no wolves were located. There are also camera bait stations located on National Forest system lands and state lands. At the time of this writing none of the stations have produced confirmed evidence. No den or rendezvous sites have been found so no resident populations are known to occur in the Blue Mountains.

Forest Service Sensitive Species

This section of Chapter 3 discusses the Affected Environment of Sensitive Species documented (shown by a D in the Occurrence column of Table 31) as a component of the Umatilla National Forest. Sensitive Species suspected (shown by an S in the Occurrence column of Table 31) to be, but not currently found on the Forest, are discussed in Appendix C.

The Regional Forester's Sensitive Species List, is a proactive approach for meeting the Agency's 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 FWS as "candidates" for listing under the ESA, and meeting the Forest Service criteria for protection, are included on the Regional Forester's Sensitive Species Lists.

Table 31 - Suspected (S) or Documented (D) Wildlife of the Umatilla NF on the Regional Forester's Sensitive Species List (July 2004)

Common Name	Scientific Name	Occurrence
Mammals		
California wolverine	*Gulo gulo*	D
Rocky Mountain Bighorn Sheep	*Ovis canadensis canadensis*	D
Birds		
American peregrine falcon	*Falco peregrinus anatum*	S
Green-tailed Towhee (WA only)	*Pipilo chlorurus*	D
Upland sandpiper	*Bartramia longicauda*	S
Gray flycatcher	*Empidonax wrightii*	S
Amphibians		
Northern Leopard frog	*Rana pipiens*	S
Columbia spotted frog	*Rana luteiventris*	D
Reptiles		
Painted Turtle	*Chrysemys picta*	S
Striped Whipsnake (WA only)	*Masticophis taeniatus*	S
D = Documented – in the context of the Forest Service sensitive species program, an organism that has been verified to occur in or reside on an administrative unit. S = Suspected – in the context of the Forest Service sensitive species program, an organism that is thought to occur, or that may have suitable habitat, on Forest Service land or a particular administrative unit, but presence or occupation has not been verified.		

California Wolverine

Wolverine range in the contiguous United States is thought to include Idaho, Montana, Oregon, Washington, Wyoming and possibly California. Wolverines inhabit dense coniferous forests and use open sub-alpine forests up to and beyond timberline. Typically, they use high elevation alpine wilderness areas in the summer and montane forest habitats in the winter (Copeland, 1996). In California and southern Oregon and throughout the Cascades, the wolverine inhabits alpine, boreal forest and mixed vegetation (Grinnell et al. 1937; Schempf and White 1977). They are associated with rocky outcrops, steep mountainous areas and transition zones between primary cover types. Forested riparian zones at upper elevations are likely to be important forage habitats for these furbearers and provide relatively safe travel corridors that allow for animals to move within and between watersheds. They most commonly use areas with a high diversity of microhabitats and high prey populations.

Natal denning habitat includes open rocky slopes (talus or boulders) surrounded or adjacent to high elevation forested habitat that maintains a snow depth greater than 3 feet into March and April (Forest Service 1994). Wolverines are known to regularly avoid human generated disturbance, and are sensitive to any disturbance; they will move natal den-sites several miles if disturbance is in the area of their den.

The wolverine is an opportunistic scavenger, with large mammal carrion the primary food source year-round. Prey items also include small and medium-sized mammals, birds and their eggs, insects, fish, roots, berries, and carrion. While foraging, they generally avoid large open areas and tend to stay within forested habitat at the mid and high elevations (greater than 4,000') and typically travel 18-24 miles to forage/hunt (Forest Service 1994).

Prior to 1973, wolverines were classified as furbearers in Oregon. They are considered rare throughout all of Oregon, Washington, Idaho, and California, but recent sightings, tracks, and a road kill document their continued presence at low densities (Csuti et al. 2001). Records for eastern Oregon include a partial skeleton and tufts of fur found near Canyon Mountain, Grant County (1992), tracks and a possible den site discovered in the Strawberry Mountain Wilderness (1997), and tracks that were noted in the Monument Rock Wilderness (1997).

There are historical sighting records of wolverines on the Umatilla National Forest but there has been no physical evidence of their occurrence found on the Forest. Formal winter track surveys for wolverine were conducted during the winters of 1991 through 1994. Those surveys found no verified tracks. There are no known den sites on the Forest. The Umatilla lacks much acreage above 7,000 feet, which is generally where wolverine prefer to den.

The most likely places wolverines would be found are the wilderness areas since wolverines prefer remote and high elevation areas for denning. The Umatilla NF has three wilderness areas totaling approximately 304,925 acres, and there are approximately 251 acres within those three wildernesses known to have invasive plants. Therefore, far less than one percent of these three wilderness areas have invasive plants. In addition, no acres above 7,040 feet have invasive plants. What this means is that potential wolverine den sites would not be disturbed by invasive plant treatments because there are no invasive plants known to exist above 7,040 feet in elevation. In addition, since less than one percent of the wilderness areas contain invasive plants the likelihood of disturbance or impacts to wolverine or their habitat is highly unlikely. Although wilderness areas appear to be the most likely places to find wolverine den sites, they could in fact be foraging just about anywhere on the Forest since they have such large home ranges and are capable of traveling long distances in a day.

Rocky Mountain 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. The distribution of escape terrain regulates the extent to which other habitat components are used. Most bighorn sheep use forage areas within 0.5 mile of escape terrain and generally not seen farther than 1.0 mile.

Summer range varies from subalpine meadows above 7,500 feet to canyon grasslands at 1,000 feet. Winter range is usually below 6,000 feet. Some herds are yearlong residents on a given area, with little or no spatial separation of summer and winter ranges (Drewek 1970). Other herds migrate several miles between summer and winter range and occupy areas that include a variety of elevations and environmental conditions (Geist 1971). Both summer and winter range must provide freedom from disturbance and a proper juxtaposition of forage, escape terrain, and water.

Terrain for lambing is rugged, precipitous and remote (Van Dyke et al. 1983). Such terrain provides pregnant ewes security and isolation during the lambing season. Ewes select rugged cliffs of at least five acres for lambing. Ewe-lamb groups prefer more rugged topography than ram groups (Valdez and Krausman 1999) and are more restricted in use of their range. Ram groups will range farther from escape terrain than ewe groups.

The Forest has both Rocky Mountain and California bighorn sheep. Rocky Mountain bighorn sheep are listed as sensitive on the Regional Forester's Sensitive Species List and includes all the herds except the Potamus herd, which is the only herd that are California bighorn sheep.

Bighorn sheep can be found in the vicinity of the Grande Ronde, Wenaha (north end) and North Fork of the John Day (south end) rivers and the Tucannon Wilderness. They were recently introduced (2002) into the Heppner/Ukiah area, and although the populations are small, they appear to be stable. Bighorn sheep habitat on the Forest is not typical in that the Forest does not have a lot of high elevation habitat so these animals utilize lower elevation habitat year-around. Table 32 in this section contains the five areas bighorn sheep are found on the Forest and the number of acres within which invasive plants are found. Invasive plants do not appear to be currently impacting bighorn sheep habitat to any measurable degree since such a small portion of the bighorn sheep habitat includes invasive plants.

Table 32 - Bighorn sheep locations and the approximate number of acres of invasive plants

Bighorn Sheep Location	Approximate Acres Within The Area	Acres with Invasive Plants	Percent of Bighorn Sheep Area with Invasive Plants
Asotin	21,745	613	2.8%
Cottonwood Creek/Lost Prairie/Mountain View	19,384	191	< 1%
Potamus	17,922	197	1.0%
Tucannon River/Wooten	7,434	146	1.9%
Wenaha	67,709	203	< 1%
Wenaha/Haas/Cottonwood	20,054	490	2.4%

Green-tailed Towhee

The green-tailed towhee is a bird of the western portion of the lower 48 states. Its northern limit is in the Blue Mountains of Washington, just over the Oregon state line. From there it breeds south to southern California and east to Wyoming and eastern New Mexico. It is migratory, spending winters in the southwestern U.S. and Mexico (Csuti et al. 2001).

The green-tailed towhee prefers vigorous shrub stands with high shrub species diversity. It occupies the undergrowth of sagebrush, bitterbrush, manzanita, mountain mahogany, and buckbrush in open ponderosa pine woodlands. During the breeding season, this species is generally found in brushy areas on the mountain slopes, where scattered trees such as juniper or aspen intermingled with significant stands of shrubs, particularly mountain mahogany or snowbrush (Marshall et al. 2003), sometimes as high as 6,000-7,000 feet. It breeds in higher-elevation coniferous woodlands in some parts of Oregon. While in the more arid portions of eastern Oregon, it occurs only in riparian woodlands and sagebrush thickets on mountain slopes (Csuti et al. 2001).

Little is known about the food habits of green-tailed towhees. Like other towhees, it scratches litter on the ground, presumably looking for seeds and insects.

It probably takes a variety of forb and shrub seeds, with more insects added to the diet in the breeding season. It will take some berries from shrubs when they are available (Csuti et al. 2001).

Forest records show a very limited number of sightings of green-tailed towhee on the Pomeroy and Walla Walla Ranger District. These sightings were on south, southwest, or west facing slopes with greater than 30 percent dry bunch grass interspersed with woody shrubs. NatureServe Explorer (2006) shows the green-tailed towhee as ‘apparently secure’ in Oregon and ‘imperiled’ in Washington, but this may be simply because southeast Washington is at the furthest northern part of their range and not much is known about them in this area. Mapping potential breeding and foraging green-tailed towhee habitat included: all dry shrubland habitat, ponderosa pine forest and juniper woodlands with less than 30 percent canopy closure, and south, southwest and west slopes. Using this broad scale analysis, there is approximately 71,394 acres of potential green-tailed towhee habitat on the Forest. Approximately 1,424 acres or two percent of those acres have known invasive plants. Approximately 43 percent of those acres are adjacent to roads (549 acres) or trails (63 acres).

Columbia Spotted Frog

Columbia spotted frogs range from southeastern Alaska to central Nevada, east to Saskatchewan, Montana, western Wyoming, and north central Utah. The Great Basin Distinct Population Segment (DPS) of the Columbia spotted frog is a federal candidate for listing. This DPS is found in Oregon, Idaho, and Nevada. The Columbia spotted frog is considered a Forest Service sensitive species and has been documented on the Malheur, Ochoco, Umatilla, and Wallowa-Whitman National Forests. This species was once considered to be included in *Rana pretiosa,* with the Oregon spotted frog

The spotted frog frequents waters and associated vegetated (grassy) shorelines of ponds, springs, marshes, and slow-flowing streams and appears to prefer waters with a bottom layer of dead and decaying vegetation (NatureServe Explore 2006, Hayes et al. 1997, Csuti et al. 2001). They occur along the grass and sedge margins of streams, lakes, ponds, springs, and marshes. They typically occur between 150 and 8,000 feet in elevation (Corkran and Thoms 2006). The Columbia spotted frog exhibits strong fidelity to breeding sites and often deposits eggs in the same locations in successive years. They deposit egg masses in still, shallow waters atop submergent herbaceous vegetation or among clumps of herbaceous wetland plants. Breeding habitats include a variety of relatively exposed, shallow-water (less than 60 centimeters), 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. After breeding, adults often disperse into adjacent wetland, riverine and lacustrine habitats. Tadpoles live in the warmest parts of ponds (Corkran and Thoms 2006). Froglets and adults live in well-vegetated ponds, marshes or slow, weedy streams that meander through meadows (Corkran and Thoms 2006). Springs may be used as over-wintering sites for local populations of spotted frogs (Hayes et al. 1997).

Larvae have a diet of algae, plant material, and other organic debris. Adults eat insects (ants, beetles, mosquito larvae, and grasshoppers), spiders, mollusks, tadpoles, crayfish, and slugs (NatureServe Explore 2006, Hayes et al. 1997, Csuti et al. 2001). Columbia spotted frogs eat arthropods, earthworms and other invertebrate prey.

Predators of the species include mink, river otter, raccoon, herons, bitterns, corvids, garter snakes, dragonfly larvae, and predacious diving beetles (McCallister and Leonard 1997).

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 1999, Bridges and Semlitsch 2000). Threats to the species include mining, livestock grazing, road construction, agriculture, and direct predation by bullfrogs and non-native fishes (USDI 1998).

Columbia spotted frogs occur in a number of locations (at least 15 sites) on the Umatilla National Forest. This species is often found in natural ponds, rock pits, old mining ponds, livestock ponds, and slow moving streams that retain water year-round. More have been found on the south end of the Forest than the north. Most spotted frog sites found on the Forest are in created habitat such as mining ponds and rock pits. Several of the known or potential spotted frog sites have invasive plants.

The Umatilla National Forest does not have GIS converage for manmade and natural ponds, lakes, reservoirs, wet meadows, springs and stockponds; however, it does have GIS coverages for lakeshores and springs. Although lakeshores and springs contain only a portion of the potential Columbia spotted frog habitat available in the Project Area, it does show some of the potential habitat available and a portion of the potential habitat which contains invasive plants. This gives a sense of what proportion of the other waterbodies mentioned above may contain invasive plants.

There are eight waterbodies and 397 springs defined in the Umatilla GIS converages. The potential habitat model for spotted frog used springs buffered by 300 feet and lakeshores 300 feet to the outside and 25 feet to the inside. Using these parameters there are approximately 2,775 acres of spotted frog habitat on the Forest, of which 133 acres contain invasive plant species.

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 1979). Table 33 includes those wildlife species that were identified as MIS for the Umatilla National Forest (USDA 1990).

Table 33 - Management Indicator Species and Their Associated Habitat for the Umatilla NF

Species	Habitat Types
Rocky Mountain elk	General forest habitat and winter ranges
Pileated Woodpecker	Dead/down tree habitat (mixed conifer) in mature and old growth stands
Northern three-toed woodpecker	Dead/down tree habitat (lodgepole) in mature and old growth stands
Pine Marten	Mature and old growth stands at high elevations
Primary cavity excavators	Dead/down tree (snag) habitat

Rocky Mountain elk

Rocky Mountain elk was selected as an indicator species in the Forest Plan to represent general forest habitat and winter ranges. Concern over this species arises from its status as an important game species. Habitat quality for elk is evaluated in terms of forage, cover (satisfactory and marginal), elk screening, and open road density. The quality of elk habitat is influenced by the presence of humans, which causes animal stress and hunting vulnerability. This is primarily associated with motorized use of open roads and the availability of vegetation (live and dead) to screen elk. Elk have been found to select habitats preferentially based on increasing distance from open roads (Rowland et al. 2000). Vulnerability and hunting mortality have been found to be higher in forested stands with greater road densities and less vegetation to provide screening (Weber et al. 2000).

Elk habitat on the Forest was mapped as part of a cooperative effort sponsored by the Rocky Mountain Elk foundation using a 1:250,000 scale map. This mid-scale mapping is used for a “big picture” perspective of habitat use. When this map is overlain with the Forest mapped invasive species layer, it shows approximately 364,188 acres of elk winter range on the Forest. Approximately 8,967 acres (two percent) of the elk winter range is currently known to contain invasive plant species.

Of the elk winter range that contains invasive plants, approximately 39 percent is adjacent to roads and trails (approximately 37 percent is along roads only).

Elk summer range (approximately 1,252,527 acres) includes most of the Forest except for small portions of the Walla Walla and Pomeroy Districts. Approximately 22,736 acres (1.8 percent) of elk summer range is infested with invasive plants. Approximately 48 percent of the summer range infested with invasive plants is adjacent to roads and trails (45 percent along roads only). About three percent of the total mapped elk calving areas are impacted by invasive plants. Of that three percent, 64 percent is adjacent to roads and trails. Invasive plants within 100 feet of a road or trail are considered to be adjacent. What this analysis shows is that a fairly high proportion of the invasive plants within elk habitat are adjacent to roads and trails.

Pileated woodpecker

Pileated woodpecker was selected as an indicator species in the Forest Plan to represent dead and down tree habitat in mature and old growth mixed conifer stands. The pileated woodpecker is the largest woodpecker species in the western United States and nests in cavities of large trees or snags. It is an occupant of mature forests, relying on dead and decaying trees for foraging and nesting. Pileated woodpeckers can act as a keystone habitat modifier by excavating large numbers of cavities that are depended upon by several other species, and by influencing ecosystem processes such as decay and nutrient cycling (Aubry and Raley 2002). The pileated woodpecker is fairly common throughout the Umatilla National Forest in mature and late-successional mixed conifer forest. Pileated woodpeckers rely on large areas of unburned, mature and old-growth forests for their foraging resources, because they forage primarily on ants (Hymenoptera and Formicidae) within softened wood (Bull and Holthausen 1992).

Parameters used for mapping potential habitat for pileated woodpecker included late forest structure in mixed conifer stands consisting of ponderosa pine, western larch, grand fir and Douglas-fir, which had greater than or equal to 50 percent canopy closure and trees and snags that were at least 15 inches diameter breast height. Using this analysis there are approximately 191,171 acres of potential pileated woodpecker habitat within the project area. There are approximately 3,719 acres (2 percent) of known invasive plant species infestations within this potential pileated woodpecker habitat.

Since pileated woodpeckers utilize down logs and snags and forage on beetles and ants buried inside decaying wood, their habitat is not impacted by invasive plant infestations but infestations may occur in proximity to pileated woodpecker habitat. Fifty-two percent (1,949 acres) of those acres are adjacent to roads and trails.

Northern Three-toed Woodpecker

The northern three-toed woodpecker was selected as an indicator species in the Forest Plan to represent dead and down tree habitat in mature and old growth lodgepole pine stands. The northern three-toed woodpecker preferred habitat (foraging and nesting) includes late successional, cold/moist forest types (lodgepole/mixed conifer) with high standing-wood density, generally in higher-elevations above 4,500 feet (Marshall et al. 2003, Csuti et al. 2001).

This woodpecker feeds mostly on wood-boring larvae of moths and beetles, which it captures by probing dead or decaying wood. It also gleans some insects (ants, caterpillars), and eats fruits, mast, and cambium (Csuti et al. 2001). The loss of mature lodgepole pine forest habitat, essential to this naturally rare species, could lead to its decline.

Pine marten

The pine marten (aka American marten) was selected as an indicator species in the Forest Plan to represent complex mature and old growth stands. Preferred habitat for the marten consists of higher elevation (greater than 4000 feet) stands of dense conifer and large down-wood, often associated with streams. Pine martens occur in dense forests containing snags and down logs, which provide suitable denning sites. The pine marten is most closely associated with heavily forested east and north-facing slopes that contain numerous windfalls (Maser 1998). Martens spend a great deal of time in trees and can even leap from branch to branch between trees. They tend to avoid areas that lack overhead protection and the young are born in nests within hollow trees, stumps, or logs. They eat a variety of small mammals, particularly squirrels, as well as voles, mice, pika, and rabbits. Martens 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.

Multi-storied, mature and old forest stands with trees and snags 15 inches in diameter at breast height or larger, and at 4,000 feet in elevation or above were used to determine broad-scale potential marten habitat. No acres of juniper woodland, hot-dry ponderosa pine or whitebark pine habitat was calculated into the marten habitat. This analysis does not include the marten preference for close proximity to riparian habitat so it is more inclusive. Using these factors to determine potential marten habitat; the Project Area contains approximately 78,595 acres of habitat. Approximately 1,662 acres (2 percent) contain known invasive plant sites. Approximately 2 percent of those sites are adjacent to roads (729 acres) and trails (67 acres). It is not entirely clear why two percent of potential marten habitat shows up with invasive plants, since they tend to use areas with dense canopy cover, which is not where invasive plants are generally found. It could be that much of the area is adjacent to roads where invasive plants are often found, the stands are adjacent to cut-over areas that contain invasive plant infestations, or there was a slight mapping error.

Cavity excavators

A large number of species rely on cavities in trees for shelter and nesting. Primary cavity excavators include 16 species of birds with the potential for habitat to occur in the Umatilla National Forest.

These species include Lewis' woodpecker, Williamson’s sapsucker, red-naped sapsucker, downy woodpecker, hairy woodpecker, white-headed woodpecker, three-toed woodpecker, black-backed woodpecker, northern flicker, pleated woodpecker, black-capped chickadee, mountain chickadee, chestnut-backed chickadee, red-breasted nuthatch, white-breasted nuthatch, and pygmy nuthatch (Johnson and O’Neil 2001, and Thomas 1979). Primary cavity excavators create holes for nesting or roosting in live, dead or decaying trees.

Secondary cavity users such as owls, bluebirds, and flying squirrels may use cavities created by primary cavity users for denning, roosting, and/or nesting. By addressing available habitat for primary cavity excavators, it is expected that habitat for secondary cavity users will be provided (USDA 1990). Habitat for primary cavity excavators includes dead trees in various size and decay classes with coniferous and hardwood vegetation and a variety of structural stages (Wahl et al. 2005, Johnson and O’Neil 2001, and Thomas 1979). This group of primary cavity excavators is considered one management indicator in the Forest Plan and represents a vast array of vertebrate species that depend upon dead trees and down logs for reproduction and/or foraging (USDA 1990).

Species of Interest

Landbirds (migratory birds)

Landbirds which include neotropical migratory birds that have been defined as those species that regularly breed in continental North America and winter south of the Tropic of Cancer, typically in Central and South America and the Caribbean. Landbirds are defined as all birds except loons, grebes, seabirds, waterfowl, long-legged waders, shorebirds, gulls, terns, alcids, cranes, and rails. One hundred sixty two species of landbirds breed in Oregon and Washington including common passerine songbirds, hawks, and owls (Andelman & Stock 1994).

Landbirds occur in a wide variety of habitat types including early and late-seral forests (Finch & Stangel 1993). In the relatively arid western United States, however, densities of neotropical migrants are highest in riparian areas, with coniferous forests being the second-most used habitat by this assemblage of species (Saab and Rich 1997).

Species Discussion

Focal Species Analyzed

The Conservation Strategy for Landbirds in the Northern Rocky Mountains of Eastern Oregon and Washington (Altman 2000) set up biological objectives and management actions. The Plan says, “Simply stated, biological objectives are “what we think the birds need. They are not regulatory nor do they represent the policies of any agency or organization.” The list of management level focal species was used to select species to analyze which represent key species of birds that could indicate any adverse affects to landbirds from the proposed invasive plant treatments.

Large-scale declines in open park-like dry forests with large trees and snags have led to population declines of the white-headed woodpecker, flammulated owl, white-breasted nuthatch, pygmy nuthatch, Williamson’s sapsucker, and Lewis' woodpecker.

These bird species have likely suffered some of the greatest population declines and range retractions (Altman 2000).

Local overstory nesting species and foliage or crown feeders may include the pine siskin, golden-crowned kinglet, mountain chickadee, hermit thrush, ruby-crowned kinglet, yellow-rumped warbler, and western tanager.

The Conservation Strategy for Landbirds (Altman 2000) identifies three priority habitat types: Dry Forest, Mesic Mixed Conifer, and Riparian Woodland and Shrub. Several “unique” habitats are also important. The Project Area contains all three forest types over large areas.

Dry Forest habitat type is characterized as coniferous forest composed exclusively of ponderosa pine, or dry stands co-dominated by ponderosa pine and Douglas-fir or grand fir. It is generally at lower elevations and mostly on xeric, upland sites with shallow soils.

Focal species include: white-headed woodpecker (large patches of old forest with large trees and snags), flammulated owl (old forest with interspersion of grassy openings and dense thickets), chipping sparrow (open understory with regenerating pines, and Lewis’ woodpecker (patches of burned old forest). Dry forest type comprises about 51 percent of the forested area within the Umatilla Forest.

Mesic Mixed Conifer habitats are primarily Douglas-fir and grand fir sites that are generally higher elevation, wetter, on northerly aspects, and in draws where soils are mesic.

Focal species include Vaux’s swift (large snags), Townsend’s warbler (overstory canopy closure), varied thrush (structurally diverse, multi-layers), MacGillivray’s warbler (dense shrub layer in forest openings or understory), and olive-sided flycatcher (edges and openings created by wildfire). Mesic mixed conifer (moist upland forest) occurs on about 33 percent of the forested habitat within the Umatilla Forest.

Riparian woodland and shrub habitats are typified by the presence of hardwood tree and shrub species, along with associated wetland herbaceous species. Water is an important component of these habitats, whether it is in the form of standing wetlands, springs, seeps, or flowing water (streams). Riparian vegetation is particularly important to Neotropical migratory songbirds (Sallabanks et al. 2001). Although these habitats generally comprise only a small portion of the landscape, they usually have a disproportionately high level of avian diversity and density when compared to surrounding upland habitats.

In addition, the Conservation Strategy identifies aspen as a unique habitat important to landbirds. In the Blue Mountains, aspen trees are nearly always associated with riparian areas or ephemeral draws, so they are included in this section.

Focal species include: Lewis’ woodpecker (large snags), red-eyed vireo (canopy foliage and structure), veery (understory foliage and structure), and willow flycatcher (willow/alder shrub patches) and red-naped sapsucker (aspen). Riparian woodland and shrub habitat occurs on less than one percent of the Forest.

Focal species for Unique Habitats include: hermit thrush (subalpine forest), upland sandpiper (montane meadows), vesper sparrow (steppe shrubland), gray-crowned rosy finch (alpine), and red napped sapsucker (aspen). The Forest has only a small amount of any of these habitat types.

Table 34 - Unique Habitat/Focal Species on the Forest

Unique Habitat	Habitat Attribute	Focal Species	Approximate Percent of Forest Acres
Subalpine Forest	Patches	Hermit thrush	Less than 1
Montane Meadows	Mesic and dry conditions	Upland sandpiper	1.4
Steppe Shrublands	Patches	Vesper sparrow	3
Aspen	Large trees/snags with regeneration	Red-naped sapsucker	Less than 1
Alpine	Patches	Gray-crowned rosy finch	Less than 1

3.3.3 Alternatives Analyzed

Effects Analysis & Methodology for Analysis

Excerpts from the Invasive Plants FEIS (USDA Forest Service, 2005a) are used throughout this discussion. The effects analysis of individual herbicides and surfactants are used here. Facts, figures, herbicides, and species analysis are modified to reflect the site-specific analysis effort on the Forest.

The following terminology and introduction from the Invasive Plants FEIS (USDA Forest Service, 2005a) are repeated here for easy reference, and are pertinent to discussion of effects on wildlife on the Forest (R6 FEIS Pages 4-42 to 4-44).

- **NOAEL (No observed adverse effect level):** An exposure level at which there is no statistically or biologically significant increases in the frequency or severity of adverse effects between the exposed population and its appropriate control. Some effects may be produced at this level, but they are not considered as adverse, or as precursors to adverse effects. In an experiment with several NOAELs, the regulatory focus is primarily on the highest one, leading to the common usage of the term NOAEL as the highest exposure without adverse effects.
- **LOAEL (Lowest Observed Adverse Effect Level):** The lowest dose associated with an adverse effect.
- **Toxicity index:** The benchmark dose used in analysis to determine a potential adverse effect when it is exceeded. Usually a NOAEL, but when data are lacking other values may be used.

When considering the effects of herbicides on wildlife species, it is important to remember these herbicides are designed to affect plants at relatively low rates, while much higher rates would be required to kill animals. Plants have metabolic systems that do not exist in animals. It is these metabolic systems at which the herbicides are targeted. Michael (2002) explained it well when he said, “All chemicals, natural or man-made, are toxic at some level of exposure. The difference between acute and chronic toxicity versus the no observed effect level (NOEL) is primarily a function of the amount of exposure in a unit of time and the mode of action of the chemical.

For example, vitamin D is essential to good health and mammals consume it on a daily basis. However, it could be very toxic, in fact more toxic than most of the herbicides used in forest management" (Michael 2002).

Results of numerous field studies indicate the likelihood for direct adverse effects to wildlife from herbicide use is low (e.g., Marshall & Vandruff, 2002; Dabbert et. al., 1997; Fagerstone et. al., 1977; Rice et. al., 1997; Sullivan et. al., 1998a, Cole et. al., 1997; Cole et. al., 1998; Johnson and Hansen, 1969; Nolte and Fulbright, 1997, McMurray et. al., 1993a; McMurray et. al., 1993b). The use of herbicides to treat invasive plants, however, does have the potential to harm free-ranging wildlife. Certain herbicides have the potential, for example, to affect the vital organs of some wildlife species, change body weight, reduce the number of healthy offspring, increase susceptibility to predation, or cause direct mortality. Individual birds and mammals may ingest vegetation or insects that have been sprayed with some herbicides and potentially experience these types of effects.

Herbicides may also cause some malformations or mortality to amphibians that have been exposed to herbicides or surfactants in water (Relyea 2005). In addition, herbicides contain impurities and additives, and produce metabolites that could be toxic to wildlife.

A metabolite of triclopyr, 3, 56-trichloro-2-pyridinol (TCP), is toxic to aquatic animals. The impurity hexachlorobenzene, found in picloram and clopyralid, is carcinogenic. Surfactants added to herbicides could substantially increase toxicity to aquatic species, like amphibians. These substances were evaluated in the relevant risk assessments and, with the exception of surfactants, were found not to contribute substantially to toxic exposures or increase cancer risk (SERA, 2003a, 2003b, 2003c, 2004b).

The results of the herbicide analysis indicate that birds or mammals that eat grass or insects are most susceptible to harm from herbicides. Birds or mammals 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). Because of their small size and relatively larger surface area, herbicide residues on insects may also be higher (Kenaga 1973). Some birds and mammals that eat grass include elk, rabbits and hares, chukar, California quail, and geese. Some bird species (like quail) are primarily herbivorous as adults but require insects as a primary food source as chicks. Insect-eating mammals include bats and shrews. Insect-eating birds include a huge number of species, such as bluebirds, flycatchers, swallows, wrens, and others.

NPE surfactants added to herbicides also have the potential to result in harmful doses to birds and mammals that eat vegetation or insects that have been sprayed. For the purpose of analysis, it is assumed that the number of plausible exposure scenarios that exceed the toxicity indices is the same for surfactant as it is for the herbicides. No estimate of acres treated using NPE surfactants is made because surfactants may not be used, or other additives may be used instead, so there is no direct correlation between acres treated with herbicide and acres treated with NPE.

Analytical Methods

The analytical methods used in determining toxicity of herbicides and surfactants on wildlife species including PETS, management indicator species and landbirds can be found in Appendix C of this document.

The number of acres of wildlife habitat benefited by removal of invasive species to restore native vegetation and rate of treatment is determined by the acres treated and the rate of treatment determined by the effectiveness of the treatment method.

The number of special status species potentially exposed to herbicides following implementation of the PDF is determined by Geographic Information System (GIS) analysis of the number of acres of herbicide treatment that dissect or traverse habitat that is potentially suitable. These acres are discussed in the wildlife effects section.

The number of special status species potentially impacted by manual, or mechanical, treatments following implementation of the PDF is determined by Geographic Information System (GIS) analysis of the number of acres of non-herbicide treatment that dissect or traverse habitat that is potentially suitable. These acres are discussed in the wildlife effects section.

3.3.4 Environmental Consequences

General Effects of Invasive Plant Treatments

Effects of invasive plant treatment methods to wildlife were evaluated and discussed in detail in the Region Six Invasive Plant Program FEIS (USDA Forest Service 2005a), the corresponding Biological Assessment (USDA Forest Service 2005b), project files, and FS/SERA risk assessments (SERA 2001, 2003a-d, 2004a-e). These documents indicate that the most plausible adverse effect to wildlife from invasive plant treatments is from disturbance caused by manual and mechanical treatments.

Wildlife species may be adversely affected by invasive plant treatment methods. All treatment methods have the potential to disturb, temporarily displace, or directly harm various wildlife species. Successful control of invasive plant infestations provides long-term benefits by restoring native habitat. Treatment of larger infestations may create more disturbances for longer periods than small infestations, but the specific amount and duration is largely dependant upon specific treatment methods. Several techniques can create bare ground, which may reduce cover and expose certain species to increased predation. Large tracts of bare ground can alter migration and dispersal of some species (Semlitsch 2000). The probability of these effects depends on the size and distribution of bare ground created.

The effects of the invasive plant treatment are also relative to the size and locations of existing and future invasive plant infestations. Treatments of infestations along disturbed roadsides are not likely to substantially affect terrestrial wildlife populations since this vegetation type does not provide essential habitat for native wildlife species, and it consists of long, narrow areas spread over large distances. Adverse effects to individuals using the roadside vegetation at the time of treatment could occur.

Treatments of moderate infestations may pose the greatest risk to native wildlife. In moderately infested areas, enough native habitats may remain to support some native wildlife, and the infestation may be large enough to require more intensive and extensive treatment techniques. Very large infestations and monocultures of invasive plants do not support native wildlife populations and the presence of native wildlife in these areas is greatly reduced in comparison to native habitat (see Duncan and Clark 2005).

There are two primary effects likely for most species from invasive plant treatments; disturbance and trampling from machinery or people treating invasive plants, and risk from herbicide contact for species in which data is not sufficient to allow quantitative estimates of risk. There is no risk to species' habitat because invasive plant treatments do not remove suitable habitat for any species, and the majority of the treatments will occur along highly disturbed roadsides which do not provide suitable habitat in most cases.

Some species in the Project Area may have suitable habitat along roads, although in small amounts relative to the amount of suitable habitat that is not within a road corridor.

Invasive Plants Treatment Methods Effects to Wildlife

Manual

Manual treatments can result in trampling of non-target plants (habitat) and animals and create bare ground. The degree of threat and effect from manual treatments depends on the number of workers present and the size of the area being treated.

Because manual techniques are slower than mechanical or chemical methods, the duration of disturbance, caused by the presence of people, may be longer in the treatment area. The slower pace of work allows animals in the area to leave and reduces the risk of direct harm from trampling. Bare ground is likely to be patchy in distribution with this method and less likely to interfere with animal movement or dispersal.

Mechanical

Some mechanical treatments may crush small mammals, reptiles, amphibians, or eggs of ground-nesting birds. Small species that lack rapid mobility (e.g. turtles and toads) are vulnerable to crushing or injury from people or equipment.

Hand-held mechanical equipment, like chainsaws and string trimmers, can be used very selectively on target plants and may be less likely than larger equipment to directly harm wildlife. Use of vehicle-mounted mechanical equipment (mowers, or hammer flails, etc.) is much less selective and more likely to directly harm small wildlife species. Vehicle-mounted equipment is most often applied to monocultures of invasive plants on gentle slopes or road verges, and even though those areas do not provide preferred or suitable habitat for most native wildlife, adverse effects from disturbance or crushing are still possible. Mechanical treatments may produce more bare ground, reducing cover, exposing more soil to erosion, potentially disrupting dispersal or foraging patterns of small animals, and possibly exposing some to increased predation as a result of decreased cover. Mechanical methods generate more noise than other treatments, except for aerial applications, and have a higher likelihood of disturbing species that are secretive or sensitive to noise.

For several species loud and sudden noises above background or ambient levels (those above 92 dB) can cause disturbance that might flush a bird off the nest or abort a feeding attempt. Based on interviews with State and County weed control operators, the vehicles used to spray roadside vegetation with herbicides do not make noise as loud as logging trucks or large delivery trucks and are therefore within the background noise level for open roads. Other mechanical devises proposed for use on invasive plants include brushing machines, mowers, chainsaws, and string trimmers. These tools have the potential to create noise above background levels that may disturb certain wildlife species. Bald eagles could be disturbed by these same tools, as well as human presence, however eagles are quite variable in their responses to activity and noise in the vicinity of their nests or roosts.

Biological

Biological control methods 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).

Biological control methods that reduce invasive plant populations, increase native plant populations, and provide a supplemental food source are indirectly beneficial to wildlife. Any biological control agents that affect native plant species could adversely affect wildlife; however these biological control agents would not be used as per standard 18.

Site Restoration/ Revegetation

Reseeding or revegetation to increase competition with invasive plants can cause short-term disturbance to wildlife similar to manual or mechanical treatments, depending on specific methods used. If native or non-native, non-invasive forage species are used in restoration or competitive plantings, increased food and native habitat could benefit wildlife.

Restoration activities have the potential to restore important wildlife habitat faster than natural or passive revegetation.

Herbicide

The herbicides proposed for use in this document were determined to have minimal impacts to wildlife species in the analysis conducted for the *Region Six Invasive Plant Program FEIS* (USDA Forest Service 2005a). Risk from herbicide exposure was determined using data and methods outlined in the SERA risk assessments (2001, 2003, 204). Tables 5 and 6 in Appendix P of the 2005 FEIS, and the Wildlife Biological Assessment (USDA 2005c pp. 24 – 27) list the toxicity indices used as the thresholds for potential adverse effects to mammals and birds (respectively) from each herbicide. A quantitative estimate of dose using a “worst case” scenario was compared to these toxicity indices. If a dose exceeded a toxicity index, then it was determined to have a potential for adverse effect.

Under “worst case” scenarios, mammals and birds that eat insects or grass that have been contaminated by herbicides are at most risk of adverse effects for some herbicides and NPE surfactants. Amphibians also appear to be at higher risk of adverse effects due to their permeable skin and aquatic or semi-aquatic life history. In most cases, there is insufficient data available on toxicity thresholds to allow a quantitative estimate of risk to an amphibian using a “worst case” scenario.

For this EIS, no aerial, broadcast or spot application will exceed the typical application rate, so highest application rate scenarios are not discussed here. For typical application rates and exposures to birds and mammals, only triclopyr and NPE surfactants produced doses that exceeded toxicity indices. Results of triclopyr exposures do not take into account the strict limitations on use required by a Forest Plan Standard, which makes the exposure scenarios implausible. NPE surfactant exceeded the toxicity index for direct spray of a small mammal, large mammal and large bird that consumed contaminated vegetation (acute), and a small mammal and small bird that consume contaminated insects. There is insufficient data to assess risk of chronic exposures for a large grass-eating bird or insect-eating birds and mammals.

Data is very limited or lacking on potential adverse effects of herbicides to reptiles and amphibians. There is some data to suggest that amphibians may be as sensitive to herbicides as fish (Berrill et al. 1994; Berrill et al. 1997; Perkins et al. 2000), so for this analysis, herbicides that pose potential risk to federally listed fish (as determined by the quantitative estimates from exposure scenarios) will also be considered to pose a risk to amphibians. Glyphosate, picloram, and sethoxydim were identified a posing potential risks to fish in the aquatic species BA (USDA Forest Service 2005c). Triclopyr used in a broadcast spray scenario may pose a risk to fish and amphibians, but a Standard in the Forest Plan restricts triclopyr to selective application methods only, almost eliminating the opportunity for exposure.

The exposure scenarios do not account for factors such as timing and method of application, animal behavior and feeding strategies, seasonal presence or absence within a treatment area, or implementation ofProject Design Features and therefore exaggerate risk when compared to actual applications proposed in this EIS.

Early Detection Rapid Response (EDRR)

EDRR is designed to be aggressive in the control of invasive plants. This is necessary to ensure success in managing and controlling the spread of these highly competitive and easily established plants.

Allowing the treatment of newly found sites adds additional risk factors to wildlife just by adding additional exposure areas. The decision tree would be used with each new infestation site.The risk factors do not change and the PDFs (Chapter 2) would still reduce the effects to little or no impacts to wildlife species.

The management direction included in all alternatives as well as the environmental conditions and animal behavior would tend to minimize actual impacts for EDRR. At the project scale, choices would be made to avoid situations that could cause harm to wildlife. For example, certain herbicides would be avoided in specific areas or times of the year where/when grass-eaters or amphibians may be at risk, or more specific application methods could be used. In addition the PDFs would be used under each action alternative. Alternative A (No Action) does not incorporate EDRR. Actual adverse effects are therefore not likely to occur. Any short-term adverse effects would be largely offset by the long-term benefits of protecting wildlife habitat from loss due to invasive plants.

Incomplete and Unavailable Information

The data available for mammals are derived from numerous studies conducted to meet registration requirements, and primarily on laboratory animals that serve as surrogates. Data for mammals are available for more types of toxicity tests and often on a wider variety of species than are available for birds.

Availability of information on the direct toxicological effects of the 10 herbicides approved for use in Region 6 on wild mammals varies by herbicide. Glyphosate has been widely studied, including field applications. Little or no data on wildlife may exist for other herbicides because they have been tested on only a limited number of species under conditions that may not well represent populations of free-ranging animals (SERA 2001b, 2003a, 2003b, 2003c, 2004a, 2004b, 2004c, 2004d, 2004e, 2004f).

Toxicity data available for birds are derived from studies conducted to meet registration requirements, and primarily on domestic birds that serve as surrogates. There are typically fewer types of toxicity studies conducted on birds using a more restricted variety of species than are conducted for mammals.

Almost all laboratory data is collected on mallards and northern bobwhite. How the sensitivities of different bird species to herbicides may vary from that reported for mallard and bobwhite is not known.

Effects Common to All Alternatives

The treatment of invasive plants has short-term impacts by reducing cover, but restoring native vegetation would have long-term benefits by providing food and cover (See Chapter 3.2.3 – Treatment Effectiveness in the EIS). Birds or mammals 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). Broadcast treatments would impact larger areas than spot treatments, however; disturbance would occur once a year and normally would last for less than a few hours. Species such as turkeys, grouse, quail, and waterfowl all consume grass as part of their diet. Other birds would eat grass seeds especially. The end result of all of the alternatives is some degree of improvement in the quality of habitat, while having a short-term negative effect on individual birds. One example from this project would be the treatment of knapweed. Knapweed seed is not consumed by birds and provides very poor nest cover. By reducing the presence of knapweed and allowing native grasses and forbs that do provide food and cover there is a positive effect from the treatment.

The effects of herbicides, from all methods of intake and to all species on the landscape, are limited. The studies that were analyzed for the Regional EIS indicated that there was a low toxicity of herbicides to birds, but because of the large gaps in data it must be stated that some effects to birds from herbicides are unknown. The data that is available would indicate that the risk is low.

Bald eagles are sensitive to disturbance from noise during the breeding season. The mandatory PDFs for disturbance to bald eagles will effectively minimize the potential for disturbance to this species, so there is no meaningful measure that can be used to compare alternatives. At this time, no bald eagle nests occur within 0.50 miles of any treatment areas, so they are not likely to be disturbed.

For some species with limited toxicity data (amphibians, snakes), their habitat, life history, or required PDFs would make herbicide exposure a negligible risk. In addition, their locations are not mapped sufficiently to enumerate overlap with treatment areas, and their movements would make mapped occurrences less meaningful. For other species (amphibians and painted turtle), there remains some risk from herbicide exposure even when PDFs are followed. For the painted turtle, there is no toxicity data upon which to base an assessment of risk, however; at this time no painted turtles are known to exist on the Forest. For amphibians, there is some toxicity data, and some information indicating that toxicity data on fish may provide a reasonable surrogate (see USDA 2005, Appendix P, p. 28). Amphibians have permeable skin and complex metamorphoses, so they could be sensitive to herbicide exposures. The aquatic PDFs required in all alternatives would reduce, but not eliminate, risk to aquatic amphibians and the painted turtle from herbicide entering the water. The majority of the known locations for spotted frogs (leopard frogs and painted turtles are only suspected, see Appendix C) are not within any proposed treatment areas.

Mechanical and manual invasive plants treatment techniques pose a risk of trampling, introduction of sediment to aquatic habitat, or disturbance from noise.

For sedentary or slow moving species like turtles and terrestrial amphibians, trampling would cause direct and immediate mortality. Aquatic amphibians are very sensitive to the introduction of sediment into their habitat.

The overall likelihood of adverse effects from invasive plant treatments is low. Sensitive species like terrestrial amphibians are often underground or other insulating structures during the dry summer months when most invasive plant treatments would occur. They would therefore not be susceptible to trampling or herbicide exposure. PDFs reduce, but do not eliminate, risk to terrestrial amphibians. This low level potential effect makes it difficult to compare effects between alternatives in meaningful ways.

The distinction between alternatives could be compared to the difference between low potential for adverse effect and very low potential for adverse effect.

Also, because reducing herbicide use often means increasing manual or mechanical methods, the risk from herbicide exposure is traded for the risk from trampling or disturbance.

General Overview of Herbicide Analysis by Species

The analysis is based on exposure scenario results from the SERA risk assessments for mammals, birds, and honeybees using the typical application rate. The effects analyses are those effects that could be expected to exceed toxicity index based on the information outlined in Appendix P of the Invasive Plant FEIS (USDA Forest Service, 2005a).

The anticipated effects are extrapolated results based on the scenarios used for particular taxonomic groups and may be different from actual toxicity of a particular species. Worst-case for both acute and chronic exposures are combined if it is anticipated that both scenarios would apply to the species analyzed. For species that are mobile and have large home ranges only the acute scenarios are applied, because these species would not be in an area long enough to receive chronic exposure to the herbicides. Effects determinations for the purpose of NEPA analysis are made on the effects to individuals and populations for Threatened and Endangered species, but only on the population basis for migratory birds, sensitive, and MIS.

Basic assumptions for wildlife species analysis:

- Aquatic organisms such as frogs would have the same sensitivity to herbicides as fish (2005 Regional Invasive Plants FEIS).
- Small insectivorous birds that defend territories may feed in the same area and could be subject to chronic exposures from some methods of applications. Exposures to herbicides is possible by the five Partners in Flight watch listed insectivorous migratory birds; however, exposure would likely be low since these species forage higher in the canopy and forage mostly on insects above the spray zone. These species may occasionally eat species from the ground or that fly into the canopy but this incidence of exposure would be low. Other land birds may forage lower and could be subjected to higher levels of exposure.
- Mustelids (wolverine) travel widely and would not be in the same area long enough to be subjected to chronic exposures.
- Peregrine falcons forage over a large territory and would not be subjected to chronic exposures.
- Aquatic birds that forage on fish or macro invertebrates would not find a concentration of herbicides in the water high enough to be exposed at levels that could get toxic (2005 Regional Invasive Plants FEIS).

- Woodpeckers would rarely be exposed to herbicides because of their feeding methods. Their food sources are protected since the beetles and ants that the woodpeckers feed on are generally buried inside of decaying wood. The food source of these of these birds is not likely to be contaminated by spraying herbicides.
- Elk (and deer) would occasionally feed in the same area for multiple days which could lead to chronic exposures.

3.3.5 Effects to Threatened, Endangered, and Sensitive (TES) Species

Effects to Bald Eagle

Effects Common to All Alternatives

At this time invasive plant infestations are not known to exist within one half mile of the one known bald eagle nest on the Umatilla National Forest. However, new bald eagle nests and roost sites could be discovered during the life of this document so Project Design Features have been incorporated to limit impacts to bald eagles should nest or roost sites be found in close proximity to invasive plants.

No effect to the bald eagles would occur from ingesting or contacting herbicides. The effects analysis showed no anticipated toxic effects. Even if they 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 exceeds any known NOAEL. The concentrations of herbicides from invasive plant treatment would not be elevated to a point where there would be any observable effect to eagles. For bald eagles, which feed upon fish, adverse effects from herbicide or NPE surfactant exposure are not plausible because the estimated dose for herbicide or NPE does not exceed a threshold of concern for potential effects (i.e. the toxicity index).

The Project Design Features (J1a and J1b) listed for bald eagles apply to all action alternatives. Because the Project Design Features are required, and because they are effective at eliminating adverse effects from disturbance to these species, none of the action alternatives will result in adverse effects from disturbance, which supports direction from Standards 19 and 20.

Therefore, no invasive plant treatments in any alternative would result in adverse effects to bald eagles.

Manual and Mechanical Methods

Potential effects of invasive plant treatment methods on bald eagles are associated with disturbance that may occur during the nesting season. Direct effects from invasive plant treatments include disturbance caused by noise, people and vehicles. Human and vehicle presence can disturb bald eagles during the breeding season, causing the birds to leave nests, or stay away from the nest long enough to have detrimental effects to eggs or young (USDI, 1986). Effects from mechanical methods (e.g. tractors, chainsaws, string trimmers, etc.) may be more likely to occur, and occur at greater distances from the project site, because machinery creates louder noise. The PDF in place for Bald Eagle should eliminate the disturbance from mechanical treatment methods.

The critical period in Oregon and Washington when human activities could disturb occupied nests extends from January 1 to August 31 (Anthony and Isaacs, 1989). Bald eagles are sensitive to human disturbance during this time, particularly within sight distance of nest sites.

Disturbance near winter roost sites is not likely to occur because invasive plant treatments generally do not occur during the winter.

Most invasive plant treatments could avoid conducting the project in proximity to an occupied nest during these time-frames, but some projects may occur during the nesting season that may adversely affect bald eagles. If a bald eagle nest was located near invasive plants, it still may be prudent to treat the invasive plants, due to the detrimental affects to habitat if these plants were to be left untreated.

Projects conducted at anytime that are more than a quarter mile from a nest, or a half mile line of sight distance from a nest, and do not result in the modification of use areas or the eagles' food resource, and noise is below ambient levels, should have no effect on bald eagles (FWS 2003). Activities that occur within a quarter mile or half mile line of sight from eagle use areas and produce noise above ambient levels, and do not result in degradation of use areas or the eagles' food resource, but implement a Limited Operating Period (LOP) (October 31 to March 31 for winter roosting and foraging; and January 1 to August 15 for nesting and rearing), are not likely to adversely affect bald eagle. The duration of the disturbance would likely be less than a day in any given year.

Invasive plant treatments will not result in the removal of bald eagle nests or roost trees, or suitable habitat, because invasive plants do not provide habitat. Invasive plants could occur within suitable habitat, however.

Treatment and Restoration

Methods used to treat invasive plants or restore habitat may affect the bald eagle. The general effects of each method (alternate from herbicide methods) to wildlife are discussed previously in this chapter and PDFs were developed specifically to limit disturbance/effects to bald eagles. The potential effects from herbicides are summarized previously in this chapter, and discussed in detail in Appendix C. All treatment methods that result in improved habitat for potential bald eagle prey species will provide a long-term benefit.

Biological Control

There is no indication that any biological controls would adversely affect the cover or forage of prey for the bald eagles. Biological controls cannot affect bald eagles directly, because they only act on invasive plants.

Herbicides

Exposure scenarios used to analyze potential effects from herbicides are discussed in USDA Forest Service 2005b, Appendix P, p. 24-27). None of the herbicides proposed for use in this EIS or NPE surfactants applied at typical application rates pose a risk to bald eagles.

Bald eagles are not likely to be directly sprayed, or encounter vegetation that has been directly sprayed, because no aerial application is proposed on the ranger district where the known nest site is located. No ground applications of herbicide would reach the upper canopies of mature trees where bald eagles nest. In addition, the bald eagle PDFs (J1a & 1b) place seasonal treatment restrictions around occupied nests if new nest locations are discovered to minimize disturbance.The potential for the herbicides to adversely affect bald eagles was determined using quantitative estimates of exposure from worst-case scenarios.

The dose estimates for fish-eating birds were calculated using herbicide or NPE concentrations in fish that have been contaminated by an accidental spill of 200 gallons into a small pond. Assumptions used include no dissipation of herbicide, bioconcentration is equilibrium with water, contaminant level in whole fish is used, and upper estimate assumes 15 percent of body weight eaten/day. For chronic exposures thescenario used was where the bird consumes fish from water contaminated by an accidental spill over a lifetime. All estimated doses used in effects analysis were the upper levels reported in the Forest Service/SERA risk assessments.

The following interpretations of the exposure scenario results are made with the reservation that toxicity data was generated from laboratory animals which may not accurately represent potential effects to free-ranging wildlife.

The results of these exposure scenarios indicate that no herbicide or NPE surfactant proposed for use poses any plausible risk to birds from eating contaminated fish. All expected doses to fish-eating birds for all herbicides and NPE are well below any known NOAEL (See Appendix C).

The weight of evidence suggests that adverse effects to bald eagles from NPE or the herbicides included in the action alternatives are not plausible. Each of the action alternatives would treat the same number of acres within the BECA. No aerial applications are currently proposed in the vicinity of the bald eagle nest.

Early Detection Rapid Response

If new invasive plant treatment sites are discovered in close proximity to a bald eagle nest, the PDF is in place to limit impacts to the bald eagle and its habitat for all action alternatives. Alternative A (No Action) does not include EDRR using integrated weed management, although manual methods without herbicide may be used.

Summary of Effects to Bald Eagle

Disturbance by humans and vehicles during project implementation is the primary adverse effect that is plausible for bald eagles. There are no bald eagle nest locations within more than a mile of proposed treatment areas. The Project Design Features (J1a and J1b) required for bald eagles, which imposes a seasonal restriction on activities near or within line-of-sight of nesting or roosting eagles, will eliminate adverse effects (per Standards 19 and 20) from disturbance to any future nests that may occur, and also applies to EDRR should new infestations of invasive plants occur near existing nests.

Conducting invasive plant treatments **may affect, but is not likely to adversely affect** the bald eagle. This conclusion is based on:

- The Project Design Feature required for application in areas within one-quarter mile of a bald eagle nest, or within one-half-line-of-sight of a bald eagle nest will minimize adverse effects from disturbance.

Adverse effects to bald eagles from herbicide exposure are not plausible because:

- Studies have shown that even if a bald eagle 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 exceeds any known NOAEL.

Cumulative Effects to Bald Eagle

Since there would be negligible direct or indirect effects to bald eagles, if any, there are no effects to accumulate. In the site-specific management plan for the Dry Creek eagle nest site, recommendations limit on-going and foreseeable future activities that would have the potential to affect the bald eagles.

Activities of man and natural processes have led to the introduction, establishment and spread of invasive plants across the Umatilla National Forest. Only the land and roads within the National Forest System would be treated in the action alternatives proposed by this EIS. The Forest, however, is intermingled with other federal, state, county, and private ownerships. Management activities and actions on neighboring lands may contribute to spread or containment of invasive plants on National Forest System lands, and vice versa. The effectiveness of the proposed invasive plant treatments 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 continues for the life of this project.

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 or Washington. So, accurate accounting of the total acreage of invasive plant treatment for all land ownerships is unavailable.

The proposed use of herbicides on and off National Forest system lands could result in additive doses of herbicides to wildlife species. For additive doses to occur, the two exposures would have to occur closely together in time, since the herbicides proposed for use are rapidly eliminated from wildlife and do not significantly bioaccumulate (USDA 2005). The application rates and extent considered in this EIS are unlikely to result in additive doses beyond those evaluated for chronic and acute exposures in the USDA Forest Service risk assessments, which formed the basis for the effects analysis in the Invasive Plant FEIS (2005). The Invasive Plant FEIS (2005), in return, served as the basis for the site-specific effects analysis discussed in this EIS.

The risk of adverse effects of invasive plant treatments in all action alternatives have been minimized by the Project Design Features (PDFs). These limit, but do not exclude, the possibility of cumulative adverse effects caused by treatment. The use of herbicides within the scope of this project is unlikely to contribute to cumulative effects beyond those described in the Invasive Plant FEIS (2005). Herbicide persistence is managed through PDFs to avoid chemical loading in the soil over time at any one site. Buffers minimize risk of herbicide concentrations of concern near water. Specific PDFs can be reviewed in section 2.2.3.

Early Detection Rapid Response is part of all action alternatives, and is considered in the direct, indirect and cumulative effects analysis. Effects of treatments each year under early detection-rapid response, by definition, would not exceed those predicted for the most ambitious conceivable treatment scenario. This is because the Project Design Features do so much to control the potential for adverse effects and because if the most ambitious treatment scenario were implemented, the potential for spread into new areas would be greatly reduced.

Effects to Canada Lynx

As stated earlier, the Umatilla National Forest is categorized as "peripheral area" based on the Draft Lynx Recovery Outline (2005) for lynx habitat. Although historically lynx occupied Oregon, self maintaining populations of lynx in Oregon are not known to have existed historically. 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 by the USDI Fish and Wildlife Service (FWS) (letter August 2006). Since lynx are not considered present in the area and it is highly unlikely that lynx will ever occupy the Forest there will be **no effects to lynx** from any of the alternatives considered in this document. As shown in the existing condition portion of this document, one LAU has invasive plants within approximately 3 percent of the LAU, two with 2 percent and six with less than 1 percent. Invasive plants do not constitute lynx habitat so treatment of invasive plants would not affect habitat. Short-term disturbance could affect prey habitat but the long-term benefits to prey habitat from invasive plant treatments outweigh the short-term impacts.

Effects to Gray Wolf

Effects Common to All Alternatives

As discussed earlier, there are no known denning or rendezvous sites on or near the Forest. There are currently no confirmed wolves on the Forest. However, investigations of wolf sightings are ongoing, and the discovery of a wolf pack is a possibility. There is potential for wolves to become established on the Forest in the future. The actions discussed below would have the same common impacts on wolves and/or their habitat for each of the alternatives considered.

Treatment and Restoration

Methods used to treat invasive plants or restore habitat though not likely, may affect the gray wolf. The general effects of each non-herbicidal method to wildlife are discussed previously in this chapter. The potential effects from herbicides are also summarized previously in this chapter, and discussed in detail in Appendix C and in the R6 Invasive Plants Program FEIS (USDA Forest Service 2005b, Appendix P). All treatment methods that result in improved habitat for elk, deer or other prey species will provide a long-term benefit to wolves.

Manual and Mechanical Methods

Direct effects from invasive plant treatment include disturbance caused by noise, aircraft, people and vehicles, which are activities common to manual and mechanical methods. These activities could potentially disturb gray wolves. However, invasive plant projects involve very short-term disturbance with few people and might only be repeated once in the same growing season. Currently, wolves may be transient within the Project Area and are unlikely to encounter any individual project.

Although wolves will travel over large distances, they are most likely to occur in wilderness and roadless areas, away from human disturbance. These areas have minimal invasive plant infestations so the likelihood of disturbance would likely be nominal. The life history traits of the species, current literature, existing guidelines, and expert opinion of biologists familiar with the species (Gaines, pers. comm.; Naney, pers. comm.) indicate that the level of disturbance expected from any invasive plant project is not likely to adversely disturb the gray wolf. In addition the PDF that addresses activities in close proximity to known denning or rendezvous sites, should wolves become established on the Forest, will limit disturbance.

Biological Control

Biological control methods have been utilized on the Umatilla National Forest, and on other National Forests where wolves currently exist. There is no indication that any biological controls adversely affect the forage of elk or other prey items for the gray wolf. Biological controls cannot affect gray wolves directly, because they only act on invasive plants.

Herbicides

Exposure scenarios used to analyze potential effects from herbicides are discussed in "Summary of Herbicide Effects to Wildlife" Appendix C and in the R6 Invasive Plants Program FEIS (USDA Forest Service 2005b, Appendix P). The potential effects are not likely to occur under actual field conditions because the worst-case scenarios do not account for plausibility of exposure, differences in application methods and timing, seasonal presence, species behavior, current protection measures in place, the current distribution of the species, or the standards adopted with the existing 2005 Pacific Northwest Region Invasive Plant Program decision. In addition, although wolves will travel over large distances, they are most likely to occur in wilderness and roadless areas, away from human disturbance. These areas have minimal invasive plant infestations so the likelihood of herbicide use where they exist would likely be nominal.

Gray wolves prey upon large mammals and will also eat carrion. It is extremely unlikely that a gray wolf would enter into an invasive plant treatment area, because they tend to be transient and generally avoid areas where there has been recent human activity. Wolves are even more unlikely to be exposed to herbicide because any appreciable exposure would require wolves to feed upon the exact individual of prey that had been feeding exclusively within the treatment area, or had been directly sprayed. Even if an elk or deer had foraged in the treatment area, or been directly sprayed, a single wolf would have to consume the entire deer or elk before the herbicide was eliminated from the herbivore's body. Again, an extremely unlikely scenario, since most of any herbicide dose for the herbicides contained in the Proposed Action is eliminated within 24-48 hours.

Small mammals are not the typical prey item for wolves. Nonetheless, the scenario in which a medium-sized canid eats small mammals that have been directly sprayed was used to evaluate a general risk to carnivores from herbicide use. This scenario, while not very plausible, would constitute the worst-case scenario of herbicide exposure for a gray wolf.

The following interpretations of the exposure scenario results are made with the reservation that toxicity data was generated from laboratory animals that may not accurately represent potential effects to free-ranging wildlife.

At typical and highest application rates, the estimated doses from the exposure scenario are all less than the reported NOAELs for all herbicides except chronic doses of triclopyr.

There is no data available to estimate an actual chronic dose in this scenario, so the chronic estimate is obtained by comparing the acute dose to the chronic toxicity index. This comparison will over-estimate the dose and risk to the carnivore. At the typical application rate, the estimated acute dose to a carnivore consuming contaminated small mammals is 2.1 mg/kg (project file worksheets USDA Forest Service 2005b). The chronic NOAEL for effects to kidneys in dogs is 0.5 mg/kg/day.

For triclopyr, the worst-case analysis uses a very conservative toxicity value. Toxicity of triclopyr acid and triclopyr BEE does not differ for mammals. The EPA has used two different values for a reference dose on the effects of triclopyr to mammals. The FS/SERA risk assessment (2003 Triclopyr) relies on a chronic toxicity index (NOEL of 5 mg/kg/day) from a rat reproduction study. In this analysis, a lower value from a 1-year feeding study of dogs is used (chronic NOEL of 0.5 mg/kg/day; Quast et al., 1976, cited in SERA, 2003 Triclopyr). Dogs were not considered by EPA to be a good model for human health effects, because they do not excrete weak acids as well as other animals (see Timchalk and Nolan 1997; Timchalk et al. 1997). Canids are, however, relevant for concerns about effects to wildlife in general and gray wolves specifically. It may be argued that the use of the 0.5 mg/kg/day value for the toxicity index in this analysis is overly cautious, because it represents competition for excretion rather than a toxic effect (Timchalk et al., 1997). However, it meets the criteria for providing a worst-case analysis based on available toxicity data for potential effects to wildlife, and is therefore consistent with the criteria for choice of other indices used in this analysis.

The use of triclopyr for invasive plant treatment is restricted in the Proposed Action by Standard #16, which states, “The use of triclopyr is limited to selective application techniques only (e.g. spot spraying, wiping, basal bark, cut stump injection).” The above exposure scenarios calculate doses based on a broadcast spray-method application that would directly spray an entire day’s diet of small mammals. The direct spray of many small mammals could not occur with triclopyr applied to non-desirable vegetation in a selective manner. Therefore, with Standard 16 in place, adverse effects to gray wolves from the use of triclopyr will not occur.

It is unlikely a wolf would be in areas with extensive acres of invasive plants, since invasive plants are not generally utilized by their prey species and are usually in more open or populated areas. It is unlikely a wolf would be directly sprayed through aerial application since the wolf would run from a low flying plane or helicopter or at least hide under some type of cover. The smallest area proposed for aerial spraying is less than one acre in size and the largest is approximaltey 286 acres. At this time, no wolves are known to occupy the Forest. If in the future they are detected, they will most likely remain in the less human populated areas, where generally there are no invasive plants. Wolf sightings are being investigated regularly so if wolves are located, their presence will be taken into account prior to aerial spraying. If it is determined that aerial spraying a particular area could negatively impact an individual or pack the spraying would be postponed until they were outside the Project Area. As the PDF requires, treatments within 0.50 mile or .50 mile line of sight occupied rendezvous sites would be timed to occur outside the season of occupancy unless treatment activity is within acceptable ambient noise levels and human presence in the area would not cause wolves to abandon the site (as determined by a local specialist). The restriction in the vicinity of active rendezvous sites is not backed up by scientific data but is intended to reduce impacts to wolves. Occupancy of both denning and rendezvous sites (i.e. whether it is active or not) will be determined each year prior to treatments. Consultation with FWS would be reinitiated (unless determined otherwise by FWS) if/when wolves are discovered in the vicinity of treatment sites.

Early Detection and Rapid Response

If new invasive plant treatment sites are discovered in close proximity to a wolf den or rendezvous site the PDF is in place to limit impacts to the wolf and its habitat for all the action alternatives. The short-term impacts of the treatments would be largely offset by the long-term benefit of protecting habitat for wolf prey species from loss due to invasive plants.

Summary of Herbicide Effects to Gray Wolf

Indirect effects to gray wolf would consist of changes to the habitat of their prey. Invasive plant treatments will not remove or degrade prey habitat since invasive plants do not provide adequate forage for elk and other prey, although certain invasive species may be utilized during some parts of the year. Successful control of invasive plant infestations provides long-term benefits to gray wolf by restoring native habitat and forage for their prey and preventing future degradation of habitat. Indirect effects of herbicide are not likely because the herbicides in the alternatives considered do not bioaccumulate and any exposure for gray wolf is highly unlikely. In addition, PDFs (J2a and J2b) would be in place to limit disturbance to denning and rendezvous sites (See Chapter 2 of the EIS).

Determination of Effects to Gray Wolf

At this time gray wolves are not known to exist on the Forest so invasive plant treatments will have **no effect** on the gray wolf. However, in the future if wolves are confirmed on the Forest invasive plant treatment projects conducted according to the standards in the Proposed Action, **"may affect, but is not likely to adversely affect"** the gray wolf. This determination is based on:

- The Region 6 Invasive Plants FEIS prevention standards will help to protect the foraging habitat of their prey from invasive plants
- Distribution of gray wolves within the infested areas would likely be very limited, and sporadic, so the opportunity for wolves to be in or near treatment areas is also very limited
- Disturbance from projects could occur, but is unlikely. In addition, the PDF for wolves would further limit possible disturbance
- Disturbance from invasive plant treatment projects is low level, short duration, and infrequent
- Doses of any herbicides in the Proposed Action that would cause potential adverse effects are not plausible

Cumulative Effects

Cumulative effects for the purposes of consultation under ESA are defined as, "the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area…" (50 CFR, Part 402).

As wolves move into Oregon and Washington, they will be subject to the same pressures and conflicts with humans that occur in Idaho, Wyoming and Montana. The projected increases in population for Oregon and Washington will likely increase recreation on the National Forests where wolves may occur. This could increase human disturbance and potential sources of mortality, to wolves in the area.

The cumulative effects described within the bald eagle portion of this document would also apply to the gray wolf.

3.3.6 Effects to Sensitive Species

Effects to California Wolverine

Effects Common to All Alternatives

Wolverines probably occur in remote wilderness areas of the Umatilla National Forest. Currently approximately 251 acres of the 304,925 acres of wilderness contain known invasive plants. The short duration, low intensity invasive plant treatments are not likely to disturb wolverines since such a small percentage of treatment areas are located in potential wolverine habitat. There is a minor potential for short-term disturbance, which is an indirect effect, from implementing any of the action alternatives. The herbicide effects analysis above shows no toxic effects (direct effect) determined from herbicide use on wolverines. There are no anticipated direct and only short duration, low intensity indirect effects from manual or mechanical treatments because their location is not in the proximity of possible denning areas or likely foraging habitat. In addition wolverine travel widely and would not be in the same area long enough to be subjected to chronic exposures.

Treatment and Restoration

Potential effects of invasive plants treatment methods on wolverine are associated with disturbance that may occur during the denning season. Direct effects from invasive plants treatment methods include disturbance caused by noise, people and vehicles. However, since wolverine den in the high country and no invasive plants have been located in potential den site habitat, it is unlikely they would be disturbed. If a wolverine were to be foraging in the immediate vicinity of a treatment, they would likely be temporarily displaced. They tend to travel widely and be opportunistic hunters so being temporarily displaced would have a minimal impact. Wolverines appear to be most vulnerable to disturbance during the winter months. Invasive plant treatments would not occur during winter.

Manual and Mechanical Methods

Methods used to treat invasive plants or restore prey habitat may have a limited affect on wolverine. The general effects of each non-herbicidal method (disturbance) to wildlife are discussed previously in this chapter and PDFs were developed specifically to limit disturbance in wilderness areas, which due to their remoteness are places wolverine likely use. Motorized treatments and aerial spraying are not permitted in the wilderness. Wilderness areas also tend not to have many invasive plants since they lack roads or much active resource management. All treatment methods that result in improved habitat for potential wolverine prey species will provide a long-term benefit.

Biological Control

There is no indication that any biological controls would adversely affect the cover or forage of prey for the wolverine. Biological controls cannot affect wolverine directly, because they only act on invasive plants.

Herbicides

The potential effects from herbicides are summarized previously in this chapter, and discussed in detail in Appendix C. As stated previously, the most likely places wolverines would be found on the Forest are the wilderness areas since wolverine prefer remote and high elevation areas for denning.

Of the 304,925 acres of wilderness approximately 251 acres have known infestations of invasive plants. In addition, no areas above 7,000 feet in elevation have invasive plants. The higher elevation areas are where wolverine would most likely den. Although wilderness areas appear to be the most likely places to find wolverine, they could be found just about anywhere on the Forest since they have such large home ranges and are capable of traveling long distances in a day. Wolverines eat a wide variety of foods; however they are opportunistic scavengers with large mammal carrion tending to be their primary food source year-round. While foraging, they generally avoid large open areas and tend to stay within forested habitat at the mid and high elevations. Unless directly along roads; the forested areas of the Forest tend not to have many invasive plants. If wolverines consume prey that has ingested herbicide, the herbicides approved for use, except for picloron, are not retained in the body.

There will be no aerial spraying in the wilderness areas and since aerial spraying will not occur in areas with canopy closure over 30 percent, it is highly unlikely aerial or broadcast spraying will impact wolverine habitat.

Infrequent and short-term disturbance from treatment projects could affect wolverines during breeding season or if they happen to be in the area at the time of treatment. However, this type of disturbance is unlikely. Worst-case exposure exceeds the toxicity index from ingesting prey that has been sprayed with triclopyr. However, the worst-case herbicide exposure is highly unlikely for the reason mentioned above in herbicide portion of the Invasive Plant Treatment Method Effects to Wildlife section (pages 45-46). Broadcast spraying in wilderness would only be applied using tanks mounted on horses. No aerial spraying would occur in the wilderness or in areas that have over 30 percent canopy closure, which are the type of areas one would expect to find wolverine. For more detail on effects to medium sized carnivores see Herbicide Effects to Wildlife (Appendix C). Invasive plants may degrade habitat for some prey species of wolverine, such as elk and deer. The possible short-term disturbance to an individual wolverine caused by invasive plant treatments are worth the long-term benefits to wolverine and their prey by protecting their habitat from loss due to invasive plants.

Early Detection Rapid Response

Since wolverine prefer remote areas that are far from human activity, it is unlikely that they would spend time in the vicinity of invasive plants. Their prey would generally not be in areas with concentrations of invasive plants. It is unlikely invasive plant sites will be discovered in close proximity to a wolverine den since no invasive plants have been located above 7,040 feet in elevation. The No Action Alternative (Alternative A), does not include EDRR and has no sites located in potential denning habitat. The short-term impacts of the treatments would not outweigh the long-term benefit of retaining habitat for wolverine prey species. Effects, if any, are expected to be negligible.

Differences between Alternatives

The effects of each of the alternatives would be similar. Alternative A has no treatments proposed in the wilderness; Alternative B would treat the same number of acres as Alternative C and D. Aerial spraying would not occur within the wilderness in any alternative and since that is where wolverine would most likely be found the impacts between the action alternatives would be similar. Alternative C would have no broadcast spraying within riparian areas, but infestations would still be treated. The No Action Alternative would be the least affective of the alternatives considered in protecting wolverine prey foraging habitat because it would treat the least number of acres and does not incorporate EDRR to help reduce the spread of invasive plants in the future.

Each alternative has the potential for short-term disturbance to wolverine due to treatments but the long-term benefit of treatments proposed in the action alternatives outweighs the possible short-term impacts.

Summary of Effects to Wolverine

There has been no recent sign of wolverine existence on the Forest. If wolverine were to be present, they would likely occur in remote areas of the Umatilla National Forest. Currently approximately 251 acres of the 304,925 acres of wilderness contain known invasive plants. The short duration, low intensity invasive plant treatments are unlikely to disturb wolverines since such a small percentage of treatment areas are located in likely wolverine habitat. If wolverines consume prey that has ingested herbicide approved for use, except for picloram, it is not retained in the body. Herbicide persistence is managed through PDFs to avoid chemical loading in the soil over time at any one site.

Therefore invasive plant treatments **"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"** of California wolverine as a result of any of the alternatives considered in this EIS.

Cumulative Effects

Though it is unlikely, there are foreseeable future actions within the Forest that could impact wolverines and their habitat. Winter recreation and hiking as well as proposed improvements for these activities increase human activity in potential wolverine habitat, and could add to the effect of disturbance. Any increase in human activity in areas where wolverines exist is a cumulative effect on this species. However, at this time wolverines have not been detected on the Forest.

Although extremely unlikely, the proposed use of herbicides on and off National Forest system lands could result in additive doses of herbicides to wildlife species. For additive doses to occur, the two exposures would have to occur approximately at the same time, since the herbicides proposed for use are rapidly eliminated do not significantly bioaccumulate (R6 FEIS 2005). The application rates and extent considered in this EIS are unlikely to result in additive doses beyond those evaluated for chronic and acute exposures in the USDA Forest Service risk assessments, which formed the basis for the effects analysis in the Region 6 Invasive Plant FEIS (2005). The Region 6 Invasive Plant FEIS (2005), in return, served as the basis for the site-specific effects analysis discussed in this EIS.

The risk of adverse effects of invasive plant treatments in all action alternatives have been minimized by the PDFs. These limit, but not exclude, the possibility of cumulative adverse effects caused by treatment. The use of herbicides within the scope of this project is unlikely to contribute to cumulative effects beyond those described in the Invasive Plant FEIS (USDA, 2005). Herbicide persistence is managed through PDF to avoid chemical loading in the soil over time at any one site.

Effects to Bighorn Sheep

Effects Common to All Alternatives

Currently approximately 1,636 acres of the 136,401 acres of the bighorn sheep areas contain known invasive plants. Approximately 44 percent of the bighorn sheep habitat with invasive plants is adjacent to roads. The short duration, low intensity invasive plant treatments are unlikely to disturb bighorn sheep since such a small percentage of treatment areas are located in bighorn sheep habitat.

There is a minor potential for short-term disturbance, which is an indirect effect, from treatments proposed by the action alternatives considered. Triclopyr and NPE surfactant are the chemicals where exposure scenario results in a dose that exceeds the toxicity index using the highest application rate and upper residue rates. However, a PDF states that the lowest effective label rates would be used. No broadcast applications of herbicide or surfactant will exceed typical label rates and NPE surfactant would not be broadcast at a rate greater than 0.5 pounds of active ingredient per acre. Triclopyr would only be spot sprayed within riparian areas, which contains over one half of the bighorn sheep habitat with invasive plants, and although it may be used, it will not be used at the highest application rate on any sites within bighorn sheep habitat. Triclopyr is not approved for the No Action Alternative. The short-term disturbance due to the treatments is worth the long term benefit to bighorn sheep foraging habitat.

Treatment and Restoration

Methods used to treat invasive plants or restore habitat may affect the bighorn sheep. The general effects of each non-herbicidal method to wildlife are discussed previously in this chapter. The potential effects from herbicides are also summarized previously in this chapter, and discussed in detail in Appendix C. All treatment methods that result in improved foraging habitat for bighorn sheep will provide a long-term benefit.

Manual and Mechanical Methods

Potential effects of invasive plant treatment methods on bighorn sheep are associated with disturbance. Direct effects from invasive plant treatment include disturbance caused by noise, people and vehicles. Effects from mechanical methods (e.g. tractors, chainsaws, or string trimmers) are not likely to occur in primary habitat since bighorn tend to utilize steep slopes and only about 1.2 percent of bighorn sheep areas currently contain invasive plants. Even if there are short-term impacts, all treatment methods that result in improved habitat for bighorn sheep and their potential forage will provide a long-term benefit.

Biological Control

There is no indication that any biological controls would adversely affect the cover or forage for bighorn sheep. Biological controls cannot affect bighorn sheep directly, because they only act on invasive plants.

Herbicides

Approximately 1.2 percent of the bighorn sheep habitat currently contains known sites with invasive plant species. Much of the bighorn sheep summer range is in the higher elevation habitat which currently has less invasive plant sites. Winter range is usually below 6,000 feet in elevation and is currently where the known infestations are located, so invasive plant treatments in the winter range is not likely to impact the bighorn sheep since treatments are done mainly during the summer months. Cheatgrass which is considered an invasive plant and is utilized by bighorn sheep is not targeted for treatment.

Triclopyr and NPE surfactant are the chemicals where exposure scenario results in a dose that exceeds the toxicity index using the highest application rate and upper residue rates. However, high rates will not be used as per the PDFs. Triclopyr would be spot sprayed within riparian areas, which contains over one half of the bighorn sheep habitat with invasive plants. Standard 16 restricts broadcast use of triclopyr, which eliminates plausible exposure scenarios.

In addition, although it may be used, triclopyr would not be used at the highest application rate on any sites within bighorn sheep habitat. Triclopyr is not approved for use in the No Action Alternative.

Currently less than 20 acres of the Asotin bighorn sheep unit is the only area within bighorn sheep habitat that is proposed for aerial spraying. This is the only aerial spray unit within bighorn sheep habitat. It is improbable that the sheep would be in the area at the time since it is winter range, and the noise from the helicopter would cause them to move if they happened to be there. Aerial spraying should have similar impacts on bighorn sheep as broadcast spraying. PDFs would be in place to reduce impacts from aerial spraying. If bighorn are in the area, disturbance from the noise and people would be short-term. It is likely that the sheep would leave areas of noise and human disturbance. If a bighorn sheep were to ingest the treated vegetation, which is highly unlikely since the area would contain unpalatable forage, it is highly unlikely an individual would choose to consume 100 percent contaminated grass for one day since the aerial spray would be only 20 acres of the approximately 21,745 acres the herd occupies. Bighorn sheep tend to graze over large areas in a day.

Early Detection Rapid Response

EDRR is designed to be aggressive in the control of invasive plants. This is necessary to ensure success in managing and controlling the spread of these competitive and easily established plants. Allowing the treatment of newly found sites adds additional risk factors to bighorn sheep just by adding additional exposure areas. The risk factors do not change because the PDFs would apply to reduce the effects to little or no impacts to wildlife species.

The management direction included in all action alternatives, as well as the environmental conditions and bighorn sheep behavior, would tend to minimize actual impacts from EDRR. Specific herbicides will be avoided in specific areas or times of the year where/when bighorn sheep may be at risk. In addition the PDFs would be applied in each action alternative. Aerial spraying is not included in EDRR. Alternative A (No Action) does not incorporate EDRR. Any short-term adverse effects would be largely offset by the long-term benefits to bighorn sheep from protecting their habitat from loss due to invasive plants. Negative effects, if any, are expected to be negligible.

Differences between Alternatives

The No Action Alternative would be the least effective of the alternatives considered in protecting bighorn sheep foraging habitat because it would treat the least number of acres and does not incorporate EDRR to help reduce the spread of invasive plants in the future.

The three action alternatives tend to have about the same impacts on bighorn sheep because they treat the same number of acres of habitat. A wider variety of chemicals may be usedin the action alternatives than in Alternative A. Alternative C would not allow broadcast herbicide treatment in the riparian areas but the areas would still be treated possibly using spot spraying or stem injection for example. It is possible under Alternative C, that bighorns would be disturbed or temporarily displaced for a longer period of time, because these methods of treatments are selective and take longer to complete.

The scenario would be the same for Alternative D; the areas would be treated though the process would be more time consuming, slower to get implemented and expensive. Currently less than 20 acres are proposed for aerial spraying in the Asotin bighorn sheep area for Alternatives B and C; and under EDRR aerial spray would not be used.

PDFs and standards would be in place to minimize the impacts of aerial spraying. Noise and disturbance could impact the bighorn sheep, depending on the location of the animals at the time of treatment. The disturbance would take place whether the site is spot, broadcast or aerially treated. However, with any of the treatments, disturbance would be limited to the time it takes to apply the herbicides and leave the area.

It is unlikely bighorn sheep would be directly sprayed during aerial spraying since they would tend to run from the noise of the helicopter. Twenty acres of the 21,745 acres of bighorn sheep habitat are proposed for aerial treatment.

Alternative B would be most efficient because it allows all available treatment methods to be considered for use, which when applied should cause less disturbance to bighorn sheep than Alternative C or D.

Summary of Effects to Bighorn Sheep and Determination of Effects

It is unlikely bighorn sheep will be in the vicinity of treatment areas at the time of treatment since they tend to go to higher elevations during the period of time most treatments will take place. In addition since less than 2 percent of their herd location areas contain invasive plants and they are not known to consume invasive plants. Disturbance from noise, people and mechanical equipment is the most probable impact to bighorn sheep and that would be minimal and short in duration.

Triclopyr and NPE surfactant result in a dose that exceeds the toxicity index using the highest application rate and upper residue rates. The PDFs prevent Triclopyr from being sprayed at the highest application rate. The lowest effective label rates would be used. No broadcast applications of herbicide or surfactant will exceed typical label rates and NPE surfactant would not be broadcast at a rate greater than 0.5 pounds of active ingredient per acre. Triclopyr will not be broadcast sprayed within riparian areas, which contains over one half of the bighorn sheep habitat with invasive plants. Standard 16 restricts broadcast use of triclopyr, which eliminates plausible exposure scenarios. The limited spatial extent of infestation, which is limited primarily to disturbed roadsides, and the limits placed on herbicide applications will reduce exposure of bighorn sheep to herbicides.

Therefore invasive plant treatments **"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"** of bighorn sheep as a result of any of the alternatives considered in this EIS.

Cumulative Effects

The cumulative effects described within the bald eagle portion of this document would also apply for bighorn sheep.

Effects to Green-tailed Towhee

Effects Common to All Alternatives

Due to the low likelihood of green-tailed towhees being present in the treatment sites, actual risk to the birds is very low. Potential effects of invasive plant treatment methods on green-tailed towhee are limited and mainly associated with disturbance that may occur during the nesting season. Direct effects from invasive plant treatment include disturbance caused by noise, people and vehicles. Green-tailed towhees are known to build their nests on the ground or low in a bush so there is the possibility of the nest being trampled or crushed, birds being flushed from the nest or being directly sprayed. However, of the potential 71,394 acres of habitat for the towhee, only about 2 percent has invasive plants. If a green-tailed towhee were to be in the immediate vicinity of a treatment, they could be temporarily displaced.

Treatment and Restoration

Potential effects of invasive plant treatment methods on green-tailed towhee are mainly associated with disturbance that may occur during the nesting season. Direct effects from invasive plant treatment include disturbance caused by noise, people and vehicles. Green-tailed towhees are known to build their nests on the ground or low in a bush so there is the possibility of the nest being trampled or crushed, birds being flushed from the nest or being directly sprayed. However, of the potential 71,394 acres of habitat for the towhee, only about 2 percent has invasive plants, and of that 43 percent is adjacent to roads. If a green-tailed towhee were to be in the immediate vicinity of a treatment, they would likely be temporarily displaced. Restoration work could cause similar temporary disturbance as well.

Manual and Mechanical Methods

Methods used to treat invasive plants or restore forage and prey habitat may affect green-tailed towhee. The most obvious impacts from manual and mechanical treatment would be the potential to crush or trample nests, disturbance from machinery noise and people. The general effects of each non-herbicidal method to wildlife are discussed previously in this chapter and PDFs were developed specifically to limit disturbance (E2, F1, F2, F4, F5, F6). The potential effects from herbicides are summarized previously in this chapter, and discussed in detail in Appendix C.

All treatment methods that result in improved habitat for green-tailed towhee and their potential forage and prey species will provide a long-term benefit.

Biological Control

There is no indication that any biological controls would adversely affect the cover or forage for the green-tailed towhee. Biological controls cannot affect green-tailed towhee directly, because they only act on invasive plants.

Herbicides

Risk of effects from herbicide exposure is evaluated using the insectivorous bird scenario. A quantitative estimate of dose was calculated for a small bird feeding on insects (or any other small item) contaminated by direct spray of herbicide. The bird is assumed to feed exclusively on contaminated insects for the entire day’s diet. There is no chronic dose estimate because there is no data on long-term herbicide residue on insects. The herbicide triclopyr cannot be broadcast sprayed and it is unlikely that an entire day’s diet of insects could be contaminated by spot spray or hand/selective applications, so quantitative estimates are not made for triclopyr. Also, triclopyr is used on invasive woody vegetation, like blackberries and Scotch broom, neither of which are present in this species habitat and if they were, green-tailed towhee would be unlikely to forage for insects exclusively on or near these plants. Exposures of concern for triclopyr are not expected.

At typical application rates, no herbicide exceeded a dose of concern for insectivorous birds. In this document no herbicide is approved for use at their highest application rate so it will not be discussed. However, NPE-based surfactants exceeded the dose of concern for insectivorous birds at typical application rates.

Contamination from NPE-based surfactants of an entire day's diet of invertebrates seems unlikely for the following reasons: 1) green-tailed towhees are not known to forage within areas dominated by invasive plants, and, 2) the presence and movement of applicators is likely to scare off some invertebrates.

The food habits of green-tailed towhees are poorly studied, although it eats insects it also scratches litter on the ground, presumably looking for seeds and insects. It probably takes a variety of forb and shrub seeds. It will also take some berries from shrubs when they are available so a worst-case scenario was used that estimated herbicide exposure for a bird eating contaminated vegetation. One paper (APERC 2000, cited in Bakke 2003) stated that no behavioral changes or mortality to quail occurred when they were fed up to 5,000 ppm of NPE for five days. The authors concluded that the LC50 for quail was greater than 5,000 ppm, which is at the higher range or well above the reported range of LC50 values for mammals. However, with only one study on birds available, data is insufficient to state whether or not birds are less susceptible to NPE than are mammals.

Using the limited data available, including toxicity thresholds from mammal data, it appears that some adverse effects from consuming contaminated vegetation are plausible from NPE surfactants.

Chronic exposures were also evaluated for herbicides. There are no long-term residue rates on vegetation for NPE, nor any exposure data on birds, so a quantitative estimate for chronic exposures is not available for NPE. There are no long-term residue rates for herbicides on insects, so quantitative estimates are not available for small birds consuming contaminated insects. Green-tailed towhees do not feed extensively on invasive plant species or contaminated insects, if at all, and they are highly unlikely to feed exclusively within treated patches for an extended amount of time.

No herbicides in the exposure scenario analysis produced exposures that exceeded the toxicity thresholds for birds when sprayed at typical application rates. Triclopyr cannot be broadcast sprayed due to a standard in the Forest LRMP, so exposures of concern are not likely.

About 43 percent (of the 2 percent of potential habitat with invasive plants) of treatments within or adjacent to potential suitable habitat for green-tailed towhee occurs along road shoulders and trails. It is highly unlikely this is preferred habitat for the green-tailed towhee. Proposed roadside treatments involve spraying the patch of invasive plants with truck-mounted nozzles or with hand-held sprayers.

Currently, there are approximately 55 acres within potential green-tailed towhee habitat that is proposed for aerial spraying. The likelihood of the birds actually being in that area at the time of aerial spraying is very low due to the extremely limited number of green-tailed towhees documented for the Pomeroy Ranger District and the sightings were not in close proximity to where the aerial spraying is proposed. Green-tailed towhees nest under brushes so it is unlikely they would be directed sprayed. If by chance they were foraging, the sound of the helicopter would likely cause them to take cover so they would not be directly sprayed. The aerial units in potential green-tailed towhee habitat are small acreages. The 55 potential habitat acres proposed for aerial spraying are not all in one unit of potential habitat. It is unlikely an individual bird would eat only contaminated seed or insects in a treated area since much of the seed or insects would not have been contaminated by the treatment. However, if birds were in the area during aerial spraying the same possible impacts as described above in the exposure discussion would be applicable.

Early Detection Rapid Response

The effects discussed above will be the same with EDRR. The No Action Alternative (Alternative A), does not include EDRR. The short-term impacts of the treatments would be largely offset by the long-term benefit of retaining habitat for green-tailed towhee prey species. Effects, if any, are expected to be negligible since very few green-tailed towhees have been detected on the Forest.

Differences between Alternatives

There is very little difference between alternatives for the green-tailed towhee. Alternative A would treat less acres and does not include EDRR so would be the least effective of any of the alternatives considered. Alternative B, the preferred alternative is the least restrictive alternative although it has standards and PDFs in place that minimize impacts to wildlife. It treats the same number of acres as Alternatives C and D, however does it more efficiently. Approximately 55 acres of potential green-tailed towhee habitat would likely be aerial sprayed under Alternative B and C. The impacts of aerial spraying would be similar to those described above for herbicide effects. Alternative C currently has close to 400 acres in riparian habitat that would not be broadcast sprayed, however it would be treated so the impacts would still be the same as discussed above. Disturbance within the riparian treatment areas with Alternative C would likely be of longer duration than under Alternatives B and D. The short-term impacts of treatment are outweighed by the long term beneficial impacts to habitat for the green-tailed towhee.

Summary of Effects and Determination of Effects to Green-tailed towhee

The plant material cup nests of the green-tailed towhee are susceptible to crushing or trampling by people or vehicles. If they were nesting in areas where invasive plant treatments occurred, eggs or nestlings could be trampled, regardless of the treatment technique used, except for aerial spraying. Data is not sufficient to distinguish in a meaningful way the magnitude or duration of disturbance or trampling between alternatives. Due to the low likelihood of green-tailed towhees being present in the treatment sites, actual risk to the birds is very low.

Using broad-scale analysis approximately 2 percent (1,424 acres) of potentially 71,394 acres contain invasive plants. Green-tailed towhees eat insects so the risk from herbicide and NPE-based surfactants is as discussed above under effects from herbicides. At typical application rates, no herbicide exceeded a dose of concern for insectivorous birds. The herbicide triclopyr cannot be broadcast sprayed and it is unlikely that an entire day’s diet of insects could be contaminated by spot spray or hand/selective applications, so quantitative estimates are not made for triclopyr. Adverse effects cannot be ruled out for glyphosate at high application rates or NPE at typical and high rates. However, high application rates would not be used due to the PDF in place.

Data is insufficient to distinguish between alternatives the likelihood or magnitude of this potential effect. Due to the low likelihood of green-tailed towhee being present in the treatment sites, actual risk to the birds is low.

This analysis shows that under any of the alternatives, though the chances are small, invasive plant treatment methods **“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”** to green-tailed towhee.

Cumulative Effects

Since the herbicides selected do not pose a risk from bioaccumulation or a long residual effect there are not anticipated cumulative effects from either projects on or off of the Forest. The cumulative effects described within the bald eagle portion of this document would also apply for the green-tailed towhee.

Effects to Columbia Spotted Frog

Effects Common to All Alternatives

Columbia spotted frog are known to have a fairly large distribution within the Project Area. Since Alternative A did not identify sites near known frog habitat, and the spotted and leopard frog PDF will be in place under all of the action alternatives, the chance of negative impacts to amphibians is considerably lessened. The PDF would avoid broadcast spraying of herbicides, and avoid spot spraying of glyphosate with POEA surfactant, sulfometuron methyl, and NPE-based surfactants, within 100 feet of occupied or suitable spotted or leopard frog habitat. The PDF also requires the coordination of the treatment methods, timing, and location with the local Biologist. Sites may require surveys prior to application.

Treatment and Restoration

Potential effects of invasive plant treatment and restoration methods on spotted frogs are mainly associated with disturbance, effects to their skin and absorption through the skin, and the potential affects of specific herbicides on their prey. Direct effects from invasive plant treatment include disturbance caused by noise, people and vehicles. Since no emergent vegetation is proposed for treatment under this plan, it is unlikely this species will be in the immediate vicinity of treatment; however they could be temporarily displaced by workers in the area.

Manual and Mechanical Methods

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 habitats. Adults and juveniles would be susceptible to trampling from invasive plant treatment activities in wetland and riparian habitat utilized by frogs. The probability that this would actually occur is low because the frogs are less likely to inhabit areas infested with invasive plants and they tend to jump back into the water whenever they detect disturbance close by. Disturbance in close proximity to amphibians would likely be for a longer duration with Alternative C since the plants would be treated individually rather than by broadcast treatment in the riparian areas. However, potential short-term disturbance would occur with all alternatives. All treatment methods that result in improved habitat for amphibians and their prey will provide a long-term benefit.

Biological Control

There is no indication that any biological controls would adversely affect the cover or forage for frogs. Biological controls cannot affect amphibians directly, because they only act on invasive plants.

Herbicides

Data on herbicide effects to amphibians is limited. Appendix P of the R6 2005 FEIS summarized available data on the effects of herbicides to amphibians and this discussion is incorporated by reference. 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; Johnson

1976; Mayer and Ellersieck 1986; Perkins et al. 2000). As stated previously, where data was lacking, toxicity data on fish was used as a surrogate for toxicity to amphibians, based on studies comparing data available for both groups of species (Berrill et al. 1994; Berrill et al. 1997; Perkins et al. 2000). For glyphosate and sulfometuron methyl there was sufficient data to do a quantitative evaluation of exposure and risk.

Results of the analysis indicate that the following herbicides pose a low risk of mortality to amphibians: chlorsulfuron, clopyralid, imazapic, imazapyr, metsulfuron methyl, and picloram. Data is insufficient to evaluate risk of sub-lethal effects. The Poast® formulation of sethoxydim is much more toxic to aquatic species than is technical grade sethoxydim. However, use of Poast®is unlikely to result in concentrations in the water that would result in toxic effects to aquatic species (SERA 2001). There is a substantial limitation to this risk characterization because there are no chronic toxicity studies on aquatic animals available for either sethoxydim or Poast®.

Formulations of glyphosate that contain POEA surfactant are much more toxic to aquatic organisms than aquatic-labeled formulations, which do not contain POEA. The concentration in water for a "worst case scenario" was compared to toxicity data on both versions of glyphosate. At typical application rate, concentrations in the water for acute and chronic exposures were well below any reported LC50 for either version of glyphosate, with the exception of one study by Smith (2001). The Smith study is not consistent with other reported studies on glyphosate and so was not used to establish the threshold of concern for aquatic species in the Glyphosate Risk Assessment (SERA 2003 Glyphosate).

At high application rate, concentrations of glyphosate with POEA surfactant exceeded lethal levels and mortality to amphibians could occur. The version of glyphosate without POEA (i.e. the aquatic-labeled formulations) did not exceed lethal doses.

Sufficient data are available for toxicity of sulfometuron methyl to allow quantitative estimates of exposure and risk. Data is limited to that generated by studies on *Xenopus*, but other studies have indicated that *Xenopus* are a sensitive indicator for effects to amphibians (Mann and Bidwell 2000, Perkins et al. 2000). Results from the "worst case scenario" for aquatic species indication that all estimated exposures were far below acute and chronic "no-observable-effect-concentration" (NOEC) values.

Triclopyr comes in two forms; triclopyr BEE and triclopyr TEA. Triclopyr BEE is much more toxic to aquatic organisms than is triclopyr TEA. Triclopyr cannot be broadcast sprayed, regardless of alternative, because the restriction is a standard in the LRMP. At typical application rates, neither version is likely to result in adverse effects to amphibians, using a sub-lethal effect for tadpole responsiveness as a threshold of concern.

At higher application rates, tadpole responsiveness could be reduced. These concentrations are not likely to occur from applications in the Proposed Action due to the restriction on broadcast spraying.

Triclopyr also has an environmental metabolite known as TCP (3, 5, 6-trichloro-2-pyridinol). TCP is about as acutely toxic to aquatic species as triclopyr BEE (SERA 2003 Triclopyr). Adverse effects to aquatic species (based on data from fish) from TCP are likely only if triclopyr is applied at the highest application rates. These rates are highly unlikely to be realized given the prohibition on broadcast spraying of triclopyr.

In summary, adverse effects to amphibians are only likely from glyphosate with POEA and triclopyr applied at high rates, both of which are actions prevented by the PDFs in place for this project.

NP and NPE have been studied for effects to aquatic organisms. NP is more toxic than NP9E, by one to three orders of magnitude (USDA FS, 2003). The toxicities of the intermediate breakdown products, NPEC and others are intermediate between NP and NPE. In the aquatic environment, the breakdown products NP1EC and NP2EC are likely to be present also. These two metabolites are known to affect vitellogenin (a precursor for egg yolk) production in male fish, but NP, which is a more potent estrogenic compound, did not cause vitellogenin increases in male Xenopus laevis, or leopard frogs (Selcer et al., 2001; cited in USDA FS, 2003).

Mann and Bidwell (2000, 2001) tested several Australian frogs and Xenopus for effects to NP8E. They found that Xenopus was the most sensitive to toxic effects, with an LC50 of 3.9 ppm (3.9 mg/L). Similar to studies with herbicides, the LC50 values for the frogs are comparable to those for fish (USDA FS, 2003). NP8E inhibited growth at concentrations as low as 1 ppm (Mann and Bidwell, 2000, 2001). Mild narcosis of tadpoles can occur at EC50 values as low as 2.3 ppm, and reduced dissolved oxygen content in the water lowered the EC50 values by about half as compared to normal oxygen levels. The tadpoles recovered from the narcosis. Malformations in Xenopus occurred at EC50 values between 2.8 and 4.6 mg/L.

NP may cause tail resorption with a 14-day NOEC of 25 ppb for *Xenopus* laevis (Fort and Stover, 1997; cited in USDA FS, 2003). NP also increased the percentage of female *Xenopus* developing from tadpoles exposed to 22 ppb for 12 weeks, but did not produce this effect at 2.2 ppb.

During operational use of NPE surfactant, ambient levels of NP9E (including a small percentage of NP, NP1EC, and NP2EC) could average 12.5 ppb (range 3.1 to 31.2 ppb). This is well below the levels reported to cause concerns dicussed above. The duration of these exposures from Forest Service use would generally be much shorter than those used in laboratory experiments, due to transport by flowing streams, dilution, and environmental degradation. These levels are not likely to adversely affect amphibians found in the Pacific Northwest for normal operations (Bakke 2003). However, overspray or accidental spills could produce concentrations of NP9E that could adversely affect amphibians, particularly in small stagnant ponds.

Early Detection Rapid Response

The impacts of EDRR for these frogs would be the same as those discussed above. The No Action alternative (Alternative A), does not include EDRR. The short-term impacts of the treatments would be outweighed by the long-term benefit of retaining habitat for Columbia spotted frogs.

Differences between Alternatives

Alternative A (No Action): Invasive plants sites are not delineated in spotted frog habitat under this alternative. The existing infestations in spotted frog habitat are not part of the current projects included in the No Action alternative. Existing spotted frog populations would not be affected by manual, mechanical, or herbicide treatments. Alternative A is the least effective for improving habitat for frog species since it does not allow for treatment in frog areas, and does not incorporate EDRR.

Alternative B (Proposed Action): No emergent vegetation would be treated under any of the action alternatives considered in this EIS, which reduces the amount of herbicide that could come in contact with water. Glyphosate isopropylamine (IPA), RoundUp and POEA surfactant used in RoundUp have been specifically tested for ability to cause malformations in the frog embryo teratogenesis assay using *Xenopus* (Perkins et al. 2000). *Xenopus* is a highly sensitive assay species for determining the teratogenicity of chemicals (Mann and Bidwell 2000, Perkins et al. 2000).

No increases in malformations were noted at levels that were not also lethal to the embryos. The 96-hour LC50 for glyphosate IPA was 7297 mg a.e./L. Formulations containing surfactant are known to have much higher toxicity to amphibians than glyphosate. RoundUp formulation containing POEA surfactant was 700 times mores toxic than glyphosate IPA (See Appendix C – Herbicide Effects to Wildlife, for glyphosate). The Forest Service does not use the formulation used in the Smith study; however, potential effects to spotted frogs from glyphosate cannot be ruled out. To further minimize frog exposure a PDF was developed that prohibits broadcast spraying of herbicides, as well as spot spraying of glyphosate with POEA surfactant, sulfometuron methyl, and NPE-based surfactants within 100 feet of occupied or suitable spotted or leopard frog habitat.

In addition, treatment methods, timing, and location would be coordinated with local Biologists. With all of this protection in place, it is very unlikely that glyphosate will enter the water adjacent to treatment areas.

Adults could also be dermally exposed to glyphosate if they were to move through treated vegetation; however invasive plants have not been identified at any of the known spotted frog sites. It is, therefore, unlikely that frogs would be exposed to herbicides in this way.

Broadcast application of triclopyr, including aquatic triclopyr TEA, is prohibited. Some exposure could occur with spot applications which triclopyr TEA up to 15 feet of perennial streams, lakes and ponds. Spot or hand applications of Triclopyr BEE are prohibited within 150 feet of streams, lakes and ponds. Exposure from spot or hand applications would be much less than that modeled in the “worst case scenario.” There would be no aerial spraying within amphibian habitat.

Alternative C: The use of triclopyr is the same as Alternative B. No adverse effects to spotted frogs would occur from triclopyr or TCP exposure. No herbicide at all is permitted within intermittent stream channels or within 10 feet of perennial streams, lakes, or ponds. This would reduce, but may not eliminate, exposure to glyphosate or other herbicides. Because glyphosate is strongly adsorbed to soil, runoff or percolation of glyphosate through the buffer and into water is unlikely. Eggs and tadpoles are unlikely to be exposed to glyphosate. Spotted or leopard frogs may be exposed to other herbicides, but available data suggests that adverse effects are unlikely. Adults could still be dermally exposed to glyphosate as they move outside the buffers through treated vegetation. There is insufficient data to quantify dose received from dermal exposure to contaminated vegetation. It is assumed there is the potential that this type of exposure could result in adverse effects.

Alternative D: There would be no aerial spraying within close proximity to amphibian habitat under any of the alternatives since PDFs would be adhered to under all alternatives so Alternative D would have the same effects as Alternative B for spotted frogs.

Summary of Effects to the Columbia Spotted Frog and the Determination of Effects

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 habitats. Adults and juveniles would be susceptible to trampling from invasive plant treatment activities in wetland and riparian habitat utilized by frogs. The probability that this would actually occur is low because the frogs are less likely to inhabit areas infested with invasive plants.

This potential effect would occur in all alternatives, but might be more likely in Alternative C due to increased use of manual and mechanical techniques. All treatment methods that result in improved habitat for frogs and their prey will provide a long-term benefit.

No emergent vegetation would be treated under any of the action alternatives considered in this EIS, which reduces the amount of herbicide that could come in contact with water. Glyphosate isopropylamine (IPA), RoundUp and POEA surfactant used in RoundUp have been specifically tested for ability to cause malformations in the frog embryo teratogenesis assay using *Xenopus* (Perkins et al. 2000). *Xenopus* is a highly sensitive assay species for determining the teratogenicity of chemicals (Mann and Bidwell 2000, Perkins et al. 2000). No increases in malformations were noted at levels that were not also lethal to the embryos. The 96-hour LC50 for glyphosate IPA was 7297 mg a.e./L.

Formulations containing surfactant are known to have much higher toxicity to amphibians than glyphosate. RoundUp formulation containing POEA surfactant was 700 times mores toxic than glyphosate IPA (See Appendix C – Herbicide Effects to Wildlife, for glyphosate). The Forest Service does not use the formulation used in the Smith study; however, potential effects to spotted frogs from glyphosate cannot be ruled out. To further minimize frog exposure a PDF was developed that prohibits broadcast spraying of herbicides, as well as spot spraying of glyphosate with POEA surfactant, sulfometuron methyl, and NPE-based surfactants within 100 feet of occupied or suitable spotted or leopard frog habitat. In addition, treatment methods, timing, and location would be coordinated with local Biologists. With all of this protection in place, it is very unlikely that glyphosate will enter the water adjacent to treatment areas.

Adults could also be dermally exposed to glyphosate if they were to move through treated vegetation; however invasive plants have not been identified at any of the known spotted frog sites. It is, therefore, unlikely that frogs would be exposed to herbicides in this way.

Buffers established for use of triclopyr (see Aquatic Species section) would be effective at avoiding adverse effects from exposure to triclopyr BEE and others. The restriction on broadcast spray of any triclopyr would also greatly reduce potential adverse effects from triclopyr TEA and TCP. Some exposure could occur with spot and selective applications; these exposures would likely be much less than that modeled in the "worst case scenario."

No herbicide is permitted within intermittent stream channels or within 10 feet of perennial streams, lakes, or ponds. This would reduce, but may not eliminate, exposure to glyphosate or other herbicides. Because glyphosate is strongly adsorbed to soil, runoff or percolation of glyphosate through the buffer and into water is unlikely. Eggs and tadpoles are unlikely to be exposed to glyphosate. Spotted frogs may be exposed to other herbicides, but available data suggests that adverse effects are unlikely.

The analysis shows that under any of the alternatives, though the probability is low, treatments could impact spotted frogs.

Therefore, the invasive plant treatments **“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”** for spotted frogs.

Cumulative Effects

Since the herbicides selected do not pose a risk from bioaccumulation or a long residual effect there are not anticipated cumulative effects from either projects on or off of the Forest. The cumulative effects described within the bald eagle portion of this document would also apply to the Columbia spotted frog.

3.3.7 Effects to Management Indicator Species

The purpose of this section is to evaluate and disclose the impacts of the Umatilla National Forest Invasive Plants Treatment Project on the Umatilla Management Indicator Species (MIS) identified in the Forest Land and Resource Management Plan (USDA 1990). This documents the effects of project alternatives on the habitat of selected MIS.

Effects to MIS from herbicide exposure were evaluated by placing the species into groups based on taxa type, body size, and diet. Exposure scenarios for various groupings were used to quantitatively estimate dose and characterize risk. Scenarios are discussed in detail in Appendix P of the R6 2005 FEIS and this information is incorporated by reference. The following scenarios were used for the following species:

- Large mammal consuming contaminated vegetation: elk
- Carnivore consuming contaminated small mammal: American (pine) marten
- Effects to pileated woodpeckers, three-toed woodpecker, and primary cavity excavator are included below

Effects to Rocky Mountain Elk

Concern over elk (and deer) arises from its status as an important game species. The grazing and browsing habits of elk (and deer) make it possible for them to consume vegetation that has been sprayed with herbicide. Quantitative estimates of risk using “worst-case” scenarios found that none of the herbicides considered for use, at typical application rates, would result in a dose that exceeds the toxicity indices in either acute or chronic scenarios. The dose for NPE surfactant exceeds the toxicity index only in an acute scenario. Elk (or deer) would have to consume an entire day’s diet of contaminated grass in order to receive this dose. Broadcast spraying is proposed over areas in which deer or elk could forage. Spot spraying, roadside boom and aerial spraying of invasive plants are not likely to expose deer or elk to harmful levels of herbicide or NPE because they are unlikely to forage exclusively on treated invasive plants, which are not their preferred forage. Also, the patchy nature of the applications makes it unlikely that the elk (or deer) would forage exclusively on the scattered treated patches.

Treatment of invasive plants in meadows and along roadsides in meadow habitat could beneficially affect elk (and deer) by preserving native forage species and maintaining the long-term suitability of the habitat. Invasive plants can reduce the ability of an area to support elk (and deer) (Rice et al. 1997). The effects to elk and deer are almost identical, since their habitat requirements and forage are so similar. Even if a few individuals were adversely impacted by herbicides or disturbance caused by people, vehicles and mechanical treatments, there would be no substantial change in the population levels for elk (or deer) due to invasive plant treatments. Elk and deer populations on the Forest are in not in danger.

Elk (and deer) have been analyzed for direct effects of the herbicides and it was determined that based on the method of application that there would be little to no effect on the species.

The fact that game animals do forage in the areas that would be sprayed, there is a potential that a hunter could harvest an animal that has been foraging on herbicide treated areas. Since these herbicides do not bio-accumulate in the fat of animals, there would be no increase in the toxic effect to someone eating the animal. The amount of herbicides that might be ingested by the animal is anticipated to be low, and depending on the size of the animal, the amount ingested by a person would be even lower. Although there is no a research data that was reviewed to confirm the effect of eating meat from an animal that has been foraging on herbicide sprayed vegetation, it is expected that there would be no observable or detectable effects on people who eat meat from an animal harvested that has ingested herbicides sprayed at the recommended rates and by the methods prescribed by this document. Since, many of these same herbicides have been sprayed in much larger quantities on private lands, especially on commercial agriculture lands, and there have not been recorded cases of humans developing problems following the consumption of game animals foraging on these lands, it is assumed that there would be no health issues on this project. See Section 3.7 – Effects of Herbicide Use on Workers and the Public- for more information. Rice (2000) demonstrated that the appropriate use of herbicides can provide clear benefits in the restoration of native plant communities and the enhancement of wildlife values in areas that had been degraded by spotted knapweed.

Effects Common to All Alternatives

Invasive plants probably affect elk (and deer) more than any other species analyzed in the MIS section. Invasive plants out compete and replace native forage plants for these ungulates. Eradicating, controlling and/or containing invasive plants would improve elk (and deer) habitat. This factor outweighs any detrimental effects of herbicide ingestion and disturbance.

Of the herbicides analyzed, triclopyr has a toxic effect on ungulates when ingested over a number of days (chronic exposure). At times, elk (and deer) could continue to return to a patch of vegetation that they prefer over other plants and continue to forage in that area. Due to this site selection behavior they are prone to chronic exposures. As a result, the *2005 Pacific Northwest Region Invasive Plant Program Record of Decision* (2005b) contains a standard that restricts the use of triclopyr and does not allow broadcast boom or aerial spraying of this herbicide. However, if there are a substantial amount of invasive species in an area (which are not preferred forage) elk (and deer) are not likely to continue to forage in such an area.

Mammals 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). Elk (and deer) eat grasses so they are more susceptible to toxic effects than carnivores.

Alternative A – No Action

Under the existing 1995 Umatilla National Forest 1995 EA for invasive plant treatment, the use of triclopyr is not available. This is the only herbicide that the effects analysis (Appendix C) shows as a potentially toxic herbicide for elk. The only herbicides available in the No Action Alternative are glyphosate and picloram. As discussed before, this alternative is the least effective at containing, preserving or restoring invasive plant sites since it has only a limited number of sites identified for treatment and does not incorporate EDRR.

Alternative B, C and D

There is at least some elk (and deer) forage on every acre of the proposed treatment areas. Potentially elk (and/or deer) could be affected by the treatment of invasive plants. As a result, potentially 25,000 acres of habitat could be improved by the removal of invasive plants, but also could expose elk (and deer) to herbicides. Acres treated with triclopyr could potentially have toxic effects for individual elk. This effect is offset by the fact that the chemical would only be used as a spot spray. The amount of forage plants that would be sprayed would be reduced substantially. This should eliminate the potential for toxic effects from acute and chronic exposure since elk (or deer) rarely forage on the invasive plants targeted for treatment.

All the acres aerial sprayed under Alternative B have the potential to expose elk (and deer) to herbicides by being sprayed directly and exposure through walking in areas that have been sprayed. Currently 675 acres are proposed for aerial treatments; and there would be no additional aerial treatments under EDRR. The 675 acres is not in one large unit. There are 14 aerial treatment sites proposed that range in size from approximately .90 acres to 286 acres. Elk would likely run from the low flying helicopter or plane and so would not expected to be directly sprayed by herbicide.

The assumptions for toxicity are similar for each alternative. This would not affect the population of elk (or deer). There have been no reports of deer or elk suffering from exposure to any herbicides used on farms or commercial tree plantations where herbicide use is more prevalent.

Alternative C could cause more disturbances to elk than Alternative B because it doesn’t allow broadcast spraying in riparian areas so application of herbicides may take longer on certain sites. Alternative D would be very similar in effects to elk (and deer) as both Alternative B and C, except there would be no aerial spraying of herbicides. The 675 acres proposed for aerial treatment in alternative B and C would be treated if safety concerns and/or cost did not eliminate sites from treatment.

Cumulative Effects

It is not known how many acres of invasive plant herbicide treatment would occur near the borders of the Forest where this project could affect elk (and deer) that move across the boundary to forage. In these isolated situations, however, there could be cumulative effect of the herbicides on individual deer or elk that forage on both private and National Forest system lands that have been treated with herbicides. In rare situations, there could be an individual animal that receives a toxic dose from this scenario. At this time there are no reports of animals in agricultural or commercial tree operations that have suffered toxic effects from use of herbicides where chemicals are used more widely for vegetation control.

Effects to Pileated Woodpecker, Three-toed Woodpecker and Cavity Excavators

These species were grouped together because for the most part they share similar habitats and the effects from treatments would be similar. The pileated woodpecker is a Forest Management Indicator Species. Concern over pileated woodpeckers arises from their association with mature forest habitat, a habitat type that has been affected by logging throughout the woodpeckers range. Breeding bird survey data collected between 1966 and 1991 shows no significant change in the population in the western United States (Bull, 2003).

Species that forage and nest in trees are not likely to be exposed because aerial applications are limited to sites with less than 30 percent canopy cover.

The aerially sprayed trees would intercept the herbicide, which would protect the cavity excavators from being directly contaminated. Lewis' woodpecker and northern flicker are the only cavity excavators that may feed on the ground or low shrubs for a substantial portion of their diet. They may encounter contaminated insects. No herbicides except triclopyr (which can't be broadcast sprayed) are a concern at typical application rates. NPE may exceed toxicity index at typical and highest application rates given the worst case scenario of feeding exclusively on contaminated insects. Given the varied diet and movement of these birds, they are unlikely to forage exclusively within one patch of treated invasive plants and actual doses exceeding levels of concern are unlikely.

Invasive plant treatments are not expected to affect the pileated woodpecker, the three-toed or cavity excavators. These birds nest in cavities in trees, usually dead trunks or dead limbs, and forage largely on trees and perhaps some shrubs, making it unlikely for them to be exposed to herbicides or affected by manual or mechanical treatments. Invasive plant treatments will not reduce the availability of dead trees, down logs or appropriate cavity sites. Since these woodpeckers utilize down logs and snags and forage on beetles and ants buried inside decaying wood, their habitat is not impacted by invasive plant infestations but infestations may occur in proximity to their habitat. The differences between alternatives do not result in any differences in effects to the pileated woodpecker, three-toed woodpecker or cavity excavators. There is no impact to these species for all action alternatives.

Alternative A – No Action

None of the treatments that occur under the existing 1995 Management of Noxious Weeds decision impact pileated habitat, three-toed woodpecker or primary cavity excavator's forage, or nesting. There are no effects to these birds from this alternative.

Alternatives B, C, & D – Action Alternatives

None of the proposed treatments would affect pileated woodpecker habitat, three-toed woodpecker or primary cavity excavator's forage or nesting habitat. The insects that pileated woodpeckers forage on live inside dead wood and snags: these insects have almost no chance of contacting herbicides at the treatment sites. The herbicide effects analysis showed no toxic effects to these species (Appendix C). Very few acres would be treated in pileated woodpecker habitat, three-toed woodpecker or primary cavity excavator's forage or nesting habitat. Any treatment sites would not be in areas slated for aerial treatment since the forest canopy would be too dense for aerial spray. Treatments in riparian areas would generally be on more open sites and therefore not in typical habitat for these species. No habitat would be affected by manual or mechanical treatments. The EDRR would not increase or decrease this risk.

Cumulative Effects

There are no anticipated effects to pileated woodpecker habitat, three-toed woodpecker or primary cavity excavator's forage or nesting habitat, and there are no expected cumulative effects.

Effects to American Marten

The American marten is a Forest Management Indicator Species. Concern for this species arises out of their association with mature and old-growth forest. Since this species is not restricted to riparian areas there is no appreciable difference between alternatives. There will be no aerial spraying within areas of dense tree cover so there will not be any difference between Alternatives B and D.

No herbicide or NPE exceeded a level of concern for carnivores eating contaminated small mammals. Invasive plant infestations are unlikely to occur in marten habitat except along disturbed roadsides, so disturbance to martens from treatment is not likely to occur.

Even if pine martens consumed for an entire day nothing but prey that had been directly sprayed, they would not receive a dose that exceeded the toxicity indices for any herbicides or NPE (USDA 2005, Appendix B). Because there is a lack of plausible effects from any treatments, there is no difference in effects regardless of alternative chosen.

Alternative A– No Action

Martens could to occur in some of the areas treated under the 1995 decision that implements the Umatilla National Forest EA for the Management of Noxious Weeds.. These animals would potentially travel through areas treated, but avoid openings.

They do, however, travel across roads and small forest openings at times, so they could go through a treatment area. Exposure would be short and acute. Their home range makes chronic exposure unlikely. The effects analysis for herbicides showed no risk of exposure. No habitat would be altered by this alternative. None of the treatment methods would have any effect on martens. The effect determination for this alternative is No Effect to martens or their habitat.

Alternatives B, C and D

Martens do occur throughout the proposed treatment areas at the higher elevations. The analysis for these alternatives is the same as Alternative A. Martens would travel through the treatment areas but there is no risk from any of the treatments methods. There are no toxic effects from herbicides as indicated in Appendix C, and there is no habitat altered. **The effect determination for martens and their habitat is No Effect. This includes the EDRR as well as all treatment methods.**

3.3.8 Effects to Other Species of Interest

Landbirds

Effects Common to All Alternatives

The treatment of invasive plants has short-term impacts by reducing cover, but restoring native vegetation would have long-term benefits by providing food and cover (See Section 3.2– Botany and Treatment Effectiveness). Birds or mammals 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). Turkeys, grouse, quail, and waterfowl would all consume grass as part of their diet. Other birds would eat grass seeds especially. The end result of all of the alternatives is some degree of improvement in the quality of habitat, while having a potential short-term negative effect on individual birds. One example from this project would be the treatment of knapweed. Knapweed seed is not consumed by birds and provides very poor nest cover. By reducing the presence of knapweed and allowing native grasses and forbs that do provide food and cover there is a positive effect to the treatment.

The effects of herbicides, from all methods of intake and to all species on the landscape, are limited. The studies that were analyzed for the adopted 2005 Pacific Northwest Region Invasive Plant Program decision indicted that there was a low toxicity of herbicides to birds.

But because of the large gaps is data it must be stated that some effects to birds from herbicides are unknown. The data that are available would indicate however that the risk is low.

Alternative A – No Action

The herbicide effects analysis from Appendix C shows no effect to the species analyzed from herbicides except triclopyr and NPE surfactant for blue grouse. These two herbicides are not allowed under the 1995 decision that implements the Umatilla National Forest EA for the Management of Noxious Weeds, so there could be no effect to these two species. The treatment areas are limited and should not result in a large exposure to blue grouse or other landbirds that are not analyzed.

Alternatives B, C and D

All of the treatment methods used to treat invasive plants have some short-term negative effect on early successional bird species use. All methods if implemented in the spring and early summer could impact nesting success of birds, especially ground nesting birds. All of these methods (herbicide, manual, and mechanical) could possibly flush birds from their nest. When flushed from a nest many birds return with no harm to the young or eggs, but some species are highly sensitive to disturbance and would abandon the nest.

These alternatives include the use of triclopyr. Since this herbicide is only approved for spot spraying, the risk of exposure is reduced substantially. It is not likely that blue grouse or other ground feeding birds would receive chronic dosages that would become toxic.

EDRR would expose landbirds to a possible additional disturbance and possible exposure to herbicides. In the short-term, this may cause some reduced reproduction from a reduction in ground cover for nesting but in the long-term their habitat would be restored or maintained and this is a greater benefit than the possible negative side affects.

Alternatives C and D could both result in more disturbance to landbirds than Alternative B since both would require more ground work involving people and machines which can crush eggs, flush birds etc. However, the short-term negative impacts are outweighed by the long-term benefits to habitat.

Cumulative Effects

Birds are mobile animals that could potentially receive a dose of herbicides on private, state, or National Forest System lands, and fly to another area where herbicides are being used. In very rare cases, there is a potential for receiving a toxic dose. It is not possible to predict the amount of times this would actually happen but it is anticipated that this would only happen in extremely rare cases. It is also impossible to predict the effect of two different chemicals interacting synergistically that could cause a toxic effect. For example if a bird were to fly here from an agricultural field where there was use of a pesticide and then the bird arrived on the National Forest and ingested a herbicide there could be a combined effect that could harm the bird. For such an individual the effects would be cumulative, there are no major cumulative effects.

Focal Species

The following species are listed in the Conservation Strategy for Landbirds and were used for analysis purposes and represent a variety of habitats and feeding strategies; hermit thrush (subalpine forest), upland sandpiper (montane meadows), vesper sparrow (steppe shrubland), gray-crowned rosy finch (alpine), and red napped sapsucker (aspen).

The herbicide effects analysis showed no toxic effects from the proposed treatment methods to these birds. Appendix P of the Invasive Plants EIS (2005a) found that small insectivorous birds could be affected by herbicides if exposed to chronic levels of certain herbicides, such as sethoxydim, which could reach “three times greater than the chronic LOAEL for birds so suppressed reproduction of insectivorous birds are expected from chronic dietary exposures.” When the focal species were analyzed, it did not appear likely that most of them would be exposed chronically due to feeding strategies of these birds. Except for the vesper sparrow the rest of the focal bird species do not occupy habitat where invasive plants are likely to be found. The potential effects to vesper sparrows would be similar to those described for the green-tailed towhee above. The invasive plant treatments are not expected to have an impact on any of the focal bird species.

3.4 Soil and Water

3.4.1 Introduction

The effect of invasive plant treatments on soil and water is a primary public issue. Specifically, there is a concern that there may be potential adverse effects of herbicide treatment on soils, riparian areas, water quality and aquatic ecosystems.

While other types of treatments are analyzed, the primary focus of this section is the effect of herbicide treatments on soil and water resources. Project Design Features (PDFs) were developed to minimize the effects of invasive plant treatments on these resources.

Project Area

The Project Area for direct and indirect effects is the Umatilla National Forest and lands administered by the Forest, approximately 1.4 million acres in Oregon and Washington. Cumulative effects analysis is on the basis of 5th field watersheds. Approximately 30 percent of the land within these watersheds is on National Forest system lands administrated by the Forest.

Methodology for Analysis

This analysis is tiered to the R6 Invasive Plant FEIS 2005. A primary focus of the site-specific analysis was developing Project Design Features to insure compliance with standards introduced by R6 as well as Umatilla National Forest Plan standards and guidelines. Information used to develop criteria to minimize effects from treatment included properties of herbicides from SERA risk assessments, properties of soils in relation to herbicide properties, proximity of treatment sites to streams, stream/road connectivity and acres of proposed treatment for each 5th field watershed. To compare alternatives, the acres treated by non-herbicide and herbicide methods were compared within each alternative. For each 5th field watershed, the number of acres of aerial treatment, broadcast treatment (both boom and hand broadcast) versus hand and spot treatment within aquatic influence zone was compared by alternative.

The Forest Service has a contract with Syracuse Environmental Research Associates, Inc. (SERA) to conduct human health and ecological risk assessments for herbicides that may be proposed for use on National Forest system lands. The information contained in this report, and in the EIS, relies on these risk assessments. Herbicide effects to stream aquatic resources was analyzed in risk assessments for each of the 10 herbicides included in the Proposed Action The risk assessments considered worst-case scenarios including accidental exposures and application at maximum reported rates.

The R6 2005 FEIS added a margin of safety to the SERA Risk Assessments by lowering acceptable thresholds of herbicide exposure to account for increased protection needed for federally listed species (EPA 2004). Although the risk assessments have limitations (see R6 2005 FEIS pages 3-95 through 3-97), they represent the best science available.

The GLEAMS model is a computer model used to simulate water quality events after herbicide application on an agricultural field. This model is well validated for agricultural use. As the GLEAMS model was originally an agriculture model, all parameters used are not compatible with site specific parameters for treatment areas on the Forest. Despite these limitations the model is the best available at this time. The SERA Risk Assessment analysis takes the herbicide concentration provided by GLEAMS and uses them in a dilution model for a stream or pond to get the water contamination rates for specific scenarios.

The risk assessment model assumes broadcast treatment along a small perennial stream. The treatment area modeled is 50 feet wide and 1.6 miles long (10 acres). This would over estimate herbicide in streams on the Forest as no broadcast is proposed within 100 feet of a perennial or flowing intermittent stream or 50 feet of a dry intermittent stream (Table 7, Table 8). However, many treatment areas are larger than 10 acres. In steeper areas, the model may underestimate the herbicide delivery as it assumes a 10 percent slope, although much of the Forest has a steeper slope. The model also assumes even rainfall every ten days.

The spreadsheets developed for the SERA Risk Assessments were modified for type of herbicide, herbicide application rates, soil texture and rainfall conditions found at treatment sites on Forest. These were run for the specific herbicides to be used at these sites to estimate the potential herbicide concentrations in streams and lakes after treatment. When specific treatment areas parameters were rerun in the worksheets for this project the upper limit of rain was set as high as 75 inches a year to model a 2 inches of precipitation in 24 hour event. While no treatment area was over a threshold of concern for sensitive fish or human consumption, there were model parameters that do not accurately reflect parameters at treatment sites, adding uncertainty to modeled results.

For aerial application the model AGDISP was used to model drift from aerial application of herbicide for the worst case scenario allowed under the PDFs of this project.

Past monitoring studies of herbicide use in forested areas were used to create PDFs, particularly stream buffers, near water resources to protect streams from adverse effects from treatments.

3.4.2 Affected Environment

Invasive Plants and Soil and Water Resources

Climate

The northern half of the Forest, generally consisting of the Pomeroy and Walla Walla Ranger Districts has a marine-influenced climate with average annual precipitation ranging from 30-65 inches. Winter conditions often include rain mixed with snow in mid elevations (2000-4500 feet) as a result of moist marine air intrusions. In contrast, the southern half of the Forest, the Heppner and North Fork John Day (NFJD) Ranger Districts has a more continental climate, with annual precipitation ranging from 20-55 inches, and colder winters dominated by snow. For all the Forest, the highest precipitation intensities occur during summer, localized, convective storms, and winter, regional, frontal storms, with varying precipitation accumulations.

Geology

For the northern half of the Forest basic geology is dominated by Columbia River basalt flows, which have been uplifted and dissected, forming gentle upland plateaus, narrow ridges, steep slopes and confined, narrow valleys. There are lake deposits interlaid between some of the basalt flows. Watersheds of the Lower Snake are deeply incised, and moderately dissected. There are both volcanic ash and loess deposits (airborn silts), and most have been reworked. The thickest deposits are found lower in the drainages.

The southern Forest geology is more complex and includes Columbia River basalts overlying older John Day volcanics and intrusive granitics. The southeast part of the Forest has the highest elevations (up to 8000'), with glaciated landforms, and areas of landslide deposits. Landforms are more complex with rolling mountain ridges, separated by steep canyons. Watersheds on the south half of the Forest are moderately incised, and moderately dissected. Volcanic ash deposits are common.

While mass wasting is rare on the Forest (USDA Forest Service 2004), there are 3,747 acres of land within the Forest listed as unstable in Forest GIS coverage, Slumps. The largest single block is about 340 acres. Of these areas, 54 acres are along gravel roads within areas proposed for treatment.

Soils

The surface texture of the soils in the northern half of the Forest are primarily silt loam and gravelly silt loam with volcanic ash dominating on the deep, footslope positions and more stable uplands. The shallower soils found on steeper shoulder and upper sideslope areas developed in the basalt and andesite rock, usually mixed with volcanic ash. They have gravelly loam and silt loam textures with some areas of silty clay loam in the more developed residuals soils. Loess subsoils also occur in similar locations as the volcanic ash, usually at depth below the volcanic ash or mixed into surface horizons of residual soils formed in basalt and andesite. These wind-blown deposits have favorable water-holding capacity, though not quite as good as ash soils, and favorable nutrient content when weathered. These soil properties, along with the marine-influenced climate, provide for the good growing conditions in the deep to moderately deep soils found on the plateaus and lower sideslopes and drainage ways.

The soil texture on the southern half of the Forest is similar to the northern Forest where the parent material is basalt or the soil contains ash. Soils that have developed on the older volcanics of the John Day formation tend to be finer textured and have higher clay content. These soils range from silty clay loam to clay loam with high gravel content (USDA Forest Service, Rimrock FEIS, 2004).

In general, the ash-derived soils are less erodable and more productive than non-ash soils, since the ash soil layer is very porous with a high water infiltration rate, and can retain more water. Thus, there is less overland water flow to cause soil erosion. With a higher water holding capacity, the vegetation on ash soils re-establishes more quickly, thus minimizing the erosion potential. However, with ground disturbing activities, these ash cap soils may easily erode. Soil particles easily detach in these ashcap surface soils once groundcover is removed. Also, with no ground cover, these soils are more susceptible to soil displacement and mixing from management activities, especially when the surface soils are dry.

The greatest surface erosion problems occur in highly erodible terrain. This would include areas with soils derived from granitics and wind-deposited soil types (volcanic ash and loess) on steep slopes. Older volcanic material on the south end of the North Fork John Day district also tend to be more prone to road-related erosion problems (USDA Forest Service, Roads Analysis, 2004).

Soil Conditions within Treatment Areas

The majority of infested sites identified for treatment under this analysis are along roads, quarries, trails and recreation sites. These areas have highly disturbed soil conditions. This generally includes the loss or mixing of surface organics and mineral soil into subsurface mineral soil horizons as a result of displacement, and/or altered soil structure and porosity as a result of compaction of mineral soil. In general, conditions affecting vegetative growth such as available moisture holding capacities and soil porosity are likely to have been altered. As many invasive plants prefer disturbed sites, this creates conditions in which invasive species can out-compete native species.

Infested sites not along roads can include areas burned by fires and areas where streams have acted as a corridor for movement of plants downstream. Burned areas temporarily lack plant cover, generally include disturbances from heavy equipment creating fire breaks, and can have changed soil properties from soil heating. Where streams have acted as a corridor for movement of invasive plants downstream, soils are fairly undisturbed.

Effects of Invasive Plants on Soils

Invasive plants can affect soils in many ways. They can cause changes in soil properties such as pH, nutrient cycling and changes in composition or activity of soil microbes. A reduction in soil nutrient levels makes it difficult for native plants to compete with the invasive plants, and probably also affects the soil biotic community. The long-term effects of these changes are not known.

Soil and Water Interactions - The rate and volume of water infiltration can be reduced on weed infested sites due to reduced cover (DiTomaso 1999; Olson 1999a). Significantly greater surface water runoff, indicating less infiltration, has been measured from spotted knapweed dominated sites compared to adjacent native grass dominated sites (Lacey et al.1989). Compaction in many weed infested sites also tends to reduce infiltration rates. Reductions in soil organic matter can also reduce the amount of water held in the soil profile, especially near the surface (Brady and Weil 1999; Tisdall and Oades 1982).

Vegetative Cover - Total vegetative cover may be reduced on weed infested sites from that provided by native vegetation and can result in higher evaporation from exposed mineral soil on the surface (Lauenroth et al. 1994, Olson 1999a). Soil water stored deeper in the profile may also be depleted more rapidly on sites where vegetative cover provided by weeds is dense and associated transpiration rates are high (Olson 1999a).

Soil Erosion - Weed infested soil has been shown to be more susceptible to erosion than soil supporting native grass species (Lacey et al. 1989). Soil erosion in a simulated rainfall test more than doubled in spotted knapweed-dominated rangeland areas when compared to natural bunchgrass/forb grasslands. This is primarily due to significantly lower infiltration rates and higher levels of bare ground on the knapweed dominated site compared to the uninfested areas (Lacey and Marlow, 1989). Weeds are less able to dissipate the kinetic energy of rainfall, overland flow, and wind that cause soil erosion, primarily due to the loss of cover provided by native species on site (Torri and Borselli 2000; Fryrear 2000).

Soil Biota- Plants and mycorrhizal fungi are strongly dependent on each other, and species of fungi are associated with specific plants. Presence of non-native plants also leads to changes in the mycorrhizal fungus community (ibid). These changes could increase the difficulty of reestablishing native vegetation after the invasive plants are removed.

Soil Nutrient Availability - Noxious weeds directly limit nutrient availability by out-competing native species for limited soil resources. Weeds have high nutrient uptake rates and can deplete soil nutrients to very low levels, especially in cases where weed species germinate prior to native species and exploit nutrient and water resources before native species are actively growing (Olson 1999a). Spotted knapweed has been implicated in reducing available potassium and nitrogen (Harvey and Nowierski 1989).Potassium, nitrogen, and phosphorous levels were shown to be 44, 62, and 88 percent lower, respectively, in spotted knapweed infested soil than in adjacent grass covered soil (Olson 1999a).

Some invasive plants are allelopathic to other plants, and produce secondary compounds that can directly increase the population of soil microbes capable of metabolizing this compound, while decreasing the populations of other microbes (Sheley and Petroff 1999). These changes will affect the soil food web and nutrient cycling, and may have impacts on the native plant community. Weed infested areas may also indirectly limit nutrient availability as a result of soil erosion from compacted conditions or reduced effective cover. Erosion selectively removes organic matter and the finer sized soil particles that store nutrients for plant use, leaving behind soil with a reduced capacity to supply nutrients (Brady and Weil 1999). An example of an invasive plant found on the Forest that out-competes other plants by changing soil nutrients is Leafy spurge. It displaces native vegetation in prairie habitats through shading and usurping available water and nutrients. Leafy spurge also secretes toxins that prevent the growth of other plants underneath it. Once present, this aggressive invader can completely overtake large areas of open land (http://www.nps.gov/plants/alien/).

Existing Condition for Water Resources

Where fractured basalts are exposed they can have high permeability, which may serve to transfer contaminants from the surface to groundwater.

Water quality and riparian condition are the two elements potentially affected by invasive plant treatments. The 24,649 acres of invasive plants identified for treatment are scattered across the Forest 34 of 39 5th field watersheds. Of these acres, 5560 (23%) are within PACFISH defined Riparian Habitat Conservation Areas (RHCAs) in 31 5th field watersheds.

Water Quality

Section 303d of the Clean Water Act requires that states develop a list of waterbodies that do not meet standards and submit the list for approval to the US Environmental Protection Agency (EPA). The most recent listings in Oregon were approved in 2002 and Washington developed their list in 2004. These water quality limited streams and the parameters they are listed for are shown in Table 35. Temperature is the most widespread water quality impairment followed by sediment. High temperatures coinciding with low rainfall and low stream flow during the summer months cause stream water temperatures to increase. South-facing aspects and lower elevations tend to create drier and hotter conditions, which serve to further elevate temperatures under these conditions.

Table 35 - Water quality impaired streams within the Umatilla National Forest on Oregon's or Washington's 303d list.

Waterbody	State	Parameter 1	Parameter 2	Invasive Plant Acres within 100 feet of 303d streams*
Big Wall Creek	Oregon	Temperature	Sedimentation	11
Camas Creek	Oregon	Temperature		18
Ditch Creek	Oregon	Temperature		11
Granite Creek	Oregon	Temperature		37
Henry Creek	Oregon	Temperature		10
North Fork John Day River	Oregon	Temperature		60
Swale Creek	Oregon	Temperature	Sedimentation	13
Willow Creek	Oregon	Temperature		15
Wilson Creek	Oregon	Temperature	Sedimentation	7
Asotin Creek	Washington	Temperature		24
Lick Creek	Washington	Temperature		12

*Acres of invasive plants proposed for treatment to contain, control or eradicate the target species.

By direction of the Clean Water Act, where water quality is limited, state agencies develop Total Maximum Daily Load (TMDL) plans to improve water quality to support the beneficial uses of water. For water quality limited streams on National Forest system lands, the USDA Forest Service provides information, analysis, and site-specific planning efforts to support state processes to protect and restore water quality. Two TMDLs have been completed for streams partially located on the Forest. The TMDLs were developed on a Sub-Basin level, not for individual streams. They are for the Umatilla Sub-Basin and the Upper Grande Ronde River and the Oregon portion of the Walla Walla Sub-Basin.

Goals for temperature and sediment reductions were developed in the Umatilla Subbasin Total Maximum Daily Load and Water Quality Management Plans (Oregon Department of Environmental Quality, approved 2001). The temperature analysis was based on a heat source model, and targets were developed for site potential vegetation and channel morphology. Forest Plan standards and guidelines including PACFISH were incorporated into an approved water quality management plan. Turbidity targets were based on studies of impacts to fish. Sediment loads were modeled using relationships between turbidity and total suspended sediment. Overall, Umatilla Forest watersheds have a negligible contribution to downstream sediment, and no load reductions were assigned to the Forest (Umatilla Monitoring Report, 2001). However, management plans specify the importance of control of sediment during Forest management operations.

The State of Oregon completed the Upper Grande Ronde River Sub-Basin Total Maximum Daily Load TMDL and Water Quality Management Plan (WQMP) in December 1999. The document established water quality goals for the streams of the Upper Grande Ronde. The TMDL analysis assigned pollutant loads for water temperature and the WQMP established water quality goals to meet the TMDL, and remove streams from impairment listing (303d). No TMDL for sediment was developed in the Upper Grande Ronde Sub-basin. The state determined that, "the load allocations provided to address temperature, pH, and dissolved oxygen standard violations, coupled with ongoing efforts by the U.S. Forest Service (USFS) to reduce loads from roads and other sources, will be adequate to address sedimentation and turbidity concerns in the Upper

Grande Ronde Sub-Basin." To insure that sediment standards are met, long-term monitoring has been implemented.

Geology and stream type play an important role in determining sediment sources, and the fate of sediment entering streams. On the Umatilla Forest, the highest potential sediment source areas are the granitic rock types and landslide-prone terrain in the Upper North Fork John Day Subbasin. The majority of perennial and intermittent streams across the Forest, have moderate to high gradients, therefore they tend to transport rather than store sediment. In general, these stream types are not susceptible to fine sediment accumulations. Lower gradient (less than 2 %) response reaches occur in the main valleys of larger streams: Asotin Creek, Tucannon River, Touchet River, Walla Walla River, Umatilla River, Meacham Creek, and the upper North Fork John Day River and its major tributaries (Desolation, Granite, Camas, and Wall Creeks). Low gradient meadow systems in the higher elevations are also areas of sediment accumulation. Examples include: Brock-Jarboe Meadow, Granite Meadows, Desolation Meadows, and Kelly Prairie. Streamside developments (including roads, trails, dikes, and campgrounds) in larger stream systems restrict floodplain areas and promote channel incision (deepening). Accelerated streambank erosion resulting from down-cut channels is also a source of sediment to streams.

Bacteria may be a concern in localized areas with heavy recreation use and grazing. Heavy metals are a concern in areas with mining such as Clear Creek and Granite Watersheds. The ability of water to hold oxygen decreases with increased water temperature, altitude, or dissolved solids (TDS). Dissolved oxygen (DO), can be lowered by high stream temperatures, bacteria blooms and decaying vegetation in water, although no streams located on the Forest are listed for low dissolved oxygen.

Flows

There are approximately 7683 miles of stream on the Umatilla. Of these, 2963 miles (39%) are perennial and 4720 miles (61%) are intermittent.

In general, high flows in Blue Mountains watersheds result from two principle hydrologic processes; rarely, a winter rain on snow event, which produces the largest flows, and spring snowmelt, which is an important annual occurrence. Lowest flows are in the summer when precipitation is low and water withdrawals are at their highest level.

Channel Morphology and Riparian Condition

Riparian shrubs are lacking on many Forest streams. There is over utilization of riparian vegetation in some areas by domestic livestock and wildlife. Large wood is lacking in many streams on the Umatilla, particularly where roads parallel streams. However, in recent years degraded riparian areas have been improved to provide for riparian-dependent resources. These improvements have resulted from better control and administration of livestock use in riparian areas, reduced timber harvest in forested riparian areas, and more roads being closed or obliterated (USDA Forest Service 2004b).

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. Riparian areas with native vegetation supply downed trees (large wood) to streams.

Riparian vegetation stabilizes stream banks, and serves as a filter to prevent the run-off of soil into streams. Riparian vegetation also provides large and small wood to streams, adding to habitat complexity and providing cover and food sourced for aquatic organisms. Aquatic ecosystems have evolved with certain vegetation types; invasive plants do not necessarily provide similar habitat.

Lakes, Wetlands and Floodplains

There are six reservoirs or lakes on the Forest. Wetlands occupy less than five percent of the Umatilla National Forest area and are generally associated with rivers and streams (USDA Forest Service 1990). Isolated wetlands occur on hillslopes in association with groundwater sources and atypical soil types (glaciated or landslide landforms).

Lakes, wetlands and floodplain areas are often popular for recreation, and so are at risk from invasive plants brought in by visitors. They are also at risk from invasive plants such as knotweed, which colonizes areas downstream of the original infestation along streams. Wetlands can be inundated with water year-round, and others are wet only seasonally. The areas that are wet only seasonally can be infested with upland invasive species, as well as invasive plants specifically adapted to wetlands.

Municipal Watersheds and Domestic Water Supplies

A municipal supply watershed is one that serves a public water system as defined in Public Law 93-523 (Safe Drinking Water Act) or as defined in State safe drinking water regulations. The municipal water supply in the Project Area is Mill Creek Watershed, which serves Walla Walla Washington. Biological controls are being used to treat the 153 acres of yellow starthistle mapped within the watershed at this time. No chemical treatments are proposed within the Mill Creek Watershed.

The city of Pendleton uses water from the North Fork of the John Day River and the Dale administrative site has a domestic water right on Desolation Creek There are also wells and springs used for domestic water at campgrounds and private water rights on isolated springs on the Forest.

Roads

The R6 2005 FEIS describes roadside ditches as herbicide delivery mechanisms, potentially posing a high risk of herbicides reaching concentrations of concern for listed aquatic species (USDA Forest Service, 2004). Ditches may function as extensions of the stream network. Roadside ditches can act as delivery routes or ephemeral streams during high rainfalls, or as settling ponds following rainfall events.

According to the 2004 Umatilla Forest-Scale Roads Analysis Report, the entire road system is fundamentally hydrologically connected to the stream system because roads are part of watersheds; however, most of the Umatilla National Forest system roads comply with regional road standards in that drainage structures, which divert runoff away from streams, are in place. The Forest roads that remain hydrologically connected capture and release snow and rain, alter patterns and direction of runoff, erosion rates and processes, and can expand the channel network affecting routing of stream discharge. The most hydrologically connected roads cross streams or are located in floodplains and wetlands. For this project, roads within RHCAs are considered hydrologically connected to streams.and at risk for delivery of herbicides to streams. Of the 836.2 miles of road within invasive plant sites, 183 miles (21%) are within RHCAs.

Invasive Plants within RHCAs

Most of the invasive plants are not unique to riparian areas. Table 36 shows acres of invasive plants within RHCAs of both perennial and intermittent streams. Of the 5560 acres infested with invasive plants within PACFISH Riparian Habitat Conservation Areas (RHCAs) only reed canarygrass is specifically a riparian species. All the invasive plant species found within the RHCAs originate from disturbed sites. For example diffuse knapweed, which most often establishes on disturbed sites, is the most common species within the RHCAs of both perennial and intermittent streams.

There are 9,968 acres of diffuse knapweed on the Forest with about 25 percent found within RHCAs. This species is commonly found in open disturbed areas along roads or in areas frequented by cattle. Hounds tongue and spotted knapweed are also found on these sites.

Table 36 - Documented Invasive plants acres within RHCAs.

Primary invasive Plant	Acres within Perennial Stream RHCA	Acres within intermittent Stream RHCA	Total Acres	Percent Perennial	Percent Intermittent
Canary reedgrass	0.1	0.0	0.1	100.0	0.0
russian knapweed	0.0	0.2	0.2	2.3	97.7
rush skeleton weed	0.3	0.0	0.3	88.9	11.1
musk thistle	0.9	1.1	2.0	45.1	54.9
scotch broom	0.0	2.2	2.3	1.3	98.7
medusahead	0.6	2.4	2.9	19.1	80.9
yellow toadflax	6.9	12.0	18.9	36.3	63.7
tansy ragwort	3.4	17.0	20.4	16.6	83.4
leafy spurge	12.5	13.8	26.4	47.5	52.5
dalmation toadflax	7.2	21.2	28.4	25.4	74.6
whitetop	53.3	35.6	89.0	59.9	40.1
common burdock	69.8	56.3	126.1	55.3	44.7
yellow starthistle	39.7	133.2	172.9	23.0	77.0
sulfur cinquefoil	47.2	145.6	192.8	24.5	75.5
scotch thistle	93.8	110.4	204.2	45.9	54.1
canadian thistle	72.5	393.0	465.5	15.6	84.4
st. johns wort	124.4	453.6	577.9	21.5	78.5
spotted knapweed	283.1	397.6	680.7	41.6	58.4
hounds tongue	122.9	563.9	686.9	17.9	82.1
diffuse knapweed	760.9	1501.8	2262.7	33.6	66.4
	1699.4	3861.1	5560.5	30.6	69.4

There are 24,649 acres within identified invasive plant sites on the Forest. Most watersheds have less than 1 percent of their area with infested acres. Meacham Creek is the only watershed with more than 2 percent infested.

Temperature- Stable banks tend to provide more shade which helps reduce water temperature. While invasive plants may provide some shade they are replacing native forbs and grasses that are better bank stabilizers and promote narrower-deeper channels. Such channels have healthier temperature gradients than wide, shallow streams.

Sediment- Reed canary grass is the only invasive riparian species presently identified on the Forest. At one time Reed canarygrass was seeded at culverts for bank stability of streams and as cattle forage. At this time it is found along many Forest streams. However, only one 0.1 acre of Reed canarygrass is proposed for treatment. This treatment area is near Sheep Creek just upstream from the confluence of Sheep Creek and Grande Ronde.

While the other invasive plant species found on the Forest are primarily upland species, they can colonize a range of sites and are present within many PACFISH defined RHCAs.

One of the more prevalent species on the Forest and within RHCAs is knapweed. Diffuse and spotted knapweed is found along many streams in the Forest. Lacey et al. (1989) reported higher runoff and sediment yield on sites dominated by knapweed versus sites dominated by native grasses.

Channel Morphology and Riparian Condition - In the Forest there are approximately 5,560 acres of invasive plants within in RHCAs (See Table 31 in Section 3.5.2). The largest amount of acres of invasive plants within RHCAs in a single 5th field watershed is 606 acres in Wall Creek. The smallest amount is one acre in the Lower North Fork John Day River.

Native riparian vegetation plays a key role in forming aquatic habitat for fish and other aquatic species. Tree roots help stabilize stream banks, preventing accelerated bank erosion and providing for the formation of undercut banks, important cover for juvenile and adult fish. Riparian areas with native vegetation supply downed trees (large wood) to streams. In turn, downed trees in streams influence channel morphology characteristics such as longitudinal profile; pool size, depth, and frequency; channel pattern; and channel geometry. Turbulence created by large wood increases dissolved oxygen in the water needed by fish, invertebrates and other biota. Invasive plants could slow down or prevent the establishment of native trees, decreasing or delaying the future supply of large wood in stream channels (USDA Forest Service, 2005 Regional FEIS).

While invasive grasses and forbs would not directly replace riparian shrubs, in degraded areas where shrubs are no longer present, invasive plants can occupy sites and out-compete native vegetation, limiting opportunities for native shrubs to reoccupy the site.

Floodplains and Wetlands- The Forest SRI (Soil Resource Inventory) shows approximately 2,820 acres of invasive plants proposed for treatment on soils associated with riparian areas. Most are associated with stream channels or floodplains. About 780 acres of invasive plants have been identified for treatment within wet grass lands. No treatment would occur in water; but may take place if these areas become dry during the summer

3.4.3 Environmental Consequences

With the exception of aerial spraying herbicides, all alternatives, including the No Action Alternative, allow similar methods of treating invasive plants. Alternative B has the most aggressive management using herbicides. Alternative C omits broadcast spraying in the Riparian Habitat Conservation Areas (RHCAs). Alternative D omits aerial herbicide application. In addition, all the action alternatives include an early detection rapid response (EDRR) process to address new or unknown infestations over the next 10 to 15 years. Project Design Features such as riparian buffers, frequency of application limitations, and herbicide limitations specific to soil type, lower the risk of chemical contamination to RHCAs. These protective measures would work equally well for EDRR site that would be identified in the future. It is important to acknowledge that aerial and ground broadcast methods have higher risk for unknown variables such as wind drift and rainfall intensity. No herbicide application would occur within municipal watersheds or on domestic water supplies under any alternative. Water contamination risk from herbicide drift, runoff or leaching is low based on evaluation using GLEAMS modeling and added herbicide restrictions. No long term impacts to soils are expected at the Forest scale, although some adverse effects from these actions are unavoidable. Adverse impacts include local effects on some groups of micro-organisms that may be temporarily sensitive to picloram (Tordon), sulfometuron methyl (Oust), and triclopyr (Gralon, Access).

The following sections discuss the general effects of manual, mechanical and herbicide treatments on soil and water resources. Specific differences in alternatives are detailed after the general discussion.

Soils

General Effects of Manual and Mechanical Treatment

Manual and mechanical treatments are proposed under all alternatives. The overall impacts of these activities are low. Manual methods would decrease ground cover**,** temporarily leading to incremental effects from erosion or slight decreases in soil moisture from groundcover reductions. Mechanical methods would not lead to adverse effects on soils since soil organic matter would be supplemented from cut vegetative material.

Public scoping issues about these treatments were not raised. Manual treatments, such as lopping or shearing, cause an input of organic material (dead roots) into the soil. As the roots are broken down in the soil food web, nutrients would be released. Rainfall may cause these nutrients to be lost to surface runoff or to groundwater. Bare soils combined with high nutrient levels may provide ideal conditions for the establishment of many invasive species. However, in lower intensity infestations, non-target vegetation could provide erosion control as well as a seed source for establishing native vegetation. In areas with larger amounts of bare soil, PDFs require restoration activities to reestablish native vegetation. The intent is to re-establish competitive local, native vegetation post-treatment in areas of bare ground, to control soil erosion and provide native competition to invasive plant seeds.

Removal of plant roots will break mycorrhizal hyphae in the soil and probably cause a transient reduction of mycorrhizal function. Studies on crop plants have shown that leaving an undisturbed mycorrhizal network in the soil after harvest (e.g. zero-till agriculture) increases the nutrient uptake of the subsequent crop (Evans and Miller, 1990). Establishment of native plants may be more successful on undisturbed soil. Indirect negative impacts from manual control could be attributed to soil disturbance and opening of the canopy (understory or depending on the species). This could cause minor and transient shifts in microsite condition such as reduction in soil moisture, disruption of mychorrhizal associations and cause an increase in surface temperatures. As the treatment areas associated with this project are generally in previously disturbed sites, treatment would improve the condition of the site by allowing reestablishment of native vegetation.

Manual and mechanical treatments may slightly increase the potential for delivery of fine sediment to streams the year after treatment**.** Removal of surface cover could cause minor localized erosion trapped by surrounding vegetation for approximately one season until vegetation becomes reestablished.

Using mowing equipment on existing roads would not further impact soils. Mowing or use of foaming or steaming machines off roads has the potential to compact soil. Soil compaction eliminates soil pores and so reduces water infiltration, aeration, and the ability of plants to root effectively. To avoid this effect, all vehicles except ATVs would be required to remain on roads or trails. ATVs could be used in meadows or other open areas to carry herbicide to chemically treat invasive plants. As ATVs are light weight machines and would be used when soils were dry, their use is unlikely to compact soils.

While the relative amounts of manual and mechanical treatments vary between the alternatives, the differences in terms of intensity or duration of effects from such treatments have no substantive differences. Other mechanical treatments, such as the use of motorized hand tools are expected to have effects similar to manual treatments.

General Effect of Biological Control

Biological control can be defined as the use of natural enemies to reduce the damage caused by invasive plant populations. Biocontrol is often viewed as a progressive and an environmentally friendly way to control pest organisms because it leaves behind no chemical residues that might have harmful impacts on humans or other organisms. When successful, it can provide essentially permanent, widespread control with a very favorable cost-benefit ratio. For example, bio-control releases on yellow starthistle and diffuse knapweed have shown positive control results on Walla Walla District in the past (J. Mitchell, 2006). Bio-control agents previously released and established on the Forest will continue to spread to other nearby invasive sites providing a potential long-term control treatment.

The primary effect from biological controls is standing dead plants. There would be intangible changes to soil or water resources from any biological control considered on the Forest.

General Effects of Cultural Treatments

No cultural treatment sites are presently identified within the treatment areas. Cultural treatments of newly found invasive species sites could include the addition of fertilizer/soil amendments, and/or competitive planting.

General Effects of Herbicides on Soils

The effect of chemical treatments may affect soils by having short term adverse impacts on certain soil microbes and indirectly from losses in vegetative cover. Most of the proposed chemicals are decayed primarily by soil microbes. Only Chlorsulfuron is mainly degraded through hydrolysis. In the short term, chemicals can adversely affect microbial growth for 1 day to 1 week depending on the chemical used. Results from field and laboratory testing are mixed since soil conditions are highly variable. In general, herbicides are decayed and therefore effects are reduced when microbial metabolic rates highest. These conditions are when adequate warmth, moisture and microbial substrate are abundant such as during spring.

The effect of a chemical treatment on the soil depends on the particular characteristics of the chemical used, how it is applied, and the physical, chemical and biological condition of the soil medium. These characteristics were used to form Project Design Features to minimize adverse effects from the use of herbicides to soil. Picloram, clorpyralid, and sulfometuron methyl are excluded from use on coarse grained soils due to the risk for groundwater and nearby waterway contamination. Chlorsulfuron was excluded from treatment on high clay soils since sheet wash particular to this soil type spreads the herbicide to nontarget soils and vegetation in addition to nearby waterways.

In general, primary herbicide routes in soil are leaching, hydrolysis, adsorption/desorption onto soil particles, and biological degradation. Soil characteristics affect the herbicide residency time through drainage and adsorptive capacities. Highly drained soils have greater propensity to transfer herbicides to groundwater stores.

Organic rich soils and finer texture soils have higher adsorption potential for holding herbicides. Herbicides will vary in the degradation potential based on their chemical structure and the biologic potential of the soil.

Overall, the proposed herbicide types and application rates are low enough to facilitate decay by soil microbes. The proposed herbicide usage would have a low risk for soils since the bulk of treatments focus on roads and rock quarries where soils are unproductive and soil communities are uniform. Adverse effects may occur where diverse native grasslands are treated with unselective herbicides and broadcast methods. These impacts are related to the short term loss of non-target broadleaf forbs that support diverse soil communities.Soil attributes at greatest risk from chemicals include damage to soil organisms and erosion from removal of ground cover. A more extensive discussion of the individual herbicide properties can be found in Appendix B. Also, see the native plant community discussion in the botany report.

Herbicide Effects to Soil Organisms

The low application rates and type of herbicides proposed in general have a low impact on soil organisms. However, Picloram (Tordon) is known to affect soil organisms at the approved application rates (SERA 2004). At high rates, sulfometuron methyl (Oust) and Tryclopr (Gralon, Access) can affect soil microbes. Sulfometuron methyl can inhibit soil microbial growth. Tryclopr may adversely affect some fungi and algae. Effects are short term and transitory since effects decrease with time. Functional groups of microbes that have similar metabolic pathways as the target weeds would be most sensitive to the herbicides. However, collective adverse effects of the proposed herbicides on soil microbes are hard to predict, given the diversity of the soil community and varying resistance to the particular herbicides. For example, some laboratory studies found glyphosate adversely impacted several types of microbes, although populations rebounded quickly (Tu et al 2003). Similarly, Busse et al (2001) found no long term impact on microbial communities when using glyphosate on ponderosa pine plantations.

Ultimately, soil microbes facilitate the degradation of the herbicides by using the herbicides as growth substrate, cometabolizing, polymerizating, accumulating or altering the chemical structure by influencing the pH of the soil environment (Bollag andd Liu 1998). The residency times are a gross collective function of average soil types, application timing and frequency, and finally the unique chemical structure. Of the herbicides, Imazapr has the longest half-life at 1 year, while Sethoxydim has a comparitively rapid half-life from 5 to 25 days. As stated above, favorable microbial growth conditions will speed herbicide degradation.

Soil Cover

The treatment of sites with herbicides could also indirectly affect site productivity in the short term through changes in total organic production on site and annual input into the soil. These effects would be most pronounced on sites heavily infested with invasive plants moving toward monocultures, including those with medusahead or houndstongue. Chemically treated plants would die and become incorporated into the soil as organic matter during the first years following treatment. Annual input in subsequent years would be limited by the number of non-target species interspersed between invasive plants or the rate at which vegetation returned to the site**.** If native populations were low native species would be seeded after treatment under all action alternatives.

Physical Properties of Herbicides

Factors that determine the fate of herbicides in soil include mobility and degradation. Herbicide degradation over time is a result of physical and chemical processes in soil and water. Herbicide fate in soil is determined by herbicide characteristics such as adsorption, solubility, degradation, and volatility. Soil characteristics such as organic matter, pH, temperature, moisture content, clay content, and microbial degradation are can modify certain properties of herbicides such as mobility in soils and half-life(time it takes for half the amount of chemical present to breakdown). General characteristics for the proposed herbicides are displayed in Table 37. Many of the proposed herbicides are highly soluble in water (Table 37). In general, this is often taken as an indicator of the mobility of the chemical in soils. There are exceptions, however. Glyphosate, while having a high solubility, also binds tightly with soil particles, and because of this it has low mobility. Herbicides with high mobility potential and long half-lives have a greater potential for leaching into near surface ground water.

Table 37 - Herbicide Properties

Herbicide	Toxicity to Soil Microbes	Potential Mobility1	Water Solubility1	Degradation path and half life2	Activation Mechanism2
Chlorsulfuron	Low	High Very high in clay soils	Very High	Hydrolysis 40 days	Acetolactate synthesis inhibitor (Selective: controls broadleaves and some grasses)
Clopyralid	Low	Very high especially in sandy soils	High	Soil microbes 14 to 29 days	Plant growth regulator (Very selective to broadleaves; post emergent)
Glyphosate	Low	Low	Very High	Soil microbes 30 days	Inhibits 3 amino acids and protein synthesis (Non-selective; quickly absorbed by leaves with rapid movement through plant; no root absorption)
Imazapic	No info	Medium (Lower with increased organic Matter)	Very High	Soil microbes 113 days	acetolactate synthesis inhibitor (Uptake by roots & leaves; active in soil as pre-emergent)

Herbicide	Toxicity to Soil Microbes	Potential Mobility1	Water Solubility1	Degradation path and half life2	Activation Mechanism2
Imazapyr	Slight at high application rates.	Medium (low Organic Matter and high pH raise mobility)	Very High	Soil microbes 25 to 180 days	acetolactate synthesis inhibitor (Uptake by roots & leaves; active in soil as pre-emergent)
Metsulfuron methyl	At high application rates short-term decrease for a few days but reversed quickly.	Very High	High	Slow microbial degradation at high pH, fast at low pH Up to 120 days	acetolactate synthesis inhibitor (Potent herbicide; uptake by roots & leaves)
Picloram	Toxic to some soil organisms, even at low levels.	Very High	Very High	Slow microbial 90 days	Plant growth regulator (Selective: rate and season dependant; pre-emergent and soil active)
Sethoxydim	Low	Medium (Organic Matter decreases)	Very High	Rapid microbial Up to 60 days	Inhibits acetyl co-enzyme (ACE) (Systemic that is absorbed rapidly by foliage and roots.
Sulfometuron methyl	Toxic to soil organisms. Soil residues may alter composition of soil microorganisms	High	Medium	Soil microbes 10 to 100 days	Acetolactate synthesis inhibitor (Non-selective pre and post emergent - uptake by roots & leaves. Potent herbicide;)
Triclopyr	Inhibits algae at low rates Toxic to fungi at high rates.	Very High	Medium	Soil microbes 46 days	Plant growth regulator (Absorbed thru roots, foliage and green bark)

1 Mobility and water solubility categories from Bautista and are general breakdowns not a definitive classification
2 Deschutes Ochoco Invasive Plant EIS Soils Report, 2006

Summary of Soil Concerns with Specific Herbicides and Project Design Features

Clopyralid has high potential mobility in sandy soils. It is degraded by soil microbes not hydrolysis and therefore can be persistent in groundwater. PDF H5 - To minimize movement of clopyralid through soils into groundwater, clopyralid would not be used on high-porosity soils (more than 20 percent coarse fragments or coarser texture than loamy sand).

Chlorsulfuron does not adhere to clay particles. PDF H6 - chlorsulfuron would be avoided on soils with high clay content (finer than loam) to avoid herbicide movement.

Picloram and sulfometuron methyl persist longest in the soil and may also have adverse effects on soil organisms. Therefore, the PDFs H7 and H8 limit the frequency of use of these herbicides under all action alternatives, and prohibit their use on shallow or coarse soils to lower the risk of contact with groundwater. The Proposed Action avoids use of picloram sethoxydim, nonaquatic glyphosate and triclopyr bee on roads having high potential for herbicide delivery.

Water

Streams are complex and dynamic systems that reflect the balance between stream flow, sediment input and substrate/bank composition. Riparian condition and water quality are the two elements potentially affected by invasive plant treatments.

General Effects of Manual and Mechanical Treatment

Mechanical treatments except for mowing would take place away from water. Mowing would occur only along established roads. Manual effects are generally cutting, digging or pulling weeds. If seeds are present the weeds are bagged and taken off site. Removal of soil cover would be very small under these circumstances. However there could be small localized areas of erosion and subsequent sediment input to the stream. These effects would be transitory and too small to measure.

Pulling weeds along stream banks could also destabilize the banks in highly localized areas. As only 4.4 acres of hand treatments over 10 sites are planned within the aquatic influence zone only localized effects would be expected, lasting only about one season until vegetation reestablished. Manual and mechanical treatments within riparian areas could accelerate sediment delivery to streams through ground disturbance. However, most of the treatments areas are previously disturbed roadways and trails so additional ground disturbance would not be a significant change from the existing condition. Modification of surface ground cover can also change the timing of run-off. For all alternatives, treatment areas comprise a small portion of any watershed so no effects to stream flows are plausible.

General Effects of Herbicide Treatments

None of the alternatives have the potential to influence stream flow and channel morphology due to the small portion of any watershed that would be treated.

Treating invasive plants would improve riparian stability where invasive plants have colonized along stream channels and out-competed native species. All invasive plant treatments carry some risk that removing invasive plants could exacerbate stream instability; however the restoration plan accounts for these areas and prescribes mulching, seeding and planting as needed to revegetated riparian and other treated areas.

A primary issue is the potential for herbicides to enter streams and impact domestic water sources and/or aquatic organisms. This section describes how Project Design Features minimize the possibility that herbicides would enter water and impact water quality.

Based on the R6 2005 FEIS, herbicides were grouped by their level of concern to aquatic resources. The herbicides of lower concern for aquatic resources are: clopyralid, imazapic, and metsulfuron methyl. The herbicides of moderate concern are chlorsulfuron, imazapyr, sulfometuron methyl. The herbicides of greatest concern are non-aqueous glyphosate, triclopyr, picloram, and sethoxydim. The aquatic formulations of glyphosate, triclopyr, and imazapyr may have more adverse effect effects to aquatic resources than the low concern herbicides but are licensed for use near or in water. Streamside buffers vary depending on the level of concern and label requirements.

Drift, Run-off and Leaching

The routes for herbicide to contaminate water are; direct application, drift into streams from spraying, runoff from a large rain storm soon after application, and leaching through soil into shallow ground water or into a stream. This section addresses each of these delivery routes.

No direct application of herbicide to water is intended under any alternative. No emergent plants would be treated under any alternative.

Effects from drift, runoff and leaching were considered in the herbicide risk assessments, prepared for the R6 2005 FEIS, and assume broadcast treatments occurr directly adjacent to streams. The Groundwater Loading Effects of Agricultural Management Systems (GLEAMS) model was used to estimate the amount of herbicide that may potentially reach a reference stream via runoff, drift and leaching in a 96 hour period, assuming broadcast treatments on a 50-foot strip along about 1.6 miles of perennial stream. SERA risk assessments evaluated the hazards associated with each herbicide based on the concentrations of herbicide predicted by the GLEAMS model using these parameters. The GLEAMS model likely overestimates the herbicide concentrations that would plausibly enter streams from this project. This is because broadcast treatments are prohibited within 100 feet of all perennial streams and within 50 feet of intermittent streams under all action alternatives. To minimize adverse effects to streams, Project Design Featues (primarily stream buffers) were developed depending on the herbicide and the method of application.

Spot treatments using herbicides of higher concern to aquatic organisms along streams would be buffered. Hand and spot treatments are inherently far less likely to deliver herbicide to water because the herbicide is applied to individual plants, so drift, runoff and leaching are greatly minimized. Small amounts of some herbicides can trans-locate from the plant to the soil or an adjacent plant, but the concentrations of herbicide that may be delivered to streams from this mechanism is much less than GLEAMS predictions.

Berg (2004) compilation of monitoring studies on herbicide treatments with various buffer widths showed that any buffer helps lower the concentration of herbicide in streams adjacent to treatment areas. In California buffers between 25 and 200 feet generally had no detectable concentrations of herbicide in monitored streams with detection limits of 1-3 mg/m3.

In South Carolina, ground applications of the herbicides imazapyr, picloram and triclopyr had no detectable concentrations of herbicide in monitored streams with buffers of 30 meters (about 100 feet) (USDA HFQLG EIS, Appendix B, 2003). No detection limits were given.

The USGS in partnership with the Oregon Department of Transportation studied runoff of herbicides along roads (Wood, 2001). The study was conducted on runoff associated with several herbicides (including sulfometuron methyl and glyphosate) along a road in western Oregon simulating rainfall at 1/3 inches an hour at 1, 7 and 14 days after treatment. Samples were collected at the shoulder of the road and found concentrations of several hundred ppb of sulfometuron-methyl and nearly 1,000 ppb of glyphosate that could potentially leave the road shoulder.

In the fall the road was again sprayed and the ditch line of the road was checked during natural rainstorms for three months. Sulfometuron-methyl was found in concentrations of 0.1 to 1 parts per billion (ppb) along the shoulder and from 0.3 to 0.1 in the ditch line but was below detectable limits in the stream. Glyphosate was not found at the shoulder, ditch line or stream.

This study indicates that the greatest risk of herbicides moving off site is from large storms soon after herbicide application. In addition, this study also indicates that sulfometuron methyl may persist in the environment as it was detectable along the shoulder of the road (but not in the stream) the duration (three months) of the study.

Berg reported that herbicide applied in or along dry ephemeral or intermittent stream channels may enter streams through run-off if a large post-treatment rainstorm occurred soon after treatment. This risk is minimized if intermittent and ephemeral channels are buffered as would occur under the action alternatives (ibid.). If a large rainstorm occurs after herbicide application, sediment contaminated by herbicide could be carried into streams. As most herbicide application occurs in the late spring through the early fall, which is the driest time of the year, the probability of a large rainstorm soon after application of herbicides is low at any particular site.

Aerial Application

Wind drift is the mechanism most likely to carry herbicide to nontarget areas such as stream channels. This is primarily dependent upon the elevation of the spray nozzle, droplet size and air movement. The smaller the droplet, the longer it stays suspended and the farther it can travel.

Spray drift can be reduced by increasing droplet size (Table 38). Droplet size can be increased by: 1) reducing spray pressure; 2) increasing nozzle orifice size; 3) using special drift reduction nozzles; 4) additives that increase spray viscosity and; 5) using rearward nozzle orientation in aircraft.

Commercial drift reduction agents are available that are designed to reduce drift beyond the capabilities of the determinants described above. These products create larger and more cohesive droplets that are less apt to break into small particles as they fall through the air. Project Design Feature F6 requires a coarse spray with a median diameter of 500-800 microns.

Table 38 - Drift Distance versus Drop Diameter

Droplet Diameter (microns)	Type of Droplet	Time	Lateral Distance Traveled in 10 foot height & 3 mph wind speed
5	Fog	66 minutes	3 miles
20	Very Fine Spray	4.2 minutes	1,100 feet
100	Fine Spray	10 seconds	44 feet
240	Medium Spray	6 seconds	28 feet
400	Coarse Spray	2 seconds	8.5 feet
1,000	Fine Rain	1 second	4.7 feet

Source http://www.ag.ndsu.edu/pubs/plantsci/weeds/a657w.htm#factors

Copy of source available in project record

Washington State Department of Ecology and Oregon Department of Forestry have monitored aerial application of herbicides in forest settings. The purpose of both studies was to look at the effectiveness of buffers protecting water quality in streams within herbicide treatment areas. The Washington study looked at many factors in addition to stream buffers that affected the concentration of herbicides in streams within treatment areas.

The Washington study collected herbicide samples at seven sites on small streams (Rashan and Graber, 1993). Buffers were 50 feet on flowing streams and no buffers on small stream channels assumed to be dry. Peak herbicide concentrations ranged between 0.2 and 7.55 microgram per liter (ug/l). Maximum 24 hour averages were between 0.13 and 3.25 ug/l. Runoff samples collected at 4 sites 2 to 24 days after application had concentrations between 0.17 and 2.49 ug/l.

Oregon requires buffers of 60 feet on fish bearing streams or streams used for domestic water supplies. Two non-fish bearing streams also received 60 foot buffers (actual buffer ranged from 60 to 100 feet). For the Oregon study most of the samples (21 sites, and 105 post spray samples) had a detection limit of 1 ug/l. None of these samples had concentrations at detectable limits. Five sites (25 samples) had detection limits of 0.04 to 0.5 ug/l. Most samples were still below detectable limits, but 7 of the 25 samples tested between 0.9 and 0.56 ug/l (Dent and Robben, 2000).

The Washington study attributed the majority of herbicide introduction in buffered streams to swath displacement, drift and secondary contribution from overspray of small stream channels mistakenly assumed to be dry. This study recommended buffers of between 15 to 25 meters for downwind applications and 75 to 90 meters for streams upwind applications.

All aerial applications of herbicides would comply with Environmental Protection Agency (EPA) label restrictions and state regulations. Using the recommendations above, PDFs were developed to minimize potential impacts to water (See Chapter 2.2.3, Table 6, PDFs E and F)

Accidental Spill

Concentrations of herbicides in the water as a result of an accidental spill depend on the rate of application and the stream ratio of surface area to volume. The persistence of the herbicide in water depends on the length of stream where the accidental spill took place, velocity of stream flow, and hydrologic characteristics of the stream channel. The concentration of herbicides would decrease rapidly down-stream because of dilution and interactions with physical and biological properties of the stream system (Norris et al.1991).

Potential for accidental spills is negligible and therefore not considered within the scope of the project. The Project Design Features to reduce the potential for spills are practices that have been developed over time and proven effective. If an accident were to occur, these PDFs would minimize the magnitude and intensity of effects. An herbicide transportation and handling plan is a project requirement. This EIS addresses spill prevention and containment (See Chapter 2.2.3, Table 6).

Lakes, Wetlands and Floodplains

Herbicides affect lakes and wetlands differently than streams. Dilution by flow or tributary inflow is generally less effective in lakes.

Dilution is partially a function of lake size, but dilution could be rapid in small lakes with large water contributing areas. Decreases in herbicide concentration in lakes, ponds, and other lentic water bodies are largely a function of chemical and biological degradation processes or preferential adsorption of the herbicide into the lake sediments rather than from dilution. As no emergent treatments are proposed the primary pathways for herbicide to enter lakes would be from drift or runoff.

Some invasive plants may grow in wetlands or near lakes and reservoirs. To protect water quality, PDFs require that only spot or hand treatments occur within 100 feet of lakes or wetlands. A large rain event after treatment could carry herbicide into water resulting in minor amounts of herbicide contacting surface water. This amount would insignificant compared to concentrations modeled with GLEAMS and well under any threshold of concern.

To minimize risk to wetlands no more than 10 acres or half of a wetland would be treated in any 30-day period. The PDFs for wetlands limit the area treated at one time for two reasons:

1. They lower the amount of herbicide near the water body at one time and allow time for the herbicide to degrade. Many of the herbicides degrade quickly in soils high in organics or in water.

2. If only half an area is treated at a time it lowers the acreage affected by vegetation decay and leaves refugia for aquatic organisms in other areas around the lake, pond or wetland. No treatments are proposed to take place directly in water. Wetlands would only be treated if and when they dry out.

Small, unmapped ponds found during implementation planning would have the same PDFs on herbicide use within 100 feet of the pond.

Emergent Vegetation

There is no treatment of emergent vegetation proposed under any alternative.

Municipal Watersheds and Domestic Water Supplies

No herbicide application would occur within the municipal watershed under any alternative. The yellow star thistle would be treated with biocontrol under all action alternatives.

Other water supplies such as wells or springs at campgrounds would be buffered from herbicide application to protect water quality. *H13- Herbicide use would not occur within 100 feet of wells or 200 feet of spring developments as required by Washington states WAC 246-290-135. Oregon has no specific requirements.)*

Comparison of Alternatives

Chapter 2 of this document offers a more detailed alternative comparison.

Table 39 - Comparison of Acres Treated by Alternative

Treatment Methods	Alternative A No Action[1]	Alternative B Prop Action	Alternative C No Broadcast in RHCA	Alternative D No Aerial herbicide treatment
	Acres			
Upland Areas				
Manual and/or mechanical and/or ground based Chemical (broadcast and/or spot)	1,252	14,456	14,456	15,131
Treatments in Riparian Habitat Conservation Areas[2,3]				
Manual, mechanical, ground based chemical broadcast and/or ground based chemical spot treatment	0	2743	0	2743
Manual, mechanical and/or ground based chemical spot treatment only (including wicking and wiping) no broadcast allowed	522[1]	2817	5,560	2817
All Areas				
Bio-Control only	1339	3917	3917	3917
Manual only	41	41	41	41
Aerial only	0	675	675	0
Total Acres Treated	**3,154**	**24,649**	**24,649**	**24,649**

1No action alternative includes '95 EA and all amendments to the document. Restrictions on herbicide us under this alternative allows no chemical application within 100' of streams or standing body of water.
2Riparian Habitat Conservation Areas (RHCA) as designated under PACFISH, INFISH
3Riparian acres are included within the total acres treated.

Alternative A – No Action

Direct and Indirect Effects to Soils

Manual, Mechanical, Cultural and Biological treatments would continue under the existing NEPA decision from the 1995 *Umatilla National Forest Environmental Assessment for Managing Noxious Weeds.* Under this alternative less than seven percent of known sites would be treated with herbicide, leaving a heavy reliance on manual treatments. Alternative A would continue the use of glyphosate and picloram on up to 1,390 acres a year. There could be a short-term (1 to 2 years) reduction in soil cover for the areas treated. This localized reduction in cover would increase treated areas vulnerability to soil erosion. The effects would be minimal given the poor quality of groundcover provided by the invasive species proposed for treatment, the scattered nature of the treatments and the small amount of land treated, especially within Aquatic Influence Zones. These effects would last approximately one season until vegetation became re-established.

The No Action Alternative allows herbicide treatment only of invasive plant sites identified at the time of the project. Because newly discovered sites can only be treated manually or mechanically, it is expected that invasive plants would continue to spread. This would increase the number of acres negatively affected by invasive plants. These effects are described above in the Affected Environment section of this EIS.

Adverse impacts to soils may occur where some noxious weeds are left to populate. Alternative A has a much less agressive strategy for addressing this weed spread. Specific changes to soil nutrient regimes are associated with large spotted knapweed infestations (Lejeune and Seastedt 2001), and allelopathic influences (Bais et al 2003); in addition to changes in surface hydrology where the plant communities are moved from bunchgrass dominated to taproot forb dominated (Lacey 1989). Similarly, the influx of cheatgrass (Bromus tectorum) can alter soil dynamics with changes in structure, nutrient pulses and soil moisture status (Norton et al 2003). These changes may be coincident with the long term shifts from perennial grasslands to annual grasslands as documented in California (D'Antonio and Vitousek 1992). Other noxious weed species may have similar impacts as demonstrated by Vinton and Burke (1994) where fertilization caused long time shifts to favor weedy forb species.

Adverse tradeoffs with Alternative A, in this case the risk of nontreatment, would be highest for Centaurea spp and others that can spread into relatively undisturbed grasslands (see Tyser and Key 1988). These tradeoffs are weighed by addressing spread rate versus the impact from treatment (D'Antonio et al 2004); especially in regards to affecting nontarget plant species (see Ortega 2005b).

The botany report discusses dry grasslands and shrublands that have the greatest risk for invasion of these species. Highly disturbed sites are not as critical since prior disturbance has offset soil community structure to favor fast growing species as demonstrated with old field succession studies. Forest standards 12 and 13 (USFS 2005b) would be used to establish long term strategies for controlling invasives where treatments are applied.

Cumulative Effects

This alternative is covered under previous NEPA projects. Treatments would occur on an extremely small percentage of any watersheds in the Project Area. Direct and indirect effects are so insignificant and temporary that treatment under No Action could not plausibly contribute to significant cumulative effects.

Alternative B – Proposed Action

Direct and Indirect Effects to Soils

Herbicide treatments are proposed for 20,691 of the total 24,649 acres inhabited by invasive plants. Approximately 4000 acres of treatment are expected to occur annually (budget allowing). Aerial and broadcast application methods have more potential than other application methods to contact soil, and affect soil organisms and/or productivity. Therefore, Alternative B has the highest tradeoff between having the most effective elimination of noxious weeds while having the highest risk for affecting non-target vegetation and soils.

Herbicide application is favored in high traffic areas such as road corridors or where high disturbance occurs such as trailheads, stock yards or old agricultural areas. Approximately, 11,753 acres is planned for herbicide treatment along travelways. Herbicide application is intended at regular intervals due to the sustained risk. In these highly disturbed areas, soil communities are largely uniform and function well under disturbed conditions; therefore, impacts are not anticipated.

Where native communities are largely intact the tradeoff is less apparent. Habitats that may be affected are the highly invasible dry grassland. Approximately, 2,505 acres are slated for broadcast spraying within the 3,068 acres of dry grassland on the forest. The mixed conifer and shrubland plant communities are more resistant to effects of herbicides because they have fewer, sensitive herbaceous species. Sylivia and Jarstfer (1997) found that after three years, pine trees in plots with grassy weeds had 75 percent fewer mycorrhizal root tips than plots that had been treated three times per year with a mixture of glyphosate and metsulfuron methyl to remove the weeds.

For dry grassland communities, broadcast herbicide application has higher risks associated with the elimination of non-target species. This risk may lead to short term reductions in plant diversity with concomitant impacts to soil microbial communities, especially given that much of the diversity may be represented by forb richness (Pokorny et al 2004). Ortega et al (2005a) showed sustained losses of arrowleaf, balsaroot and other native forbs over three years of monitoring in fescue grassland in Montana. Further, the risk for spraying one target species must be balanced with the risk for invasion by another species. Ortega has preliminary findings with winter range restoration that suggest cheatgrass is increasing in response to spraying for spotted knapweed (Ortega 2005b). To address this risk, the Umatilla NF is directed to the long term strategy of weed managment of Forest Standards 12 and 13 of the Forest Plan (USFS 2005b).

For the dry grasslands, the knapweeds and star thistle have very high invasive potential. Broadcast methods as proposed in this alternative would have the greatest effectiveness in lowering the potential for these noxious weeds to expand in dry grassland habitat, particularly in the southern portion of the forest. Morghan et al (2003) suggested clopyralid would only have short term decreases on nontarget species as long as the spray intervals were greater than one year.

The 675 acres of aerial application sites proposed are primarily for treatment of yellow starthistle and diffuse knapweed. The geology underlying this site is primarily basalt and the associated soil is generally a loam. Clopyralid and picloram are the selective herbicides most effective for these species. Clopyralid would be sprayed because the area contains some conifers and clopyralid does not affect these species. The largest area is approximately 630 acres with slopes ranging from 6 to 56 percent (GIS). This site is next to private land (138 acres) that would be sprayed at the same time. This large site has a higher risk for wind movement of herbicide affected soil due to the nonselective nature of the herbicides, and the aerial application method. However, most of the treatment areas are in open forest of mixed ponderosa pine or grasses. Clopyralid would not affect these species; so much of the treatment areas would retain some vegetative covering to protect the soil.

Of the ten herbicides approved for use in Region 6, picloram and sulfometuron methyl pose risks to soil microorganisms and are most persistent in the soil. To protect soil organisms and therefore protect soil productivity, PDFs require sulfometuron methyl would only be used once a year and picloram once every two years. This will prevent accumulation of herbicides in the soils. The intent is to lower the noxious weed population where manual, mechanical or more selective herbicide methods could be used thereafter.

The other herbicides have small to no effect on soil microorganisms at normal application rates and could potentially be used three times on the same area in one year. More than likely, if an area was broadcast sprayed once, subsequent treatments would consist of spot spraying to treat missed areas, to treat areas where seeds have germinated since the last spraying, or to treat the small areas where invasives were damaged but are resprouting.

The Project Design Features limit herbicide uses based on soil textures. For example, chlorsulfuron is not to be used on heavy clay soils (see PDFs in Table 6). If herbicide treatment is necessary near streams or lakes when soils are wet, aquatic-labeled herbicides or those that pose low risk to aquatic organisms would be applied according to label directions and applicable PDFs.

Early Detection Rapid Response

Early Detection Rapid Response (EDRR) is part of all the action alternatives. Under this approach new or currently unknown infestations may be treated using the range of methods analyzed in this EIS on sites similar to those presently proposed for treatment. PDFs would protect soil properties by constraining treatment methods according to site specific conditions.

Cumulative Effects

Soil productivity is protected by the PDF allowing only one herbicide treatment a year of suflometron methyl, which has detrimental effects to soil organisms and therefore soil productivity. Picloram would only be used once every two years to let this persistent herbicide degrade. These herbicides have half-lives of 90 days and 10-100 days depending on soil conditions. While the proposed project has sufficient safeguards to protect soil microbes, this project along with other herbicide treatments occurring on adjacent lands has the potential of multiplying effects. If, for example, an adjacent landowner was aerially spraying picloram and it drifted onto a National Forest site that was broadcast sprayed one month earlier, the cumulative effect could be significant to soil microbes.

It could also potentially be delivered to a nearby stream if the area treated had high clay content in the soil and a significant rain event occurred. While it is not probable that all of those circumstances would occur, it is still possible. If duplicate applications occurred the effects would be localized and small compared to the total Project Area. Furthermore, PDF B1 (see Section 2.3.3) ensures that Forest staff coordinates with owners and managers of neighboring lands. Such coordination would make duplicate treatment a very remote possibility.

Additional cumulative effects may occur where repeated herbicide application change plant community structure. In Ortega’s monitoring (2005b), repeated applications of picloram cumulatively led to an increase in cheatgrass even though knapweed cover decreased. The new forest standards 12 and 13 (USDA 2005b) suggest a long term strategy is used to evaluate these circumstances and restoration considered. Seeding with native and naturalized species may reduce the invasibility of treated sites.Biocontrol agents spreading from adjacent lands onto National Forest system lands would likely have the beneficial effects of reducing weeds. Invasive plants killed by such agents would also contribute organic matter to soils.

Alternative B is unlikely to have significant effects to soil or water resources and therefore is unlikely to approach a threshold of concern, or contribute to significant cumulative effects. No adverse cumulative effects are expected from implementation of this alternative.

Alternative C – No Broadcast within Riparian Conservation Habitat Areas

Direct and Indirect Effects to Soils

The effects of this alternative are the same as for Alternative B except within RHCAs. Where approximately 50 percent of the acres within the RHCA could be broadcast under Alternative B, all 5,560 acres of potential herbicide treatment would be limited to hand or spot spray under Alternative C.

Most of these treatment areas are along roads more than 100 feet from streams. The direct effect would be less potential for herbicide contact with soil. There would be less effect to non target plants that add soil cover. With no broadcast spray within the riparian area there would be less potential effect to soil organisms within these areas.

Cumulative Effects

Cumulative effects are the same as discussed under Alternative B.

Alternative D – No Aerial Application

Direct and Indirect Effects to Soils

The effect of this alternative would be the same as for Alternative B except for 675 acres proposed for aerial application. These areas would be treated by other methods. Region 6 Invasive Plant FEIS considers aerial spraying a higher risk than other methods due to potential for drift to nontarget areas. As aerial spray is generally a broadcast method, more herbicide contacts soil than from spot treatments. This alternative is designed to use more targeted methods to treat these areas. More targeted methods mean less contact of herbicide to soil so less chance of effecting soil organisms in these areas. There would be less chance of damage to nontarget plants and soils, thus this alternative would have less potential to negatively affect soil biological communities and protective groundcover.

Cumulative Effects

Cumulative effects are the same as discussed under Alternative B.

Effects to Water Resources

Alternative A – No Action

Direct and Indirect Effects to Water Resources

Under this alternative no additional management of invasive plants would occur other than what is identified under the existing 1995 EA decision for the Umatilla NF to Manage Noxious Weeds, except manual and mechanical treatments, which can occur anywhere. No aerial application of herbicides is allowed. Invasive plants would continue to grow on sites where their treatment is currently not authorized by a NEPA analysis. Invasive plants are often less effective for stream bank stabilization than deeper rooted native plant species. Most invasive plants also provide less stream-shading than native hardwoods and conifers.

No herbicide application takes place within 100 feet of water under this alternative. Under this alternative there is negligible chance of herbicide drift into streams. Only two herbicides are available for use under this alternative. Picloram is of high concern for aquatic resources but preferred in some situations because it is a selective herbicide which kills only certain plants and has a residual effect to repress reestablishment of target invasive species. Glyphosate is the other choice, is nonspecific and kills all vegetation.

Cumulative Effect

This alternative is covered under previous NEPA projects. Treatments would occur on an extremely small percentage of any watersheds in the Project Area.

Potential direct and indirect effects from treatments are so insignificant and temporary that treatment under No Action does not contribute to significant cumulative effects. Lack of treatment would allow the continued spread of invasive plants and the associated changes in ecosystems.

Alternative B – Proposed Action

Direct and Indirect Effects to Water Resources

Up to 5,560 acres of treatment, including chemical treatment could take place in RHCAs. Almost 50 percent could be broadcast sprayed and the other 50 percent treated by spot or hand methods. In reality, most of these areas have only discontinuous infestations of invasive plants, but, as acres of infestations change year to year; analysis is done as if all acres within a treatment area are infested.

None of the treatments are extensive enough under any alternative to effect peak flows, low flows or water yield. Methods used for treatment would have negligible effect on water infiltration into soil and associated surface runoff. No 5th field watershed has more than 2.5 percent proposed for treatment and most have less than one percent. This amount is much too small an area to show effects to flows from treatment.

Generally, small areas would be treated along streams. As most invasive plants provide little shade, removal of these plants is unlikely to have any measurable effect to stream temperature. As these methods target individual plants, the risk from spot or hand application of herbicides to native riparian vegetation is small. Increasing native forbs and grasses would improve bank stability and potential for narrower, deeper channels, potentially reducing water temperature over time. Where passive restoration occurred, native vegetation would slowly become reestablished. Where restoration was applied, re-establishment of native vegetation could occur more quickly; possibly within a couple of years.

Where manual methods remove invasive plants near streams there could be minor loss of ground cover and soil disturbance leading to erosion, and a minor localized increase in fine sediments particularly if vegetation is removed from stream banks. This increase would only last a season until vegetation became re-established and is not considered significant. Many treatment sites are small and would reseed naturally with existing native vegetation. Restoration would allow sites lacking a native vegetation seed source to re-vegetate to control erosion.

Project Design Features also minimize the chance of herbicides reaching streams or wetlands through drift, runoff, or leaching into soils. Buffer widths vary depending on herbicide aquatic risk ranking (established in the Regional Invasive plant FEIS) and application method. PDFs and label requirements prohibit use of the more mobile herbicides on shallow soils. This would protect groundwater, particularly in areas where shallow soils cover fractured bedrock.

Glyphosate and imazapyr are the only herbicides used for spot spraying up to waters edge along perennial channels. Glyphosate is highly water soluble but because it adheres tightly to soils is unlikely to be carried into a stream unless the soil particle is carried into the stream. This is unlikely to happen during the late spring or summer when herbicides would be applied because there is less rain in the summer and more vegetation growth to hold soil particles in place. If glyphosate is carried into a stream by runoff it preferentially stays with the soil over partitioning into water. Imazapyr is only moderately water soluble and forest field studies have not found it very mobile in soils (Appendix B).

Herbicides entering surface water through surface runoff are also expected to be minimal, since targeted spot spraying techniques would be used to apply herbicide within 100 feet of surface water. This would minimize the amount of herbicide reaching the ground surface as well as minimize the potential for herbicide drift. No herbicides considered high risk to aquatic resources would be broadcast within 100 feet of streams and none would be spot sprayed within 50 feet of streams (Table 7, Table 8, Table 9).

Some streams within road corridors have treatment areas that parallel both the road and the stream with many continuous acres of treatment within the aquatic influence zone. In reality these areas have invasive plants scattered among other vegetation along the stream. To model a worst case scenario a few of these areas were modeled for site specific soil types and rainfall with the SERA spreadsheet. For NF Astonin River and Little Phillips Creek clay soils were modeled due to the compacted road conditions near the streams within the treatment areas. In addition, the model was run for a hypothetical site with the highest rainfall on the Forest and a sandy soil, the soil most likely to allow runoff into the stream. Only aquatic glyphosate and aquatic imazapyr were modeled with the high rainfall and sandy soil as they are the only herbicides allowed for spot spray treatments below bankfull, and PDFs do not allow the use of clopyralid on sandy soils.

NF Asotin Creek has up to 81 acres of treatment of scotch thistle on 3.9 miles along the trail that follows the creek and tributaries within 100 feet of the stream channel. In reality the scotch thistle is probably patchy and covering less than 25 percent of the acres within the treatment area at this time. Modeling limitations include: modeling only the 50 feet closest to the channel and 1.6 miles of stream channel, and assumes broadcast spray, not spot spray. The broadcast spray would over estimate concentrations in the stream. PDF H16 requires that no more than 10 acres of treatment would occur within the aquatic influence zone of a stream within any year. This would keep treatment at this site within the modeled parameters.

Analysys of these sites indicates all HQ values were below 1; therefore, no herbicide concentrations in water reached a levels of concern for sensitive fish (Table 46) The R6 2005 FEIS notes that as HQ increases above 1, the margins of safety decrease compared to the most sensitive toxic effect shown in laboratory studies.

Domestic Water Supplies

Water sources, including those in campgrounds, recreational homes, and individual special use permit would be protected by PDF-H13, which requires that herbicide use would not occur within 100 feet of wells or 200 feet of spring developments.

Roads

There are 836.2 miles of road within treatment areas. Of these, 183 miles (21%) are within RHCAs and proposed for chemical treatments. Roads and their associated ditchlines are often connected to streams and during storm events can carry herbicide to streams; however, much of the Umatilla National Forest system roads comply with regional road standards in that drainage structures are in place that divert runoff away from streams. Still, some roads with connected ditchlines are within RHCAs. Under this alternative, broadcast application of herbicides (both boom and hand) are allowed within the outer part of the RHCA. To minimize risk to aquatic resources, PDF H3 requires that no high risk herbicides would be broadcast within RHCAs. Therefore, for the 183 miles of road identified within RHCAs, picloram, non-aquatic triclopyr (Garlon 4), non aquatic glyphosate, and sethoxidim would not be used.

Though the probability of a large rain storm happening after application is low at any particular site, this additional protection measure would ensure that high risk herbicides are not delivered to streams in concentrations that exceed levels of concern.

Aerial Application

Aerial application of herbicide would occur on the Pomeroy District covering approximately 675 acres on 17 sites ranging in size from 1 to 290 acres. Most of the acres are in one area of 625 acres where both yellow starthistle and spotted knapweed are found. There are approximately 195 acres of grasslands with most of the area in open ponderosa pine forest. There are also small areas of lodgepole pine, grand fir and mixed forest types,. The herbicide to be applied aerially would be clopyralid. Clopyralid is a selective herbicide that would preserve soil cover by not harming nontarget vegetation such as pines, firs and grasses.

There are another set of small sites totaling 62 acres. These sites are scattered along the Little Tuconnon River. There are only three acres classified as grasslands with the rest of the cover a mixture similar to the larger site described above. Clopyralid would be used in these areas also.

Given the soil protection provided by non-target vegetation, erosion and associated sediment delivery to streams would be minor and short-term (1 to 2 years).

As drift is a concern with aerial application AGDISP was used to model drift from aerial application of herbicides. AGDISP was first developed by NASA, improved by the USDA Forest Service and implemented by the Spray Drift Task Force and the U.S. Environmental Protection Agency into a regulatory version (Teske et al.2003).

Site specific conditions for aerial application of the Umatilla National Forest were modeled. In general, for aerial application at these sites, the helicopter would be flown at 10 to 25 feet off the ground when spraying grasslands. However, there is a section of the treatment area with up to 30% tree cover. For safety reasons if this area is sprayed the pilot may need to fly higher when near trees. The higher release heights are more of a concern.

Spray application height, wind speed and droplet size are the three most significant factors impacting drift distance and the potential to affect non-target areas. To model worst case scenarios, cross wind speed and droplet size were kept at the highest wind speed allowed (8mph) and a coarse spray droplet size (500 µm) commonly used for aerial application of herbicides and the smallest droplet size allowed in this project (PDF F-6). Three release heights were modeled for the largest aerial site. See Appendix F for more details on aerial modeling.

The first run was for open grassland with a spray height of 25 feet and the following runs were with a spray height of 35 and 50 feet respectively with the other conditions remaining the same.

Conditions

- Eight mile an hour cross winds toward the stream
- Median droplet size is approximately 500 microns
- Release height 25, 35 and 50 feet off the ground

Results

As expected, drift became greater as the release height increased. At a 25 foot release height there was minimal drift. At a 35 foot release height the maximum deposition was displaced 25 feet downwind with a large amount of deposition up to 50 feet downwind.

At a 50 foot release height the maximum herbicide deposition was displaced approximately 50 feet downwind with a large amount of deposition up 150 feet downwind.

For example, for a small stream directly downwind of the spray area, 300 feet from the last swath, with no interception from vegetation (ground cover 1 foot tall) the concentration of clopyralid in the stream varied between 0.21 ppb for the conditions at 25 feet spray height and 6.15 ppb at a spray height of 50 feet. This is well under the 5000 ppb considered a concern for fish. However, the purpose of this project is to treat invasive terrestrial plants, not to treat streams or other sensitive areas and to minimize offsite deposition to sensitive areas such as streams or non-target vegetation, SOLIs or other sensitive areas under the worst case scenario conditions the following design criteria would be used to lower drift.

Two options could be used 1) Table 40 lists conditions where an increased buffer width is required. 2) Low drift technology (i.e. nozzle design) and/or additives that maximize deposition to the intended target and minimized drift into non-target and sensitive areas as directed in PDFs.

Either method would increase the effectiveness of the buffer for sensitive areas and streams. Drift cards would be used to track the effectiveness of the buffers.

Table 40 - Additions to buffer widths under specified conditions

Buffer Widths	25 foot Release Height	35 foot Release Height	50 foot Release Height
Buffer width at 6-7 mph	Designated buffer	Add 1 swath widths to buffer	Add 2 swath widths to buffer
Buffer width at 7-8 mph	Designated buffer	Add 2 swath widths to buffer	Add 3 swath widths to buffer

Alternatively use low drift technology, ie nozzle design and/or additives that ensure little to no drift into stream buffers or sensitive areas as directed in PDFs.

Water contamination from aerial herbicide drift is a large concern. The following Project Design Features are included to address this concern by minimizing risk for aerial herbicide drift and contamination to waterways:

- E2 requires that aircraft fueling occurs outside RHCAs
- F5 requires that herbicide applications occur when winds are between 2 and 8 miles per hour
- F6 requires coarse droplet size to minimize drift
- F8 requires that aerial units be ground checked and water features marked and buffered before application
- F8 and Tables 7, 8, 9 require buffers of 300 feet on perennial or wet intermittent streams and wetlands, and 100 feet buffers are required on dry channels.
- F8 Additional buffers or drift reduction methods are required in winds over 5 mph with flight heights over 30 feet as shown in Table 40 above

Based on buffer effectiveness documented by Rashin and Graber (1993) and Dent and Robben (2000) concentrations of herbicides reaching streams are expected to be well below concentrations of concern to beneficial uses. Spray cards would be used to track the effectiveness of the stream buffers.

Lakes, Wetlands and Floodplains

There are approximately 19 acres of treatment proposed within 100 feet of lakes or reservoirs on the Forest. The main invasive plants to be treated are diffuse knapweed and Canadian thistle. Treatments are proposed near three waterbodies, generally at campgrounds.

Most of these treatment acres are at Jubilee Lake, which proposes approximately 17 acres of chemical treatment of Canadian thistle around the 92 acre lake. PDF H10 requires that no more than half the perimeter, or 50 percent of the vegetative cover, or 10 contiguous acres around a lake or pond would be treated with herbicides in any 30-day period. This PDF reduces exposure to herbicides for aquatic organisms by providing some untreated areas as refugia. Buffers minimize the potential for herbicides to move into surface water. Buffers displayed in Chapter 2, Table 7, Table 8, and Table 9, minimize the potential for herbicides to move into surface water as described above in the section on general effects of herbicides on water.

The most effective herbicides for Canadian thistle are clopyralid, picloram, chlorsulfuron and glyphosate (best in the fall). No broadcast applications would occur within 100 feet of the lake. Picloram and chlorsulfuron could only be spot sprayed to within 50 feet of the lake. Clopyralid (considered low aquatic risk) could be spot sprayed to within 15 feet of the high water mark of the lake. Aquatic glyphosate and aquatic imazapyr could be spot sprayed up to the edge of the water. Adverse effects to beneficial uses of the lake are unlikely with these specific protection measures in place.

While the PDFs make it highly unlikely that herbicide concentration in water would reach a level of concern, high rainfall soon after application could deliver herbicide to the lake. To model this scenario the SERA worksheet was rerun for specific rainfall and soils for this area for clopyralid (most likely to be used where allowed), and the two aquatic formulations available for spot spray closer to the lake. No concentrations of concern were reached for any herbicide. Use of PDFs further lowers potential for higher concentrations of herbicides near the lakes. Therefore treatments are unlikely to affect functioning of wetlands or waterbodies or to contribute to significant adverse effect of beneficial uses.

To control the infestation the treatments would continue over several years, with fewer acres needing treatment each year. Wetlands would be treated using non-herbicide methods where such treatments are likely to be effective.

Early Detection Rapid Response

Early Detection Rapid Response (EDRR) is part of all the action alternatives. Under this approach new invasive species or currently unknown infestations may be treated using the range of ground based methods analyzed in this EIS, on sites similar to those presently proposed for treatment. PDFs limit types and methods of treatments and types of herbicides by aquatic risk within RHCAs and would minimize the risk of treating these new or undiscovered infestations.

Aerial application of herbicides would not be allowed in the EDRR process. If treatment sites or types of treatment were not within the range of the ground based treatments discussed above, then additional analysis would occur under another NEPA document. Two examples would be if there was a need to use different herbicides than the 10 discussed in this document, or a need to treat emergent vegetation.

The regional invasive plant FEIS classified aerial spraying of herbicide a high risk treatment method (USFS 2005b). The risk is related to lack of control for applying herbicide.

Unpredictable weather patterns can lead to adverse effects where herbicide is applied near buffered areas. Wind speeds and direction can change quickly leading to more drift to waterways and nontarget plant species and soil. Aerial spraying on steep forest sites may have increased risk drift from alternating wind currents in addition to higher risk for herbicide movement from overland flow. Furthermore, stream buffers may be difficult to maintain since stream channels can be hard to identify in some forest environments. Given these uncertainties, aerial spraying is a high risk tool for use under EDRR.

Cumulative Effects

Only the land and roads within the National Forest system would be treated in the action alternatives proposed by this EIS. The Forest, however, is intermingled with other federal, state, county, and private ownerships.

Management activities and actions on neighboring lands may contribute to spread or containment of invasive plants on National Forest system lands, and vice versa.

Chemical treatments are scattered across the watershed making it unlikely that herbicide concentrations would be additive with similar treatments at the watershed scale. The potential for cumulative effects is negligible due to the implementation of PDFs that limit direct and indirect effects, the scattered nature of the treatments, and the dilution over time and space by mixing and addition of inflow downstream.

Table 41 - Watersheds with the largest percent of proposed chemical treatments

Watershed Name	Watershed Acres	Proposed Treatment					
		Biocontrol	Chemical Acres	Manual Acres	Total Acres	Percent of Total Treatment	Percent of Chemical Treatment
Asotin Creek	208532	1	2104	0	2105	1.0	1.0
Looking Glass Creek	60527	264	889	0	1153	1.9	0.0
Meachem Creek	114158	1019	1798	2	2820	2.5	1.6
Wall Creek	128327	30	1723	2	1756	1.4	1.3

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 or Washington. Accurate accounting of the total acreage of invasive plant treatment for all land ownerships is unavailable.

The risk of adverse effects of invasive plant treatments have been minimized by the Project Design Features (PDFs). These limit the possibility of cumulative effects of treatment by minimizing direct and indirect effects.

Another possible concern is duplicating herbicide application in an RHCA that is near a land ownership boundary where herbicide treatments could be occurring. If duplicate applications occurred, effects level of concern could be approached. Project Design Feature B1 (see Section 2.3.3) ensures that Forest staff coordinates with owners and managers of neighboring lands. Such coordination would make duplicate treatment a very remote possibility.

Biocontrol agents spreading from adjacent lands onto National Forest system lands would likely have the beneficial effect of reducing weeds. Invasive plants killed by such agents would have no effect on water resources.

Alternative B is unlikely to have significant effects on water resources and therefore is unlikely to approach a threshold of concern or contribute to significant cumulative effects. No adverse cumulative effects are expected from implementation of this alternative.

Alternative C – No Broadcast within Riparian Habitat Conservation Areas

Direct and Indirect Effects

The effects from treatments under this alternative are the same as for Alternative except for the 3,022 acres within the RHCAs available for broadcast of herbicides. Potentially these areas would be treated with mechanical or manual methods. As the main methods are mowing and cutting or pulling weeds, and the areas to be treated are between 100 and 300 feet from a stream, effects from treatment on streams would be negligible. If these acres were treated with herbicide then spot or hand methods of application would be used under Alternative C. Spot spraying is more targeted to specific plants; therefore, there would be less herbicide in contact with soil and available for runoff into streams. There would be less nontarget vegetation removed so more groundcover would be available in these areas lowering the potential for sediment delivery to streams.

Cumulative Effects

The cumulative effects are the same as those discussed under Alternative B

Alternative D – No Aerial Application

Direct and Indirect Effects

The effects from treatment under this alternative are the same as for Alternative B except for 675 acres proposed for aerial application. These acres would need to be treated by other methods. Under this alternative there would be lower risk of herbicide contaminating water due to drift.

Cumulative Effects

The cumulative effects are the same as discussed under Alternative B.

3.5 Aquatic Organisms and Habitat

3.5.1 Introduction

Invasive plants are displacing native plants, and have the potential to destabilize streams, reducing the quality of fish and wildlife habitat and degrading natural areas in the Umatilla National Forest. Invasive plants found growing adjacent to or within aquatic influence areas can invade, occupy, and dominate riparian areas and indirectly impact aquatic ecosystems and fish habitat.

Invasive plants can change stand structure and alter future inputs of wood and leaves that provide the basic foundation of the aquatic ecosystem food webs. Native vegetation growth may change as a result of infestation, and the type and quality of litter fall, and quality of organic matter may decline, which can alter or degrade habitat for aquatic organisms.

Under the Proposed Action, infested areas would be treated with an initial prescription and retreated in subsequent years, if needed, until the site was restored with desirable vegetation. Herbicide treatments would be part of the initial prescription for most sites; however, use of herbicides would be expected to decline in subsequent entries as a result of effective treatment. Ongoing inventories would confirm the location of specific invasive plants and effectiveness of past treatments. Treatment prescriptions would be strict enough to ensure that adverse effects are minimized, while flexible enough to adapt to changing conditions over time. Future infestations will be treated using an Early Detection/Rapid Response protocol.

This DEIS has been prepared to consider the site-specific environmental consequences of treating invasive plants over the next 5 to 15 years (until invasive plant objectives are met or until changed conditions or new information warrants the need for a new decision). This EIS is tiered to a broader scale analysis (the Pacific Northwest Region Invasive Plant Program – Preventing and Managing Invasive Plants Final Environmental Impact Statement and the accompanying Record of Decision (2005), hereby referred to as the R6 2005 EIS, and R6 2005 ROD.

The R6 2005 ROD added management direction relative to invasive plants to the Umatilla National Forest Plan. The management direction applied to the broader Forest invasive plant program, establishing goals, objectives and standards for public education and coordination, prevention of the spread of invasive plants during land uses and activities, reducing reliance on herbicides over time, and treatment and restoration.

Methodology for Analysis

This analysis is tiered to the 2005 R6 Invasive Plant FEIS and ROD. A primary focus of the site-specific analysis was development of Project Design Features (PDFs) to insure compliance with standards adopted by R6 as well as Forest standards and guidelines. Information used to design criteria to minimize effects and the method of comparison of alternatives was the same as that used for water and soil (see Section 3.4.1 above).

Herbicide concentrations derived from SERA herbicide risk assessments were used with the GLEAMS worksheet as an indicator of potential herbicide delivery to water. The GLEAMS worksheet developed for the SERA risk assessments was run for site specific conditions (rainfall, soil type, and herbicide) on the Forest. GLEAMS is a model used as a tool to evaluate the impact of management decisions (such as herbicide use) on water quality. The model can be used to estimate herbicide exposure for aquatic species in worst-case scenarios.

As the GLEAMS model was originally an agriculture model, all parameters used are not compatible with treatments for the Forest. The model assumes broadcast treatment along a small perennial stream. The treatment is 50 feet wide and 1.6 miles long. This would overestimate herbicide in streams on the Forest as no broadcast is proposed within 100 feet of a perennial stream. In steeper areas the model may underestimate the herbicide delivery as it assumes a 10 percent slope, although much of the Forest has a higher slope. The model also assumes even rainfall every ten days, which is very different than the rainfall patterns for the Forest.

When specific treatment areas were modeled, the upper limit of rain was set as high as 75 inches to attempt to model a larger summer storm.

3.5.2 Affected Environment

The Project Area includes the Umatilla National Forest. This section discusses Watershed conditions for each of the 4th Field HUCs; Threatened, Endangered and Sensitive fish species and their habitat are also described.

Watershed Condition

Table 42 displays the relative distribution of the invasive plants proposed for treatment at the 5th field watershed scale. The Meachum Creek watershed has the greatest proportion of infested acres being proposed for treatment (about 2.5 percent of that watershed is proposed for treatment).

Table 42 - Fifth Field Watersheds within Umatilla National Forest Proposed for Treatment

Fifth Field Watershed Name	HUC	Acres	Acres of Invasive Plants	Percent Watershed to Treat	Treated Acres in RHCAs*	TES Fish Present*
Asotin Creek	1706010302	208,532	2105	1.0%	380	SRS, SRC,BT,
Upper Grande Ronde River	1706010401	133,777	98	0.07%	0	NF
Meadow Creek	1706010402	116,100	44	0.04%	7	NF
Grande Ronde River/Five Points Creek	1706010404	87,630	78	0.008%	13	NF
Willow Creek	1706010408	53,565	162	0.3%	73	NF
Lookingglass Creek	1706010410	60,527	1153	1.9%	132	SRS, SRC, BT
Grande Ronde River/Cabin Creek	1706010411	108,389	1018	0.9%	447	SRS
Grande Ronde River/Grossman Creek	1706010601	114,787	1108	1.0%	129	SRS, SRC, BT
Wenaha River	1706010603	189,224	958	0.5%	155	SRS, SRC, BT
Lower Grande Ronde River	1706010607	160,794	370	0.2%	69	SRS, SRC
Pataha Creek	1706010705	118,434	176	0.1%	28	NF
Upper Tucannon River	1706010706	140,811	762	0.5%	199	SRS, SRC, BT
Upper Walla Walla River	1707010201	101,385	234	0.2%	22	MCS, BT
Mill Creek	1707010202	76,051	906	1.2%	141	MCS, BT
Upper Touchet River	1706010203	146,115	1128	0.8%	104	MCS, BT
Upper Umatilla River	1707010301	86,765	1410	1.6%	239	MCS, MCC, BT
Meacham Creek	1707010302	114,158	2820	2.5%	367	MCS, MCC, BT
Birch Creek	1707010306	182,206	505	0.3%	176	MCS

Fifth Field Watershed Name	HUC	Acres	Acres of Invasive Plants	Percent Watershed to Treat	Treated Acres in RHCAs*	TES Fish Present*
Upper Butter Creek	1707010309	206,658	199	0.1%	21	NF
Upper Willow Creek	1707010401	94,088	340	0.04%	176	NF
Rhea Creek	1707010403	145,967	2	0.001%	0	NF
Upper North Fork John Day River	1707020201	71,525	17	0.02%	9	MCS
Granite Creek	1707020202	94,513	277	0.3%	169	PL, WCT, MCS, MCC, BT
North Fork John Day River/Big Creek	1707020203	105,881	344	0.3%	277	PL, MCS, MCC
Desolation Creek	1707020204	69,675	126	0.2%	21	WCT, MCS, MCC, BT
Upper Camas Creek	1707020205	104,623	539	0.5%	297	MCS, MCC, BT
Lower Camas Creek	1707020206	157,015	815	0.5%	158	PL, MCS, MCC
North Fork John Day River/Potamus Creek	1707020207	185,288	1772	1.0%	388	PL, MCS, RT, MCC
Wall Creek	1707020208	128,327	1756	1.4%	606	MCS, RT
Lower North Fork John Day River	1707020210	117,016	12	0.01%	1	NF
Camp Creek	1707020302	125,940	1166	0.9%	344	NF
Lower Middle Fork John Day River	1707020305	60,635	2	0.003%	0	NF
Lower John Day River/Kahler Creek	1707020401	197,919	1676	0.8%	339	RT
Upper Rock Creek	1707020411	177,121	567	0.3%	74	NF
Total			**24,643****		**5560**	

*Riparian Habitat Conservation Areas (RHCA) are based on designated PACFISH buffers as delineated in GIS.
*SRC=Snake River Chinook, MCC=Middle Columbia Chinook, SRS=Snake River Steelhead, MCS=Middle Columbia Steelhead, BT= Bull Trout, RT=Redband Trout, WCT=Westslope Cutthroat Trout, MS=Margined Sculpin, PL=Pacific Lamprey, NF=No TES Fish Present
**24,643 acres is slightly different from 24,649 acres displayed elsewhere. This minor difference can be explained as rounding errors.

Umatilla Subbasin (17070103)

Streamside vegetation in the upper watershed consists of conifers, deciduous trees and shrubs, and grass. Riparian conditions are generally good at higher elevations. At lower elevations, brush, grass, and deciduous trees are the major types of bank vegetation. Riparian conditions at mid-elevations have been impacted by livestock grazing, road and railroad construction. Riparian areas at lower elevations are in generally poor condition as a result of extensive farming operations (CTUIR 1990a). Riparian vegetation may have been influenced extensively by past beaver (*Castor canadensis*) activity. Current beaver activity is very limited.

Some streams in the Subbasin are in relatively pristine condition while others have felt the impacts of a considerable amount of human activities. Pristine stream segments are mostly under public ownership and are managed by the Forest Service. Examples of these include the North Fork Umatilla River and its tributaries, which are within the North Fork Umatilla Wilderness Area; North Fork Meacham Creek, the upper seven miles of the South Fork Umatilla River, and their tributaries, which are part of the Hellhole Roadless Area; and East Fork Meacham and its main tributary, Owsley Creek.

Steelhead are widely distributed within the Umatilla River Subbasin. The Oregon Department of Fish and Wildlife (ODFW) and CTUIR have maintained an extensive hatchery steelhead program in the Subbasin since 1981. The origins of the current hatchery stock are from within the Subbasin, although releases of Skamania, Hells Canyon, and Fall River stocks occurred from 1967 to 1970. Smolt release sites include volitional releases from acclimation ponds at Bonifer on Meacham Creek (RM 2) and Minthorn Springs on the Umatilla River (RM 63). The hatchery fish are managed under the Oregon Department of Fish and Wildlife's (ODFW) Wild Fish Management Policy (WFMP) Type II hatchery program. The interaction between hatchery and wild steelhead is undetermined.

The Confederated Tribes of the Umatilla Indian Reservation (CTUIR) continue to make efforts to restore salmon in the Umatilla and Walla Walla River systems. These fisheries are a major concern because of cultural uses. Meacham Creek has some of the most productive habitat for steelhead near the Forest boundary. The Tribe constantly monitors Meacham Creek as it is one of the major focus areas for watershed improvement projects.

Lower Grande Ronde River ((17060106)

This watershed includes the Grande Ronde River/Grossman Creek, Wenaha River and Lower Grande Ronde River fifth code watersheds from Table 42.

Aquatic species diversity in the Grande Ronde River Basin has declined in recent years (Umatilla National Forest, 2001). Native anadromous fish species have suffered local extirpation (sockeye salmon, *Oncorhynchus nerka;* coho salmon, *Oncorhynchus kisutch;* early fall Chinook salmon, *Oncorhynchus tshawytscha*). Others have been listed under the Endangered Species Act as Threatened or Endangered (Snake River steelhead, *Oncorhynchus mykiss*; Snake River spring/summer Chinook salmon, *Oncorhynchus tshawytscha*).

The Interior Columbia Basin Ecosystem Management Project (ICBEMP) Draft Environmental Impact Statement (DEIS) identified the Blue Mountains as an area especially important to the genetic integrity of anadromous salmonids.

The ICBEMP DEIS defined aquatic strongholds in the Grande Ronde Basin as key elements for rebuilding and maintaining functioning aquatic ecosystems. Key to rebuilding aquatic ecosystems would be connecting habitat patches with corridors or dispersal habitat and eliminating barriers to ensure that all parts of the regional population interact by allowing individuals to move between patches (ICBEMP Integrated Scientific Assessment, 1996)

Upper Tucannon River (17060107)

This watershed includes the Pataha Creek and Upper Tucannon River fifth code watersheds from Table 42.

The Tucannon Watershed drains approximately 75,000 acres of land and contains approximately 175 miles of perennial streams. There are approximately 30 miles of Class I (anadromous and resident fish) streams, 25 miles of Class II (resident fish) streams, and 120 miles of Class III (other perennial stream) streams.

Vegetation within the Tucannon River Watershed varies with elevation and aspect. South facing slopes and ridge tops contain shallow soils with limited water holding capacity; therefore, vegetation is mainly grass forb or grass shrub mixture with a limited timber component. North facing slopes contain deeper soils with higher water holding capacity and are, therefore, heavily timbered with mixed conifer stands containing firs, spruce, larch and pine. Ponderosa Pine is also common on drier sites at lower elevations. The riparian areas contain moist meadows, cottonwood stands, alder and other shrubs, in addition to dense stands of fir and pine.

The Tucannon Fish Hatchery is located just upstream of Cummings Creek. The channel at the fish hatchery drains approximately 80 percent of the area in the Tucannon Watershed Assessment.

Winter storm run-offs are the main factor responsible for the majority of sediment transportation in the Tucannon River followed by peak snowmelt and summer cloudburst. Other events such as mud avalanches and rain-on snow produce large increases in the amount of sediment transported (SCS, 1982b). Sediment transported in the Tucannon River is composed of silts and clays (suspended) and gravels and cobbles (bedload).

In the Tucannon Subbasin, spring/summer Chinook are restricted to portions of the mainstem Tucannon River, with little or no use of its tributaries. Spawning occurs in the Tucannon River from the mouth of Sheep Creek (RM 52) downstream to King Grade (RM 21). Spawning has not been observed in any Tucannon River tributaries. The Tucannon River is inhabited by steelhead. Cummins Creek has adults that migrate within the Forest boundary. The history of adults in Tumalum Creek is little known. Adults have been known to spawn within the creek but many miles of habitat tend to go subterranean, before the summers end. Adults cannot get to the Forest Boundary. Juvenile steelhead are present in Grub and Hixon Creek, and Little Tucannon. Steelhead are confirmed in Pataha Creek. Complete spawning surveys, however, have not been conducted in the stream. Rearing occurs from RM 23.7 to 45.7 (StreamNet 2004).

Both resident and migratory forms of bull trout occur in the Tucannon River Basin. Radio-tagging studies have shown that bull trout spawn in headwater areas of the Tucannon River and use the remainder of the river for migration.

Bull trout spawning ground surveys have been conducted intermittently since 1990. The headwater areas known to support bull trout spawning include the upper reaches of the mainstem Tucannon (from Panjab Creek to a point above Bear Creek) and upper Tucannon tributaries including Cummings Creek, Sheep Creek, Cold Creek, Bear Creek, Panjab Creek, and several tributaries of Panjab Creek, including Turkey Creek, Meadow Creek, and Turkey Tail Creek. Surveyed areas include various portions of the Tucannon River mainstem (RM 44.6 to RM 58.0), Bear Creek (RM

0.0 – 0.6), Cold Creek (RM 0.0 – 0.8), Panjab Creek (RM 0.0 – 3.8), Meadow Creek (RM 0.0 – 4.9), Turkey Creek (RM 0.0 – 2.1), and Turkey Tail Creek (RM 0.0 – 3.4). Redd counts were as low as 57 in 1991 and as high as 222 in 1999. Redd counts do not cover the same areas consistently enough to be used for definitive population numbers. They merely show a healthy population is present due to number of streams used and habitat areas accessible.

Walla Walla (17070102)

This watershed includes the Upper Walla Walla River, Mill Creek and Upper Touchet River fifth code watersheds from Table 42.

The Walla Walla River Subbasin is located in northeastern Oregon and southeastern Washington. The Walla Walla River drains approximately 1,760 square miles and is a direct tributary to the Columbia River. The Subbasin is composed of three primary streams and several smaller ones. The primary streams are, from north to south, the Touchet River, Mill Creek, and the Walla Walla River (North and South Forks). The Walla Walla River Subbasin contains a total of 1,126,000 acres. Most of the headwater areas within the Subbasin are under public ownership and managed by the Forest Service. These public lands comprise approximately 18 percent of the Subbasin.

The Walla Walla River Subbasin provides spawning and rearing habitat for steelhead trout *Oncorhynchus mykiss* belonging to the middle Columbia River evolutionarily significant unit (ESU) (Busby et al. 1996). The Walla Walla River Subbasin also contains unoccupied habitat for fall Chinook salmon *Oncorhynchus tshawytscha* (Myers et al. 1998). Although the Subbasin is not proposed as critical habitat, it has been designated as ESU due to reintroduction of Snake River Basin Chinook salmon by the Tribe.

North Fork John Day River (17070202)

Includes the Upper North Fork John Day River, Granite Creek, North Fork John Day River/Big Creek, and Desolation Creek, Upper Camas Creek, Lower Camas Creek, and North Fork John Day River/Potamus Creek, Wall Creek and Lower North Fork John Day River fifth code watersheds from Table 42.

The John Day River is un-dammed and has anadromous fish, which are considered genetically pure and minimally mixed with hatchery stock due to straying. According to the North Fork John Day Ecosystem Analysis (1999), fish populations have declined, but the North Fork John Day Subbasin sustains one of the few remaining wild anadromous fish runs in the Mid-Columbia River Basin. The North Fork John Day Subbasin is the most important in terms of water quality and flow contribution to the John Day River. The North Fork John Day Subbasin supplies approximately 60 percent of the water to the John Day Basin and 70 percent of the wild spring Chinook salmon population. Major North Fork John Day tributaries are Cottonwood, Fox, Big Wall, Potamus, Camas, Desolation, and Granite Creeks.

The North Fork John Day River Subbasin is the major producer of wild spring chinook and summer steelhead in the John Day Basin. Approximately 58 percent of the total Basin spring chinook population and 43 percent of the total summer steelhead population are produced in this drainage. In the 1980s, as many of 1,855 adult spring chinook and 8,000 adult summer steelhead have returned annually to the Subbasin to spawn.

In addition, the North Fork John Day is the migratory route for runs traveling to and from the Middle Fork John Day Subbasin. The North Fork John Day drainage also supports warm water and coldwater resident fish populations.

Warm water small mouth bass and channel catfish reside in the North Fork John Day River below RM 22.6 and coldwater resident trout are found throughout the Subbasin. It also supports healthy wildlife populations, including deer and elk herds which winter along the stream corridor.

The middle and upper North Fork John Day Subbasin contains approximately 72 miles of spring chinook spawning and rearing habitat and 700 miles of steelhead habitat. Spring chinook habitat lies between Camas and Baldy Creeks on the North Fork John Day Subbasin, and in the Granite Creek system. Per mile, Granite Creek produces more spring chinook than any other area in the John Day Basin. Located in the North Fork John Day headwaters, this system, which includes Clear and Bull Run Creeks, produces 42 percent of the total John Day spring chinook population. Major steelhead producing streams in the North Fork John Day Subbasin are Cottonwood, Rudio, Deer, Wall, Potamus, Desolation, Granite, Ditch, Mallory, Trout, Meadowbrook, Trail, Olive, Clear, Bull Run, Camas, Beaver, and Big Creeks.

Spring chinook and steelhead production has decreased in the North Fork John Day Subbasin. Increased logging, road building, and poaching activities in the forested uplands probably have contributed to the declining populations. Between 1969 and 1973, biologist counted an annual average of 32 spring chinook redds (spawning beds) per mile in the system. Counts for 1981 to 1985, show spawning-density decreased to an average level of 10 redds per mile. Summer steelhead production also has declined slightly. Declines in spring chinook production are primarily attributable to damn mortality (USDA 1999). The degradation of spawning and rearing habitat has also had a major impact. High summer water temperatures limit juvenile spring chinook distribution.

Past mining operations have left their imprint in the Granite Creek system. Water quality continues to be affected by leaking and leaching of toxic effluent from inactive mines. Some historically productive spawning and rearing habitat remains degraded from dredging, which took place into the 1930s in Granite Creek and into the 1950s in Clear Creek.

Middle Fork John Day River (17070203)

This watershed includes the Camp Creek and Lower Middle Fork John Day River fifth code watersheds from Table 42.

Anadromous and resident fish species are known to inhabit the Middle Fork John Day River (Middle Fork John Day River) Subbasin including tributaries to the Middle Fork John Day River for all or part of their life history. Both resident and anadromous forms of rainbow trout (steelhead/redband), bull trout, mountain whitefish, and spring Chinook salmon are found within this watershed. In addition, sculpins, dace, shiners, and suckers are non-game species found in most streams. Larger tributary streams in the Subbasin are Clear Creek Vinegar Creek, Granite Boulder Creek, Big Boulder Creek, Butte Creek, and Big Creek. These tributaries provide the greatest water yield and late season flows, and lowest late season water temperatures.

Management activities that have impacted streams within the watershed include timber harvest with associated road construction, livestock grazing, and placer and hardrock mining. Habitat quality throughout the watershed is variable; individual reaches may not meet one or more of the minimum habitat objectives such as pools per mile, water temperature, large woody material (LWM) per mile, bank stability, and/or width-to-depth ratios.

Roads Having High Potential for Herbicide Delivery

Roads are the primary vector for invasive plants to enter the Forest. Native soil has been removed along roads, and fill and surfacing have been placed within the road prism. Ditches have been compacted, allowing them to deliver run-off to streams, which may include herbicides used in broadcast treatments along the roads. Road cutbanks can be a combination of disturbed soil and exposed bedrock.

The R6 2005 FEIS describes roadside ditches as an herbicide delivery mechanism; potentially posing a high risk of herbicides reaching concentrations of concern for listed aquatic species (see Chapter 3.5). Ditches may function as an extension of the stream network. Roadside ditches can act as delivery routes or intermittent streams during high rainfalls, or as settling ponds following high rainfall events. Because the Proposed Action includes treatment of road prisms with herbicides, the concern for herbicides being indirectly delivered to waterbodies containing fish via roadside ditchlines was addressed by identifying roads that have a high potential for herbicide delivery.

To reduce the potential for herbicides to come in contact with water via runoff at or near concentrations of concern, the following restrictions would apply to treatments along roads having high potential for herbicide delivery (See Appendix E):

- No broadcast spraying of any herbicide
- No use of picloram or non-aquatic triclopyr
- Only spot or hand select methods of aquatic labeled herbicides or low risk herbides (as defined in this document) would be applied within 15 feet of wet roadside ditches
- Apply appropriate buffer widths to road sections that cross streams (See Table 7, Table 8, and Table 9)

According to the 2004 Umatilla Forest-Scale Roads Analysis Report, the entire road system is fundamentally hydrologically connected to the stream system because roads are part of watersheds. Roads capture and release snow and rain, alter patterns and direction of runoff, erosion rates and processes, and expand the channel network affecting routing of stream discharge. The most hydrologically connected roads cross streams or are located in floodplains and wetlands. For this project, roads considered most hydrologically connected were those located within 100 feet of Class 1 and 2 streams.

An estimated 28.65 miles of roads considered high risk for potential herbicide delivery are proposed for herbicide treatment (See table in Appendix E). Nearly all watersheds on UNF have roads that have a high risk of herbicide delivery; invasive plants are widely scattered along these roads. Roadside treatment areas include compacted ditch lines, disturbed soil and thin soils near exposed bedrock. Due to the extensive reworking of properties of soils along roads, the Soil Resource Inventory (SRI) may be misleading for roadside treatment areas. As roads and ditchlines are compacted, roadside soils are assumed to function with a high runoff rate. Therefore, those roads that have a high potential for herbicide delivery would not be treated by broadcast applications. See Appendix E of this EIS for a list of roads with treatments proposed within 100 feet of fish-bearing streams.

Threatened, Endangered and Sensitive Fish Species and Habitat

The Umatilla National Forest has three Federally Listed fish species and five fish species listed on the Region 6 Sensitive Species list (See Table 43 and Table 44).

Steelhead, Chinook, and chum are under the jurisdiction of NOAA Fisheries, and bull trout fall under the jurisdiction of the US Fish and Wildlife Service.

Table 43 - Threatened, Endangered and Proposed Fish Species and Critical Habitat on Umatilla National Forest

Species - DPS		Status	Listing Status	Critical Habitat
Steelhead (*Oncorhynchus mykiss*)	Snake River Basin	Threatened MIS	Listed on 8/18/97; (62 FR 43937) Status Reaffirmed 6/28/05; (70 FR 37160)	09/02/05 70 FR 52630
	Middle Columbia River	Threatened	Listed on 3/25/99; (64 FR 14517) Status Reaffirmed 6/28/05; (70 FR 37160	09/02/05 70 FR 52630
Chinook Salmon (*Oncorhynchus tshawytscha*)	Snake River Spring/Summer Run	Threatened	Listed on 4/22/92; (57 FR 14653) Status Reaffirmed 6/28/05; (70 FR 37160)	10/25/99 64 FR 57399
	Snake River Fall Run	Threatened	Listed on 6/3/92; (57 FR 23458) Status Reaffirmed 6/28/05; (70 FR 37160)	12/28/93 58 FR 68543
Bull Trout (*Salvelinus confluentus*)	Columbia River	Threatened	Listed on 6/10/98; (63 FR 31647	10/06/04 69 FR 59996

MIS = Management Indicator Species

Table 44 – Sensitive Species on the Umatilla National Forest

Species	Designation
Middle Columbia River Spring Run Chinook Salmon (*Oncorhynchus tshawytscha*)	Sensitive
Redband Trout (*Oncorhynchus mykiss gairdneri*)	Sensitive/MIS
Westslope Cutthroat Trout (*Oncorhynchus clarkii lewisi*)	Sensitive/MIS
Margined Sculpin (*Cottus marginatus*)	Sensitive

MIS = Management Indicator Species

For purposes of addressing federally listed fish species under the jurisdiction of NOAA Fisheries within the context of their status and life history, only brief summaries from various sources are presented in this document. Additional information related to brief life history information and status of populations at the ESU or DPS scale can be found in the following sources:

- Regional Invasive Plant EIS Fisheries Biological Assessment, Environmental Baseline
- NMFS Federal Register documents (http://www.nwr.noaa.gov/ESA-Salmon-Listings/Salmon-Populations/Index.cfm)

Snake River (SR) spring/summer run Chinook salmon (Threatened)

Critical Habitat

Critical habitat was designated for Snake River spring/summer chinook salmon on December 28, 1993 (58 FR 68543). Critical habitat is designated to include river and tributary reaches presently or historically accessible (except reaches above impassable natural falls, and Dworshak and Hells Canyon Dams) to Snake River spring/summer chinook salmon in the Snake River basin. Migratory habitat in the Columbia River mainstem from the mouth to the Snake River confluence is also included. Essential habitat consists of four components: spawning and juvenile rearing, juvenile migration, areas for growth and development to adulthood, and adult migration corridors. Essential features of migration corridors are further defined as: substrate, water quality, water quantity, water velocity, cover/shelter, food (juveniles only), riparian vegetation, space, and safe passage conditions.

The main 5th field watersheds on Umatilla National Forest with designated critical habitat are the Lower Grande Ronde River, Asotin River and Upper Grande Ronde River watersheds.

Life History

The Snake River spring/summer chinook ESU includes current runs to the Tucannon River, the Grand Ronde River system, the Imnaha River and the Salmon River (Matthews and Waples 1991). Some or all of the fish returning to several of the hatchery programs are also listed, including those returning to the Tucannon River, Imnaha River, and Grande Ronde River hatcheries and to the Sawtooth, Pahsimeroi, and McCall hatcheries on the Salmon River.

Spring and summer chinook from the Snake River Basin exhibit stream-type life history characteristics (Healey, 1983). Most SR spring/summer chinook salmon enter individual subbasins from May through September. Eggs are deposited in late summer and early fall, incubate over the following winter and hatch in late winter/early spring of the following year. Juvenile SR spring/summer chinook salmon emerge from spawning gravels from February through June (Peery and Bjornn 1991). Typically, after rearing in their nursery streams for about 1 year, smolts begin migrating seaward in April and May (Bugert et al. 1990, Cannamela, 1992). Depending on the tributary and the specific habitat conditions, juveniles may migrate extensively from natal reaches into alternative summer rearing and/or overwintering areas. After reaching the mouth of the Columbia River, spring/summer chinook salmon probably inhabit nearshore areas before beginning their northeast Pacific Ocean migration. Snake River spring/summer chinook return from the ocean to spawn primarily as 4 and 5 year old fish, after 2 to 3 years in the ocean. A small fraction of the fish return as 3-year-old 'jacks', heavily predominated by males.

Many of the Snake River tributaries used by spring and summer chinook runs exhibit two major features: extensive meanders through high elevation meadowlands and relatively steep lower sections joining the drainages to the mainstem Salmon (Matthews and Waples, 1991).

The combination of relatively high summer temperatures and the upland meadow habitat creates the potential for high juvenile salmonid productivity. Historically, the Salmon River system may have supported more than 40 percent of the total return of spring and summer chinook to the Columbia system (e.g., Fulton 1968).

Action Area Information

Lower Grande Ronde River Subbasin, approximately 25 percent of which is within the Umatilla National Forest, and another 25 percent of which is within the Wallowa-Whitman National Forest, has 14 major streams that contain more than five miles of anadromous fish habitat inside National Forest system land, including Grande Ronde River, Wenaha River, Butte Creek, Crooked Creek, Joseph Creek, Elk Creek, Swamp Creek, Davis Creek, Cottonwood Creek, Peavine Creek, Mud Creek, McAllister Creek, Tope Creek, and Wildcat Creek Wenaha River holds roughly 26 miles of anadromous fish habitat inside Umatilla National Forest system land. Lower Snake/Asotin Subbasin has two major streams that contain more than five miles of anadromous fish habitat inside the National Forest, including Snake River (WWNF) and Asotin River (UNF). Asotin River holds roughly 10 miles of anadromous fish habitat inside Umatilla National Forest system land.

Lower Snake/Tucannon Subbasin, approximately 10 percent of which is within Umatilla National Forest, has one major stream, Tucannon River, which holds roughly 13 miles of anadromous fish habitat inside the National Forest system land. Upper Grande Ronde River Subbasin approximately 10 percent of which is within the Umatilla National Forest, has 18 major streams that contain more than five miles of anadromous fish habitat inside National Forest system land, including Grande Ronde River, Meadow Creek, Burnt Corral Creek, McCoy Creek, Indian Creek, Dark Canyon, Spring Creek, Five Points Creek, Sheep Creek, Clear Creek, Beaver Creek, Limber Jim Creek, Lookingglass Creek, Little Lookingglass Creek, and Phillips Creek. Lookingglass Creek holds roughly 7 miles of anadromous fish habitat inside Umatilla National Forest system land.

Snake River (SR) fall-run Chinook salmon (Threatened)

Critical Habitat

Critical habitat was designated for Snake River fall chinook salmon on December 28, 1993, (58 FR 68543). Critical habitat for the listed ESU is designated to include river reaches presently or historically accessible (except reaches above impassable natural falls, and Dworshak and Hells Canyon Dams) to Snake River fall chinook salmon in the Columbia River from its mouth upstream to the confluence of the Columbia and Snake Rivers; all Snake River reaches from the confluence of the Columbia River, upstream to Hells Canyon Dam; the Palouse River from its confluence with the Snake River upstream to Palouse Falls; the Clearwater River from its confluence with the Snake River upstream to its confluence with Lolo Creek; the North Fork Clearwater River from its confluence with the Clearwater River upstream to Dworshak Dam.

Essential habitat consists of four components: spawning and juvenile rearing, juvenile migration, areas for growth and development to adulthood, and adult migration corridors. Essential features of migration corridors are further defined as: substrate, water quality, water quantity, water velocity, cover/shelter, food (juveniles only), riparian vegetation, space, and safe passage conditions.

The main 5th field watersheds on Umatilla National Forest with designated critical habitat are the Lower Grande Ronde River and Asotin Creek watersheds.

Life History

Snake River fall chinook spawn above Lower Granite Dam in the mainstem Snake River, and in the lower reaches of major tributaries entering below Hells Canyon Dam. Adult fall chinook enter the Columbia River in July and August. The Snake River component of the fall chinook run migrates past the Lower Snake river mainstem dams in September and October. Spawning occurs from October through November. Juveniles emerge from the gravels in March and April of the following year. Downstream migration generally begins within several weeks of emergence (Becker, 1970, Allen and Meekin, 1973), and juveniles rear in backwaters and shallow water areas through mid-summer before smolting and migrating to the ocean—thus they exhibit an ocean-type juvenile history. Once in the ocean, they spend 1 to 4 years (though usually 3 years) before beginning their spawning migration. Fall returns in the Snake River system are typically dominated by 4-year-old fish.

Fall chinook returns to the Snake River generally declined through the first half of this century (Irving and Bjornn 1991). In spite of the declines, the Snake River basin remained the largest single natural production area for fall chinook in the Columbia drainage into the early 1960s (Fulton 1968). Spawning and rearing habitat for Snake River fall chinook was significantly reduced by the construction of a series of Snake River mainstem dams. Historically, the primary spawning fall chinook spawning areas were located on the upper mainstem Snake River. Currently, natural spawning is limited to the area from the upper end of Lower Granite Reservoir to Hells Canyon dam and the lower reaches of the Imnaha, Grande Ronde, Clearwater and Tucannon Rivers.

Action Area Information

Lower Grande Ronde River Subbasin, approximately 25 percent of which is within Umatilla NF, has 10 major streams that contain more than five miles of anadromous fish habitat inside National Forest system land, including Grande Ronde River, Wenaha River, Butte Creek, Crooked Creek, Joseph Creek, Elk Creek, Davis Creek, Cottonwood Creek, Mud Creek and Wildcat Creek.

Wenaha River holds roughly 26 miles of anadromous fish habitat inside the Umatilla National Forest. Lower Snake/Asotin sub-basin includes the Asotin River, which has 10 miles of anadromous fish habitat inside Umatilla National Forest system land. Lower Snake/Tucannon Subbasin, approximately 10 percent of which is within the Umatilla National Forest, has one major stream, Tucannon River, which holds roughly 13 miles of anadromous fish habitat inside National Forest system land.

Middle Columbia River (MCR) steelhead (Threatened)

Critical Habitat

Critical habitat was designated for Middle Columbia River steelhead on September 2, 2005 (70 FR 52630). NMFS designates critical habitat based on physical and biological features that are essential to the listed species. Essential features of designated critical habitat are: (1) substrate, (2) water quality, (3) water quantity, (4)water temperature, (5) water velocity, (6) cover/shelter, (7) food for juveniles, (8) riparian vegetation, (9) space, and (10) safe passage conditions (50 CFR 226.212).

The three freshwater primary constituent elements of critical habitat are:

1) Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development;

2) Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks;
3) Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.

Recent designated critical habitat on the Umatilla National Forest includes the stream channels in each designated reach, and a lateral extent as defined by the ordinary high water line (Sept. 2, 2005; 70 FR 52629). The primary constituent elements essential for conservation of listed ESUs are those sites and habitat components that support one or more fish life stages, including freshwater spawning sites, freshwater rearing sites, and freshwater migration corridors.

The main 5th field watersheds on Umatilla National Forest with designated critical habitat are the Upper Walla Walla River, Mill Creek, Upper Touchet River, Upper Umatilla River, Meacham Creek, Birch Creek, Upper North Fork John Day River, Granite Creek, North Fork John Day River/Big Creek, Desolation Creek, Upper Camas Creek, Lower Camas Creek, North Fork John Day River/Potamus Creek, Wall Creek and Lower North Fork John Day River watersheds.

Life History

Major drainages in this ESU are the Deschutes, John Day, Umatilla, Walla-Walla, Yakima, and Klickitat river systems. Almost all steelhead populations within this ESU are summer-run fish, the exceptions being winter-run components returning to the Klickitat and Fifteen Mile Creek watersheds. A balance between 1- and 2-year-old smolt emigrants characterizes most of the populations within this ESU. Adults return after 1 or 2 years at sea.

Most fish in this ESU smolt at two years and spend one to two years in salt water before re-entering fresh water, where they may remain up to a year before spawning. Age-2-ocean steelhead dominate the summer steelhead run in the Klickitat River, whereas most other rivers with summer steelhead produce about equal numbers of both age-1- and 2-ocean fish. Juvenile life stages (i.e., eggs, alevins, fry, and parr) inhabit freshwater/riverine areas throughout the range of the ESU. Parr usually undergo a smolt transformation as 2-year-olds, at which time they migrate to the ocean. Subadults and adults forage in coastal and offshore waters of the North Pacific prior to returning to spawn in their natal streams. A non-anadromous form of O. mykiss (redband trout) co-occurs with the anadromous form in this ESU, and juvenile life stages of the two forms can be very difficult to differentiate. In addition, hatchery steelhead are also distributed within the range of this ESU.

Recent estimates of the proportion of natural spawners of hatchery origin range from low (Yakima, Walla Walla, and John Day Rivers) to moderate (Umatilla and Deschutes Rivers). Most hatchery production in this ESU is derived primarily from within-basin stocks.

Action Area Information

Walla Walla Subbasin, approximately 10 percent of which is within Umatilla NF, has four major streams that contain more than five miles of anadromous fish habitat inside National Forest system land, including North Fork Walla Walla River, South Fork Walla Walla River, North Fork Touchet

River, and Mill Creek. The South Fork Walla Walla River holds roughly 13 miles of anadromous fish habitat inside the National Forest.

Umatilla Subbasin, approximately 15 percent of which is within Umatilla National Forest, has six major streams that contain more than five miles of anadromous fish habitat inside National Forest system land, including North Fork Umatilla River, South Fork Umatilla River, Ryan Creek, Meacham Creek, North Fork Meacham Creek, and Pearson Creek. Meacham Creek holds roughly 15 miles of anadromous fish habitat inside National Forest system land.

North Fork John Day Subbasin, approximately 50 percent of which is within the Umatilla National Forest has 20 major streams that contain more than five miles of anadromous fish habitat inside National Forest system land, including North Fork John Day River, Big Wall Creek, Wilson Creek, Ditch Creek, Mallory Creek, Potamus Creek, Camas Creek, Fivemile Creek, Hidaway Creek, Granite Creek, Clear Creek, Olive Creek, Lake Creek, Crane Creek, Desolation Creek, South Fork Desolation Creek, East Fork Meadow Brook Creek, Winom Creek, and Big Creek. North Fork John Day River holds roughly 33 miles of anadromous fish habitat inside the Umatilla National Forest.

Snake River Basin (SRB) Steelhead (Threatened)

Critical Habitat

Critical habitat was designated for Snake River steelhead on September 2, 2005 (70 FR 52630). NMFS designates critical habitat based on physical and biological features that are essential to the listed species. Essential features of designated critical habitat are: (1) substrate, (2) water quality, (3) water quantity, (4)water temperature, (5) water velocity, (6) cover/shelter, (7) food for juveniles, (8) riparian vegetation, (9) space, and (10) safe passage conditions (50 CFR 226.212). The three freshwater primary constituent elements of critical habitat are:

1) Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development;
2) Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks;
3) Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.

Recent designated critical habitat on the Umatilla National Forest includes the stream channels in each designated reach, and a lateral extent as defined by the ordinary high water line (Sept. 2, 2005; 70 FR 52629). The primary constituent elements essential for conservation of listed ESUs are those sites and habitat components that support one or more fish life stages, including freshwater spawning sites, freshwater rearing sites, and freshwater migration corridors.

The main 5th field watersheds on Umatilla National Forest with designated critical habitat are the Asotin Creek, Upper Grande Ronde River, Meadow Creek, Grande Ronde River/Five Points Creek, Willow Creek, Lookingglass Creek, Grande Ronde River/Cabin Creek, Grande Ronde

River/Grossman Creek, Wenaha River, Lower Grande Ronde River and Upper Tucannon River watersheds.

Life History

The Snake River historically supported more than 55 percent of total natural-origin production of steelhead in the Columbia River Basin. It now has approximately 63 percent of the basin's natural production potential (Mealy, 1997). The Snake River steelhead ESU is distributed throughout the Snake River drainage system, including tributaries in southwest Washington, eastern Oregon and north/central Idaho (NMFS, 1997a).

Snake River steelhead migrate a substantial distance from the ocean (up to 1,500 km) and use high elevation tributaries (typically 1,000-2,000 m above sea level) for spawning and juvenile rearing. Snake River steelhead occupy habitat that is considerably warmer and drier (on an annual basis) than other steelhead ESUs. Snake River basin steelhead are generally classified as summer run, based on their adult run timing patterns. Summer steelhead enter the Columbia River from late June to October. After holding over the winter, summer steelhead spawn during the following spring (March to May). Managers classify up-river summer steelhead runs into to groups based primarily on ocean age and adult size upon return to the Columbia River. A-run steelhead are predominately age-1 ocean fish while B-run steelhead are larger, predominated by age-2 ocean fish.

With one exception (the Tucannon River production area), the tributary habitat used by Snake River steelhead ESU is above Lower Granite Dam. Major groupings of populations and/or subpopulations can be found in (1) the Grande Ronde River system; (2) the Imnaha River drainage; (3) the Clearwater River drainages; (4) the South Fork Salmon River; (5) the smaller mainstem tributaries before the confluence of the mainstem; (6) the Middle Fork salmon production areas, (7) the Lemhi and Pahsimeroi valley production areas and (8) upper Salmon River tributaries.

The A-run populations are found in the tributaries to the lower Clearwater River, the upper Salmon River and its tributaries, the lower Salmon River and its tributaries, the Grand Ronde River, Imnaha River, and possibly the Snake River's mainstem tributaries below Hells Canyon Dam. B-run steelhead occupy four major subbasins, including two on the Clearwater River (Lochsa and Selway) and two on the Salmon River (Middle Fork and South Fork); areas that are for the most part not occupied by A-run steelhead. Some natural B-run steelhead are also produced in parts of the mainstem Clearwater and its major tributaries. There are alternative escapement objectives of 10,000 (Columbia River Fisheries Management Plan) and 31,400 (Idaho) for B-run steelhead. B-run steelhead, therefore, represent at least 33 persecent and as much as 60 percent of the production capacity of the ESU.

B-run steelhead are distinguished from the A-run component by their unique life history characteristics. B-run steelhead were traditionally distinguished as larger fish with a later run timing. The recent review by the U.S. v. Oregon Technical Advisory Committee (TAC), a group that monitors adult salmon and steelhead escapement in the Snake River Basin, indicated that different populations of steelhead do have different size structures, with populations dominated by larger fish (i.e., greater than 77.5 cm) occurring in the traditionally defined B-run basins. Larger fish occur in other populations throughout the basin, but at much lower rates. Evidence suggests that fish returning to the Middle Fork Salmon River and Little Salmon River have a more equal distribution of large and small fish. B-run steelhead also are generally older. A-run steelhead are predominately 1-ocean fish, whereas most B-run steelhead generally spend 2 or more years in the ocean before spawning. The differences in ocean age are primarily responsible for the differences in the size of A- and B-run steelhead. However, B-run steelhead are also thought to be larger at any given age than

A-run fish. This may be due, at least in part, to the fact that B-run steelhead leave the ocean later in the year than A-run steelhead and thus have an extra month or more of ocean residence when growth rates are thought to be greatest.

Action Area Information

Lower Grande Ronde River sub-basin, approximately 25 percent of which is within the Umatilla National Forest, has 10 major streams that contain more than five miles of anadromous fish habitat inside National Forest system land, including Grande Ronde River, Wenaha River, Butte Creek, Crooked Creek, Elk Creek, Swamp Creek, Davis Creek, Cottonwood Creek, Mud Creek and Wildcat Creek. Wenaha River holds roughly 26 miles of anadromous fish habitat inside the Umatilla National Forest.

Lower Snake/Asotin Subbasin has one major stream that contains more than five miles of anadromous fish habitat inside the Umatilla National Forest. Asotin River holds 10 miles of anadromous habitat inside the National Forest system land. Lower Snake/Tucannon Subbasin, approximately 10 percent of which is within Umatilla National Forest, has one major stream, Tucannon River, which holds roughly 13 miles of anadromous fish habitat inside National Forest system land.

Upper Grande Ronde River Subbasin, approximately 10 percent of which is within the Umatilla National Forest, has 14 major streams that contain more than five miles of anadromous fish habitat inside National Forest system land, including Meadow Cr., Burnt Corral Cr., McCoy Cr., Indian Cr., Dark Canyon, Spring Creek, Five Points Creek, Sheep Creek, Clear Creek, Beaver Creek, Limber Jim Creek, Lookingglass Creek, Little Lookingglass Creek, and Phillips Creek. Lookingglass Creek holds roughly 7 miles of anadromous fish habitat inside the Umatilla National Forest.

Columbia River Bull Trout

This section is taken directly out of the R6 2005 FEIS Fish BA so as not to recreate information.

The FWS BOs for the FS LRMPs as amended by the NWFP and the FS LRMPs as amended by the PACFISH and INFISH provided a general description of the status of bull trout in the NWFP (USDI, 1998 and USDI, 2004). The draft Bull Trout Recovery Plan provides information on the distribution and abundance of bull trout in all Distinct Population Segments (DPS) in the conterminous United States, and offers the most recent status information for the species by recovery unit (USDI, 2002). Of the 23 recovery units for bull trout, 16 extend into NF lands. Chapters 2, 5 to 14, and 20 to 24 of the Draft Recovery Plans describe the current distribution and abundance of the recovery units considered in this BA. Reasons for decline for each recovery unit are identified within draft Bull Trout Recovery Plans.

Detailed accounts of life history, taxonomy and behavior can be found in the final rule listing the Columbia River and Klamath River populations of bull trout as threatened (USFWS, 1998b), and in the determination of threatened status for bull trout in the conterminous United States (USFWS, 1999a) for Coastal-Puget Sound, and the Status of Oregon's bull trout; distribution, life history, limiting factors, management considerations, and status (Buchanan et al., 1997).

The FWS has draft recovery plans for the Columbia River and Klamath River DPSs (USFWS 2002a) and the Coastal-Puget Sound DPS (USFWS 2004a). Through these efforts, the FWS has converted bull trout subpopulations into "core areas." Core areas represent a combination of habitat that provides all elements for the long-term security of bull trout and the presence of bull trout inhabiting core habitat.

Thus, core areas form the basis on which to gauge recovery within a recovery unit. Thus, a core area, by definition, is considered habitat occupied by bull trout and serves as a biologically discrete unit upon which to base bull trout recovery. Within core areas, groups of bull trout or local populations which spawn in various tributaries are generally characterized by relatively small amounts of genetic diversity within a tributary, but high levels of genetic divergence between tributaries (Chapter 1, recovery plan). Individual local populations may come and go or expand and contract over time, but the focus of the draft recovery plan is maintaining all existing core areas.

Critical Habitat

Critical habitat was designated by the FWS for the Columbia River DPS bull trout on October 6, 2004 (69 FR 59996) (USFWS 2004b). Lands not designated as critical habitat for Columbia River Basin bull trout include those that do not meet the requirement of needing special management or protection and are excluded due to the exercise of the Secretary of Interior's Authority under section 4(b)(2) of the ESA.

On September 21, 2004, the FWS designated 2,812 km (1,748 mi) of streams and 24,781 ha (61,235 ac) of lakes in Oregon, Idaho, and Washington as critical habitat for bull trout. Within the Columbia River Basin, 1,136 km (706 mi) of streams in Oregon and 1,186 km (737 mi) of streams in Washington were designated as critical habitat (USFWS 2004b).

The FWS determined that PACFISH, INFISH, the Interior Columbia Basin Ecosystem Management Project (ICBEMP) strategy, and the Northwest Forest Plan (NWFP) Aquatic Conservation Strategy (ACS) provide conservation, adequate protection and special management for the primary constituent elements (PCEs) essential for bull trout. Protection is at least comparable to designating critical habitat. As a result, those lands are not being designated critical habitat as they do not meet the statutory definition. In many specific ways these plans are superior to a designation in that they require enhancement and restoration of habitat, acts not required by the designation.

Areas related to the scope of this BA and exempt from designated critical habitat are national forest (NF) lands under the Northwest Forest Plan. However, downstream impacts from activities on NF lands are still possible and are assessed appropriately.

The FWS critical habitat designation identified those physical and biological features of the habitat that are essential to the conservation of the species and that may require special management consideration or protection. These physical and biological features include, but are not limited to:

- Space for individual and population growth
- Space for normal behavior; food, water, or other nutritional or physiological requirements
- Cover or shelter
- Sites for breeding, reproduction, or rearing of offspring
- Habitats that are protected from disturbance or are representative of the historic geographical and ecological distribution of a species

All areas proposed as critical habitat for bull trout are within the historic geographic range of the species and contain one or more of these physical or biological features essential to the conservation of the species. The FWS also included a list of known primary constituent elements with the critical habitat description. The primary constituent elements may include, but are not limited to, features such as spawning sites, feeding sites, and water quality or quantity. The FWS determined the primary constituent elements for bull trout from studies of their habitat requirements, life-history characteristics, and population biology, as outlined above. These primary constituent elements are:

- Permanent water having low levels of contaminants such that normal reproduction, growth and survival are not inhibited
- Water temperatures ranging from 2 to 15 °C (36 to 59 °F), with adequate thermal refugia available for temperatures at the upper end of this range. Specific temperatures within this range will vary depending on bull trout life history stage and form, geography, elevation, diurnal and seasonal variation, shade, such as that provided by riparian habitat, and local groundwater influence
- Complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and instream structures
- Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine substrate less than 0.63 cm (0.25) in diameter and minimal substrate embeddedness are characteristic of these conditions
- A natural hydrograph, including peak, high, low and base flows within historic ranges or, if regulated, a hydrograph that demonstrates the ability to support bull trout populations
- Springs, seeps, groundwater sources, and subsurface water connectivity to contribute to water quality and quantity
- Migratory corridors with minimal physical, biological, or chemical barriers between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows
- An abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish
- Few or no predatory, interbreeding, or competitive nonnative species present

Life History and Habitat Description

Biology

Bull trout exhibit both resident and migratory life-history strategies (Rieman and McIntyre 1993). Resident bull trout complete their entire life cycle in the tributary (or nearby) streams in which they spawn and rear. Migratory bull trout spawn in tributary streams where juvenile fish rear one to four years before migrating to either a lake (adfluvial form), river (fluvial form) (Fraley and Shepard1989, Goetz 1989), or in certain coastal areas, to saltwater (anadromous) (Cavender 1978; McPhail and Baxter 1996; WDFW et al., 1997). Resident and migratory life-history forms may be found together but it is unknown if they represent a single population or separate populations (Rieman and McIntyre 1993). Either form may give rise to offspring exhibiting either resident or migratory behavior (Rieman and McIntyre 1993). The multiple life-history strategies found in bull trout populations represent important diversity (both spatial and genetic) that help protect these populations from environmental stochasticity.

The size and age of bull trout at maturity depends upon the life-history strategy and habitat limitations. Resident fish tend to be smaller than migratory fish at maturity and produce fewer eggs (Fraley and Shepard 1989; Goetz, 1989). Resident adults usually range from 150 to 300 millimeters (6 to 12 inches) total length (TL). Migratory adults however, having lived for several years in larger rivers or lakes and feeding on other fish, grow to a much larger size and commonly reach 600 millimeters (24 inches) TL or more (Pratt 1985; Goetz 1989).

The largest verified bull trout was a 14.6-kilogram (32-pound) adfluvial fish caught in Lake Pend Oreille, Idaho, in 1949 (Simpson and Wallace 1982).

Size differs little between life-history forms during their first years of life in headwater streams, but diverges as migratory fish move into larger and more productive waters (Rieman and McIntyre 1993).

Ratliff (1992) reported that bull trout under 100 mm (4 inches) in length were generally only found in the vicinity of spawning areas, and that fish over 100 mm were found downstream in larger channels and reservoirs in the Metolius River Basin. Juvenile migrants in the Umatilla River were primarily 100-200 mm long (4 to 8 inches) in the spring and 200-300 mm long (8 to 12 inches) in October (Buchanan et al., 1997). The age at migration for juveniles is variable. Ratliff (1992) reported that most juveniles reached a size to migrate downstream at age 2, with some at ages 1 and 3 years. Pratt (1992) had similar findings for age-at-migration of juvenile bull trout from tributaries of the Flathead River. The seasonal timing of juvenile downstream migration appears similarly variable.

Bull trout normally reach sexual maturity in 4 to 7 years and may live longer than 12 years. The species is iteroparous (i.e., can spawn multiple times in their lifetime) and adults may spawn each year or in alternate years (Batt 1996). Repeat-spawning frequency and post-spawning mortality are not well documented (Leathe and Graham 1982; Fraley and Shepard 1989; Pratt 1992; Rieman and McIntyre 1996) but post-spawn survival rates are believed to be high.

Bull trout typically spawn from late August to November during periods of decreasing water temperatures (below 9 degrees Celsius/48 degrees Fahrenheit). Redds are often constructed in stream reaches fed by springs or near other sources of cold groundwater (Goetz 1989; Pratt 1992; Rieman and McIntyre 1996). Migratory bull trout frequently begin spawning migrations as early as April and have been known to move upstream as far as 250 kilometers (km) (155 miles) to spawning grounds in Montana (Fraley and Shepard 1989; Swanberg 1997). In Idaho, bull trout moved 109 km (67.5 miles) from Arrowrock Reservoir to spawning areas in the headwaters of the Boise River (Flatter 1998). In the Blackfoot River, Montana, bull trout began spring spawning migrations in response to increasing temperatures (Swanberg, 1997). Depending on water temperature, egg incubation is normally 100 to 145 days (Pratt 1992), and after hatching, juveniles remain in the substrate. Time from egg deposition to emergence of fry may surpass 220 days. Fry normally emerge from early April through May, depending on water temperatures and increasing stream flows (Pratt 1992; Ratliff and Howell 1992).

Bull trout are opportunistic feeders, with food habits primarily a function of size and life-history strategy. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macro-zooplankton, and small fish (Boag 1987; Goetz 1989; Donald and Alger 1993). Adult migratory bull trout feed on various fish species (Leathe and Graham 1982; Fraley and Shepard 1989; Brown 1992; Donald and Alger 1993). In coastal areas of western Washington, bull trout feed on Pacific herring (Clupea pallasi), Pacific sand lance (Ammodytes hexapterus), and surf smelt (Hypomesus pretiosus) in the ocean (WDFW et al., 1997).

Habitat Affinities

Bull trout have more specific habitat requirements than most other salmonids (Rieman and McIntyre 1993). Habitat components that influence the species' distribution and abundance include water temperature, cover, channel form and stability, valley form, spawning and rearing substrate, and availability of migratory corridors (Fraley and Shepard, 1989; Goetz 1989; Hoelscher and Bjornn 1989; Sedell and Everest 1991; Howell and Buchanan 1992; Pratt 1992; Rieman and McIntyre 1993, 1995; Rich 1996; Watson and Hillman 1997).

Watson and Hillman (1997) concluded that watersheds must have specific physical characteristics to provide the habitat requirements necessary for bull trout to successfully spawn and rear and that these specific characteristics are not necessarily present throughout these watersheds. Because bull trout exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993), individuals of this species should not be expected to simultaneously occupy all available habitats (Rieman et al., 1997).

Bull trout are found primarily in cold streams, although individual fish are found in larger, warmer river systems throughout the Columbia River Basin (Fraley and Shepard 1989; Rieman and McIntyre 1993, 1995; Buchanan and Gregory 1997; Rieman et al., 1997). Water temperature above 15 degrees Celsius (59 degrees Fahrenheit) is believed to limit bull trout distribution, a limitation that may partially explain the patchy distribution within a watershed (Fraley and Shepard 1989; Rieman and McIntyre 1995).

Spawning areas are often associated with cold-water springs, groundwater infiltration, and the streams with the coldest summer water temperatures in a given watershed (Pratt 1992; Rieman and McIntyre 1993; Rieman et al., 1997; Baxter et al., 1999). Water temperatures during spawning generally range from 5 to 9 degrees Celsius (41 to 48 degrees Fahrenheit) (Goetz 1989). The requirement for cold water during egg incubation has generally limited the spawning distribution of bull trout to high elevations in areas where the summer climate is warm. Rieman and McIntyre (1995) found in the Boise River Basin that no juvenile bull trout were present in streams below 1613 m (5000 feet). Similarly, in the Sprague River Basin of south-central Oregon, Ziller (1992) found in four streams with bull trout that “numbers of bull trout increased and numbers of other trout species decreased as elevation increased. In those streams, bull trout were only found at elevations above 1774 m [5500 feet].”

All life-history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Fraley and Shepard 1989; Goetz 1989; Hoelscher and Bjornn 1989; Sedell and Everest 1991; Pratt 1992; Thomas 1992; Rich 1996; Sexauer and James 1997; Watson and Hillman 1997). Jakober (1995) observed bull trout overwintering in deep beaver ponds or pools containing large woody debris in the Bitterroot River drainage, Montana, and suggested that, because of the need to avoid anchor ice in order to survive, suitable winter habitat may be more restricted than summer habitat. Maintaining bull trout habitat requires stability of stream channels and of flow (Rieman and McIntyre 1993). Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997). These areas are sensitive to activities that directly or indirectly affect stream channel stability and alter natural flow patterns. For example, altered stream flow in the fall may disrupt bull trout during the spawning period, and channel instability may decrease survival of eggs and young juveniles in the gravel from winter through spring (Fraley and Shepard 1989; Pratt 1992; Pratt and Huston 1993).

Preferred bull trout spawning habitat consists of low-gradient stream reaches with loose, clean gravel (Fraley and Shepard 1989). In the Swan River, Montana, abundance of bull trout redds was positively correlated with the extent of bounded alluvial valley reaches, which are likely areas of groundwater to surface water exchange (Baxter et al., 1999). Survival of bull trout embryos planted in stream areas of groundwater upwelling used by bull trout for spawning were significantly higher than embryos planted in areas of surface-water recharge not used by bull trout for spawning (Baxter and McPhail 1999). Pratt (1992) indicated that increases in fine sediment reduce egg survival and emergence.

Migratory corridors link seasonal habitats for all bull trout life-history forms. For example, in Montana, migratory bull trout make extensive migrations in the Flathead River system (Fraley and Shepard 1989), and resident bull trout in tributaries of the Bitterroot River move downstream to overwinter in tributary pools (Jakober 1995). The ability to migrate is important to the persistence of bull trout (Rieman and McIntyre 1993; M. Gilpin, in litt., 1997; Rieman et al., 1997). Migrations facilitate gene flow among local populations when individuals from different local populations interbreed, or stray, to non-natal streams. Local bull trout populations that are extirpated by catastrophic events may also become re-established by migrants.

Action Area Information

Bull trout are found in the following **fifth field** and *sixth field* watersheds on the Umatilla National Forest:

- **Asotin Creek** *(North Fork Asotin Creek)*
- **Desolation Creek** *(North Fork Desolation Creek)*
- **Grande Ronde River/Grossman Creek** *(Elbow Creek, Grande Ronde River/Bear Creek*
- **Granite Creek** *(Clear Creek)*
- **Lookingglass Creek** *(Little Lookingglass Creek, Upper Lookingglass Creek, Lower Lookingglass Creek)*
- **Meacham Creek** (Boston Canyon, Camp Creek, North Fork Meacham Creek),
- **Mill Creek** *(Upper Mill Creek,*
- **Upper Touchet River** *(Upper North Fork Touchet River)*
- **Upper Tucannon River** *(Cummings Creek, Little Tucannon River, Tucannon River Headwaters, Panjab Creek)*
- **Upper Umatilla River** *(Bear Creek, North Fork Umatilla River, Buck Creek, Ryan Creek, South Fork Umatilla River, Thomas Creek)*
- **Upper Walla Walla River** *(North Fork Walla Walla River, Upper South Fork Walla Walla River, Middle South Fork Walla Walla River)*
- **Wenaha River** *(Upper South Fork Wenaha River, Lower South Fork Wenaha River, Wenaha River/Rock Creek, Lower Butte Creek, Upper Butte Creek, Wenaha River/Cross Canyon, Upper Crooked Creek, Lower Crooked Creek, Lower Wenaha River, First Creek)*

Middle Columbia River Spring Run Chinook Salmon (Sensitive)

Middle Columbia River spring run Chinook salmon are stream-type salmon that spawn in the Klickitat, Deschutes, John Day, and Yakima Rivers.

Historically, spring-run populations from the Hood, Walla Walla, and Umatilla Rivers may have also belonged in this ESU, but these populations are now considered extinct. MCR spring run Chinook salmon emigrate to the ocean as yearlings and apparently migrate far off-shore, as they do not appear in appreciable numbers in any ocean fisheries. The majority of adults spawn as 4-year-olds, with the exception of fish returning to the upper tributaries of the Yakima River, which return predominantly at age 5. Populations are genetically distinguishable from other stream-type chinook salmon in the Columbia and Snake Rivers. Streams in this region drain desert areas east of the Cascades (Columbia Basin Ecoregion) and are ecologically differentiated from the colder, less productive, glacial streams of the upper Columbia River Spring-Run ESU and from the generally higher elevation streams of the Snake River.

Redband Trout (Sensitive)

Inland redband trout are the same species as steelhead (O. mykiss) and juveniles cannot be distinguished phenotypicaly. Isolated populations of O. mykiss above longstanding natural passage barriers (and barring hatchery introductions) may be reasonably assumed to be resident redbands.

Redband trout are sensitive to changes in water quality and habitat. Redband trout of interior Oregon basins are believed to be best adapted to cold (less than 21° C), clean water, but a few Great Basin populations possess a hereditary basis to function at high temperatures (Behnke 1992). Adult redband trout are generally associated with pool habitats, although various life stages require a wide array of habitats for rearing, hiding, feeding, and resting. Pool habitat is important refugia during low water periods.

Spawning success decreases as fine sediment increases. The quantity and quality of pool and interstitial habitat also decrease as fine sediment increases. Other important habitat features include healthy riparian vegetation, undercut banks, and LWD (large woody debris).

Spawning occurs during the spring, generally from March to June. Redds tend to be located where velocity, depth and bottom configuration induce water flow through the stream substrate, generally in gravels at the tailouts of pools. Water temperatures influence emergence of fry, which is typically from June through July.

Redband trout are widely distributed across Oregon east of the Cascade Mountains. According to the Umatilla Forest GIS data, redband trout are found within the Project Area in the North Fork John Day River/Potamus Creek, Wall Creek and Lower John Day River/Kahler Creek watersheds. They are also found in the Tucannon and Asotin watersheds (S. Reinecke Pers. Comm.).

Westslope Cutthroat Trout (Sensitive)

Westslope cutthroat trout inhabit small mountain streams, main rivers, and large natural lakes. They require cool, clean, well-oxygenated water and prefer large pools and slow velocity areas. 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 (Spahr et al. 1991, McIntyre and Rieman 1995). Many fry disperse downstream after emergence (McIntyre and Rieman 1995). Juveniles tend to overwinter in interstitial spaces in the substrate. Larger individuals congregate in pools in winter.

Westslope cutthroat trout spawn in small tributary streams on clean gravel substrate where mean water depth is 17-20 cm and mean water velocity is 0.3-0.4 m/sec.

They tend to spawn in natal stream (see McIntyre and Rieman 1995). 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 (McIntyre and Rieman 1995). 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 (Behnke 1992).

Westslope cutthroat trout are native to the upper Missouri River drainage in Montana, extreme northwestern Wyoming, and southern Alberta; the Salmon, Clearwater, and Spokane (including the Coeur d'Alene and St. Joe drainages) river drainages in Idaho; and the Clark Fork and Kootenai river drainages in Idaho, Montana, and British Columbia (Spahr et al. 1991); also westward to the Cascade

Mountains as disjunct populations, for example, in the Lake Chelan drainage in Washington, the John Day River drainage in Oregon (where limited hybridization with redband trout apparently has occurred), and elsewhere in mid-Columbia tributaries (Behnke 1992), including the Methow, Entiat, and Wenatchee river Basins in Washington (McIntyre and Rieman 1995).

According to Umatilla Forest GIS data, westslope cutthroat trout occur within the Project Area in the Granite Creek and Desolation Creek subwatersheds.

Margined Sculpin (Sensitive)

Margined sculpin appear adaptable to a wide variety of currents and substrates (Lee et al. 1980). In areas where they are not competing with other species of sculpins, they are typically found in moderate to rapid current on rubble or gravel substrate. They probably spawn in the spring like most other sculpins.

Margined sculpin occurs in the Columbia River drainage from the Tucannon and Walla Walla River systems, Washington, to the Umatilla River system, Oregon. They are fairly common within that small range (Page and Burr 1991).

3.5.3 Environmental Consequences

This section discusses the general effects of herbicide use for invasive plant treatments to fish and other aquatic organisms as well as the specific effects of the No Action and Action Alternatives. Much of the effects discussion is incorporated from Risk Assessments and the Fisheries BA completed for the Region 6 2005 Final Environmental Impact Statement for the Regional Invasive Plant Program and associated documents. A full discussion of the Herbicide Risk Assessments in regard to proposed treatments can be found in the Fisheries Report available in the Project Record. A discussion of toxicity indexes and hazard quotients of chemicals and surfactants are disclosed in Appendix E.

General Effects of Herbicide Use for Invasive Plant Treatments

Fish and other aquatic organisms have the potential to be adversely affected by contact with concentrations of herbicide that exceed levels of concern in water. For example, herbicides applied near a stream could inadvertently contact aquatic invertebrates that rely on terrestrial plants to fulfill their life cycle and thus reduce the availability of food for fish. Herbicides can alter the structure and biological processes of both terrestrial and aquatic ecosystems; these effects of herbicides may have more profound influences on communities of fish and other aquatic organisms than direct lethal or sublethal toxic effects (Norris et al. 1991). Herbicides used for aquatic invasive plant control have been shown to affect aquatic ecosystem components, however concentration of herbicides coming in contact with water following land-base treatments are unlikely to be great enough to cause such changes (ibid). Since this project does not include treatment of emergent aquatic plants, effects from aquatic invasive plant control are not a concern.

Sublethal effects can include changes in behaviors or body functions that are not directly lethal to the aquatic species, but could have consequences to reproduction, juvenile to adult survival, or other important components to health and fitness of the species. Or, sublethal effects could result from effects to habitat or food supply.

Residues in food from direct spraying are not likely to occur since herbicides would not be applied to emergent aquatic vegetation. Drift from herbicides used on terrestrial vegetation may affect aquatic vegetation at low concentrations, however they show little tendency to bioaccumulate and are likely to be rapidly excreted by organisms as exposure decreases (Norris et al. 1991).

Therefore, while the herbicides considered for use in this project may kill individual aquatic plants, aquatic habitats and the food chain would not be adversely impacted because the amount of herbicide that could be delivered is relatively low in comparison with levels of concern from SERA Assessments and the duration to which any non-target organism (including aquatic plants) would be exposed is very short-lived and impacts to aquatic plants would be very localized.

The application rate and method, along with the behavior of the herbicide in the environment, influence the amount and length of time an herbicide persists in water, sediment, or food sources. Once in contact, the herbicide must be taken up by the organism and moved to the site of biochemical action where the chemical must be present in an active form at a concentration high enough to cause a biological effect (Norris et al. 1991).

Herbicides vary in their environmental activity and physical form. Some may be oil- or water-soluble molecules dissolved in liquids, or attached to granules for dry application to soil surface. Herbicides may move from their location of application through leaching (dissolved in water as it moves through soil), volatilization (moving through air as a dissolved gas), or adsorption (attached by molecular electrical charges to soil particles that are moved by wind or water).

In soil and water, herbicides may persist or decompose by sunlight, microorganisms, or other environmental factors. Soil properties, rainfall patterns, slope, and vegetative cover greatly influence the likelihood that an herbicide will move off-site, once applied.

In combination with other site and biological factors, these characteristics influence both the probability of meeting site-specific goals for invasive plant control, and the potential of impacting non-target components of the environment.

The effects from the use of any herbicide depends 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. Risk to aquatic organisms can be reduced by choosing herbicides with lower potential for toxic effects when exposure may occur. Exposure of federally listed fish to herbicides can be greatly reduced or increased depending on site-specific implementation techniques and timing used in herbicide application projects. Exposure can be reduced by such methods as streamside buffer zones, timing applications to avoid sensitive seasons, varying application methods used, and combining herbicide treatments with non-herbicide treatments to reduce overall use. Project Design Features included in the Proposed Action are expected to minimize potential exposures to federally listed fish.

The hazards associated with each herbicide active and inert ingredients, impurity or metabolite were determined by a thorough review of available toxicological studies. For a background discussion of all toxicological tests and endpoints considered in Forest Service Risk Assessments, refer to SERA, 2001.

Herbicides are not pure compounds and they contain the active ingredient, impurities, adjuvants, inert ingredients, and may also contain surfactants. The effects of inert ingredients, adjuvants, impurities, and surfactants to wildlife (includes fish) are discussed first, followed by a discussion of the effects of the active ingredients.

The movement, persistence, and fate of an herbicide in the environment determine the likelihood and the nature of the exposure fish and other aquatic organisms will receive. Stream and lake sediments may be contaminated with herbicides by deposition of soils carrying adsorbed herbicides from the land or by adsorption of herbicides from the water (Norris et al. 1991). Persistence of the herbicide is the predominant factor affecting its presence in the soil.

Stream and lake sediments may be contaminated with herbicides by deposition of soils carrying adsorbed herbicides from the land or by adsorption of herbicides from the water (ibid).

Effects of Active Ingredients in Herbicide to Aquatic Organisms

The most sensitive effect from the most sensitive species tested was used to determine the toxicity indices for each herbicide. Quantitative estimates of dose from each exposure scenario were compared to the corresponding toxicity index to determine the potential for adverse effect. Doses below the toxicity indices resulted in discountable effects. Table 45 lists the toxicity indices for fish used for the R6 2005 FEIS BA. Values in bold are the values used to assess risk to fish from acute exposures. Indices represent the most sensitive endpoint from the most sensitive species for which adequate data are available. Numbers in bold indicate the toxicity index used in calculating the hazard quotient for exposures to listed fish. 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 45 - Toxicity Indices for Listed Fish

Herbicide	Duration	Endpoint	Dose	Species	Effect Noted at LOAEL
Chlorsulfuron	Acute	NOEC	**2 mg/L** (1/20th of LC50)	Brown trout	LC50 at 40 mg/L
	Chronic	NOEC1	3.2 mg/L	Brown trout	rainbow trout length affected at 66mg/L
Clopyralid	Acute	NOEC	**5 mg/L** (1/20th of LC50)	Rainbow trout	LC50 at 103 mg/L
	Chronic				none available
Glyphosate (no surfactant)	Acute	NOEC	**0.5 mg/L** (1/20th/LC50)	Rainbow trout	LC50 at 10 mg/L
	Chronic	NOEC	2.57 mg/L2	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	salmonids	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 weigh 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/L3
	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
	Chronic4	NOEC	104 mg/L	Fathead minnow	Reduced survival of embryo/larval stages at 140 mg/L
NPE Surfactants	Acute5	NOEC	0.2 mg/L (1/20th LC50)	fathead minnow, rainbow trout	LC50 at 4.0 mg/L
	Chronic6	NOEC	1.0 mg/L	trout	no LOEL given

1 Chronic value for brown trout (sensitive sp.) was estimated using relative potency in acute and chronic values for rainbow trout, and the acute value for brown trout.
2 Estimated from minnow chronic NOEC using the relative potency factor method (SERA Glyphosate 2003).
3 Using Wan et al. (1989) value for lethal dose
4 Chronic and subchronic data for triclopyr are limited to triclopyr TEA. No data is available for triclopyr BEE.
5 Exposure includes small percentage of NP and NP1-2E (Bakke, 2003).
6 Chronic exposures are from degredates NP1EC and NP2EC, because NPE breaks down rapidly and NPECs are more persistent (Bakke, 2003).
NOEC = No Observable Effect Concentration
LOAEL – Lowest Observed Adverse Effect Level

Results of the exposure scenarios as applied to listed fish on the Umatilla National Forest are displayed below in Table 46. The R6 2005 FEIS Fish BA displayed the results by placing stars (*) and diamonds (♦) where there was an exceedence in the level of concern (LOC). For purposes of this BE the table of stars and diamonds has been modified to show the hazard quotients (HQ) value in order to exemplify the magnitude of difference between typical and high application rates, and aquatic and non-aquatic formulations. Where table cells display "--"and no number means that there was no exceedence in level of concern. The LOC exceedences occur when the HQ value exceeds 1. Exceedences in LOC indicate occasions where the expected exposure concentration (EEC) is greater than the no observable effect concentration (NOEC) value used for that aquatic species group, which may lead to an indirect effect to listed aquatic species if conditions were similar to what was modeled in the SERA risk assessments. To calculate a HQ, simply take the ratio of EEC/NOEC values. Toxicity indices used in the R6 2005 FEIS for aquatic organisms are NOEC values, refer to table above.

Two types of indirect effects are possible, those toxic to the listed aquatic species, and those mediated by toxic effects to an ecosystem component that is part of the Primary Constituent Elements (PCE) or associated essential habitat features.

Table 46 - Hazard Quotient Values for Acute Exposure Estimates for Sensitive Aquatic Organisms from the R6 2005 FEIS Broadcast Spray Scenarios

Aquatic Species Group / Application Rate	Chlorsulfuron	Clopyralid	Glyphosate w/o surfactant*	Glyphosate with surfactant	Imazapic	Imazapyr*	Metsulfuron Methyl	Picloram	Sethoxydim	Sulfometron Methyl	Triclopyr TEA*	Triclopyr BEE	NPE surfactant
Fish High	--	--	6	43	--	--	--	5	3	--	15	125	--
Typical	--	--	2	12	--	--	--	2	2.5	--	1.5	13	--
Aquatic invertebrates High	--	--	--	2.5	--	--	--	--	--	--	--	1.8	--
Typical	--	--	--	--	--	--	--	--	--	--	--	--	--
Algae High	5	--	--	3.1	--	5	--	--	--	3	9.5	214	--
Typical	--	--	--	--	--	2	--	--	--	--	--	21	--
Aquatic macrophytes High	1064	--	--	--	1.4	8	9	2	--	36	9.5	214	--
Typical	234	--	--	--	--	3	2	--		4		21	

'--' Predicted concentrations less than or equal to the estimated or measured 'no observable effect concentration' at both typical and high application rates.
'*' Aquatic formulations analyzed in the R6 2005 FEIS.

The exposure scenarios do not account for factors such as timing of application, animal behavior and feeding strategies, animal presence within a treatment area, or other relevant factors such as site-specific conditions. However, the SERA risk assessments do represent a worst-case scenario that is a good benchmark for assessing true concerns with actual application. Results of triclopyr exposures take into account the strict limitations on use identified in the forest plan standards, which makes the exposure scenarios implausible or impossible. Table 46 displays the results of exposure if all "worst-case" conditions reflected in the scenario occur, which is highly unlikely for Umatilla National Forest.

In Appendix E, the Chronic and Acute Exposures section focuses on the probability and magnitude of acute exposures from herbicide treatments based on results from the SERA risk assessments Table 46 above). It also contains a summary of herbicide characteristics in soil in order to gain a better understanding of the probability of adverse effects to aquatic organisms should the herbicide come in contact with water.

Effects of Surfactants

Appendix 3c of the SERA 2003 risk assessment summarizes the available ecological information from all of the Material Safety Data Sheets (MSDS) for the formulations that are labeled for forestry applications. It is apparent that these formulations fall into relatively clear groups. The most toxic formulations appear to be Credit Systemic, Credit, Glyfos, Glyphosate, glyphosate Original, Prosecutor Plus Tracker, Razor SPI, Razor, Roundup Original, Roundup Pro Concentrate, and

Roundup UltraMax. It may be presumed that these formulations contain the most toxic surfactants. Other formulations such as Aqua Neat, Aquamaster, Debit TMF, Eagre, Foresters' Non-Selective Herbicide, Glyphosate VMF, and Roundup Custom are much less acutely toxic (See Appendix E of this EIS, and the BE for this EIS (available in the Project Record at the Umatilla National Forest in Pendleton, OR), for more details about surfactants).

For the SERA 2003 risk assessment, the uncertainties involving the presence or absence of a surfactant and the possibly differing effects of using various surfactants cannot be resolved with certainty. The R6 2005 FEIS addresses this uncertainty through Standard #18.

Effects of the Alternatives

Alternative A – No Action

Direct and Indirect Effects

Manual, mechanical, cultural and biological treatments would continue under an existing decision from the Umatilla National Forest 1995 EA for the Treatment of Noxious Weeds. Under this alternative less than seven percent of known sites would be treated with herbicide, leaving a heavy reliance on manual treatments, which in many cases is cost prohibitive. Repeated manual treatments may effectively control small, isolated populations of certain plants, however associated labor, time and cost may make manual treatments less practical and effective, especially when treating large infestations.

The decision made in the "95 EA" allows use of glyphosate and picloram on up to 125 acres per year. Picloram is a high risk herbicide for aquatic resources but is preferred in many situations because it is a selective herbicide that represses reestablishment of target invasive species. Glyphosate is nonspecific and kills all vegetation.

According to the soil and water analysis for this EIS, there could be a short-term reduction in soil cover for the areas treated. This localized reduction in cover would increase treated areas vulnerability to soil erosion. The effects would be minimal given the small amount of land treated, especially within Aquatic Influence Zones, and the scattered nature of the treatments. These effects would last approximately one season until vegetation became re-established. Most invasive plants provide less stream-shading than native hardwoods and conifers and less bank stabilization than deeper rooted native vegetation.

Invasive plants would continue to grow on sites where treatment is currently not authorized by a NEPA analysis. There is no mechanism in Alternative A that allows for Early Detection Rapid Response (EDRR). No broadcast application takes place within RHCAs under the No Action Alternative so there is little chance of herbicide drift into streams.

Cumulative Effects

This alternative is covered under the decision made for the 1995 EA. Treatments would occur on an extremely small percentage of any watersheds in the Project Area. Direct and indirect effects are so insignificant and temporary that treatment under No Action could not plausibly contribute to significant cumulative effects.

Alternative B – Proposed Action

Direct and Indirect Effects

Non-herbicide Treatment Methods

All invasive plant treatments can result in some erosion, stream sedimentation, and disturbance to aquatic organisms if carried out over a large enough area. Sedimentation can cover eggs or spawning gravels, reduce prey availability, and harm fish gills. Soil can also become compacted and prevent the establishment of native vegetative cover. All invasive plant treatments can reduce insect biomass, which would result in a decrease in the supply of food for fish and other aquatic organism. Reductions in cover, shade, and sources of food from riparian vegetation could result from herbicide deposition in a streamside zone (Norris et al. 1991).

Riparian vegetation affects habitat structure in several important ways. Roots of riparian vegetation hold soil, which stabilizes banks, prevents addition of soil run-off to water bodies with subsequent increases in turbidity or filling substrate interstices, and helps to create overhanging banks. Riparian and emergent aquatic vegetation can provide hiding cover or refuge for fish and other aquatic organisms where native plants have been replaced.

Manual, Mechanical, Site Restoration and Revegetation Methods

Manual and mechanical treatments related to the Proposed Action are described as methods that may include brush cutters, or other machinery with various types of blades to remove plants. Manual methods include the use of hand-operated tools (e.g., axes, brush hooks, hoes, shovels, hand clippers) to dig up and remove noxious species (USDI 2003).

Direct and indirect effects of manual and mechanical treatments were analyzed in the R6 2005 FEIS (Appendix J). Public scoping issues about these treatments were not raised. Manual treatments, such as lopping or shearing, cause an input of organic material (dead roots) into the soil. As the roots are broken down in the soil food web, nutrients will be released. Rainfall may cause these nutrients to be lost to surface runoff or to groundwater. Bare soils combined with high nutrient levels provide ideal conditions for the establishment of many invasive species. In lower intensity infestations, non-target vegetation could provide erosion control as well as a seed source for establishing native vegetation. In areas with larger amounts of bare soil, PDFs require restoration activities to reestablish native vegetation. The intent is to re-establish competitive local, native vegetation post-treatment in areas of bare ground.

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 in RHCAs on the Umatilla National Forest are not extensive enough to result in significant sediment/turbidity and emergent vegetation will not be treated. Effective invasive plant treatment and restoration of treated sites would improve the function of riparian areas and lead to improved fish habitat conditions.

The Proposed Action would benefit aquatic ecosystems to the extent they effectively restore riparian habitats, especially habitats adjacent to fish bearing streams. The impacts of invasive plants on these habitats can last decades, while the impacts of treatment tend to be short term. Passive and active restoration would accelerate native vegetative recovery in treated sites.

Removal of plant roots along a streambank will cause some ground disturbance and may introduce some sediment to streams. For example, weed wrenching of scotch broom may loosen soil and cause minor amounts of erosion for approximately one season until vegetation was reestablished. These minor amounts of erosion would be negligible once contact with water is made. Under the Proposed Action, significant removal of riparian invasive species would not occur because of the proposed use of herbicides reducing the potential for significant soil disturbance.

Using mowing equipment on existing roads is not expected to impact soils. Soil compaction eliminates soil pores and so reduces water infiltration, aeration, and the ability of plants to root effectively. However, the limited amount of mechanical treatment proposed eliminates risk of extensive soil impacts.

While the relative amounts of manual and mechanical treatments vary, the differences in terms of effects from such treatments are negligible. Other mechanical treatments, such as the use of motorized hand tools, are expected to have effects similar to manual treatments.

Turbidity and Sediment

Manual, mechanical, and restoration treatment activities that incorporate substantial ground-disturbing activities in riparian areas may lead to increased erosion and stream sedimentation. Persistence of increased turbidity depends on the size of the suspended particle and velocity of the water. Impacts related to fine sediment depends on the amount of fine sediment introduced and the holding capacity of the surface water. Increased turbidity can reduce feeding ability or gill function in some fish species and fine sediments can cover eggs or spawning gravels. Effects to listed aquatic species will vary with the proximity of the species and their habitat to the treatment area, the sensitivity of the listed species to turbidity and fine sediment, and the size of the area treated.

Manual, mechanical, and restoration treatments include activities such as hand pulling, mowing, brushing, seeding, and planting. Manual treatments within 100 feet of streams with listed species would occur along the North Fork John Day River, Third Creek, Camas Creek and Alder Creek. The amount of sediment created by these non-herbicide treatments is anticipated to be insignificant because the methods of treatments do not include ground disturbing activities by heavy equipment. Ground disturbing activities by hand pulling and planting will cover a relatively small area and any sediment created at these sites would be quickly dispersed in the large volume of water. In addition, the only listed fish species at the location of treatment are bull trout and Middle Columbia steelhead, therefore Snake River steelhead, Snake River Chinook salmon, and Middle Columbia Chinook salmon would not be exposed to effects from treatments at these sites.

Temperature

Aquatic species have specific needs in terms of water temperature. Increasing water temperature may decrease the dissolved oxygen in water which may affect metabolism and food requirements. Many factors influence water temperature including shade, discharge, channel morphology, air temperature, topography, stream aspect, and interactions with ground water. Shade is the factor that has the potential to be impacted by non-herbicide treatments.

Manual, mechanical, and restoration treatments of some invasive plant species (such as knotweed) may decrease riparian vegetative shading in some areas, thereby increasing the amount of solar radiation striking the water. This may result in a warming effect but many other factors in addition to shade affect water temperature. A significant amount of vegetation would need to be removed to change water temperature in the stream, and shade would have to be provided only by the invasive plant removed.

The only known treatment sites that would remove invasive vegetation directly adjacent to water are the Camas Creek and Alder Creek sites. The amount of vegetation that will be removed at these sites is not enough to measurably impact stream temperature and therefore listed fish will not be exposed to the effects of increased stream temperature from treatments at this site.

Herbicide Treatments

Herbicide treatments proposed for use may result in some minor amounts of herbicide coming in contact with water where there may be fish present, however; the likelihood of the amount being at a level of concern is low. The Project Design Features (PDFs) and Buffers (See Chapter 2.2.3 of the EIS) minimize or eliminate the potential for any herbicide to reach a threshold of concern for listed and sensitive fish species. The Proposed Action would not apply herbicides directly to any stream for purposes of treating aquatic weeds that are floating or submerged in any situation. There are no sites with emergent vegetation proposed for treatment; therefore the potential for high concentrations causing acute toxicity effects is extremely remote.

An accidental spill could result in concentrations of herbicides that could harm aquatic organisms. The Proposed Action includes Project Design Features that would reduce the likelihood and impact of a spill. The Proposed Action allows only certified applicators that have gone through various courses and training to properly use herbicides in a safe manner.

The Proposed Action includes limitations on the type and application method of herbicides in Aquatic Influence Zones and along roads that have high potential for herbicide delivery to streams. The PDFs included in the Proposed Action apply to known sites and those detected in the future. In both cases, the limitations in the PDFs are expected to ensure that herbicide use will not exceed a level of concern for aquatic organisms tested by the SERA risk assessments.

Buffers act as a safety zone to limit the potential for herbicides coming in contact with water at concentrations of concern for aquatic resources through leaching, run-off, or drift. The buffers included in the Proposed Action become more restrictive within Aquatic Influence Zones, especially when water is present. PDFs and buffers were developed based on label advisories, SERA "worst case" risk assessments, previous Section 7 Consultation for the R6 2005 FEIS, Neil Berg's 2004 study of broadcast drift and run off to streams, as well as monitoring data from other herbicide applications projects.

No broadcast applications of herbicides would occur within 100 feet of perennial and wet intermittent streams, lakes, or wetlands, or on roads that have a high potential for herbicide delivery. The majority of herbicides have 50-foot buffers for spot treatments, except for low risk and aquatic labeled herbicides. Spot applications of aquatic labeled formulations of glyphosate and imazapyr may be used up to the water's edge or within 15 feet of isolated standing water present in roadside ditches that are outside the stream buffer. Spot applications of aquatic labeled triclopyr may not be used within 15 feet of perennial and wet intermittent streams or other waterbodies.

Spot applications of aquatic formulations of glyphosate and imazapyr are not likely to result in harmful amounts coming in contact with water and harming fish, invertebrates, and algae. Some aquatic plants would be damaged at the immediate spot spray locations. Glyphosate would not be applied directly to water for weed control, but if it does enter the water it is bound tightly to dissolved and suspended particles and to bottom sediments and becomes inactive.

The Proposed Action limits broadcast application of herbicide to the following situations:

- Outside established buffers for aquatic influence zones along perennial/intermittent streams and other waterbodies (buffers differ by chemical, based on risk factors)
- Outside established buffers when water is present within roadside ditches
- On roads that do not have a high potential for herbicide delivery (see PDF H4)

Analysis of the Effects

Herbicide applications may occur near streams utilized by ESA listed fish species found in the project area. Physiological responses from exposure to herbicides proposed for use are probably similar between bull trout, salmon and steelhead.

Herbicide characteristics and basic hazard identification to aquatic organisms for each herbicide proposed for use is discussed above. The herbicides with a greater likelihood of coming in contact with water are the aquatic formulations of glyphosate, imazapyr, and triclopyr. Therefore, the focus of the quantitative analysis included in this report is on the aquatic formulations. Quantitative analysis of the non-aquatic formulations is covered in the R6 2005 FEIS and is incorporated by reference.

Higher Risk Treatment Scenarios on the Umatilla National Forest

Higher risk treatment scenarios are defined as situations where herbicide exposure could exceed a level of concern for listed fish. Higher risk treatment scenerios also include aerial application of herbicide. Many treatment areas on UNF are within riparian areas and along roads with potential to deliver herbicide to streams. As discussed previously, broadcast treatments would not occur within 100 feet of a wet stream or 50 feet of a dry stream. The treatment methods and herbicides proposed for use within the Aquatic Influence Zone are far less likely to deliver herbicide at levels of concern than broadcasting. Results from the risk assessments far overestimate the amount of herbicide likely to enter surface waters for proposed treatments because actual treatments will not broadcast spray 10 acres immediately adjacent to streams and the Proposed Action contains PDFs that restrict application methods and rates near water. For more information about how risks are abated see Table 6.

Analysis of Higher Risk Scenario 1

The following ten 6th-field watersheds contain at least ten acres of estimated treatment within the Aquatic Influence Zones. In all cases, the existing treatment sites were found to be small and scattered throughout the watersheds. The PDFs and buffers appear to sufficiently reduce risks to a low level, even if all these treatments were to occur simultaneously (unlikely). One of the 6th field watersheds listed below does not contain any federally listed fish, refer to Table 10 in the BE for a complete listing of federally listed fish by 6th field watershed.

Lick Creek – Approximately 17 acres of treatment lie with the aquatic influence zone. One road within this watershed is associated with high risk for delivery of herbicide to streams, with specific PDFs applying. There are no federally listed fish in the Lick Creek 6th field watershed.

North Fork Asotin Creek – Approximately 62 acres of treatment lie within the aquatic influence zone. None of the roads in this watershed are associated with high risk for delivery of herbicides to streams. Federally listed fish include Snake River Steelhead, Snake Rriver Chinook Salmon and Bull Trout.

Little Lookingglass Creek – Approximately 26 acres of treatment lie within the aquatic influence zone. Two roads within this watershed are associated with high risk for delivery of herbicides to streams, with specific PDFs applying. Federally listed fish include Snake River Steelhead and Bull Trout.

Phillips Creek - Approximately 150 acres of treatment lie within the aquatic influence zone. Many roads within this watershed are associated with high risk for delivery of herbicides to streams, with specific PDFs applying. Federally listed fish include Snake River Steelhead

Lower Crooked Creek - Approximately 45 acres of treatment lie within the aquatic influence zone. No roads within this watershed are associated with high risk for delivery of herbicides to streams. Federally listed fish include Bull Trout.

Lower Wenaha River - Approximately 15 acres of treatment lie within the aquatic influence zone. No roads within this watershed are associated with high risk for delivery of herbicides to streams. Federally listed fish include Snake River Steelhead, Snake Rriver Chinook Salmon and Bull Trout.

Little Tucannon River - Approximately 35 acres of treatment lie within the aquatic influence zone. Three roads within this watershed are associated with high risk for delivery of herbicides to streams, with specific PDFs applying. Federally listed fish include Snake River Steelhead, Snake Rriver Chinook Salmon and Bull Trout.

Thomas Creek - Approximately 29 acres of treatment lie within the aquatic influence zone. Many roads within this watershed are associated with high risk for delivery of herbicides to streams, with specific PDFs applying. Federally listed fish include Middle Columbia Steelhead, Middle Columbia Chinook Salmon and Bull Trout.

Butcher Creek - Approximately 66 acres of treatment lie within the aquatic influence zone. Many roads within this watershed are associated with high risk for delivery of herbicides to streams, with specific PDFs applying. Federally listed fish include Middle Columbia Steelhead.

Pearson Creek - Approximately 50 acres of treatment lie within the aquatic influence zone. Many roads within this watershed are associated with high risk for delivery of herbicides to streams, with specific PDFs applying. Federally listed fish include Middle Columbia Steelhead.

Texas Bar - Approximately 28 acres of treatment lie within the aquatic influence zone. Many roads within this watershed are associated with high risk for delivery of herbicides to streams, with specific PDFs applying. Federally listed fish include Middle Columbia Steelhead and Middle Columbia Chinook Salmon.

Bowman Creek - Approximately 39 acres of treatment lie within the aquatic influence zone. Many roads within this watershed are associated with high risk for delivery of herbicides to streams, with specific PDFs applying. Federally listed fish include Middle Columbia Steelhead.

Lane Creek - Approximately 14 acres of treatment lie within the aquatic influence zone. Many roads within this watershed are associated with high risk for delivery of herbicides to streams, with specific PDFs applying. Federally listed fish include Middle Columbia Steelhead and Middle Columbia Chinook Salmon.

East Fork Meadow Creek - Approximately 15 acres of treatment lie within the aquatic influence zone. Many roads within this watershed are associated with high risk for delivery of herbicides to streams, with specific PDFs applying. Federally listed fish include Middle Columbia Steelhead.

Meadow Brook - Approximately 12 acres of treatment lie within the aquatic influence zone. Many roads within this watershed are associated with high risk for delivery of herbicides to streams, with specific PDFs applying. Federally listed fish include Middle Columbia Steelhead.

Upper Ditch - Approximately 29 acres of treatment lie within the aquatic influence zone. Many roads within this watershed are associated with high risk for delivery of herbicides to streams, with specific PDFs applying. Federally listed fish include Middle Columbia Steelhead.

Upper Potamus - Approximately 14 acres of treatment lie within the aquatic influence zone. Two roads within this watershed are associated with high risk for delivery of herbicides to streams, with specific PDFs applying. Federally listed fish include Middle Columbia Steelhead.

Alder/Upper Skookum - Approximately 70 acres of treatment lie within the aquatic influence zone. Many roads within this watershed are associated with high risk for delivery of herbicides to streams, with specific PDFs applying. Federally listed fish include Middle Columbia Steelhead.

Middle Big Wall - Approximately 28 acres of treatment lie within the aquatic influence zone. Many roads within this watershed are associated with high risk for delivery of herbicides to streams, with specific PDFs applying. Federally listed fish include Middle Columbia Steelhead.

Swale Creek - Approximately 13 acres of treatment lie within the aquatic influence zone. Many roads within this watershed are associated with high risk for delivery of herbicides to streams, with specific PDFs applying. Federally listed fish include Middle Columbia Steelhead.

Upper Wilson - Approximately 21 acres of treatment lie within the aquatic influence zone. Many roads within this watershed are associated with high risk for delivery of herbicides to streams, with specific PDFs applying. Federally listed fish include Middle Columbia Steelhead.

Analysis of Higher Risk Scenario 2

Aerial application is proposed in three 6th field watersheds;

Little Tucannon River – Approximately 37 acres are estimated for treatment within this watershed, however none of these acres are within the aquatic influence zone These acres are not concentrated within a single part of the watershed. Specific PDFs apply to aerial treatments, including no application with 300 feet of fish-bearing streams. This watershed includes Snake River steelhead, Snake River Chinook salmon and bull trout.

Middle North Fork Touchet River – Approximately 632 acres are estimated for treatment within this watershed, however none of these acres are within the aquatic influence zone. In fact, the treatment site is more than a mile from the nearest fish-bearing stream. Specific PDFs apply to aerial treatments, including no application with 300 feet of fish-bearing streams. There are no listed fish within this watershed.

Headwaters Tucannon River – Approximately 7 acres are estimated for treatment within this watershed, however, none of these acres are within the aquatic influence zone. In fact the treatment site is almost a mile from the nearest fish-bearing stream. Specific PDFs apply to aerial treatments, including no application with 300 feet of fish-bearing streams. This watershed includes Snake River steelhead, Snake River Chinook salmon and bull trout.

SERA Risk Assessment Worksheets

Some streams within road corridors have treatment areas that parallel both the road and the stream with many continuous acres proposed for treatment within the aquatic influence zone. In reality most of these areas have pockets of invasive plants within a much larger assembly of native vegetation along the stream. To model a worst case scenario a few of these areas were modeled for site specific soil types and rainfall with the GLEAMS spreadsheet. In addition, the model was run for the highest rainfall on the Forest with sandy soil, the soil most likely to allow runoff into the stream (Table 47). Only aquatic glyphosate and aquatic imazapyr were modeled with the high rainfall and sandy soil as they are the only herbicides allowed for spot spray treatments below bankfull.

NF Asotin River has up to 81 acres of treatment of scotch thistle on 3.9 miles of the River and tributaries within 100 feet of the stream channel. Modeling limitations include: modeling only the 50 feet closest to the channel and 1.6 miles of stream channel, and assumes broadcast spray, not spot spray.

The results of this analysis indicate all HQ values were below one; therefore, no levels of concern were exceeded for sensitive fish. The R6 2005 FEIS notes that as HQ increases above one, the margins of safety decrease, compared to the most sensitive toxic effect shown in laboratory studies.

Table 47 - Water contamination rates (mg/L per lb/acre), peak concentrations in water, and range of Hazard Quotients for worst case scenario on the Umatilla NF for aquatic glyphosate, aquatic imazapyr, and aquatic triclopyr at the typical application rate

Herbicide/ location	Annual Precipitation (inches)	Peak Water Contam. Rate (mg/L per lb/acre)	Range of Concentration in water (dose) (mg/L)	Toxicity Index for Listed Fish (mg/L)	Range of Hazard Quotients
Glyphosate (2 lbs/acre)					
NF Asotin River	20-24	0.001 to 0.011	0.002 to 0.022	0.5	4E-03 to 4E-02
Little Phillips Creek	32-56	0.01 to 0.035	0.02 to 0.07	0.5	0.04 to 0.14
Dry, Intermittent Channel, Sandy Soil	25-75	0.0191 to 0.09854	0.03821 to 0.19854	0.5	0.0764 to 0.3942
Jubilee Lake	48-56	0.0031 to 0.00425	0.0062 to 0.0085	0.5	0.0726 to 0.211
Imazapyr (0.45 lbs/acre)					
NF Asotin River	20-24	0.0001 to 0.00042	0.000024 to 0.000019	0.135	0.0002 to 0.001
Little Phillips Creek	32-56	0.00021 to 0.00096	0.000095 to 0.00043	0.135	0.0007 to 0.003
Dry, Intermittent Channel, Sandy Soil	25-75	0.0000691 to 0.00035	0.0003.11 to 0.0001057	0.135	0.0002 to 0.0008
Jubilee Lake	48-56	0.000019 to 0.000021	0.0000086 to 0.0000095	0.135	6E-05 to 7E-05
Chlopyralid (1 lbs/acre)					
NF Asotin River	20	0.0045 to 0.0093	0.0015 to 0.0303	5.15	0.0003 to 0.0006
Little Phillips Creek	32-56	0.008 to 0.011	0.0019 to 0.0039	5.15	0.0004 to 0.0007
Dry, Intermittent Channel, Sandy Soil	Not allowed According to PDFs and buffers				
Jubilee Lake	48-56	0.013 to 0.0204	0.0046 to 0.032	5.15	9E-04 to .6E-03

Sources: Precipitation records from USGS, local site knowledge; SERA 2003, 2004.

It is highly unlikely that the low values modeled in the worksheets would even be approached given that treatment methods within buffers established by PDFs for each herbicide/surfactant are limited to spot and hand/select methods. Hand selective treatment methods have a much less likelihood of herbicides coming in contact with water than spot spray (which far reduces exposure potential compared to broadcast treatment).

Aerial Herbicide Treatments

Aerial application is proposed for 675 acres on the Pomeroy District. The primary overstory in these areas is ponderosa pine with small numbers of lodgepole pine and grand fir, and grasslands. The herbicide most likely to be applied is clopyralid. It is a selective herbicide that would leave soil cover by not harming nontarget vegetation such as pines, firs and grasses. The dead plants would also be left on site contributing to ground cover. Erosion and associated sediment delivery to streams would be minimal and transitory.

Of more concern is water contamination from drift during aerial spray. Project Design Features were designed to control drift and overspray of headwater streams. PDF E3 requires that fueling would not occur in RHCAs; F5 requires that herbicide applications occur when winds are between 2 and 8 miles per hour; F6 requires coarse droplet size to minimize drift; F7 requires that aerial units be ground checked and water features marked and buffered before application. Buffers of 300 feet are required on perennial or wet intermittent streams and wetlands, and 100 feet buffers are required on dry channels. Based on buffer effectiveness documented by Rashin and Graber (1993) and Dent and Robben (2000) concentrations of herbicides reaching streams are expected to be well below concentrations of concern to beneficial uses.

Accidental Spill

Accidental spills are not considered within the scope of the project. Project Design Features would reduce the potential for spills to occur, and if an accident were to occur, minimizes the magnitude and intensity of impacts. An herbicide transportation and handling plan is a project requirement. This plan would address spill prevention and containment.

EDRR

Early Detection Rapid Response (EDRR) allows for newly identified or currently unknown invasive plant infestations to be treated using the range of methods analyzed in the Umatilla Invasive Plant FEIS 2006, on sites similar to those presently proposed for treatment. PDFs would protect aquatic resources by constraining treatment methods according to site specific conditions.

The analysis for treatments within the aquatic influence zone for EDRR is summarized below. Included is the basis for treatment caps with respect to EDRR.

Treatments above bankfull - The basis of the analysis for treatments from bankfull to upland are the HQ's from the SERA risk assessment scenario worksheets and the assumptions of the worst-case scenario (10 contiguous acres of broadcast spray, adjacent to a 1.8 cfs stream, sparsely vegetated). Ten contiguous acres of treatment in a 6th field subwatershed are not likely to exceed the HQ's calculated for the NF Asotin River, Little Phillips Creek and Jubilee Lake sites. Ten acres of infestation spread out in patches (not contiguous) throughout a 6th field sub-watershed are also not likely to exceed the HQ's in the SERA risk assessment scenario because there is more water and less herbicide in each patch area than that estimated in the scenario. Based on knowledge of rainfall patterns, stream sizes, fish species present, it is reasonable to expect that treatments within the riparian/aquatic influence areas within a 6th field subwatershed would not exceed the HQ's estimated by the SERA risk assessment worksheet calculations. To provide a limit to the extent of treatment and herbicide exposure for projects implemented under EDRR where there are federally listed fish or designated critical habitat, no more than 10 acres per year within the riparian area of any 1.5 mile stream reach within a 6th field watershed would be treated at a single time.

Proximity, Probability, and Magnitude of Effects from Herbicide Use

By using the analysis above, the effects to each ESA listed fish species and habitat can be described by further analyzing factors of proximity, probability, magnitude, duration, nature, distribution, frequency, and timing of the Proposed Action. Habitat pathway indicators discussed in this analysis for herbicide use is "chemical contaminants" and "sediment/turbidity". The Proposed Action had no causal mechanisms to affect any other matrix indicators; therefore this analysis will address only those indicators mentioned above. This section complements the designated critical habitat analysis.

Chemical Contaminants Indicator

Baseline information for this indicator within the UNF is "properly functioning" for the majority of watersheds. Watersheds identified as "at unacceptable risk" for the chemical contaminants indicator are the Walla Walla and Umatilla River subbasins, refer to project BA.

Walla Walls Subbasin – The Oregon Department of Environmental Quality's and the Washington Department of Ecology's 1996 303(d) lists of water quality-limited waterbodies (DEQ 1996, DOE 1996) were used as data sources for this indicator. DEQ does not list any stream in the Walla Walla River subbasin as being water quality-limited for chemical contamination or nutrients. The DOE lists Mill Creek for excess amounts of chlorine, nitrogen, and phosphorus, and lists the Walla Walla River for excess amounts of a variety of agricultural chemicals. The DOE does not specify any particular sections of the streams as containing these contaminants, but the nature of the pollutants suggests that they are present only in lower stream reaches in the subbasin. Forest Service water quality testing has not found these contaminants to be present on the Forest. For this reason, this indicator was judged to be properly functioning for the four subpopulation checklists but was judged to be functioning at unacceptable risk for the combined checklist. However, it should be noted that these contaminants may not be at concentrations of concern during the winter months when steelhead and fall chinook would normally be using these lower stream reaches.

Umatilla River Subbasin - DEQ does not list any stream in the upper Umatilla River, Meacham Creek, or Pearson Creek as being water quality-limited for chemical contamination or nutrients. This indicator was judged to be properly functioning for the three main steelhead PAs. This parameter was judged to be not properly functioning for the subbasin as a whole due to elevated phosphorus levels in two stream reaches (DEQ 1996).

It is expected that the baseline condition will not change as a result of the Proposed Action. The discussions below complement the analysis for designated critical habitat.

Proximity of Streams toTreatment Areas

Many of the treatment areas are on or near roads that cross either perennial or intermittent streams on UNF. For the purpose of analyzing close proximity of treatment areas to listed fish, streams containing listed fish that flow through treatment areas were identified, and a width of 100ft from the stream up into the riparian area was used to identify treatment areas that may be located immediately adjacent to a stream (i.e., up to bankfull) with listed fish. A total of 158 treatment areas have been identified that include areas within 100 ft of streams with ESA fish (Table 48).

Many mainstem rivers, such as Grande Ronde River and Tucannon River serve as migration corridors to pacific salmon and bull trout. Tributaries to these mainstem rivers provide spawning and rearing habitat. For fall Chinook, juveniles will not typically be found in freshwater on UNF because they migrate to salt water immediately upon emergence. Most of the spawning and rearing for bull trout occurs in the headwaters, and typically in the lower reaches only adults can be find.

Herbicide application is expected to occur on the streambanks in close proximity to rearing and migration habitat within the rivers listed in Table 48, however no treatments would occur below the ordinary high water mark. Spring chinook salmon may occasionally utilize some of these stream reaches for spawning. Steelhead and Chinook share a majority of the rivers, while other fish are limited on habitat based on their ability to access tributaries or quality of habitat available.

Table 48 - Herbicide Treatment Areas on the UNF within 100 feet of Streams with Listed Fish

Fifth Field Watershed Name	Stream Name	Treatment Site Identification	Treatment Type	Listed Fish Species* present within Stream*
Asotin Creek	Charlie Creek	614045279	Herbicide	SRS
	North Fork Asotin Creek	614400194	Herbicide	SRS, SRC, BT
Lookingglass Creek	Little Lookingglass Creek	6140601365	Herbicide	SRS ,BT
	Mottet Creek	6140600747	Herbicide	SRS
		6140600054	Herbicide	SRS
Grande Ronde River/Cabin Creek	Phillips Creek	06140600577	Biocontrol	SRS
		06140600773	Herbicide	SRS
		06140600781	Herbicide	SRS
		06140601318	Biocontrol	SRS
		06140601319	Biocontrol	SRS
		06140601320	Herbicide	SRS
		06140601321	Herbicide	SRS
		06140601322	Herbicide	SRS
		06140601323	Biocontrol	SRS
		06140601534	Herbicide	SRS
	Little Phillips Creek	06140600393	Herbicide	SRS
Wenaha River	Third Creek	06140600141	Manual	BT
		06140600142	Herbicide	BT
		06140600138	Herbicide	BT
	Crooked Creek	06140600144	Herbicide	SRS, SRC, BT
		06140600146	Herbicide	SRS, SRC, BT
		06140600153	Herbicide	SRS, SRC, BT
		06140600155	Herbicide	SRS, SRC, BT
		06140600241	Herbicide	SRS, SRC, BT
		06140600242	Herbicide	SRS, SRC, BT
		06140600244	Herbicide	SRS, SRC, BT
		06140600263	Herbicide	SRS, SRC, BT
	Wenaha River	06140600157	Herbicide	SRS, SRC, BT
		06140600508	Herbicide	SRS, SRC, BT
		06140600268	Herbicide	SRS, SRC, BT
Lower Grande Ronde River	Menatchee Creek	06140600236	Herbicide	SRC
Upper Tucannon	Unnamed Trib to	06140600236	Herbicide	SRS, BT

Fifth Field Watershed Name	Stream Name	Treatment Site Identification	Treatment Type	Listed Fish Species* present within Stream*
River	Tucannon River	06140600162	Herbicide	SRS, BT
	Little Tucannon River	06140600056	Herbicide	SRS, BT
		06140600057	Herbicide	SRS, BT
		06140600075	Herbicide	SRS, BT
	Tucannon River	06140600075	Herbicide	SRS, SRC, BT
		06140600083	Herbicide	SRS, SRC, BT
		06140600088	Herbicide	SRS, SRC, BT
		06140600099	Herbicide	SRS, SRC, BT
	Panjab Creek	06140600098	Herbicide	SRS, BT
Upper Walla Walla River	South Fork Walla Walla River	06140600229	Herbicide	MCS, BT
		06140600183	Herbicide	MCS, BT
Mill Creek	Low Creek	06140601356	Biocontrol	BT
	Tiger Creek	06140600261	Herbicide	MCS
		06140600271	Herbicide	MCS
Upper Touchet River	North Fork Touchet River	06140600176	Herbicide	MCS
Upper Umatilla River	North Fork Umatilla River	0614066928	Herbicide	MCS, MCC, BT
	Umatilla River	06140601361	Herbicide	MCS, MCC, BT
		06140601380	Herbicide	MCS, MCC, BT
	South Fork Umatilla River	06140600099	Herbicide	MCS, MCC, BT
		06140600166	Herbicide	MCS, MCC, BT
		06140601776	Herbicide	MCS, MCC, BT
Meacham Creek	Meacham Creek	06140600706	Herbicide	MCS, MCC, BT
Birch Creek	Pearson Creek	06140600221	Herbicide	MCS
		06140600305	Herbicide	MCS
		06140600308	Herbicide	MCS
		06140600309	Herbicide	MCS
Upper North Fork John Day River	Unnamed Trib to North Fork John Day River	06140600483	Herbicide	MCS
		06140600484	Biocontrol	MCS
Granite Creek	Granite Creek	06140500109	Herbicide	MCC, MCS
		06140500140	Herbicide	MCC, MCS
		06140500241	Herbicide	MCC, MCS
		06140500289	Herbicide	MCC, MCS
		06140500390	Herbicide	MCC, MCS
		06140500391	Herbicide	MCC, MCS
		06140500392	Herbicide	MCC, MCS
		06140500492	Herbicide	MCC, MCS
		06140500108	Herbicide	MCS
		06140500111	Herbicide	MCS
		06140500219	Herbicide	MCS
		06140500248	Herbicide	MCS
		06140500571	Herbicide	MCS
		06140500546	Herbicide	MCC, MCS
	Lick Creek	06140500155	Herbicide	MCS
		06140500195	Herbicide	MCS

Fifth Field Watershed Name	Stream Name	Treatment Site Identification	Treatment Type	Listed Fish Species* present within Stream*
	Squaw Creek	06140500559	Herbicide	MCS
	Ten Cent Creek	06140500492	Herbicide	MCS
	Unnamed Trib to Granite Creek	06140500047	Herbicide	MCS, MCC
		06140500048	Herbicide	MCS, MCC
		06140500337	Herbicide	MCS, MCC
North Fork John Day River/Big Creek	North Fork John Day River	06140500103	Herbicide	MCS, MCC
		06140500125	Herbicide	MCS, MCC
		06140500135	Herbicide	MCS, MCC
		06140500142	Herbicide	MCS, MCC
		06140500147	Herbicide	MCS, MCC
		06140500186	Herbicide	MCS, MCC
		06140500226	Herbicide	MCS, MCC
		06140500236	Herbicide	MCS, MCC
		06140500237	Herbicide	MCS, MCC
		06140500324	Herbicide	MCS, MCC
		06140500413	Herbicide	MCS, MCC
		06140500416	Herbicide	MCS, MCC
		06140500419	Herbicide	MCS, MCC
		06140500420	Herbicide	MCS, MCC
		06140500421	Herbicide	MCS, MCC
		06140500423	Herbicide	MCS, MCC
		06140500425	Herbicide	MCS, MCC
		06140500430	Herbicide	MCS, MCC
		06140500432	Herbicide	MCS, MCC
		06140500434	Herbicide	MCS, MCC
		06140500435	Herbicide	MCS, MCC
		06140500436	Herbicide	MCS, MCC
		06140500437	Herbicide	MCS, MCC
		06140500438	Herbicide	MCS, MCC
		06140500440	Herbicide	MCS, MCC
		06140500442	Herbicide	MCS, MCC
		06140500443	Herbicide	MCS, MCC
		06140500457	Herbicide	MCS, MCC
		06140500485	Herbicide	MCS, MCC
		06140500610	Herbicide	MCS, MCC
	Texas Bar Creek	06140500466	Herbicide	MCS
Desolation Creek	Desolation Creek	06140500038	Herbicide	MCS, MCC
		06140500045	Herbicide	MCS, MCC
		06140500451	Herbicide	MCS, MCC
		06140500591	Herbicide	MCS, MCC
		06140500594	Herbicide	MCS, MCC
Upper Camas Creek	Lane Creek	06140500225	Herbicide	MCS
	Bear Wallow Creek	06140500080	Herbicide	MCS
	Camas Creek	06140500012	Herbicide	MCS
		06140500576	Manual	MCS
	Bowman Creek	06140500280	Herbicide	MCS
	Hideaway Creek	06140500069	Herbicide	MCS, MCC
		06140500599	Herbicide	MCS, MCC

Fifth Field Watershed Name	Stream Name	Treatment Site Identification	Treatment Type	Listed Fish Species* present within Stream*
Lower Camas Creek	Fivemile Creek	06140500004	Herbicide	MCS
	Sugarbowl Creek	06140500004	Herbicide	MCS
North Fork John Day River/Potamus Creek	Ditch Creek	06140203122	Herbicide	
		06140203121	Herbicide	MCS
	Mallory Creek	06140203080	Herbicide	MCS
	Potamus Creek	0614026885	Herbicide	MCS
		0614026853	Herbicide	MCS
	Hinton Creek	06140500166	Herbicide	MCS
	West Fork Meadow Brook Creek	06140500060	Herbicide	MCS, MCC
		06140500215	Herbicide	MCS, MCC
		06140500298	Herbicide	MCS, MCC
	East Fork Meadow Brook Creek	06140500517	Herbicide	MCS
Wall Creek	Wilson Creek	06140200591	Herbicide	MCS
		06140201428	Herbicide	MCS
		06140203029	Herbicide	MCS
		06140203030	Herbicide	MCS
	Big Wall Creek	06140201068	Herbicide	MCS
		06140201427	Herbicide	MCS
		06140201430	Herbicide	MCS
		06140203023	Herbicide	MCS
		06140203027	Herbicide	MCS
		06140200717	Herbicide	MCS
	South Fork Big Wall Creek	06140203021	Herbicide	MCS
	Indian Creek	06140203059	Herbicide	MCS
	Little Wall Creek	06140201119	Herbicide	MCS
		06140201121	Herbicide	MCS
		06140203063	Herbicide	MCS
		06140200452	Herbicide	MCS
	Alder Creek	06140200229	Herbicide	MCS
		06140202953	Manual	MCS
	Unnamed Trib to Alder Creek	06140200176	Herbicide	MCS
	Swale Creek	06140200180	Herbicide	MCS
		06140200187	Herbicide	MCS
		06140203070	Herbicide	MCS

Probability of Herbicide Exposure (increased chemical contaminants)

The probability that an ESA listed fish will be exposed to non aquatic formulations of herbicide is very low. The probability of being exposed to the aquatic formulation of triclopyr is also very low. However, there is a possibility of being exposed to aquatic formulations of glyphosate and imazapyr but the probability of being exposed at levels of concern is very low. Glyphosate and imazapyr have a low propensity for leaching, but can enter water by other means such as overspray, drift, or erosion of contaminated soil. This probability is discussed by potential exposure vector below:

Water contamination from hand/select methods: The probability of hand-select methods resulting in herbicides coming in contact with water is low.

The plant begins to take in the herbicide immediately after it is applied directly to a leaf or stem with the use of approved binding surfactants. Overland transport to the water column from stem injections is unlikely because the injected herbicide is contained within the plant stem. Transfer through the stem to the roots might allow some herbicide to enter the soil, but it is likely to adhere to soil particles or is degraded by soil microbes before leaching into the ground water. In addition, other general protection measures of the applicators themselves result in a very low risk of water contamination.

Water contamination from drift: The ability to contaminate water varies with the herbicide application method. For example, spot and hand application methods substantially reduce the potential for loss of non-target vegetation because there is little potential for drift. Drift is most associated with broadcast treatments and can be mitigated to some extent by the applicator. Droplet size is key to drift as larger droplets are heavier and therefore less affected by wind and evaporation. Figure 5 demonstrates the relationship between droplet size and buffer distance. As droplet size increases, the distance herbicide may travel in concentrations sufficient to harm plants decreases.

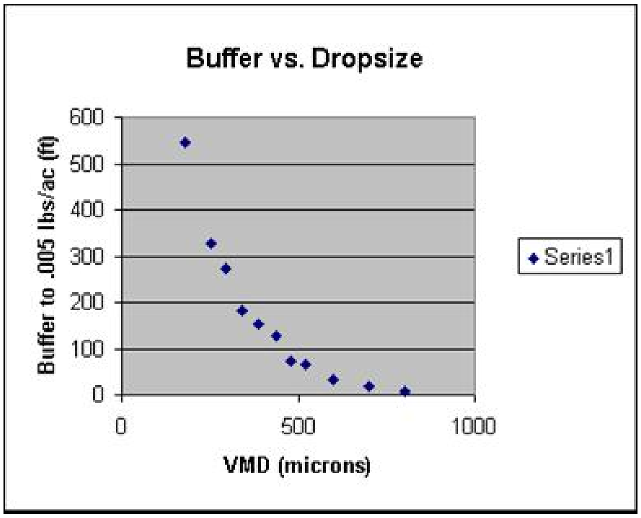
Dr. Harold Thistle, a physical scientist from the USDA in Morgantown, WV, specializes in computer modeling of herbicide drift. He modeled the potential for glyphosate to impact non-target vegetation from drift. The model predicted a 100-foot broadcast buffer would prevent glyphosate from harming plant species that are further away.

Factors affecting droplet size are nozzle type, orifice size and spray angle, as well as spray pressure, and the physical properties of the spray mixture. Wind speed restrictions also substantially contribute to a reduction in drift (Spray Drift Task Force, 2001). By simply changing the type of nozzle (diameter of pore size) used during broadcast treatments, the drift potential of herbicide can be effectively and substantially decreased as the droplet size forced out the nozzle is increased in size.

Spray nozzle pressure, the amount of water applied with the herbicide, and herbicide release height are also controllable determinants of drift potential. Weather conditions such as wind speed and direction, air mass stability, temperature and humidity and herbicide volatility also affect drift.

Commercial drift reduction agents are available that are designed to reduce drift beyond the capabilities of the determinants previously described. These products create larger and more cohesive droplets that are less apt to break into smaller particles as they fall through the air. They reduce the percentage of smaller, lighter particles that are the size most apt to drift.

Marrs, R.H., in the 1989 publication, “Assessment of the Effects of Herbicide Spray Drift on a Range of Plant Species of Conservation Interest,” examined the distances drift affected non-target vascular plants using broadcast treatment methods similar to those considered in this analysis. Their observations are consistent with drift-deposition models in which the fallout of herbicide droplets has been measured. The maximum safe distance at which no lethal effects were found was 20 feet, but for most herbicides the distance was 7 feet. 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 vascular non-target vegetation further than 66 feet from the broadcast treatment zone. Little information is available for how drift distances may effect non-vascular non-target vegetation. The distance spray drift will travel can vary substantially based on wind speed, topography, temperature, the herbicide applied, and the vegetation present, see Figure 10 this section.



Drift is the most likely vector for herbicides coming in contact with water from riparian area treatment sites. Some locations may have some invasive plants such as reed canary grass, or purple loosestrife growing on streambanks above ordinary high water that would be treated with a spot-spray. Such areas are limited in spatial extent, and given the distance between target vegetation and water, it is likely that much of the herbicide will have been sprayed on to the plant.

Figure 10 – Droplet Size and Drift Distance

In addition, roads that have a high potential for herbicide delivery have been identified and have added restrictions, such as no broadcasting.

Since there will be no herbicide applied directly to the water column for purposes of treating submerged or emergent vegetation the probability of even fine droplets coming in contact with water is low.

Water contamination from contaminated soil: Riparian treatments are limited in spatial extent, and given the restrictions noted above, it is likely that much of the herbicide will have either adhered to the soil or broken down not being available for transport into the water. See previous sections for more information on herbicide properties. The probability of water contamination from contaminated soil is low.

Water contamination from an accidental spill: Concentrations of herbicides in the water as a result of an accidental spill depend on the rate of application and the streams' ratio of surface area to volume. The persistence of the herbicide in water depends on the length of stream where the accidental spill took place, velocity of stream flow, and hydrologic characteristics of the stream channel. The concentration of herbicides would decrease rapidly down-stream because of dilution and interactions with physical and biological properties of the stream system (Norris et al.1991). Project Design Features would reduce the potential for spills to occur, and if an accident were to occur, minimize the magnitude and intensity of impacts. An herbicide transportation and handling plan is a project requirement. This plan would address spill prevention and containment.

Extensive monitoring of herbicide application using similar treatment methods has occurred over the last few years in NW Oregon and Western Washington. All personnel applying the herbicides are well trained and licensed. No accidental spills have been reported. The risk of an accidental spill under the Proposed Action is extremely low.

Probability of exposure to aquatic organisms: The probability of localized effects to individual aquatic plants is low since no treatments are proposed within the bankfull channel. Spot applications of aquatic formulations of glyphosate and imazapyr on streamside vegetation are not likely to result in harmful amounts coming in contact with water and harming fish, invertebrates, and algae.

The use of glyphosate will not be applied directly to water for weed control, but if it does enter the water it is bound tightly to dissolved and suspended particles and to bottom sediments and becomes inactive. The probability of exposure to aquatic organisms is low.

Direct Mortality due to Trampling: The project does not propose treatments on emergent vegetation that would require applicators to enter the water, therefore the risk of disturbing spawning adults or stepping on redds is very low.

Magnitude of the Effect

The severity and intensity of herbicides coming in contact with streams containing ESA listed fish is variable due to different application techniques and specific herbicide properties. The severity and intensity of the effect will depend on the size of stream, type of waterbody, herbicide type and its properties. Any treatment of emergent vegetation proposed in the future would require additional NEPA anlaysis.

Hand/select Methods: The magnitude of hand-select methods resulting in water contamination is discountable because the application will be directed to a leaf or stem, and the herbicide and surfactant will quickly bind to the plant material. The magnitude is predicted to be extremely low from any droplets that come in contact with water.

Drift: Drift is the most likely vector for herbicides coming in contact with water from treatments within riparian areas. However, the magnitude of drift compared to an aerial application or broadcast application, such as what was analyzed above in the SERA risk assessment worksheets, immediately adjacent to a stream is extremely low. Label restrictions, restrictions on application rate, type of herbicide, application method restrictions, buffers, and the use of a surfactant all factor in to limiting the potential amount of drift. In addition, roads that have a high potential for herbicide delivery have been identified and have added restrictions, such as no broadcasting. The magnitude of drift is expected to be very low.

Contaminated soil: Riparian treatments are limited in spatial extent, and given the restrictions on methods and type of herbicide, it is likely that much of the herbicide will have either adhered to the soil or broken down not being available for transport into the water. The intent of the Proposed Action is to apply herbicide to a plant, not to the soil. Any amount of herbicide that would indirectly come in contact with the soil as a result of drift or droplets is expected to be insignificant; therefore the magnitude of contaminated soil would be low.

Accidental spill: The probability of an accidental spill for this project is low. If a spill were to occur, the magnitude is limited by Project Design Features, where only daily use quantities of herbicides will be transported to the project site, transport via watercraft will require extra precautions, impervious material will be placed over mixing areas in such a manner as to contain any spills associated with mixing/refilling, and the requirement that a spill kit will be on site during all herbicide application

Aquatic Organisms: The potential to reach toxicity levels for each trophic level under spot and hand/select applications with glyphosate and imazapyr is low. Localized effects would not disrupt aquatic ecosystem function of the aquatic food web because spot applications of aquatic formulations of glyphosate and imazapyr are not likely to result in harmful amounts coming in contact with water and harming fish, invertebrates, and algae. However, some aquatic plants could be damaged if enough herbicide comes in contact with the aquatic plant. It is believed that the magnitude of effect to fish as a result of local aquatic plant mortality is extremely low because there will not be enough herbicide coming in contact with water to result in extensive aquatic plant mortality.

Trampling: The probability of stepping on a redd while wading across a stream to access either the opposite streambank is low. Should an individual wade across a stream and accidentally step on a redd, then there is the possibility of impacting individual eggs in the gravel. The magnitude of effect from accidentally stepping on a redd is limited to the amount of eggs in the gravel that are impacted from the actual weight of the person and disturbance to the redd itself (i.e., shifting of the gravel, etc), thus leading to a negative impact to individual egg(s). An egg can be dislodged and eaten by a predator, or smashed between gravel or amongst other eggs, which can impede successful development of eggs. Although there are few scenerios where workers would need to cross a live stream, each egg has the potential to contribute to the overall success of a returning population, therefore, the magnitude of effect from accidentally stepping on a redd is high. (Magnitude is high)

Distribution: Refer to Table 48 for a list of treatment sites within aquatic influence zones. Effects, if they occur, would be limited in scope and widely scattered due to the patchy nature of the infestations. The distribution of effects will be small and scattered throughout UNF.

Frequency: The proposed treatments would occur over the next 15 year period and the acreage treated is expected to decline as long as funding is available and patches are eradicated. The programmatic nature of the Proposed Action is the treatment of future unknown infestations. It is expected that the frequency of herbicide use will be low given that treatment of invasive plants is an activity composed of integrated methods (i.e., mix of non-herbicide and herbicide methods) to facilitate effectiveness.

Duration: Any herbicides coming in contact with water are expected to be short-term events that subside quickly due to the stream volumes moving through the area (pulse effect). Herbicide coming in contact with smaller streams containing extensive riparian infestations is a high risk because of the need for simultaneous treatment and lower volumes of water. Given the properties of glyphosate and imazapyr, it is unlikely that these two active ingredients would persist long enough in the environment to harm ESA fish. A simultaneous treatment is believed to be a short-term event whose effects subside immediately because of the herbicide properties and factors that push a concentration up would be off-set by those that push the concentration down.

Timing: Most of the treatments would likely occur in the summer when eggs of all the listed species would not be in the gravel and only rearing life stages are present. However, there is a potential for some treatments to occur in fall or spring when chinook salmon or steelhead may be spawning adjacent to treatment sites. There is also the potential for some treatments to occur in late summer or early fall when bull trout are spawning. Since no treatments are proposed below bankfull, there is a low probability of accidentally stepping on a redd and displacing spawning fish.

Summary of Effects to the Chemical Contamination Indicator

Treatment of emergent vegetation with aquatic formulations of glyphosate and imazapyr may lead to some minor amounts of herbicide droplets coming in contact with water. Fish may be exposed to these minor amounts of herbicide in smaller streams, especially when treatment needs to take place during spawning activities. The need to treat during spawning or accidentally stepping on a redd is limited in spatial and temporal extent. Fish in the mainstem of rivers and streams may not be exposed because of the river's large flow and density of fish during time of treatment. Smaller streams however, do not have as much flow and may not dilute herbicides as quickly. Fish in smaller streams tend to be juveniles and fry, and are also lower in density, thus lowering the potential for exposure. Although there is a probability for herbicide to come in contact with water in proximity to ESA fish, the magnitude of the effect from the amount of herbicide ESA fish are exposed to is low.

The magnitude of effect from disturbance to breeding/spawning and/or accidentally stepping on a redd is also low, since no emergent vegetation is proposed for treatment.

Restrictions on method, type, and location serve to limit the potential amount of herbicides that may come in contact with water where fish or other aquatic organisms are present, even if an unexpected storm occurred shortly after treatment. The amount of herbicide that would be available for runoff, leaching and/or drift is necessarily limited by restrictions on broadcast use. Spot and hand/select treatments do not have high potential to deliver herbicide because the treatments are directed at target vegetation and herbicide is quickly taken up by the plant.

The likelihood of meeting or exceeding levels of concern for fish is extremely low because herbicide use in the aquatic influence zone is limited to typical application rates, application methods are restricted to spot or hand/select, buffers on broadcast applications and other methods, Project Design Features, and low potential for herbicides proposed for use near water to move through soils.

Sediment/turbidity

The presence of people or crews with spot spray or hand/select tools along streambanks could lead to localized, sediment/turbidity to fish habitat because of trampling, soil sloughing due to stepping on banks. However, amounts of potential localized sediment/turbidity would be negligible because the invasive plant populations on the Umatilla National Forest are not extensive enough to result in significant sediment/turbidity. Effective invasive plant treatment and restoration of treated sites would improve the function of riparian areas and lead to improved fish habitat conditions.

Under the Proposed Action, significant removal of riparian invasive species would not occur because of the proposed use of herbicides reducing the potential for significant soil disturbance. While the relative amounts of spot and hand/select methods vary, the differences in terms of effects from such treatments are negligible.

Proximity

The amount of sediment created by herbicide treatments is anticipated to be insignificant because the methods of treatments do not include ground disturbing activities by heavy equipment. There will be no ground disturbing activities associated with spot or hand/select methods.

Probability and Magnitude

There is a possibility that some minor bank erosion may occur in locations where invasive plants have taken over a streambank, especially in smaller streams. For example, killing knapweed with an herbicide would devegetate a portion of the streambank and result in a loss of roots that help to hold soil particles together. This may expose streambanks at higher flows and result in some erosion. The total spatial extent of heavy infestations along streambanks within the action area is low. The amount of sediment released into any particular stream reach would depend on how extensive a particular invasive plant patch is and how close the invasive plant is to the actual wetted perimeter of the channel. Exposed streambanks are expected to revegetate during the spring/summer following treatment. In addition, site restoration and revegetation methods preclude erosion as a result of herbicide treatment. It is expected that most patches would be relatively small and any erosion negligible.

The probability of sedimentation and turbidity as a result of herbicide treatments is extremely low, therefore the magnitude of effect to listed fish and/or critical habitat is low.

GLEAMS Model Estimates for Blue Mountains Ecotype

The R6 FEIS Fisheries BA considered whether ecosystem conditions associated with a variety of bioregions (ecotypes) might affect herbicide concentrations/hazards predicted using the GLEAMS model. The BA found that risk assessment modeling tends to estimate water contamination rates adequately for undisturbed forested vegetation types within the Blue Mountains ecotype (Umatilla National Forest fits this ecotype). Modeling an agricultural field would more adequately model the other vegetation types and would tend to underestimate water contamination rates in these circumstances. At higher stream flows (larger stream channels or wet season flow conditions), risk assessment model predictions tend to overestimate the herbicide concentration in most local streams. For smaller streams, other factors considered have a more pronounced effect than for larger streams.

Based on the modification of the SERA GLEAMS stream herbicide concentration predictions by local factors in the Canyon Creek area, results in the R6 2005 FEIS identified the potential for increase in concern with picloram, glyphosate, and triclopyr for fish. There was also an increase in concern for aquatic macrophytes with chlorsulfuron, glyphosate, imazapic, metsulfuron methyl, triclopyr and picloram; for invertebrates with glyphosate and triclopyr, and for aquatic plants with chlorsulfuron, glyphosate (with surfactant only), metsulfuron methyl, picloram and triclopyr. The R6 2005 Record of Decision (ROD) specifically limited triclopyr to spot and hand methods (no broadcast of triclopyr allowed as per standard 16) to avoid scenarios of concern related to triclopyr.

In general, situations that increased concern for potential effects to aquatic species from the level of risk stated in the SERA risk assessments occurred for smaller stream channels with steeper side slopes, with risk increasing at higher altitudes. Conversely, risk lower than that stated in the risk assessments was identified for larger stream channels at lower altitude, and possibly in smaller stream channels with sideslopes less than 10 percent.

Slopes in the Canyon Creek watershed are generally the 10 percent modeled, and herbicide delivery to streams could be expected to increase significantly. Local soil types do not appear to markedly change expected herbicide delivery for most herbicides likely to be applied in the watershed, except in disturbed areas using highly soluble herbicides that do not bind well with soil particles, such as picloram and chlorsulfuron.

Because all of the action alternatives avoid broadcasting within 50 feet of any stream (wet or dry), the GLEAMS model would still overestimate the amount of herbicide that would enter water, because:

- Spot and selective methods would only be used within 100 feet of wet streams and 50 feet of dry streams. These methods substantially reduce potential for off site impacts, drift, and other herbicide delivery mechanisms to water (runoff, leaching). Applicators can immediately respond to site conditions to ensure PDFs are followed as planned.
- The model does not account for vegetation uptake of herbicide (the entire label rate is assumed to be subject to run off). The herbicides allowed for use within the Aquatic Influence Zone are rapidly taken up by plants and/or bind to soil and would not be available for runoff soon after application.
- PDFs do not allow broadcast on roads with high potential to deliver herbicide, which also significantly reduces the potential for herbicides to reach streams in concentrations predicted by the GLEAMS model scenarios.

Previous Monitoring Studies

Berg, N. (2004) compiled monitoring results for broadcast herbicide treatments given various buffers along waterbodies. The results showed that any buffer helps lower the concentration of herbicide in streams adjacent to treatment areas. In California, when buffers between 25 and 200 feet were used, herbicides were not detected in monitored streams (detection limits of 1to 3 mg/m3) (ibid).

In South Carolina, buffers of 30 meters (comparable to 100 feet) during ground applications of the herbicides imazapyr, picloram and triclopyr resulted in no detectable concentrations of herbicide in monitored streams (USDA HFQLG EIS, Appendix B, 2003). No detection limits were given.

Even smaller buffers have successfully protected water quality. For example, where imazapyr was aerial sprayed without a buffer, the stream concentration was 680 mg/ml. With a 15-meter buffer, the concentration was below detectable limits (Berg, 2004). No detection limits were given.

Berg collected samples of several herbicides (including sulfometuron methyl and glyphosate) following roadside application one, seven and fourteen days after treatment. Rainfall of one-third inch occurred throughout the period.

Berg detected concentrations of sulfometuron-methyl and glyphosate along road shoulders through the period. In the fall the road was again sprayed, and the ditch line of the road was checked during rainstorms for three months. Sulfometuron-methyl was detected along the shoulder in the ditch line, but was below detectable limits in the nearby stream. Glyphosate was not found at the shoulder, ditch line or stream.

This study indicates that the greatest risk of herbicides moving off site is from large storms soon after herbicide application. In addition, this study also indicates that sulfometuron methyl may persist in the environment as it was detectable along the shoulder of the road (but not in the stream) the entire duration (three months) of the study.

Berg also reported that herbicide applied in or along dry ephemeral or intermittent stream channels may enter streams through run-off if a large post-treatment rainstorm occurred soon after treatment. This risk is minimized if intermittent and ephemeral channels are buffered (ibid.) as would occur under the Proposed Action. If a large rainstorm occurs sediment contaminated by herbicide could be carried into streams.

Project Design Features require no forecast rain for 24 hours after application to allow the herbicide to adhere to the plant, give time for the plant to uptake the herbicide and to minimize risk of herbicide being washed from the plant.

Dry sediment contaminated by herbicide could plausibly be carried by wind and enter a stream or water body. This is an unlikely scenario as most of the forest is heavily vegetated so there is less bare soil for movement by wind.

Designated Critical Habitat

Invasive plant treatment would have many beneficial effects on critical habitat for federally listed fish species. In the long-term, treatment of invasive weeds on the Umatilla National Forest would increase native vegetation growth and successional patterns leading to cover and food. Thus, it improves essential habitat features for federally listed fish species. Potential downstream effects to critical habitat for bull trout are not likely given the PDFs that limit the potential for herbicide concentrations coming in contact with water where fish are present. Information here complements the analysis provided for non-herbicide treatment methods.

In 1996, NMFS developed a methodology for making ESA determinations for individual or grouped activities at the watershed scale, termed the "Habitat Approach". A Matrix of Pathways and Indicators (MPI) was recommended under the Habitat Approach to assist with analyzing effects to listed species. The MPI was used by the Umatilla National Forest in previous years to analyze project effects on listed fish species.

When using the MPI, project effects to the Pathways (significant pathways by which actions can have potential effects on anadromous salmonids and their habitats) and Indicators (numeric ratings or narrative descriptors for each Pathway) are used to determine whether Proposed Actions would damage habitat or retard the progress of habitat recovering towards properly functioning condition.

The Sept. 2, 2005 designated critical habitat Primary Constituent Elements (PCEs) pertinent for analysis on the Umatilla National Forest's freshwater habitats include spawning sites, rearing sites, and migration corridors. The Habitat Approach's Matrix of Pathways (MPI) has numerous habitat-associated Indicators that closely "cross-walk" with the PCEs of the Sept 2, 2005 designated critical habitat. Table 49 displays a "cross-walk" between the MPI and PCEs used to assess effects on designated critical habitat.

Table 49 - MPI for Primary Constituent Elements Crosswalk

Primary Constituent Elements	Matrix of Pathways and Indicators
Spawning Habitat, as defined by water quality, water quantity, substrate	**Water Quality**: Temperature, Suspended Sediment, Substrate, Chemical Contaminants and Nutrients **Flow/Hydrology**: Change in Peak/Base flows **Habitat Elements**: Substrate/Embeddedness
Rearing as defined by adequate water quantity and floodplain connectivity	**Channel Conditions and Dynamics**: Floodplain connectivity **Flow/Hydrology**: Change in Peak/Base flow
Rearing as defined by adequate water quality and forage	**Water Quality**: Temperature, Substrate **Habitat Elements**: Large Woody Debris, Pool Frequency and Quality, Off-channel Habitat
Rearing as defined by adequate natural cover	**Habitat Elements**: Large Woody Debris, Pool Frequency and Quality, Large Pools, Off-channel Habitat
Migration as defined by habitat free of artificial obstructions, and adequate water quality, water quantity, and natural cover	**Habitat Access**: Physical Barriers **Water Quality**: Temperature **Flow/Hydrology**: Change in Peak/Base flow **Habitat Elements**: Large Woody Debris, Pool Frequency and Quality, Large Pools

The following is an analysis of the effects on Primary Constituent Elements of the Sept. 2, 2005 designated critical habitat, as determined via analysis of MPI indicators. Please refer to the hydrology analysis for effects on Riparian Condition and Water Quality, Lakes, Wetlands and Floodplains.

Habitat Indicator Effects

- **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, none of which would be influenced by invasive plant treatments.

Treatment of invasive plants using integrated methods, specifically herbicides, along small streams may increase solar radiation at a localized level (i.e. on a small portion of a stream) if invasive plants are the only source of shade. Where invasive plants provide the only source of shade on small streams, removing 100 percent of the shade producing cover can change forest floor microclimates and water temperature at the localized level.

However, the precise effects to water temperature from treating invasive plants would depend on the size of the stream, how close to the stream a treatment site is, how much is treated along the stream, and what vegetation is currently available to shade the stream.

Removal of invasive plants from the banks of small, intermittent streams would not affect temperature because they are dry during the hottest time of the year, relative size of the infestation is small within context of the watershed, and more than likely there is overstory canopy present. Conditions would have to mimic post wildfire in order to impact stream temperatures.

On larger perennial streams, a significant amount of vegetation would need to be removed to change water temperature and shade would have to be provided only by the invasive plant removed – a situation that is not likely on the Umatilla National Forest. One reason treatment of invasive plants is being proposed is to recover vegetation structure and, in time, provide more stream shade with the establishment of native coniferous and deciduous trees. The PDFs prohibit broadcast applications within 100 ft. of wet perennial and intermittent waterbodies, and along roads that have a high likelihood of transporting herbicides to streams to prevent any potential adverse affects to stream channels or water quality conditions. This PDF will protect overhanging vegetation and smaller trees that are currently providing shade closest to the stream and other waterbodies. The treatment of invasive plants outside of the 100 ft buffer should have no affect on stream temperature because it is unlikely that vegetation growing 100 feet from the stream is providing enough shade to influence water temperature.

The US Environmental Protection Agency under the Clean Water Act (CWA) of 1972 requires States to set water quality standards to support the beneficial uses of water. The Act also requires states to identify the status of all waters and prioritize water bodies whose water quality is limited or impaired.

For water quality limited streams on National Forest lands, the Forest Service provides information, analysis, and site-specific planning efforts to support state processes to protect and restore water quality. The Regional Pacific Northwest Region Invasive Plan EIS and the Umatilla National Forest Plan both include standards and guidelines and other management measures designed to protect and improve water quality. This project adheres to all of the above protection measures and adds site specific design criteria to further protect water quality, meeting the requirements of the Clean Water Act.

There are eleven streams the Umatilla Invasivive Plants treatment area on the 303d list (See Table 35 in Chapter 3.4.2 above). All are listed for temperature.

- **Pathway: Water Quality**
- **Indicator: Sediment/Turbidity**
- **PCE Crosswalk: Spawning habitat PCEs**

Herbicide treatment methods that would be utilized within the Aquatic Influence Zone include spot-spray and hand applications. These treatment methods are unlikely to produce sediment because very little ground disturbance would take place.

Manual and mechanical treatments are also unlikely to contribute sediment. Manual labor such as hand pulling may result in localized soil disturbance, but increases of sediment to streams would likely be undetectable. Not all vegetation in a treated area would be pulled or removed, so some ground cover plants would remain. Not all sediment from pulling weeds along roads would reach a stream because many relief culverts intercept ditch flow and drain it on to the forest floor away from streams. Handpulling is very labor intensive and costly. Thus, few acres per year could be treated using this technique across a watershed.

When compared to the total acres within a watershed, project-related soil disturbance from handpulling would be negligible.

Utilizing a combination of manual, mechanical and herbicide treatments, rather than manual alone, would limit the potential for excessive trampling of streambanks.

- **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 as well as drift from aerial spraying. Project Design Features were designed to control drift and overspray of headwater streams. PDF E3 requires that fueling would not occur in RHCAs. F5 requires that herbicide applications occur when winds are between 2 and 8 miles per hour. F6 requires coarse droplet size to minimize drift. F8 requires that aerial units be ground checked and water features marked and buffered before application. Buffers of 300 feet are required on perennial or wet intermittent streams and wetlands, and 100 feet buffers are required on dry channels. Based on buffer effectiveness documented by Rashin and Graber (1993) and Dent and Robben (2000) concentrations of herbicides reaching streams are expected to be well below concentrations of concern to beneficial uses.

Boom or hand broadcast treatments with Aquatic Influence Zones would be limited to herbicides posing low levels of concern for aquatic organisms. Herbicides considered high risk to aquatic organisms would not be applied using any method within 15 feet of ditches that feed streams, or 50 to 100 feet from intermittent streams, even when ditches or intermittent streams are dry. These buffers are considered adequate to minimize herbicide concentrations in water because, buffer studies in forested areas (Berg, 2005) show that buffers greater than 25 feet commonly lower herbicide concentrations below any threshold of concern and often below detectable limits.

Glyphosate and imazapyr are the only herbicides used for spot spraying below bankfull along perennial channels. Glyphosate is highly water soluble, but because it adheres tightly to soils is unlikely to be carried into a stream unless the soil particle is carried into the stream. This is unlikely to happen during the late spring or summer when herbicides would be applied because there is less rain in the summer and more vegetation growth to hold soil particles in place. Imazapyr is only moderately water soluble and forest field studies have not found it very mobile in soils (Soil and Hydrology Analysis).

Herbicides entering surface water through surface runoff are also expected to be minimal, since targeted spot spraying techniques would be used to apply herbicide within 100 feet of surface water. This would minimize the amount of herbicide reaching the ground surface as well as minimize the potential for herbicide drift. No herbicides considered high risk to aquatic resources would be broadcast within 100 feet of streams and none would be spot sprayed within 50 feet of streams

- **Pathway: Channel Condition & Dynamics**
- **Indicator: Floodplain Connectivity**
- **PCE Crosswalk: Rearing habitat PCE**

Some invasive plant treatments can have 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 and 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. There is no risk of negatively impacting channel condition and dynamics as a result of treating invasive plants.

- **Pathway: Habitat Access**
- **Indicator: Physical Barriers**
- **PCE Crosswalk: Migration habitat PCE**

Invasive plant treatments will not create physical barriers or otherwise degrade access to aquatic habitat.

- **Pathway: Habitat Elements**
- **Indicator: Substrate/Sediment**
- **PCE Crosswalk: Spawning, Rearing habitat PCEs**

Invasive plant treatments are not expected to affect substrate composition. All PDFs that minimize sediment would be implemented, such as no heavy equipment within riparian areas. These practices would reduce, but not eliminate sediment. Some sediment may enter stream channels as a result of extensive manual labor and could result in exposed soils. The amount of sediment that enters a stream is expected to be small, infrequent, of short duration, and at a localized level. Localized increases in fine sediment in gravels or along channel margins may be seen at the immediate treatment site. However, substrate quality would not decrease over time because treatment of invasive plants would not result in a chronic sediment source. Diffuse and spotted knapweeds are found along many streams in the Forest. Lacey et al. (1989) reported higher runoff and sediment yield on sites dominated by knapweed versus sites dominated by native grasses. Therefore reestablishment of native vegetation would provide long-term benefit to sediment levels in aquatic habitat.

- **Pathway: Habitat Elements**
- **Indicator: Large Woody Debris, and Pool Area, Quality and Frequency**
- **PCE Crosswalk: Spawning habitat PCE**

Treatment of invasive plants would not impact pool area, quality and frequency. Treatment of invasive plants in RHCAs would not impact current wood debris in streams. The PDF that establishes a 100 foot buffer for broadcast applications provides protection to the recruitment of conifer seedlings within riparian areas which will sustain channel and habitat features in the future. Controlling invasive plants would allow for reestablishment of native vegetation, allowing riparian stands over time to develop larger recruitment trees, increasing the size and quantity of inchannel debris. The use of spot-spray applications of aquatic glyphosate and aquatic imazapyr may result in some minor non-target vegetation impact because of drift. However, the amount necessary to drift into the entire riparian area and kill trees is not possible with spot-spray applications.

- **Pathway: Flow/Hydrology**
- **Indicator: Change in Peak/Base Flows**
- **PCE Crosswalk: Spawning, Rearing, Migration habitat PCEs**

None of the treatments are extensive enough under any alternative to effect peak flows, low flows or water yield. Methods used for treatment would have negligible effect on water infiltration into soil and associated surface runoff.

No 5th field watershed has more than 2.5 percent proposed for treatment and most have less than one percent. This amount is much too small an area to show effects to flows from treatment

Cumulative Effects

Cumulative effects include the effects of future State, tribal, other federal, local or private actions that are reasonably certain to occur within the action area of the Federal action subject to consultations (50 CFR 402.02). The “reasonably certain to occur” clause is a key factor in assessing and applying cumulative effects and indicates, for example, actions that are permitted, imminent, have an obligation of venture, or have initiated contracts (U.S. Fish and Wildlife Service and National Marine Fisheries Service, 1998). Past and present impacts of non-Federal actions are part of the environmental baseline.

Only the land and roads within the National Forest system would be treated in the action alternatives proposed by this EIS. The Forest, however, is intermingled with other federal, state, county, and private ownerships. Management activities and actions on neighboring lands may contribute to spread or containment of invasive plants on National Forest system lands, and vice versa.

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, county and other Federal 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 or Washington. Therefore, accurate accounting of the total acreage of invasive plant treatment for all land ownerships is unavailable. However, risk assessments indicate no measurable amounts would be in the waters adjacent to the treatment area. Project PDFs also are designed to reduce the chance of drift reaching streams minimizing direct and indirect effects. Treatments from this project would not likely cause a measurable change when combined with treatments on private lands.

Local County Noxious Weed Boards continue to focus on priority weeds that pose a risk to high valued areas, such as riparian corridors and recreational lakes. It is expected that joint partnerships between the Umatilla NF and local counties would work cooperatively to treat invasive plants. Forest Service standards described in this document will be incorporated into official participating agreements, challenge cost-shares, and in contract clauses. All contracts require an inspector to ensure that Forest Service standards are being met.

The Proposed Action is unlikely to have significant effects to fish and their habitat. It is unlikely that effects from proposed treatments would approach a threshold of concern; therefore, the Proposed Action would not contribute to significant cumulative effects.

Alternative C – No Broadcast within Riparian Habitat Conservation Areas (RHCAs)

Direct and Indirect Effects

The effects from treatments under this alternative are analogous to those of Alternative B except no broadcast would occur within RHCAs. Alternative B proposes 2,743 acres of broadcast within the RHCAs. Potentially these areas would be treated with mechanical or manual methods under Alternative C.

Not broadcasting herbicides within RHCAs would reduce the potential for contamination of water; however, utilizing manual and mechanical methods within these treatment areas could increase risk of sediment delivery to streams. As the main methods are mowing and cutting or pulling weeds, and the areas to be treated are between 100 and 300 feet from a stream, effects from manual and mechanical treatment on streams would be negligible. These areas could also potentially be treated with herbicides using spot or hand methods of application. Spot spraying is more targeted to specific plants; therefore less non-target vegetation would be removed resulting in more groundcover. Retaining as much groundcover as possible would lower the potential for sediment delivery to streams. Spot spraying also reduces the amount of herbicide that comes in contact with soil resulting in less herbicide available for runoff into streams.

Cumulative Effects

The cumulative effects are the same as those discussed under Alternative B

Alternative D – No Aerial Application of Herbicide

Direct and Indirect Effects

The effects from treatments under this alternative are analogous to those of Alternative B except no aerial application of herbicides would occur. Alternative B proposes 675 acres of aerial application. These acres would need to be treated by other methods. Under this alternative there would be a lower risk of herbicide contaminating water due to drift, however many of these areas are in remote locations where manual and mechanical treatments would not be feasible due to cost or safety. In those areas no treatment would occur and invasive plants would be allowed to spread.

Cumulative Effects

The cumulative effects are the same as discussed under Alternative B.

Effects Determinations

The effects determinations below are based on effects that have a reasonable probability of occurring due to invasive plant treatments within the action area, and conducted according to the Standards in the R6 FEIS and Project Design Features in the action alternatives.

The potential for sublethal effects to fish from herbicide exposure was considered and addressed in the R6 2005 FEIS. Because there is insufficient data on the herbicides included in the action alternatives to conclude that there may or may not be sublethal effects, the 1/20th of the NOEC values were used in the SERA risk assessments to account for the potential of sub-lethal effects from those herbicides that could potentially reach streams with listed and sensitive fish. The lack of information on sub-lethal effects did not affect our ability to make determinations of effects to listed species because of the degree of risk for herbicides coming in contact with water at levels of concern.

Effects from the action alternatives are expected to vary because of proximity to water, species occurrence, life stage present, and herbicide properties. Some treatments completely outside of the aquatic influence zone with no mechanism for herbicide delivery fall under a "no effect" determination. However, spot treatments up to the water's edge and along intermittent streams have the potential to deliver aquatic glyphosate and aquatic imazapyr to water.

These treatments are not likely to adversely affect fish and their habitat because treatments have been designed to minimize introduction of herbicide into aquatic habitats as well as avoid substantial amounts of sedimentation. Toxic levels of herbicides are unlikely to enter streams or lakes due to the ability to alter application methods and distance from water, timing, active ingredients and formulations, and other project design features.

Effects to immediate streamside cover cannot be avoided and there may be small droplets of aquatic glyphosate and aquatic imazapyr coming in contact with water. For example, treatment of riparian species growing along the streambank (above ordinary high water) may result in insignificant amounts of aquatic glyphosate and aquatic imazapyr in water 24 hours after treatment. Any treatment method, could introduce minor amounts of sediment and/or herbicide into adjoining waters as result of spot/hand applications, manual/mechanical plant removal, stream bank trampling, and planting. Effects from these activities are expected to be insignificant and therefore, discountable.

Herbicide Treatment, Non-Herbicide Treatment, and EDRR

Table 50 - Effects Determination for Herbicide Treatments, Non-Herbicide Treatments, and EDRR

Species	Status	Determination
Snake River Basin Steelhead	Threatened	MA-NLAA
Middle Columbia River Steelhead	Threatened	MA-NLAA
Snake River Spring/Summer Run Chinook Salmon	Threatened	MA-NLAA
Snake River Fall Run Chinook Salmon	Threatened	MA-NLAA
Columbia River Bull Trout	Threatened	MA-NLAA
Middle Columbia River Spring Run Chinook Salmon	Sensitive	MII
Redband Trout	Sensitive	MII
Westslope Cutthroat Trout	Sensitive	MII
Margined Sculpin	Sensitive	MII

NE=No Effect; MA-NLAA = May Affect, Not Likely to Adversely Affect; MA-LAA = May Affect, Likely to Adversely Affect
NI = No Impact; MII = May adversely impact individuals, but not likely to result in a loss of viability in the Planning Area, nor cause a trend toward federal listing; LRLV = likely to result in a loss of viability in the planning area, or in a trend toward federal listing.

Rationale for Determination

- Assumptions used for analyzing the worst case situations on UNF are beyond the Proposed Action (PDFs and buffers) and ground conditions on UNF, thus grossly overestimating potential exposures.
- Invasive plant treatments (herbicide and non-herbicide) and site preparation for revegetation can result in insignificant amounts of localized sediment due to trampling and removal of plant roots,
- Some herbicides could be introduced into the water indirectly from spot-spray and may impact aquatic plants at the immediate site. However, it is unlikely that a significant amount of aquatic

plants would be adversely affected to the degree of impacting an entire food chain in the aquatic ecosystem and indirectly harming a fish.

- Within the aquatic influence zone, aquatic formulations of glyphosate or imazapyr would be spot sprayed on plants, and could be indirectly delivered to water. However, spot applications reduce the potential to reach any expected exposure concentration of concern.
- Invasive plant treatments could temporarily reduce streamside vegetation (albeit non-native and low quality) that provides cover for fish. However, it is unlikely that removal of invasive plants providing cover along streams containing federally listed fish would lead to significant losses of cover. Removal would be localized (plants surrounding target plant) and overhead story would still provide cover via shade and future input of woody material.
- The potential for non-aquatic formulations of herbicide coming in contact with water is very low under the Proposed Action
- Biological controls will not influence any of the pathways for effects to federally listed fish or their habitat.
- Project Design Features significantly reduce the potential for herbicides coming in contact with water where there are federally listed fish present, if any were to come in contact with water the amounts would be far below levels of concern and potentially not at detectable levels.
- Localized effects from invasive plant treatments will be insignificant and discountable, yet still allow for restoration of important native riparian habitat.
- Water flow in streams quickly dilutes herbicide, reducing the potential for herbicide exposure, and dissipates any sedimentation as a result of invasive plant treatments and revegetation.
- Transitory water quality impact, if any, would be limited to the point of contact with water and not an entire stream reach
- No emergent vegetation is proposed for treatment.
- EDRR does not include aerial herbicide application.

NE=No Effect; MA-NLAA = May Affect, Not Likely to Adversely Affect; MA-LAA = May Affect, Likely to Adversely Affect
NI = No Impact; MII = May adversely impact individuals, but not likely to result in a loss of viability in the Planning Area, nor cause a trend toward federal listing; LRLV = likely to result in a loss of viability in the planning area, or in a trend toward federal listing.

Determination for Critical Habitat

Under existing Forest Service standards and guidelines, projects implemented under the Proposed Action cannot have a negative impact, in the long term, on riparian-dependent resources or ecological processes in RHCAs at the watershed scale. Each project must maintain or restore the physical and biological processes required by riparian dependent-resources at the watershed scale or broader to comply with PACFISH.

The potential, site-specific effects from implementation of the action alternatives on critical habitat was evaluated when addressing effects to Riparian Condition and Water Quality, Lakes, Wetland, and Floodplains (in Hydrology section).

The implementation of PDFs in the Proposed Action will reduce adverse affects to listed species' habitats during herbicide and non-herbicide treatment methods to a minimum, as discussed below and throughout this BE.

Water Quality Indicators: Changes in water temperature resulting from herbicide use to control invasive plants would be negligible to non-existent. Invasive plants provide little to no shade to streams, and the risk for adverse affects to native vegetation is low with backpack or hand operated sprayers. Removal of solid vegetation stands by herbicide treatment may result in short-term, insignificant increases in surface erosion that will diminish as vegetation re-establishes treated areas. No large-scale changes in land cover conversions or stand structure (e.g. timber to grass) will result from chemical invasive plant control as proposed in this project. Herbicide treatment of invasive plants is expected to result in a low risk of water contamination because of standards in the R6 FEIS, with additional PDFs in the Proposed Action. Site-specific soil characteristics, proximity to surface water and local water table depth were used to determine herbicide formulation, size of buffers, and application method and timing. Only those herbicides registered for aquatic use are allowed near streams or surface water with limitation on application and timing.

Habitat Access Indicators: Implementation of the Proposed Action would not create physical barriers to listed aquatic species.

Habitat Element Indicators: Implementation of the Proposed Action would not significantly affect substrate, large woody debris, pool quality, off-channel habitat, and refugia at the watershed scale. Large trees that provide shade and large wood would not be impacted by the use of herbicides as proposed under the Proposed Action.

Channel Condition Indicators: Implementation of the Proposed Action would result in reduction of invasive plants within riparian areas and along streambanks. Any impacts to streambank stability are expected to be localized, of low intensity and duration, and not significantly affecting fish habitat. Reduction of invasive plants along streambanks and riparian areas will benefit native plant species and result in improved streambank stability and riparian condition in the long-term.

Flow/Hydrology Indicators: Implementation of the Proposed Action is expected to result in no measurable effect to peak/base flow or water yield of watersheds.

Watershed Condition Indicators: No new roads or watershed scale disturbances are expected to result from the use of herbicides to treat invasive plants.

Invasive and noxious plants are a threat to overall watershed ecological condition. Long-term beneficial effects from the reduction of invasive plants in riparian areas, wetlands, and streams and subsequent increases in desirable vegetation will result in improved watershed conditions. The effect determination for proposed critical habitat of Columbia River Bull Trout, Snake River Spring/Summer Run Chinook Salmon, Snake River Fall Run Chinook Salmon, Snake River Basin Steelhead, and Middle Columbia River Steelhead is “may affect, but not likely to adversely affect.” These determinations are based on potential effects to the primary constituent elements, including the following:

- Although, invasive plant treatment projects may be conducted in close proximity to designated critical habitat, the potential to impact any of the PCEs at significant levels is very low.
- Invasive plant treatment projects are not expected to create sediment that may adversely affect embeddedness and availability of suitable substrate in localized areas.
- Only aquatic formulations of glyphosate and imazapyr are likely to come in contact with water inhabited by listed fish and amounts or concentrations would more than likely be negligible or below a level of concern, and will not impact available food resources.
- Non-aquatic formulations of herbicides are not likely to enter streams with designated critical habitat because of buffers and restrictions of herbicide use on roads that have high potential for herbicide delivery.

Invasive plant treatments are not expected to create significant amounts of sediment leading to direct or indirect adverse effects to habitat. Any increase in sediment would be localized given that herbicides would be used as opposed to heavy machinery. Manual and mechanical removal is not expected to create measurable amounts of sediment. Invasive plant treatments conducted in critical habitat would help to restore or maintain the native riparian vegetation that is essential to maintaining the primary constituent elements of the critical habitat in the long-term.

Conclusion

The R6 2005 FEIS and Fisheries Biological Assessment analyzed the risk of herbicide use to aquatic plants, algae, macroinvertebrates and fish, including listed species. The analysis relied on SERA Risk Assessments (1997a, 1997b, 1999a, 1999b, 2001a, 2001c, 2003a, 2003b, 2003c, 2003d, 2003e, 2003f) to determine effects to fish and other aquatic organisms if herbicide is delivered to streams and other water bodies. The Project Design Features (PDFs) listed in Chapter 1 were developed to avoid scenarios of concern to fish species of local interest considering the R6 2005 FEIS analysis and local conditions. These restrictions go beyond label requirements by limiting the amount and type of herbicide that may be used adjacent to waterbodies or along roads with high potential to deliver herbicide to streams and other water bodies. The only herbicides proposed for use where there is a likelihood of indirect delivery to water are aquatic formulations of glyphosate, imazapyr, and triclopyr. Refer to Table 7, Table 8 and Table 9 for buffers and acceptable use of herbicides adjacent to waterbodies. For example, spot application within 15 feet of streams is limited to the aquatic formulations of glyphosate and imazapyr.

Herbicides can disappear from treated water by dilution, adsorption to bottom sediments, volatilization, absorption by plants and animals or by dissipation. Dissipation refers to the breaking down of an herbicide into simpler chemical compounds. Herbicides can dissipate by photolysis (broken down by light), hydrolysis, microbial degradation, or metabolism by plants and animals. Both dissipation and disappearance are important considerations to the fate of herbicides in the environment because even if dissipation is slow, disappearance due to processes such as adsorption to bottom sediments makes a herbicide biologically unavailable. For example, glyphosate is not applied directly to water for weed control, but when it does enter the water it is bound tightly to dissolved and suspended particles and to bottom sediments and becomes inactive, posing a very low risk to fish, the aquatic food web, and critical habitat.

The likelihood that fish or other aquatic organisms may be impacted under the worst-case situations analyzed for the Proposed Action is very low. Any use of herbicide in Aquatic Influence Zones or along roads with high potential to deliver herbicides is associated with some risk, however the degree of risk is very low given the Project Design Features for the Proposed Action.

Adverse effects to fish under the worst case situations are not likely to occur because any herbicide or sediment that came in contact with water, regardless of the amount, would be quickly washed downstream and diluted. Based on the R6 2005 FEIS, the potential to reach levels of concern for invertebrates and aquatic plants is expected to be low and herbicides coming in contact with water as a result of the Proposed Action would more than likely be insignificant. Therefore, impacts to the aquatic food web are not likely and therefore, indirect effects to fish are discountable.

Project Design Features minimize and avoid concentrations of herbicide exceeding a level of concern coming in contact with fish and other aquatic organisms because:

- Established buffers along perennial and intermittent streams greatly reduce the potential for drift of herbicide to surface waters;

- No broadcasting of herbicides are allowed along roads that have a high potential for herbicide delivery, thereby significantly reducing the potential amount of herbicides delivered to streams via road-side ditches;
- Broadcast spray of triclopyr is prohibited, thereby greatly reducing risk of triclopyr coming in contact with surface waters;
- With the eliminated potential for concern for increased risk to aquatic species, the potential for effects to the aquatic food web is greatly reduced.

The potential for herbicides to enter streams in concentrations that are near or exceed thresholds of concern for federally listed fish and impacting aquatic ecosystems is very low. Therefore, the degree of risk is low and discountable. Whether known sites or new sites are treated following the Proposed Action, it is unlikely that the Forest will reach the most ambitious conceivable treatment scenario identified in the Proposed Action. In addition, the PDFs are likely to minimize or eliminate the risk of adverse affects.

Magnuson-Stevens Fishery Conservation and Management Act – Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance essential fish habitat (EFH) for those species regulated under a Federal fisheries management plan.

Essential Fish Habitat is defined in the Act as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” Essential Fish Habitat includes all freshwater streams accessible to anadromous fish (Chinook, coho, and pink salmon), marine waters, and inter-tidal habitats. The objective of this EFH assessment is to determine whether or not the Proposed Action “may adversely affect” designated EFH for relevant commercially, federally-managed fisheries species within the Project Area.

Umatilla National Forest may incorporate an EFH assessment into the analysis for this EIS pursuant to 40 CFR section 1500. NEPA and ESA documents prepared by the Umatilla National Forest should contain sufficient information to satisfy the requirements in 50 CFR 600.920(g) for EFH assessments and must clearly be identified as an EFH assessment.

Identification of Essential Fish Habitat

Pursuant to the MSA the Pacific Fisheries Management Council (PFMC) has designated EFH for federally managed fisheries within the waters of Washington, Oregon, and California. Designated EFH for groundfish and coastal pelagic species encompasses all waters from the mean high water line, and upriver extent of saltwater intrusion in river mouths, along the coasts of Washington, Oregon and California, seaward to the boundary of the U.S. exclusive economic zone (370.4 km) (PFMC, 2004, 1998).

Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable artificial barriers (as identified by the PFMC, 2003), and longstanding, naturally-impassable barriers (i.e., natural waterfalls in existence for several hundred years) (PFMC, 2003). In estuarine and marine areas, designated salmon EFH extends from the nearshore and tidal submerged environments within state territorial waters out to the full extent of the exclusive economic zone (370.4 km) offshore of Washington, Oregon, and California north of Point Conception to the Canadian border (PFMC, 2003).

Detailed descriptions and identifications of EFH are contained in the fishery management plans for groundfish (PFMC 2004), coastal pelagic species (PFMC 1998), and Pacific salmon (PFMC, 2003).

The geographic extent of EFH on Umatilla National Forest is specifically defined as all currently viable waters and most of the habitat historically accessible to Chinook salmon within the watersheds identified in Table 10. Salmon EFH excludes areas upstream of longstanding naturally impassible barriers (i.e., natural waterfalls in existence for several hundred years). Salmon EFH includes aquatic areas above all artificial barriers.

Effects of the Proposed Action

The MSA defines adverse effects as any impact, which reduces the quality and/or quantity of Essential Fish Habitat. Non-herbicide treatment methods would have very localized effects to soil at the project scale. Herbicide treatment methods may result in insignificant amounts of herbicides coming in contact with water as a result of drift and runoff from roadside ditches. Effects from both non-herbicide and herbicide treatment methods would not impact those waters necessary for spawning, breeding, feeding, or growth to maturity because there is no treatment of emergent or submerged invasive plants and the predicted amount of herbicide coming in contact with water is well below levels of concern. As discussed above in the Effects Analysis section Chinook salmon would not be adversely affected because:

- The quantity of EFH will not be reduced
- The quality of EFH will be maintained and not degraded

PDFs will be applied and Northwest Forest Plan standards would be met. Conservation measures and management alternatives are listed in the Pacific Coast Salmonid Plan that help conserve and enhance salmon EFH. These measures should be applied unless more specific or different measures based on the best and most current scientific information are developed prior to, or during, the EFH consultation process and communicated to the appropriate agency. The PDFs in the Proposed Action are more detailed measures and should take the place of ones listed in the Pacific Coast Salmonid Plan. However, there may be conservation measures that are different and complement the PDFs.

As described in detail in the Effects Analysis section of this BE, the exclusion of heavy machinery from the Proposed Action will not result in impacts to sediment and cover. The use of non-herbicide methods as described in the Proposed Action is not expected to reduce the quality and/or quantity of EFH. The use of herbicide treatments as described in the Proposed Action and analyzed in this BE is not expected to reduce the quality and/or quantity of EFH.

Conclusion

The Proposed Action is not expected to adversely affect EFH for Pacific salmon species listed in Table 51. The Proposed Action is expected to impove long-term essential fish habitat conditions in locations currently infested with invasive plants.

Table 51 - Potential Effects to Commercially Important Fish Species Under the Proposed Action

Species	Magnuson-Stevens EFH Determination
Snake River Spring/Summer Run Chinook Salmon	No Effect
Snake River Fall Run Chinook Salmon	No Effect

3.6 Recreation

3.6.1 Introduction

Invasive Plants and Recreation Resources

Recreational activities are influenced by, and have influence on, the rate and degree of invasive plant spread in campgrounds, trails, wilderness areas, and wild and scenic rivers of the Umatilla National Forest. Recreationists move in and out of these forest settings, inadvertently transporting seeds and propagating plant parts throughout the forest as well as across and between landscapes.

Heavy use areas such as trailheads, parking lots and riparian areas can be denuded of their native vegetation, creating prime environment for invasive plants to seed. The most likely vectors of invasive plant spread are roads, trails and riparian corridors (R6 2005 FEIS).

Invasive plants can detract from the desirability of using recreation sites and participating in certain recreational activities. For example, stiff plant stalks, thorns, sharp bristles, and allergies created by invasive plants can prevent humans from walking, sitting, setting up camp, and finding a place to fish or tie up a raft (R6 2005 FEIS). Recreation use associated with hunting such as off-highway vehicle (OHV) use, dispersed camping, wilderness and back country access using pack stock all increase substantially the likelihood of spreading invasive plants.

This section will describe the affected environment and analyze the effects of the proposed project and alternatives on the recreation resource and congressionally designated areas. The analysis will evaluate the impacts of invasive plant treatment methods on recreation in the general forest, developed recreation sites, and trails. Congressionally designated areas include wild and scenic rivers and wilderness areas. The effects on the outstandingly remarkable values, water quality and free flowing characteristics of designated and eligible wild and scenic rivers and the effects on wilderness character will be evaluated. Invasive plant treatment methods are described in detail in Chapter 2 of the Draft Environmental Impact Statement (DEIS).

3.6.2 Affected Environment

Congressionally Designated Areas

Wilderness

Wilderness is to be managed according to the 1964 Wilderness Act, which directs agencies to protect wilderness character (1964 Wilderness Act, Section 2(a) and Section 4(b)). Four qualities, derived from the Definition of Wilderness (Section 2(c) of the 1964 Wilderness Act), define wilderness character:

- **Untrammeled** – wilderness is essentially unhindered and free from modern human control or manipulation
- **Natural** – wilderness ecological systems are essentially free from the effects of modern civilization
- **Undeveloped** – wilderness is essentially without permanent improvements or modern human occupation

- **Outstanding opportunities for solitude or a primitive and unconfined type of recreation** – wilderness provides opportunities for people to experience solitude or primitive and unconfined recreation, including the values of inspiration and physical and mental challenge (USDA 2005).

There are three designated wilderness areas on the Umatilla National Forest; the Wenaha-Tucannon, the North Fork Umatilla, and the North Fork John Day. Invasive plants have been identified in all three. Invasive plants within wilderness are typically found at trailheads, along trails, riparian areas, and near popular dispersed camping sites. Invasive plant infestations within wilderness areas are minor compared to the general forest acres. Infestations outside wilderness boundaries have the potential to spread into wilderness areas and threaten wilderness values.

Invasive plants have adverse effects on wilderness character as they can disrupt natural processes. Invasive plants may alter natural plant communities, interact in unknown ways with native wildlife species, and alter ecological processes such as plant community dynamics and disturbance processes such as fire. This potential change in ecological condition can threaten the natural integrity of the wilderness and the values for which it was designated. The presence of invasive weeds is typically a result of human use.

Weed infestations are typically associated with human activities such as grazing, pack stock use, trails; activities that create disturbed conditions that allow weeds to establish.

The 1964 Wilderness Act presents managers with direction that creates a dilemma regarding what to do about invasive plants. Section 2 (a) of the Act provides direction to preserve natural conditions in wilderness. Section 2 (c) of the Act defines wilderness as an area where earth and its community of life are “untrammeled”. Untrammeled is interpreted to mean uncontrolled, unconfined, not restrained by people; protected from human control or at least intentional manipulation. The dilemma that this direction creates regarding what to do about invasive plants is that managers must choose either to preserve natural conditions by actively manipulating wilderness to reduce or eliminate invasive plants, or to keep wilderness free from intentional human manipulation, but lose natural conditions due to the changes caused by invasive plants. This analysis will describe effects of invasive plant treatments and the effects of invasive plants on wilderness character.

The Pacific Northwest Region Invasive Plant Program Final Environmental Impact Statement (FEIS) identified wilderness as an area of special concern and it is in the highest priority treatment category (R6 2005 FEIS). The Record of Decision (ROD) approved herbicide use as a potential tool in designated wilderness throughout the region (R6 2005 ROD).

The ROD also amended all forest plans in the region; requiring use of certified weed-free feed for all pack and saddle stock used on National Forest system lands. As of January 2007, certified weed-free feed or pelletized feed is required in all wilderness and wilderness trailheads on National Forest lands in the Pacific Northwest Region. This will help prevent further introduction of invasive weeds into the wilderness through stock feed. This requirement is being phased in to allow recreationists time to adjust to the change and due to lack of available weed-free hay certification programs in Washington and a limited program in Oregon.

Wenaha-Tucannon Wilderness

The primary recreation activity within the Wenaha-Tucannon Wilderness has traditionally been elk hunting with a large number of hunters packing in on horses each fall. Overall use is considered light to moderate with the majority of use occurring during hunting season.

Recently, however, there has been an increase in anglers and backpackers during the summer and early fall months.

There are approximately 158 acres of invasive weed infestations identified within the Wenaha-Tucannon Wilderness. The largest concentrations are located near the Three Forks Trailhead and along the Three Forks and the Crooked Creek Trails. These trails are popular with horseback riders and people packing in for big game hunting.

North Fork Umatilla River Wilderness

The North Fork Umatilla River Wilderness is the smallest wilderness on the Forest, and currently there are only 17 acres of invasive plant sites identified. There are extensive infestations identified and mapped along roads outside the wilderness boundary. Minor infestations are located at access points such as Umatilla Forks Campground, Buck Creek, and Corporation Organizational Camp. These infestations have potential to spread and threaten wilderness values.

North Fork John Day Wilderness

The North Fork John Day Wilderness is comprised of four separate units, three on the North Fork John Day District, Umatilla National Forest, and one on the Baker Ranger District, Wallowa-Whitman National Forest. Use of this wilderness is typically light and increases during the big game hunting seasons.

There are approximately 22 acres of invasive plant infestations identified within the North Fork John Day Wilderness, Umatilla National Forest. There are minor infestations that have been identified and mapped along roads outside the wilderness boundary. The most significant infestations are along FR 1035 which accesses Granite Creek Trail. and FR 5506 which accesses Oriental Creek Campground and the trailhead for Big Creek, Corral Creek and North Fork John Day River Trails.

Table 52 – Wilderness Areas and Acres of Invasive Plants

Wilderness Name and Acres		Acres Invasive Plants
Wenaha-Tucannon	177,432	158
North fork Umatilla	20,435	17
North Fork John Day	107,058	22
Total Acres	**304,925**	**197**

Wild and Scenic Rivers

The Wild and Scenic Rivers Act was enacted to preserve in a free-flowing condition, rivers which possessed outstandingly remarkable values such as scenic, recreational, geologic, fish and wildlife, historic or cultural. Congress declared that it was important to manage certain rivers in their free flowing condition, and to manage them and their immediate environment to protect those qualities for the benefit and enjoyment of present and future generations.

In the planning process for the Umatilla National Forest, the Forest Service also identified rivers that are eligible for designation as wild and scenic rivers.

Designated and eligible rivers are assigned a classification of wild, scenic, or recreational. Characteristics of these classifications are:

- **Wild -** Rivers or sections of rivers that are free of impoundments, generally inaccessible except by trail (no roads), with watersheds or shorelines essentially primitive, with little or no evidence of human activity and having unpolluted waters.
- **Scenic -** Rivers, or sections of rivers, that are free of impoundments, having shorelines or watersheds largely primitive and shorelines largely undeveloped, but accessible in places by roads.
- **Recreational –** Rivers or sections of rivers that are readily accessible by road or railroad, may have some development along the shoreline, and may have had some impoundment or diversion in the past.

Forest Service Manual 2354.42 provides direction for resource protection and management activities in WSR corridors. FSM 2354.42(l) Forest Pest Management states "Control forests pests in a manner compatible with the intent of the Act and management objectives of contiguous National Forest System lands." Invasive plants can alter the ecology and recreation setting within WSR corridors, impacting the outstandingly remarkable values for which it was designated.

Segments of the Grande Ronde, the North Fork John Day and the Wenaha Rivers have been designated as part of the National Wild and Scenic River system (WSR). Desolation Creek, Granite Creek, North Fork Asotin Creek and the Tucannon River are identified as eligible WSR's. The river management corridor typically extends one quarter mile from the riverbank on each side of the designated segment. Invasive plant species have been found in all three river corridors. The presence of invasive species along the river corridor can detract from the aesthetic and recreational opportunities and impact the values for which the river has been designated. Acres in WSR corridors that occur in wilderness would be subject to laws, standards and project design features pertaining to wilderness. The following table summarizes each river and the outstandingly remarkable values for which it was designated.

Table 53 - Wild and Scenic Rivers on the Umatilla National Forest and their Outstandingly Remarkable Values

River Name	Wild (mi.)	Scenic (mi.)	Recreation (mi.)	Outstandingly Remarkable Values
Grande Ronde River	17.4		1.5	Scenery, Recreation, Fisheries, Wildlife
Wenaha River	18.7	2.7	0.2	Scenery, Fisheries, Geology
North Fork John Day River	27.8	10.5	15.8	Scenery, Recreation, Fisheries, Wildlife, Cultural Resources
Desolation Creek (Eligible)		21.5		Recreation, Botanical/Ecological
Granite Creek (Eligible)		7.9		Fisheries
North Fork Asotin Creek (Eligible)		18.0		Fisheries
Tucannon River (Eligible)	9.1	4.6	8.6	Recreation, Fisheries, Cultural/Historic, Botanical/Ecological

Grande Ronde WSR

The Grande Ronde River receives moderate to heavy use by rafters and kayakers during spring and summer seasons with the heaviest use occurring on weekends and holidays. The wild segment of the river that occurs on National Forest system lands has limited vehicle access. The put-in and take out sites are located on, and managed by, the Bureau of Land Management and state agencies.

Dispersed camping occurs along the river on National Forest system lands in conjunction with multi-day raft trips.

There are 28 acres of invasive plants identified within the WSR corridor, the majority of which is leafy spurge within the riparian area. The infestations are typically small sites, less than two acres each. The sites are located along the entire length of the wild segment of the river. There are no invasive plants identified in the recreation segment of the river.

North Fork John Day (NFJD) WSR

The NFJD River has Wild, Scenic and Recreation designations on the Umatilla National Forest. The Wild segment is within the North Fork John Day Wilderness. Use along this segment is typically by foot or horseback along the NFJD River Trail. The Scenic section follows Forest Road 5506 from the Big Creek trailhead to Texas Bar. The Recreation section follows Forest Highway 55 from Texas Bar past Tollbridge Campground. Use along both these segments consists of dispersed camping along the road and river during summer, with use increasing during big game hunting season. There is some float use on the river during early spring run-off, with use declining after mid June.

There are approximately 179 acres of invasive plants identified along the NFJD WSR. The majority of invasive plant acres are within Recreation and Scenic designations. The invasive plants are predominantly associated with the road right of way within the managed river corridor. Thirty acres identified in the Wild segment of the river are primarily along 1.5 miles of the NFJD River Trail, closest to the wilderness trailhead at the end of FR 5506. The remaining five acres are scattered small sites along the NFJD River Trail and Crane Creek Trail.

Wenaha WSR

The Wenaha WSR receives light use due to its remote character. The Wild segment is located in the Wenaha-Tucannon Wilderness and is accessible by pack stock or foot along the Wenaha River Trail.

There are approximately 20 acres of invasive plants along the Wenaha WSR; 15 acres within the Wild segment associated with the Wenaha River Trail and the Cross Canyon Trails, and five acres within the Recreation segment that is part of a larger area outside of the forest boundary on Bureau of Land Management and state lands.

Desolation Creek - WSR Eligible

Desolation Creek is proposed as a recreation river along its entire length. The area provides dispersed camping opportunities, hiking and big game hunting.

There are approximately 27 acres of invasive plants identified along this creek. They are primarily associated with the road corridors of Forest Highway 34 and 10. There are also infestations near Tollbridge Campground at the confluence with the North Fork John Day River.

Granite Creek - WSR Eligible

Granite Creek is proposed as a recreation river. This creek is considered high quality spawning grounds for Chinook salmon. The Granite Creek Trail is a popular access to the North Fork John Day Wilderness Area.

There are approximately 108 acres of invasive plants along this creek. They are primarily associated with the FR 1035 road corridor and Granite Creek Trail.

North Fork Asotin Creek - WSR Eligible

The North Fork Asotin Creek is proposed as a scenic river. It contains native Chinook, bull trout and steelhead. NF Asotin Creek Trail follows the length of the creek. Use on the trail includes motorcycle, mountain bike, foot and horse use.

There are approximately 159 acres of invasive plants identified along its banks. The majority of the invasive plants are along the NF Asotin Creek Trail from the forest boundary to the junction with Pinkam Trail.

Tucannon River - WSR Eligible

The Tucannon River has segments proposed as wild, scenic and recreation. The river is popular for camping, sight-seeing, fishing and wildlife viewing.

There are approximately 116 acres of invasive plants identified primarily along the scenic segment. The majority of invasive plants are associated with the FR 4712 road corridor.

Table 54 - Wild and Scenic Rivers, Designation, and Acres of Invasive Plants

Wild and Scenic River Name and Designation		Acres of Invasive Plants
Grand Ronde	Recreation	0
	Wild	28
Grand Ronde Total		**28**
NFJD	Recreation	45
	Scenic	98
	Wild **	35
NFJD Total		**179**
Wenaha	Recreation	5
	Wild **	15
Wenaha Total		**20**
Desolation Creek (Eligible)	Recreation	**27**
Granite Creek (Eligible)	Recreation	**108**
North Fork Asotin Creek (Eligible)	Scenic	**159**
Tucannon River (Eligible)	Scenic	**116**
Grand Totals		**637**

Developed Recreation Sites

The Umatilla National Forest has 32 developed recreation facilities that have invasive plants within the managed use area of the site. These sites include campgrounds, trailheads, winter sports areas, cabin rentals, interpretive sites and organizational camps. Many of the invasive plant sites are small, less than one acre. Fairview Campground and Woodward Campground have the largest area to be treated at 10.3 and 18.9 acres, respectively.

There are 17.2 acres of invasive plant infestations associated with winter sports and snow play areas (toboggan, and sledding area). Weeds associated with these areas are typically located near parking lots or along access roads. There are no recreation facilities associated with the winter sports areas during the snow-free season. Use of these areas during snow-free seasons, as dispersed sites, is incidental.

The following table shows developed recreation sites by ranger district, site name and acres of invasive plants.

Table 55 - Ranger District, Developed Recreation Site Name, and Acres of Invasive Plants

Ranger District and Site Name		Acres of Invasive Plants
Heppner	Bull Prairie Campground	6.2
	Fairview Campground	10.3
	Penland Lake Campground	0.2
	Coalmine Hill Campground	0.1
	Ditch Creek Guard Station Rental	0.5
Heppner Totals		**17.3**
Pomeroy	Alder Thicket Campground	2.6
	Pataha Campground	0.1
	Meadow Creek Trailhead	0.9
	Panjab Trailhead	2.8
	Tucannon Trailhead	0.6
	Rose Spring Winter Sports Area	2.5
Pomeroy Totals		**9.5**
North Fork John Day	Bear Wallow Campground	2.2
	Big Creek Meadows Campground and Trailhead	0.2

Ranger District and Site Name		Acres of Invasive Plants
	Driftwood Campground	2.3
	Gold Dredge Campground	2.7
	Oriental Campground & Trail Head	1.1
	Tollbridge Campground	0.3
NFJD Totals		**8.8**
Walla Walla	Jubilee Lake Campground	4.6
	Target Meadows Campground	2.4
	Umatilla Forks Campground	1.6
	Woodland Campground	1.6
	Woodward Campground	18.9
	Fry Meadows Guard Station Rental	0.2
	Burnt Cabin Trailhead	0.5
	Whitman Route Interpretive Site	4.3
	Corporation Organizational Camp	1.9
	Buck Creek Organizational Camp	0.1
	Andies Prairie Snow Play Area	4.3
	Bone Springs Winter Sports Area	3.7
	Spout Springs Ski Area	5.8
	Ruckle Junction Winter Sports Area	0.1
	Woodland Snow Play Area	0.8
Walla Walla Totals		**50.8**
Grand Total		**86.4**

Trails

Non-motorized and motorized trails are considered high spread potential sites for invasive plants. Trail corridors are defined as the area 100 feet on either side of the trail tread. Invasive plant acres that are in trail corridors within wilderness areas or WSR are included in wilderness or WSR acres. All other invasive plant acres that occur outside the trail corridor are included in the general forest area.

Non-Motorized

There are approximately 613 miles of non-motorized trails on the forest. Non-motorized trail types include pack and saddle trails, hiking trails and cross-country ski trails. Pack and saddle trails and the feed, straw and disturbance associated with such use can facilitate the establishment and spread of invasive plants. There are approximately 404 acres of invasive plant infestations within non-motorized trail corridors outside of wilderness areas and WSR corridors.

Motorized

Motorized trails include off-highway vehicles (OHV) motorcycle and snowmobile trails. OHV trails and "cross country" use can create the conditions that are favorable for invasive plant establishment and subsequent spread by vehicle use (Lacey et al 1997).

Snowmobile trails are typically on roads that are not plowed during winter seasons. Invasive plant acres along snowmobile trails are included in the general forest area as roads.

There are approximately 50 acres of invasive plant infestation within motorized trail corridors. The following table summarizes the acres of invasive plants by trail type. Acres along trails within wilderness areas and wild and scenic river corridors are not included in these totals.

Table 56 - Trail Types and Acres of Invasive Plants

Trail Type	Acres of Invasive Plants
OHV/Motorcycle	50
Hiking/Pedestrian	23
Pack and Saddle	211
Cross Country Ski	170
Total	**454**

General Forest Area

The general forest area, for the sake of this writing, is considered all areas not within a developed recreation site boundary, designated wilderness, wild and scenic river corridor, or trail corridors. The majority of invasive plant sites within the general forest area occur along roads. Roads are considered to be high spread potential areas.

There are currently 6,846 miles of forest roads that are determined to be needed for long-term motor vehicle use on the Umatilla National Forest. The Forest has jurisdiction for 4,957 miles while approximately 1,889 miles have county, state, BLM, or private jurisdiction (USDA 2004).

Recreational access to the forest is the predominant use of the transportation system. Driving for pleasure is a primary use of the forest (USDA 2003).

Dispersed recreation sites are typically along roads and have developed due to repeated use by recreationists. These site types are not usually inventoried, signed, or have any other use controls associated with them other than access. Repeated use by recreationists can create the conditions that favor invasive plant establishment and spread.

Overall incidence of summer dispersed camping is moderate, and is associated with OHV riding and river use. Dispersed camping during the hunting season would be considered high with camps occurring along many roads. Many hunter campsites have been used by the same hunting group year after year.

Approximately 23,272 acres of invasive plants have been identified in the general forest area. The general forest acres are derived from the total acres of invasive plants identified (24,236 acres) minus the acres within the boundaries of congressionally designated areas, trail corridors and developed recreation sites. The following table summarizes acres of invasive plants by recreation type.

Table 57 - Recreation Areas, General Forest and Acres of Invasive Plants

Recreation Area	Acres of Invasive Plants
Wilderness	197
WSR	227
Developed Recreation	86
Trails	454
General Forest Area	23,272
Grand Totals	**24,236**

3.6.3 Environmental Consequences

Effects Common to Recreation for the No Action Alternative

The 3,154 acres of invasive plants approved for treatment under existing decision documents (USDA 1995) have proven ineffective in controlling the spread of invasive plants (see Botany Report). Though new infestations of invasive plants can be treated using mechanical and manual methods they have proven to be ineffective at controlling the Forestwide spread of invasive plants.

Effects Common to Recreation for all Action Alternatives

Direct Effects

Visitors may notice invasive plant treatments when traveling through the forest by car, OHV, foot, pack stock or water craft. The size of the invasive plant site being treated and the type of treatment being used would determine how noticeable the treatment is.

Chemical application methods vary from individual plant application to broadcast spraying. Wicking and stem injection treat individual plants and only target plants would be affected. Spot spraying would target individual plants but overspray may affect adjacent vegetation. Broadcast spraying would treat an area and all plants within the site may be affected depending on the herbicide. Broadcast application could include hand spreading and spraying from vehicle mounted tanks. Individual plant application would use less chemical agent overall.

Visitors that are concerned about exposure to herbicides may be more accepting of individual plant application methods, especially in high use areas and gathering areas for berries and mushrooms.

Chemical treatments may leave dead vegetation that would be noticeable for several days to several weeks. Individual plant treatments would be less noticeable than broadcast treatments overall. These effects would be of short duration, typically one growing season.

Physical treatments include manual and hand mechanical treatments. Manual treatments may show signs of disturbed earth from digging or grubbing out root systems. Hand mechanical treatments may leave evidence of cut vegetation due to mowing, weed whipping and roadside brushing. These effects are commonly seen by the visitor on and off the forest and are not expected to detract from their overall recreation experience in the general forest areas. These effects would be of short duration, typically one growing season.

Biocontrol measures would not be noticeable to the casual forest visitor. It is a long term method of treatment that does not eradicate the invasive plant, but instead keeps the population in check so that native species can compete.

Eradicating invasive plants can make areas more desirable for recreation. Invasive plants that have characteristics such as thorns, bristles, stiff plant stalks and chemical irritants would be treated, making areas more inviting to recreationists. Recreationists may appreciate a more natural landscape with intact native vegetation.

Early Detection/Rapid Response (EDRR) is a treatment strategy that allows managers to rapidly respond to new or expanding invasive plant sites. The Treatment Decision Tree (See Figure 8, Chapter 2) provides a decision process for determining treatment methods for invasive plant sites. Areas treated under EDRR would be subject to all regional and forest standards. Effects to recreation would be similar to those described above and within the categories described below.

Indirect Effects

All sites and areas that are treated with herbicides would be posted to inform forest visitors what herbicide was used, when it was applied and how long the herbicide would persist in the area before breaking down. Visitors would be able to make informed decisions concerning their comfort level with recreating in an area where herbicides have been recently applied.

People may decide not to recreate in areas where herbicides have been applied. The greatest impact to visitors would be if they were not aware that herbicides had been applied in their destination recreation area. Standard 23 of the Regional FEIS provides for public notification through various media but it is impossible to contact all potential visitors prior to them arriving on the forest. Posting signs at key access points would alert visitors to the presence of herbicides; however notification upon arrival may disrupt a visitor’s plans and activities. Similar recreational opportunities exist across the forest so a visitor may, if desired, be able to find a substitute place to recreate. This may provide an opportunity for forest visitors to explore new areas.

Effects on Congressionally Designated Areas

Alternative A - No Action Alternative

Under this alternative, approximately eight acres within wilderness that is currently approved for treatment would continue to receive treatments. Invasive plants have spread substantially beyond these sites. Without treatment of new invasive plant sites, populations that have become established within wilderness would continue to spread. By not aggressively treating weeds, wilderness character would remain “untrammeled” and free from human manipulation; however, the spread of invasive plants may change the character of the ecosystem such that they threaten the apparent naturalness and natural integrity of the wilderness.

Approximately 0.4 acres within WSR corridors would continue to be treated under this alternative. Invasive plants have spread beyond these sites. Invasive plants can detract from the outstandingly remarkable values for which the WSR’s were designated. These include scenery, recreation, fisheries, wildlife, botanical, ecological, cultural and geological values. Refer to their respective reports for detailed descriptions of impacts invasive plants have on these resources.

Effects Common to all Action Alternatives

Wilderness

To best preserve the wilderness resource, alternatives will be evaluated for their potential effects on the four qualities of wilderness character previously mentioned: Untrammeled, natural, undeveloped, and outstanding opportunities for solitude or a primitive and unconfined type of recreation. The untrammeled quality is the extent to which wilderness ecosystems remain free from modern human manipulation. Natural integrity is the extent to which long-term ecological processes are intact and operating. The undeveloped quality is a measure of how natural the environment appears and how free it is from any structures or developments. The outstanding opportunities for solitude or a primitive and unconfined type of recreation are subjective values defined as isolation from the sights, sounds and presence of others, and the developments and activities of people. Primitive recreation opportunities are those that allow the recreationists to use backcountry skills, knowledge and abilities that do not rely on developed facilities, mechanical transport or motorized equipment.

Invasive Plant Treatment and Transport Methods in Wilderness

Approximately 197 acres of invasive plants are identified within wilderness areas. These acres are located along trails that access the wilderness areas. Treatment methods that may be utilized include non-mechanical hand treatments such as hand-pulling or use of hand tools for cutting, digging and grubbing. Herbicide treatments may use application methods such as wicking, stem injection, spray bottle, hand pressurized pumps, battery or solar powered pumps and propellant based systems such as those that use pressurized carbon dioxide. Gas-powered, motorized pumps and aerial application of herbicides are not proposed as application methods in wilderness under any of the proposed alternatives including for EDRR.

Approved herbicide application methods described above are considered acceptable herbicide application methods within wilderness without further analysis of the Wilderness Act’s prohibitions on use of motorized equipment.

Battery or solar powered pumps are considered motorized equipment. These devices are used to apply herbicides from horseback mounted spray systems.

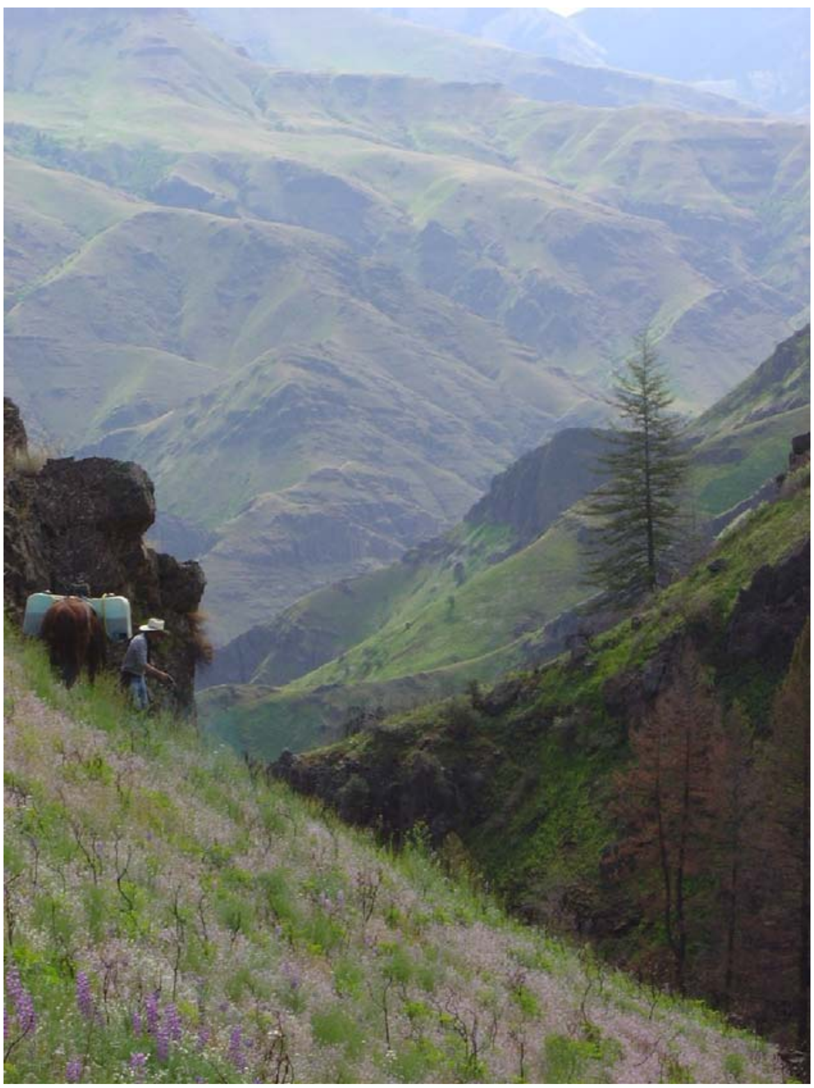
Solar panels and/or batteries to operate pumps may be evident on pack stock. These types of pumps are quiet and would not impact opportunities for solitude or a primitive and unconfined type of recreation in wilderness.

Use of herbicides as a treatment method is estimated to be 80 percent effective in reducing invasive plants with one treatment application (see Botany Report).

Treatment is most effective when herbicides are applied during the active growing season of the plant, typically May through July. Areas would be treated one to two times per year during the growing season to effectively eliminate the invasive species at that site. Where continued disturbance occurs such as at trailheads and popular campsites annual treatments may be necessary to prevent the re-establishment of invasive plants and subsequent spread.

Visitors may feel their wilderness experience is degraded if they happen to visit a treatment site during treatment due to encounters with weed treatment crews. While important to those visitors it affects, it is a short-term impact, lasting one to several days at each site per year, depending on its size. Effects on visitor's wilderness experience can be minimized through public notification and treating areas during low visitor use periods.

Use of wilderness on the Umatilla National Forest is typically low during the summer and it increases during the fall big game hunting season. Invasive plant treatments typically occur during the summer growing season. Some visitors may appreciate encountering people working with pack stock in the wilderness. "Packing in" is a traditional skill that many people associate with wilderness.



Proposed methods to transport people and supplies to carry out invasive plant treatments include non-mechanized methods considered acceptable within wilderness including backpack and pack stock use. These types of traditional transport methods used within wilderness do not require additional analysis of the Wilderness Act's prohibitions on use mechanical transport. Use of helicopters or other mechanized methods to transport supplies and people to carry out invasive plant treatments is not proposed under any alternative or EDRR.

Figure 11 – Contract worker spraying invasive plants in the Wilderness from horseback

Picture by Leigh Dawson

Untrammeled

Treatment of invasive weed infestations within wilderness can be viewed as human manipulation on the landscape. Evidence of human manipulation can detract from the "untrammeled" feel of wilderness.

There will be short-term evidence of weed treatments including dead or wilting plants and areas of disturbed soils where plants have been pulled up or grubbed out. Where plants are dead or dying, some people may recognize that herbicides were sprayed.

These effects may not appear natural to the forest visitor. Hikers and pack stock users are typically traveling at a slow pace and these changes may be noticeable. Biocontrol measures would be not be noticeable to the casual visitor and would not affect the apparent naturalness of the area.

The amount of area proposed to be treated in wilderness is very small; approximately 197 acres of 304,925 acres in wilderness on the forest. Effects would be localized to the treatment areas and effects to the wilderness ecosystem are limited to these treatment areas. Regional standards and project design features are in place to protect ecological resources including non-target botanical species, water, soils, fisheries and wildlife. Refer to the botany, hydrology, soils, fisheries and wildlife reports for details concerning the effects of invasive plants and the effects of invasive plant treatments on these resources. Apparent naturalness of treatment areas will improve as the evidence of invasive plants decreases and they are replaced with native vegetation.

Natural

Aggressive treatment of weeds in the wilderness would improve natural integrity under all alternatives. Invasive weed treatments would decrease establishment and expansion of invasive species in wilderness areas, and allow native vegetation and ecological processes to continue. Apparent naturalness of treated areas would improve as the evidence of invasive plants decreases and they are replaced with native vegetation.

Early Detection/Rapid Response treatment strategy would allow managers to treat infestations within wilderness quickly while the infestation is still small. This strategy would reduce the opportunity for the spread of invasive plants within wilderness, protecting the natural integrity or the wilderness. In addition, treating areas while small will reduce the visual effects of treatments. Impacts to apparent naturalness would be less.

Undeveloped

No new developments, facilities, or structures are proposed by any alternatives. There would be no impact to the undeveloped quality of wilderness.

Outstanding Opportunities for Solitude or a Primitive and Unconfined Type of Recreation

Forest visitors may encounter workers applying herbicides using hand sprayers, backpack or horseback sprayers in the wilderness. The sounds from battery or solar powered electric pumps would be localized to the treatment area and would not disrupt entire watersheds. Visitors may also encounter worker digging, grubbing or pulling invasive plants. These encounters may affect some people's sense of remoteness and their opportunity for solitude. This effect would be short term, typically one to several days, and backcountry crews treating weeds would be small (typically 1-4 people). Duration of effects would depend on size of invasive plants site being treated.

Early Detection/Rapid Response treatment strategy would allow managers to treat invasive plants while the infestation is still small. Treatment methods and duration would be less intrusive to the forest visitor if areas are treated when small. Less time would be necessary for workers to be in an area, reducing the opportunity for forest visitors to encounter work crews. New infestations would be treated 1-2 times per year until the invasive weeds were eliminated.

Under EDRR, treatment methods would be limited to non-mechanical hand treatments and herbicide application methods as described previously.

Wilderness trailheads would be posted, informing visitors that herbicides have been or will be sprayed in the area. This may cause the visitor to recreate elsewhere, reducing their opportunity to engage in wilderness recreation. Invasive plant treatments overall would not detract from the opportunity for primitive recreation. Effects would be the same under Early Detection/Rapid Response treatment strategy.

Wild and Scenic Rivers

The presence of invasive plants and treatments of them may impact the outstandingly remarkable values for which the rivers were designated or deemed eligible. Outstandingly remarkable values include scenery, recreation, geology, fisheries, wildlife, and botany/ecology, historic or cultural resources. Effects of invasive plants and invasive plant treatments on resource values other than recreation are covered in their respective resource report. Each resource area has identified Project Design Features to protect their resource.

Regional standards and Project Design Features are in place for herbicide use near water to protect water quality. Refer to the hydrology and soils sections of the analysis for detailed information concerning these resources.

The Wenaha River has outstandingly remarkable values of scenery, fisheries and geology. Granite Creek and North Fork Asotin Creek are noted for their fisheries resource. Refer to those respective resource reports for details. The Wenaha River and a portion of Granite Creek are located within wilderness. Effects of invasive plants and visitor perceptions of treatments along these rivers would be the same as those described for wilderness.

The NFJD, Grande Ronde, Desolation Creek and Tucannon River have recreation identified as an outstandingly remarkable value, in addition to other resource values mentioned above. See Table 54 for those values and refer to the respective resource reports for detailed information regarding these resources.

Visitors may notice dead vegetation due to herbicide application when traveling forest roads or when floating rivers. Effects to these rivers and the outstandingly remarkable value of recreation would be similar to those effects common to recreation for all action alternatives.

Early Detection/Rapid Response treatment strategy would allow managers to treat infestations within WSR corridors quickly while the infestation is still small. This strategy would reduce the opportunity for the spread of invasive plants within WSR corridors, protecting the outstandingly remarkable values for which they were designated or deemed eligible.

Alternative B - Proposed Action

Approximately 184 acres of 197 acres are proposed to be treated with herbicides in wilderness. The remaining treatments are five acres of biocontrol and eight acres of manual treatment. The effects on the wilderness character qualities of untrammeled, natural, undeveloped, and outstanding opportunities for solitude or primitive and unconfined recreation would be the same as described for all action alternatives. Broadcast application from horseback mounted pumps could be an application method utilized. Larger areas of vegetation may be treated and dead and dying plants may be more noticeable to forest visitors, reducing the apparent naturalness. The following table summarizes the acres of invasive plants to be treated by treatment method.

Table 58 - Wilderness Areas and Acres of Proposed Treatments

Wilderness Name and Acres		Acres of Proposed Treatments				
		Biocontrol	Chemical	Chemical Riparian	Manual	Total
Wenaha-Tucannon	177,432	0	66	84	8	158
North fork Umatilla	20,435	0	5	12	0	17
North Fork John Day	107,058	5	13	4	0	22
Total Acres	**304,925**	**5**	**84**	**100**	**8**	**197**

Approximately 616 acres of 637 acres would be treated with herbicides in WSR corridors. The majority of these acres occur in riparian areas. There are 19 acres of biocontrol and two acres of manual treatments proposed under this alternative.

Effects would be the same as those for all action alternatives. The following table summarizes the acres of invasive plants to be treated by treatment method.

Table 59 - Wild and Scenic Rivers, Designation, and Acres of Proposed Treatments

Wild and Scenic River Name and Designation		Acres of Proposed Treatments				
		Biocontrol	Chemical	Chemical Riparian	Manual	Total
Grand Ronde	Recreation	0	0	0	0	0
	Wild	0	0	28	0	28
Grand Ronde Total		**0**	**0**	**28**	**0**	**28**
NFJD	Recreation	0	17	28	0	45
	Scenic	0	7	91	0	98
	Wild **	2	0	32	2	35
NFJD Total		**2**	**24**	**151**	**2**	**179**
Wenaha	Recreation	0	5	0	0	5
	Wild **	0	2	13	0	15
Wenaha Total		**0**	**7**	**13**	**0**	**20**
Desolation Creek (Eligible)	Recreation	**0**	**19**	**8**	**0**	**27**
Granite Creek (Eligible)	Recreation	**6**	**77**	**25**	**0**	**108**
NF Asotin Creek (Eligible)	Scenic	**0**	**0**	**159**	**0**	**159**
Tucannon River (Eligible)	Scenic	**11**	**3**	**102**	**0**	**116**
Grand Totals		**19**	**130**	**486**	**2**	**637**

**These acres occur in designated wilderness and would be subject to laws, standards and project design features pertaining to wilderness.

Alternative C- Restricted Use – No Broadcast Herbicide Application in Riparian

Of the 637 acres identified for herbicide treatment in wilderness and WSR, 486 acres are within the riparian zone. Most access into the wilderness is along trails that follow the riparian area of streams and rivers. By using methods other than broadcast spraying, less herbicide would be used overall. Individual plants would be targeted and resulting dead vegetation would be less noticeable. Potential for impacts to non-target plants would be reduced, reducing the effects on untrammeled and natural wilderness character qualities.

Application of herbicide to individual plants is typically more work intensive. There may be more workers in the wilderness for more days than if broadcast methods were used. Visitors may feel a loss of solitude due to the presence of workers in the wilderness.

Impacts to WSR and the outstandingly remarkable values of fisheries, botany, ecology and wildlife would be reduced by eliminating broadcast spraying in riparian areas. Potential impacts to non-target plants, delivery of herbicides to water and subsequent impacts on fish would be reduced. Refer to the respective resource reports for details about this alternative.

By using methods other than broadcast spraying, less herbicide would be used overall. Individual plants would be targeted and resulting dead vegetation would be less noticeable to forest visitors. Impacts to recreation as an outstandingly remarkable value of WSR's would be the same as those common to recreation for all action alternatives.

Alternative D- No Aerial Application

There are no aerial treatments proposed in congressionally designated areas under Alternative D. The direct and indirect effects would be the same as those common to all action alternatives.

Effects on Developed Recreation Sites

Alternative A - No Action Alternative

Approximately 13 acres of invasive plants in five developed recreation sites would continue to be treated under current decision documents in Alternative A. These sites include Alder Thicket, Woodland, Woodward and Tollgate Campgrounds and Spout Spring Winter Sports/Ski Area. New invasive plant infestations would be treated by manual methods. These treatments have proven ineffective and it is likely invasive plants would spread. Developed sites are considered high spread potential sites. Humans, the vehicles they use, pets and pack stock, associated with developed recreation sites would continue to be vectors spreading invasive plants and propagating plant parts.

Effects Common to all Action Alternatives

Many campgrounds, rental cabins, trailheads and picnic site are destination recreation sites. Recreation visitors that have made plans to use a certain facility may find that herbicides have been applied within or near the site. Recreationists may choose to recreate elsewhere due to the presence of herbicides.

Alternative B - Proposed Action

Approximately 86 acres in 32 out of 39 developed recreation sites would be treated with herbicides in Alternative B. If all developed recreation sites were treated at the same time, recreationists that do not want to be exposed to herbicides would have a limited choice of facilities to use. This scenario is not likely due to program priorities, budget constraints and different weed species require treatments at different times of the year.

The regional FEIS Standard 21 prohibits aerial application of herbicides within 300 feet of a developed recreation facility. No invasive plant sites in or adjacent to developed recreation facilities would receive aerial application of herbicides including new infestations treated under EDRR.

If new infestations were found near developed sites and aerial application was determined to be the most effective method of application, indirect effects may be noise disturbance to visitors due to aerial application near developed sites. Aerial applications typically occur in the early morning or late evening hours when wind velocities are low. These are typically times when visitors are relaxing in camp. The following table summarizes the acres of invasive plants to be treated by treatment method.

Table 60 – Ranger District, Site Name and Acres of Proposed Treatments

Ranger District and Site Name		Acres of Proposed Treatments			
		Biocontrols	Chemical	Chemical Riparian	Total
Heppner	Bull Prairie Campground	0	6.2	0	6.2
	Fairview Campground	0	10.3	0	10.3
	Penland Lake Campground	0	.2	0	.2
	Coalmine Hill Campground	0	.1		.1
	Ditch Creek Guard Station Rental	0	.5	0	.5
Heppner Totals		**0**	**17.3**	**0**	**17.3**
Pomeroy	Alder Thicket Campground	0	2.6	0	2.6
	Pataha Campground	0	0	.1	.1
	Meadow Creek Trailhead	0	0	.9	.9
	Panjab Trailhead	0	0	2.8	2.8
	Tucannon Trailhead	0	0	.6	.6
	Rose Spring Winter Sports Area	0	2.5	0	2.5
Pomeroy Totals		**0**	**5.1**	**4.4**	**9.5**
North Fork John Day	Bear Wallow Campground	0	0	2.2	2.2
	Big Creek Meadows Campground and Trailhead	0	0	.2	.2
	Driftwood Campground	0	0	2.3	2.3

Ranger District and Site Name		Acres of Proposed Treatments			
		Biocontrols	Chemical	Chemical Riparian	Total
	Gold Dredge Campground	0	0	2.7	2.7
	Oriental Campground & Trail Head	0	1.1	0	1.1
	Tollbridge Campground	0		.3	
NFJD Totals		**0**	**1.1**	**7.7**	**8.8**
Walla Walla	Jubilee Lake Campground	0	4.6	0	4.6
	Target Meadows Campground	0	2.4	0	2.4
	Umatilla Forks Campground	0	0	1.6	1.6
	Woodland Campground	0	0	1.6	1.6
	Woodward Campground	0	18.9	0	18.9
	Fry Meadows Guard Station Rental	0	.2	0	.2
	Burnt Cabin Trailhead	.5	0	0	.5
	Whitman Route Interpretive Site	0	4.3	0	4.3
	Corporation Organizational Camp	0	0	1.9	1.9
	Buck Creek Organizational Camp	0	0	.1	.1
	Andies Prairie Snow Play Area	0	0	4.3	4.3

Ranger District and Site Name		Acres of Proposed Treatments			
		Biocontrols	Chemical	Chemical Riparian	Total
	Bone Springs Winter Sports Area	0	3.7	0	3.7
	Spout Springs Ski Area	0	0	5.8	5.8
	Ruckle Junction Winter Sports Area	0	.1	0	.1
	Woodland Snow Play Area	0	0	.8	.8
Walla Walla Totals		**.5**	**34.2**	**16.1**	**50.8**
Grand Totals		**.5**	**57.7**	**28.2**	**86.4**

Alternative C- Restricted Use – No Broadcast Herbicide Application in Riparian

Alternative C would have the same effects as the Proposed Action however; the 28 acres in riparian zones would receive an individual plant method application of herbicide or an alternate treatment type. Overall, less herbicide would be used by targeting individual plants. There would be less chance for herbicide to drift to the areas commonly used by visitors such as picnic tables, campsites, water sources and bathroom facilities.

Alternative D- No Aerial Application

There are no aerial treatments are proposed in or adjacent to developed recreation sites in Alternative D. This alternative would have the same effect as those described in the Proposed Action.

Effects on Trails

Alternative A - No Action Alternative

Approximately 92 acres of 454 acres of known invasive plants within trail corridors would be treated. Additional invasive plant sites would not be treated. Trails are considered high spread potential sites and it would be expected that existing and new infestations would continue to spread along trail corridors.

Effects Common to all Action Alternatives

Direct Effects

Non-motorized trail users such as hikers and pack stock users are typically traveling at a slow pace and dead vegetation immediately adjacent to trails would be noticeable. Non-motorized trails users may be more likely to come in contact with vegetation treated with herbicides by walking along recently treated trail areas.

Motorized trail users will also notice dead vegetation but should pass through an area faster than non-motorized users. Motorized trail users would be less likely to come in contact with vegetation treated with herbicides as the trail tread is maintained to a width that accommodates the motorized vehicle.

Indirect Effects

Trailheads would be posted alerting recreationists to the fact that herbicides have been applied to vegetation along the trail. This may cause recreationists to choose to recreate elsewhere, regardless of the trail type.

Alternative B - Proposed Action

Approximately 454 acres of invasive plants within trail corridors would be treated under this alternative. Of this, 345 acres would be treated with herbicides, 107 acres treated with biocontrol measures and two acres would receive manual treatments.

There are three treatment areas proposed for aerial application of herbicides that occur along non-motorized trails. One site (#06140400086) occurs along Salter Trail and is approximately seven acres in size. Two sites occur along Hixon Canyon Trail (#061404000495 and #06140400051). The first site is five acres and the other is three acres.

The Salter and Hixon Trails would be directly impacted by this alternative. The trails would have to be closed during the aerial spraying operations for safety reasons. Users would be displaced to other trails. The closure would be short term, lasting during the aerial spraying operation. These trails receive low use during the regular summer season; however use increases during big game hunting season. The following table summarizes the acres of invasive plants to be treated by treatment method.

Table 61 - Trail Type and Acres of Proposed Treatment

Trail Type	Acres of Proposed Treatments				
	Biocontrol	Chem	Chem-Riparian	Manual	Total
OHV/Motorcycle	26	13	11	0	50
Hiking/Pedestrian	0	22	1	0	23
Pack and Saddle	24	87	98	2	211
Cross Country Ski	57	112	1	0	170
Total	**107**	**234**	**111**	**2**	**454**

Alternative C- Restricted Use – No Broadcast Herbicide Application in Riparian

This alternative would have the same effects as the Proposed Action, however; approximately 111 acres that are proposed for chemical treatment in riparian areas would be treated with non-broadcast herbicide methods or an alternate treatment type.

Alternative D- No Aerial Application

The effects of Alternative D would be the same as those described for the Proposed Action, however; areas identified for aerial application would receive an alternate method of herbicide application or treatment type. The trails would not have to be closed for aerial spraying operations, however; herbicide would most likely be applied by another broadcast spraying method.

Effects on General Forest Area

Alternative A - No Action Alternative

Of 24,649 acres of known invasive plants, only 3,154 acres would be treated under the No Action Alternative. The remaining acres could be treated by manual methods. Manual treatments are less practical and effective for treating large infestations. Invasive plants would be expected to continue to spread throughout the forest.

Effects Common to all Action Alternatives

Direct Effects

Approximately 23,275 acres of the general forest area would be treated for invasive plants. Approximately 19,461 acres would be treated with herbicides. These acres occur along roads, quarries, rangelands, parking areas and dispersed sites as well as forest lands. These acres are not associated with destination recreation facilities, trails, wilderness or Wild and Scenic Rivers.

The forest visitor is most likely to encounter invasive plant treatments while traveling through an area on a forest road. Visitors may notice dead vegetation, signs informing visitors that an area has been treated with herbicides or people with equipment applying herbicides.

Visitors gathering mushrooms, berries and other forest products may be displaced to areas where herbicides have not been applied. Refer to the Pacific Northwest Region Final Environmental Impact Statement, Preventing and Managing Invasive Weeds, 2005 for discussion of human health and safety regarding exposure to herbicides.

Indirect Effect

Indirect effects would be similar to those described as common to recreation for all action alternatives.

Alternative B - Proposed Action

Treatments will utilize all available tools, including biocontrols, chemical, mechanical, aerial and manual methods. Approximately 675 acres of aerial application or herbicide are proposed on the Pomeroy District. The majority of chemical aerial application acres are in one contiguous 631-acre block. This site is in the Jim Creek area, west of Forest Highway 46, near the forest boundary. This area would be closed to the public during aerial operations and posted to inform visitors that herbicides have been applied. The area would be closed to public access only during the aerial application operations. This impact would be short term. Other effects would be similar to those described as common to recreation for all action alternatives. The following table summarizes the acres of invasive plants to be treated by treatment method.

Table 62 - Recreation Areas, General Forest and Acres of Proposed Treatment

Recreation Area	Biocontrol	Chemical	Chemical Riparian	Manual	Total
Wilderness	5	84	100	8	197
WSR	19	130	486	2	637
Developed Recreation	1	57	28	0	86
Trails	107	234	111	2	454
General Forest Area	3785	14626	4835	29	23275
Grand Totals	**3917**	**15131**	**5560**	**41**	**24649**

Alternative C- Restricted Use – No Broadcast Herbicide Application in Riparian

This alternative would have the same effects as the Proposed Action; however; approximately 5,560 acres that are proposed for chemical treatment in riparian areas would be treated with non-broadcast herbicide methods or an alternate treatment type.

Alternative D- No Aerial Application

This alternative would have the same effects as the Proposed Action, except the 675 acres identified for aerial application of herbicide would be treated with alternative, applicable methods.

Cumulative Effects

The cumulative effects discussion considers past, present and reasonably foreseeable actions that occur within the Project Area. These actions include existing, ongoing and planned vegetation management, grazing and recreation activities. A discussion of the cumulative actions considered in this analysis is included in Chapter 3.1.2.

The cumulative effects Project Area for the recreation resource is the Umatilla National Forest and other public lands within and adjacent to the forest boundary. Recreationists move between public lands regardless of managing agency for recreation purposes.

Short term effects are associated with invasive plant treatment methods, especially use of herbicides, and the impact they have on the recreationist's desire to recreate in an area. Long term effects are related to the presence of invasive plants and how they may alter the natural environment or detract from the desirability of using recreation sites and participating in certain recreational activities.

The effects to recreation associated with invasive plant treatments are short term. It is unlikely that all recreation facilities, trails, wilderness areas or WSRs would be treated for invasive plants at the same time. Recreationists that are displaced due to their concern about herbicide exposure can recreate in alternate facilities or other areas. Similar recreation opportunities would be available on the forest and adjacent public lands or some private land that may not have been treated with herbicides.

3.7 Effects of Herbicide Use on Workers and the Public

3.7.1 Introduction

The effect of herbicides on human health is a primary public issue. This section focuses on plausible effects to workers and the public from herbicide exposure. The R6 2005 FEIS evaluated human health risks from herbicide and non-herbicide invasive plant treatment methods. Hazards normally encountered while working in the woods (strains, sprains, falls, etc) 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 key issue for this project-level analysis.

Many people express concern about the effects of herbicides on human heath. Workers and the public may be exposed to herbicides used to treat invasive plants. However no exposures exceeding a threshold of concern are predicted. Chemistry of the herbicides considered and the mechanisms by which exposures might occur are the basis of this prediction.

The R6 2005 FEIS considered potential hazards to human health from herbicide active ingredients, metabolites, inert ingredients, and adjuvants. As a result, the R6 2005 ROD standards were adopted to minimize herbicide exposures of concern to workers and the public. Site-specific Project Design Features (PDFs) were developed for this project to ensure that herbicide and surfactant application rates and methodologies minimize or eliminate exposures of concern.

The R6 2005 FEIS relied on professional risk assessments completed by Syracuse Environmental Research Associates, Inc (SERA) using peer-reviewed articles from the open scientific literature and current EPA documents, including Confidential Business Information. The SERA Risk Assessment full citations are listed in Chapter 3.1.5. Appendix Q of the R6 2005 FEIS provides detailed information about the human health hazards of the herbicides considered for invasive plant treatments.

The following terminology describes relative toxicity of herbicides proposed for use.

Exposure Scenario: The way a person may be exposed to herbicides' active ingredients or additives. The application rate and method influences how much herbicide an organism may be exposed to.

Threshold of Concern: A level of exposure below which the potential for adverse effects to an organism is low. This level was made more conservative in the R6 2005 FEIS to add a margin of safety to the risk assessment process (see Figure 3, section 3.1.2).

Hazard Quotient (HQ): The Hazard Quotient (HQ) is the amount of herbicide or additives to which an organism may be exposed divided by the exposure threshold of concern. An HQ less than or equal to one indicates an extremely low level of risk and therefore. A HQ less than one indicates a level below a threshold of concern.

The basis for risk assessment consists of the following parts:

1. Hazard Characterization	What are the dangers inherent with the chemical?
2. Exposure Assessment	Who gets what and how much?
3. Dose Response Assessment	How much is too much?

4. Risk Characterization Indicates whether or not there is a plausible basis for concern

The integration of the exposure rate and the dose response actually characterizes the risk for a particular herbicide. In other words, the inherent hazard of the chemical may be discounted (known carcinogen) if the exposure and dose are below any level of concern (EPA's standard of acceptable risk of less than one in one million for cancer causing chemicals). For instance, some high rates and high doses of herbicides exposure may cause liver damage, but without this combination the risk is actually very low. Some of the herbicides are of such low toxicity that a person could neither be exposed to, nor consume enough herbicide to have an observable negative effect.

3.7.2 Affected Environment

Many people live near, spend time, work in, drink water from, or depend on forest products from the Umatilla National Forest. Public concern for drinking water quality in municipal watersheds these watersheds is high.

These people may be inadvertently exposed to chemicals from proposed invasive plant treatment. Municipal watersheds dispersed and developed recreation areas (trailheads, campgrounds, picnic areas, recreation sites, work centers, etc) and special forest product collection areas are currently near invasive plant sites.

Special forest products such as blackberries, huckleberries, salal, bear grass, mushrooms and herbs are gathered for personal use and commercial sale. Some of these products like St. John's wort are gathered but most are not. People who harvest special forest product may have more contact with sprayed vegetation than other Forest visitors.

People who gather special forest products tend to be ethnically diverse. A recent unpublished study of commercial permit holders demonstrated that the largest ethnic groups involved with forest product gathering were Hispanics and Southeast Asians (Khmer, Khmer Krom, Laotian and Vietnamese).

Infested sites are scattered and occupy less than three percent of the national forest lands. Invasive plant treatments are implemented in partnership with the local counties.

Crews mostly come from the communities near the national forest. Herbicide applicators are licensed and well-trained in safe handling and application practices.

Worker Herbicide Exposure Analysis

Herbicide applicators are more likely than the general public to be exposed to herbicides. Worker exposure is influenced by the application rate selected for the herbicide; the number of hours worked per day; the acres treated per hour; and variability in human dermal absorption rates. Appendix Q: Human Health Risk Assessment in the R6 2005 FEIS displayed risks for typical and maximum label rates under a range of conditions. Four potential exposure levels were evaluated for workers, ranging from predicted average exposure (typical application rate-typical exposure variables) to a worst-case predicted exposure (maximum application rate-maximum exposure variables).

In routine broadcast and spot applications, workers may contact and internalize herbicides mainly through exposed skin, but also through the mouth, nose or lungs. Contact with herbicide formulations may irritate eyes or skin.

The ten herbicides proposed for use under the action alternatives, used at rates and methods consistent with PDfs, have little potential to harm a human being. Appendix Q of the R6 2005 FEIS lists the HQ values for all herbicides considered for this project.

In most cases, even when maximum rates and exposures are considered, HQ values were below the threshold of concern (HQ values ranged from 0.01 to 1).

Risk assessments indicate concern for worker exposure to triclopyr, especially the Garlon 4 formulation. This is one reason why broadcast application of triclopyr is not allowed under R6 2005 ROD Standard 16. However, a potential worst-case scenario exists exceeding a level of concern for workers given a backpack (spot) application of the Garlon 4 formulation of triclopyr. A PDF eliminates this scenario by favoring use of Garlon 3A, minimizing application rates of all triclopyr formulations, and following safe work practices and label advisories.

For all other herbicides and surfactants, the amount of plausible worker exposure is below levels of concern for all application methods, including broadcast. Project Design Features for all action alternatives reduce both the application rate and the quantity of drift if triclopyr and/or NPE are used. Non-NPE surfactants would always be favored where effective.

Chronic (daily over 90 days) worker exposure was also considered in SERA Risk Assessments. Chronic exposures do not rise to the levels of concern because the herbicide ingredients are water-soluble and therefore rapidly eliminated from the body.

3.7.3 Environmental Consequences

Public Herbicide Exposure Analysis

The general public would not be exposed to substantial levels of any herbicides used in the implementation of this project. R6 2005 FEIS Appendix Q considered plausible direct, acute and chronic exposures from herbicide ingredients. Few plausible scenarios exist that exceed even the most conservative threshold of concern for public health and safety. Appendix Q shows Risk Assessment results assuming a human contacts sprayed vegetation or herbicide or consumes sprayed vegetation, contaminated water, and/or fish.

Direct Contact

Members of the public could come into direct contact with herbicides that are aerially applied. Project Design Features would eliminate most potential for exposure by notifying the public prior to application, limiting which herbicides can be applied aerially (triclorpyr cannot) and limiting aerial spraying to conditions that would minimize drift.

There is virtually no chance of a person being directly sprayed given broadcast, spot and hand/select methods considered for this project. A person could brush up against sprayed vegetation soon after herbicide is applied. Such contact is unlikely because public exposure would be discouraged during and after herbicide application. For all herbicides except triclopyr, even if a person were directly sprayed with herbicide applied at typical broadcast rates, chemical exposure would not exceed a level of concern.

Exposures exceeding a conservative level of concern could occur if a person accidentally contacts vegetation spot-sprayed with triclopyr (especially Garlon 4). However, such contact is implausible because no broadcast spraying with triclopyr would occur under any alternative.

The R6 2005 ROD added Standard 16 to the Umatilla National Forest Plan to only allow spot or hand/selective treatment if triclopyr is used.

The use of Garlon 4 is further limited by the PDF (for instance, no use of Garlon 4 would be allowed within 150 feet of any water body or stream channel; Garlon 4 would be avoided in special forest product gathering areas, campgrounds, or administrative sites).

Gathering areas, campgrounds and administrative sites may be closed immediately after triclopyr application to eliminate accidental exposures.

Eating Contaminated Fish, Berries or Mushrooms

The public may also be exposed to herbicide if they eat contaminated fish, berries, or mushrooms (etc). Several exposure scenarios for recreational and subsistence fish consumption were considered in the SERA Risk Assessments; none are near any herbicide exposure level of concern. Fish contamination is unlikely given the Project Design Features that reduce potential herbicide delivery to water.

Non-target, native berries or mushrooms may be affected by drift or runoff. Members of the public, for example could eat huckleberries that have herbicides on them due to drift.

The R6 2005 FEIS considered exposure scenarios for both short term and chronic consumption of contaminated berries. The herbicide dose from eating a quantity of mushrooms would be greater than for the same quantity of berries (Durkin and Durkin, 2005). The dose, however, would be less than the dose from a dermal contact with sprayed vegetation scenario, and below a very conservative threshold of concern (Hazard Quotient greater than one).

Appendix Q displayed the exposure scenarios and HQ values associated with eating berries or other herbicide contact. Of the ten herbicides considered in this project, triclopyr remains the single herbicide with exposure scenarios exceeding a level of concern if berries or mushrooms containing herbicide residue are consumed. To respond to this concern, PDFs limit the application methods and rate of application for triclopyr (especially Garlon 4). In addition, under worst-case scenarios and maximum label rates, exposure to NPE surfactant may also exceed a level of concern. Thus PDFs limit the rate of NPE that may be applied. Special forest product gathering areas may be closed to public use immediately after triclopyr application to avoid inadvertent exposure.

People who both harvest and consume special forest products may be exposed both through handling contaminated plant material and chewing or eating it. Chewing and eating contaminated plant material cause different exposure and dose patterns. Such doses would be additive, but are unlikely to exceed a threshold of concern (see Cumulative Effects, below).

Drinking Contaminated Water

Acute exposures and longer-term or chronic exposures from direct contact or consumption of water, fruit or fish following herbicide application were evaluated in the R6 2005 FEIS. Risks from two hypothetical drinking water sources were evaluated: 1) a stream, into which herbicide residues have contaminated by runoff or leaching from an adjacent herbicide application; and 2) a pond, into which the contents of a 200-gallon tanker truck that contains herbicide solution is spilled. The only herbicide scenarios of concern would involve a person drinking from a pond contaminated by a spill of a large tank of herbicide solution.

The risk of a major accidental spill is not linked in a cause-and-effect relationship to how much treatment of invasive plants is projected for a particular herbicide; a spill is a random event. A spill could happen whenever a tank truck involved in an herbicide operation passes a body of water.

The potential risk of human health effects from large herbicide spills into drinking water are mitigated by Project Design Features that require an Herbicide Transportation and Handling Plan be developed as part of all project safety planning, with detailed spill prevention and remediation measures to be adopted.

Environmental Justice and Disproportionate Effects

The R6 2005 FEIS found that some minority groups may be disproportionately exposed to herbicides, either because they are disproportionately represented in the pool of likely forest workers, or they are disproportionately represented in the pool of special forest product or subsistence gatherers. 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 Project Design Features and compliance with occupational health and safety standards.

People of Hispanic and Southeast Asian (Khmer, Khmer Krom, Laotian and Vietnamese) descent are minority groups that tend to gather mushrooms. However, no mushrooms are target species and Project Design Features are in place to protect fungi. Whenever herbicide treatment is going to happen, the Forest will notify tribes, plant collectors and the general public with media postings, handouts attached to permits, annual tribal contacts and on-the-ground signing. Information about invasive plant treatments would be added to existing multi-lingual mushroom gathering permit material to eliminate inadvertent exposures if appropriate. Some areas may be closed to gathering following treatment to avoid exposures. Even given plausible inadvertent exposures, the HQ values would not exceed the threshold of concern.

Direct and Indirect Effects of the Alternatives

No Action

The herbicides and herbicide applications approved in No Action were previously analyzed in the 1995 EA and found to pose no significant potential risks to health for workers or the public.

Action Alternatives

All alternatives similarly resolve issues related to human health. No individual worker or public exposures of concern are predicted for any alternative. Alternative C has the least risk of adverse effects from herbicide use of all action alternatives because it eliminates broadcast spraying applications in riparian areas. While this is primarily to protect riparian and aquatic ecosystems from exposure, it would also reduce potential exposure to workers applying herbicides and lower possible exposure of members of the public by reducing the overall amount of herbicide applied. Alternative D reduces the risk of human exposure by eliminating aerial spraying which has some potential of human exposure due to drift. As previously stated despite that potential exposure, even if it does occur it would not likely, under any scenario rise to a level of concern.

Alternative B would have the greatest risk of human exposure because it proposes the greatest amount of broadcast spraying. However, the Project Design Features, particularly the perennial stream buffers, and limitations on application rate of some herbicides also eliminate plausible exposures of concern in Alternative B and the other action alternatives.

3.8 Range

3.8.1 Introduction

Invasive Plants and Range Resources

Presently 74 percent of the Umatilla National Forest is appropriated into range allotments (1,038,829 acres). There are 48 cattle allotments in which 94 percent of the invasive species sites (1948 of the 2067) are located totaling approximately 80 percent of the infested acres forest wide (19,770 acres of the total 24,649 infested acres forest wide). Approximately 74 percent (2,000 of the 2,770 acres) of acres approved for treatment in the 1995 EA are located in active allotments. Thirty eight percent of these allotments have recently evaluated noxious weed issues under the current forest plan standards. Table 63 lists the allotment name, acreage, present use, and the invasive weed acres.

3.8.2 Affected Environment

Direct impacts of invasive species to grazing animals, include nitrate poisoning from Canada thistle in ruminants, fatal poisoning of horses from Russian knapweed and yellow starthistle, excessive salivation and diarrhea in cattle from leafy spurge (Knight and Walter 2003). Domestic and wild grazing animals contribute to invasive plant establishment and spread through selective eating, redistribution of invasive plant seeds in scat, skin or fur, and hooves, and soil disturbance, therefore creating conditions favorable for seed germination. Historically, several intentional and unintentional introductions of invasive plants into native plant communities have been associated with livestock management, resulting in widespread invasions (Baker, 1974; Sheley and Petroff, 1999). Healthy and vigorous vegetation capable of resisting weed invasion is possible through proper grazing methodologies (Sheley, et al., 1996).[4]

Current Trends

Presently 74 percent of the Umatilla National Forest is appropriated into range allotments (1,038,829 acres). There are 48 cattle allotments in which 94 percent of the invasive species sites (1948 of the 2067) are located totaling approximately 80 percent of the infested acres forest wide (19,770 acres of the total 24,649 infested acres forest wide). Approximately 74 percent (2,000 of the 2,770 acres) of acres approved for treatment in the 1995 EA are located in active allotments. Thirty eight percent of these allotments have recently evaluated noxious weed issues under the current forest plan standards. Table 63 lists the allotment name, acreage, present use, and the invasive weed acres.

[4] For a complete review of the influence of ungulates on non-native plant invasions in forests and rangelands, see the Regional FEIS, Appendix D, PNW Causal Paper Ungulates. This paper presents the current understanding in the Region with respect to ungulates as contributors to the spread of invasive plants. Selective foraging, effects of site disturbance or alteration, and knowledge gaps and future research needs are discussed.

Table 63 - Range allotments and invasive weed acres

Range Allotment	Use (A=active, V=vacant)	District	Forest Service lands allotment acres	Number of Invasive species sites	Number of Invasive Species present within allotment1	Acres of invasive species
ASOTIN	A	Pomeroy	39,076	41	10	1,592
BROCK	A	WW	942	2	2	2
BUTCHER CREEK	A	NFJD	10,890	4	5	34
CENTRAL DESOLATION	A	NFJD	14,133	19	5	70
COALMINE	A	Heppner	6,919	2	3	2
COLLINS BUTTE	A	Heppner	20,099	75	6	519
COOPER CREEK	A	NFJD	4,443	1	2	2
CUNNINGHAM	A	NFJD	43,726	12	35	58
DITCH CREEK	A	Heppner	37,545	110	7	1,121
EDEN	A	WW	40,753	177	13	1,328
F. G. WHITNEY	A	NFJD	52,237	58	7	674
GOODMAN	V	WW	30,908	49	16	425
HARDMAN	A	Heppner	23,918	77	6	472
HIDAWAY	A	NFJD	31,901	25	8	131
HUTCHISON	A	NFJD	1,697	0	0	0
INDIAN CREEK	A	NFJD	77,387	63	9	1,523
JIM CREEK	A	Pomeroy	104	2	1	95
JOHNSON	V	NFJD	399	1	1	1
KLONDIKE	A	NFJD	23,642	35	10	500
LITTLE WALL	A	Heppner	37,312	78	4	475
LUCKY STRIKE	A	NFJD	17,115	25	5	575
MACKEE	V	Pomeroy	38	0	0	0
MATLOCK	A	NFJD	10,706	5	2	88
MCDONALD SPRING	A	NFJD	139	0	0	0
MONUMENT	A	Heppner	19,099	35	4	99
NORTH END	A	WW	126,221	406	20	3,614
NORTH FORK	V	NFJD	683	0	0	0
PEDRO	V	NFJD	643	0	0	0
PEOLA	A	Pomeroy	22,973	31	10	625
POMEROY	A	Pomeroy	21,225	127	11	811
POTAMUS	V	NFJD	350	1	3	0
SPRING CANYON	V	NFJD	165	0	0	0
SPRING MOUNTAIN	A	WW	33,688	96	11	1,302
STONEHILL	A	Umatilla NF	2,945	0	0	0
SWALE CREEK	A	Heppner	27,057	35	4	378
SWISS FLAT	V	NFJD	174	0	0	0
TAMARACK	A	Heppner	19,438	70	5	856
TEXAS BAR	A	NFJD	58,803	69	11	229
THOMPSON FLAT	A	NFJD	6574	12	5	29
TOUCHET	V	WW	22,735	19	8	445
TROUT MEADOWS	CLOSED	NFJD	25,934	3	1	9
WALLA WALLA	V	WW	28,805	32	12	326

Range Allotment	Use (A=active, V=vacant)	District	Forest Service lands allotment acres	Number of Invasive species sites	Number of Invasive Species present within allotment1	Acres of invasive species
WENAHA	V	Pomeroy	14,919	17	8	36
WENATCHEE	A	Pomeroy	6,271	20	5	231
WESTERN DESOLATION	A	NFJD	13,400	19	5	130
WINLOCK	A	Heppner	5,149	35	4	288
YELLOW JACKET	A	Heppner	17,229	60	4	675
TOTAL	**47**		**1,038,829**	**1,948**		**19,770**

Data for allotment acreages were derived from Umatilla National Forest INFRA database (9_14_06). Overlay of invasive weed sites were completed using Umatilla National Forest corporate database (BMP_Prov)

Diffuse and spotted knapweed, Canada thistle, and houndstongue are invasive species that are most prevalent in the allotments forest-wide (Table 65), and mostly found along roads. Disperal vectors for houndstongue seed (burs) are primarily by cattle. It is also thought that deer, elk and other small mammals readily disperse houndstongue seed, but minor compared to cattle (Clerck-Floate 1997). Canada thistle is found along many of the roads especially in the Asotin allotment on the Pomeroy district. In many instances cattle and other browsers will avoid areas where invasive weeds are prevalent in large monocultures, and move to areas where there is better forage. In areas where occasional invasive species occur with other desirable species it is highly likely that these animals would ingest some invasive weed seed and disperse viable seed in feces. Some weed seeds are destroyed within the gastrointestinal tract; however, leafy spurge and spotted knapweed seeds can pass thru 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 thru gastrointestinal tracts of cows and grizzly bears (Janzen 1984). It is suggested that land managers control movement of domestic rumunants, and that these animals should not be moved from infested areas to uninfested areas where viabile seed is present on the stems. Alternatively, the animals could be confined into a dry lot for 5 to 10 days to allow any viable weed seeds to pass ensuring no futher dispersal of invasive seed is possible (Sheley and Petroff 1999).

Watering systems such as troughs and tanks with frequent animal visitation and other range structural improvements where the ground is disturbed and invasive species can be easily established and dispersed represent approximately 387 acres of the high potential spread areas. Additionally, cattle often exhibit trailing behavior along fence lines that can result in disturbed areas for invasive species to establish. Estimates of fence lines with potential trailing impacts from cattle is suggested to be approximately 50 percent of fence lines in allotments forest-wide (M. Bulthuis 2006). This estimate would suggest that there is approximately 1,900 additional acres where invasive species could establish. Presently, there are 70 invasive weed sites (representing 113 acres) near fences (10 foot fence line corridor) located within the 50 allotments along the 3,133 miles of fence on the Umatilla National Forest (Umatilla NF GIS database 10/06).

Table 64 - Invasive species acres in Umatilla National Forest grazing allotments -

Invasive Species[1]	Estimates of Total Acres infested[2]
Diffuse knapweed	8807
Canada thistle	4355
Houndstongue	2413
Spotted knapweed	2078
St. John's wort	1368
Scotch thistle	220
Yellow starthistle	189
Common burdock	170
Sulphur cinquefoil	165
Dalmation toadflax	82
Tansy ragwort	72
Whitetop	44
Musk thistle	42
Leafy spurge	21
Scotch broom	6
Russian knapweed	3
Medusa head	3
Rush skeletonweed	0
Orange hawkweed	0

1 For Scientific names see botany report
2 These acreages are gross acres where areas are delineated by the outer perimeter of the weed infestation and may contain significant areas that are not currently occupied by weeds.

Table 65 - Invasive species in all allotments across the Umatilla National Forest -

Range improvement	Number of improvements forest-wide (all allotments)	Acres in high spread
Water system (spring, metal trough or tank with concrete bottom)	337	385
Handling facility	1	1.5
Fence lines	3,133 miles	113 current 1,908 potential[1]
Total	**N/A**	**500**

These acerages are gross acres where areas are delineated by the outer perimeter of the weed infestation and may contain significant areas that are not currently occupied by weeds.
1 Based on 10' wide path along 50% of fencelines

3.8.3 Environmental Consequences

Direct and Indirect Effects

This section will present the direct and indirect effects analysis for range resources. Issues presented during public scoping and effects related to range resources will be presented by alternative.

The regional FEIS amended the existing forest plan, therefore, all action alternatives require incorporation of invasive plant prevention practices in annual operating instructions/plans and allotment management plans. The incorporation of these prevention practices are expected to reduce environmental impacts of livestock grazing forest wide. Ultimately, invasive plant prevention practices may result in some reduction to livestock grazing, but prevention of invasive plants is only one of several resource protection measures that reduce grazing such as consideration; multiple factors including range condition, stream protection, and endangered species management will also influence allotment management. For complete discussion of these practices in relation to range resources see the Regional FEIS, Chapter 3 (USDA 2005a). The effects analysis described in this document analyze effects of the alternatives on grazing allotment permittees and range resources. As Project Design Feature N1 states, adjustments suggested to protect range resources will be addressed through existing administrative mechanisms such as grazing allotment management plans, grazing permits, etc. Suggestions to address invasive plants or their potential introduction 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, which could requires 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

An actual reduction in Animal Unit Month (AUMs) 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.

Table 66 - Comparison of factors affecting ability of alternatives to reduce invasive species spread on grazing allotments on the Umatilla National Forest

Comparison Factors	Alt A – No Action	Alt B Proposed Action	Alt C. Restricted Riparian	Alt D. No Aerial Broadcast Treatment
Loss of native plant communities and plant bio-diversity	+++	+	++	++
# of herbicide formulations available for use	2	10	10	10
Acres of invasive plant that could be treated within existing allotments (all methods – Manual, Biocontrol, and/or Herbicide)	3,154	20,040	20,040	20,040
Acres of invasive plant sites that could be treated with herbicides either alone or in combination with other techniques within allotments	742	16,898	16,989	16,898
EDRR (including herbicide use)	No	Yes	Yes	Yes
Treatment Effectiveness (derived from Botany report)	Low	Highest	High	High
% of Total Forest Landbase Treated with Chemicals (all identified acres/annually)[3]	Apprx: 0.12%, <0.008% annually	Apprx: 1.5%, 0.3% annually	Apprx: 1.5%, 0.3% annually	Apprx: 1.5%, 0.3% annually

Alternative A - No Action

This alternative is legally required and forms the basis for comparison against the action alternatives. Under this alternative, there would be no change in current management direction or in the level of ongoing management activities. Currently, approximately 2,000 acres in grazing allotments are approved for treatment under the existing 1995 EA

Invasive plants are currently damaging the ecological integrity of lands within and outside these allotments. Despite management direction in the 1995 EA, invasive plants continue to increase and occupy previously uninfested areas. Invasive plants spread at a rate of 8-12 percent annually (USDA 2005) within National Forest system lands and neighboring areas, affecting all land ownerships (See existing condition section in the Botany report, available in the Project Record, for estimates of invasive species growth forest wide based on current treatment effectiveness). As the current conditions change, and as invasive species continue to spread via common dispersal methods, management activities such as livestock grazing will be affected. Livestock and their human managers have the potential to spread invasive species. As the spread of invasive species becomes more obvious to the public, they will put more pressure on public land managers to restrict vectors the spread invasive species. This includes livestock and livestock operations.

Under current, allowable treatments, invasive weeds would likely continue to displace palatable native vegetation and could reduce forage on grazing allotments. Activities within allotments will continue to serve as seed dispersal vectors as these invasive species sites continue to grow. Loss of native plant communities may continue to occur as invasive weeds occupy and out-compete native species. Once invasive species begin to dominate these communities, a loss of species diversity, composition, and ecosystem function could occur.

Noxious weeds would likely continue to spread into areas that are not currently infested, such as recently burned areas. Once weeds become established, these areas would likely serve as weed seed source for other areas of the forest and nearby non-National Forest System lands.

Toxic species such as Canada thistle and leafy spurge would continue to increase under the no action alternative. Most of the Canada thistle is along roadsides and grazing animals would likely avoid these areas in search of more palatable forage elsewhere. Leafy spurge is only documented on 20 acres across the forest and even with the potential for spread it is likely cattle will avoid these areas and no impacts to cattle from toxic properties from either of these two species would occur with this alternative.

This alternative would not meet the desired future condition of the area which is 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" (See Chapter 1.2). Invasive species will continue to spread as documented from past inventories compared to the current inventories.

Alternative B (Proposed Action)

This alternative proposes to address problems posed by invasive plants that compromise our ability to manage native ecosystems on the Forests. New management direction and tools made available for use in Region 6 will be utilized. Analysis will tier to the R6 Invasive Plant Program Final Environmental Impact Statement (USDA, 2005), including the use of the newly approved herbicides as described in the document. There is a need to reduce the extent of specific invasive plant infestations on the 2,069 known weed sites, and to protect uninfested areas using Early Detection Rapid Response.

Long-term effects of invasive weed treatments on the 48 affected grazing allotments (approximately 20,000 acres) would be the retention of currently available forage, reduction in spread from existing and unknown future sites, and recovery of native vegetation in areas currently impacted by invasives. Because these treatments are anticipated at a rate of approximately 4,000 acres per year and treatment sites will be prioritized at each individual district level there may be some short-term direct effects to existing permittees and allotment(s), management such as timing and duration of grazing, pattern of use, requirements to use only weed free feed, and the potential of quarantine periods if these activities are implemented on active allotments. Operators may experience 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 all potential impacts to operators

Some herbicides have label use restrictions that will be followed regarding livestock grazing and/or slaughtering post herbicide treatment and subsequent exposure. As mentioned previously, 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 will be followed in addition to PDFs that require permittee notification prior to any proposed aerial application. Notification and coordination should also occur during annual operating instruction/plan meetings and by posting/signing areas to be treated prior to and after treatment (USDA 2005b). For aerial herbicide application within allotments, permittees would be notified of proposed expected timeframes for treatment to allow the option to remove animals. No adverse effects to large mammals were found from direct spray of herbicides that could be applied aerially at the highest expected rates (R6 EIS 2005 SERA Risk Assessment-Effects to Wildlife). Of the 675 acres proposed for aerial herbicide treatment, there are presently 287 acres proposed within grazing allotments and could be additional sites in the future. Most aerial sites are located in steep terrain with limited access areas where livestock generally do not prefer however, PDFs would provide additional protection in the event stay grazing animals were present in areas (see PDFs N1, N2 in Section 2.3.3 above).

Under the Proposed Action it is acknowledged that more chemicals would be used in the environment while effectively treating invasive species (See Chapter 2.2.3) compared to the No Action Alternative. The potential for a spill to occur during herbicide operations would be greater than under the no action alternative based on the additional number of acres that would be treated. Minimal to no effects are anticipated to grazers or operators due to strict adherence to label handling directions and spill containment protocols in the unlikely event of a spill. There has been a concern that livestock grazing is a major cause of non-native plant invasions (Belsky and Gelbard 2000) and that removal of livestock would reduce much of the cause of invasive species spread. No manipululative studies with appropriate treatments and controls have rigorously tested this hypothesis. Additionally, no known manipulative experiments of grazing effects of wild ungulates on non-native plant species dynamics have been done (Parks et al. 2005). Scientific support is growing for the hypothesis that large herbivores facilitate the invasion and establishment of non-native plants, however, substantial controversy exists about the specific process in time and space and the associated predictions of effects.

Under this alternative treatment of invasive species including eradication at some locations, would allow grazing activities to remain much as they are under current conditions and would meet the desired future conditions within the project area. Additional benefits to this alternative would be the reduction of potential spread of invasive species into uninfested disturbed areas such as fencelines. Also, early detection and response for any newly established invasive species would occur. Compared to the no action alternative the impacts, especially long-term impacts, to permittees would potentially be reduced, because native and desirable non-native vegetation would increase. The treatment of existing and future documented sites under this alternative would positively affect range resources.

Alternative C - Riparian Restriction

Alternative C would meet the same objectives as Alternative B, but intends to minimize impacts from chemical use in riparian areas by not allowing broadcast herbicide treatments within riparian areas. This alternative would not allow broadcast herbicide treatments in approximately 2,005 riparian acres in allotments. This means that any invasive species that are presently known or discovered in the future could only be treated with manual spot treatments and in accordance with all PDF's (see section 2.3.3).

Impacts to livestock and operators would be similar to those described in alternative B, but the potential for exposure of livestock and livestock managers will be slightly decreased as less chemical will be used within riparian areas. The potential for reestablishment of species with seed present in the riparian area soil seed bank are greater because riparian areas may not be as effectively treated as allowed under Alternative B.

Alternative D - No Aerial Herbicide Application

Alternative D would meet the same objectives as Alternative B, but would avoid potential effects from drift by not allowing aerial application of herbicides. Because the 287 acres of grazing allotment may still be treated by other methods, little impact to forage availability is expected. It is anticipated that these existing infestations will likely recover to native vegetation in the future, however, the treatment method may not be as effective or recovery of vegetation may not happen as quickly as suggested in the proposed alternative. Livestock do not prefer to graze on steep slopes where most aerial treatments are proposed, therefore, impacts from no aerial herbicide treatments would likely have little to no effect.

By not aerially treating, the potential for exposure to livestock and livestock managers will be reduced. Other benefits of this alternative would be the same as the Alternative B.

Cumulative Effects

The cumulative effects spatial Project Area is the Umatilla National Forest and nearby adjacent Tribal, private, state and other federal lands. The time frame of the analyses includes the past 20 years and the next 15 years which is expected to be the life expectancy of this document. Invasive species have been present and programs existed to treat them on the Forest prior to the past 20 years. However, most Land Resource Management Plans in the late 1980s and early 1990s did not recognize the specific details of the ecologic implication of invasive plants

Past, Present and Reasonably Foreseeable Future Actions

Past management activities on the Forest in combination with the conservative approach to controlling invasive weeds has resulted in an increase in infested acres and impacts to ecosystem integrity. Various activities such as recreational use, road use, fire and its associated management activities, other management activities, grazing, and climatic events such as drought are all documented to contribute to the potential for establishment and spread of invasive species. All of these activities have contributed to the increase in invasive species within the Umatilla National Forest.

Present and reasonably foreseeable future actions will continue to provide opportunities for invasive species to establish. The Regional FEIS estimates that invasive species will continue to spread at a rate of 8-12 percent annually (USDA 2005). Expected treatment effectiveness of all methods approved within the Regional FEIS including the site specific treatment methods evaluated in alternatives B, C, and D would increase treatment effectiveness to 80 percent compared to the 35 percent effectiveness presently reported (see Botany report). For a full discussion of direct indirect and cumulative effects to native vegetation that is tightly linked to grazing see effects analysis in the Botany report. Because impacts to grazing are tightly linked to the health of native vegetation Roads will continue to be a major conduit for invasive plants.

Forest Service projections suggest that recreation uses of National Forests will continue to increase, and other land management and use activities such as grazing, vegetation management, fuels management (Healthy Fuels Initiative), and fire suppression will continue to cause ground disturbances and contribute to the introduction, spread and establishment of invasive plants on National Forest system lands (USDA, 2005).

Land uses and development on lands adjacent to or outside National Forest boundaries will likely continue to contribute to the potential for invasive species to be distributed in the Forest. For example, the use of invasive plants by landowners for landscaping, while small individually, can collectively result in significant impacts, especially along riparian corridors (USDA Forest Service 2005).

Cumulative effects to grazing and range management of this project by alternative are listed in Table 67 Cumulative effects are expected to be positive for alternatives B, C and D because more aggressive treatments combined with Early Detection Rapid Response activities and cooperative efforts with other federal, state and private landowners will reduce the potential for additional spread and loss of available forage.

Table 67 - Cumulative Effects on Grazing and Range Management within the Project Area

Alternative	Effects on Grazing and Range Management
Alternative A No Action	Over time infested areas will continue to increase and forage plants will be reduced through displacement and reduced ecosystem health. As conditions change over time within the allotments, livestock use will likely be reduced thru additional NEPA allotment analysis to prevent the further spread of invasive species.
Alternative B Proposed Action	Some limitations on livestock grazing may occur. As implementation of the Proposed Action occurs, it is expected that increased retention of desirable species, vegetation density, and plant vigor of desired native vegetation will increase and/or improve.
Alternative C Riparian Restrictions	Same as the Proposed Action.
Alterntaive D No Aerial Herbicide Application	Same as the Proposed Action.

Irreversible and Irretrievable Commitment of Resources

Implementation of Alternatives B, with appropriate environmental protection would not result in irreversible or irretrievable loss of range resources. Implementing Alternative A (No Action) would likely result in eventual irreversible impacts on grazing resources as weeds would continue to spread and invade in and around the proposed treatment areas. Implementing Alternative C&D would likely result in eventual irreversible impacts on grazing resources as weeds would continue to spread and invade in and around the proposed treatment areas that are treated with methods not as effective as those proposed in Alternative B, however, at a level much lower level of loss compared to the no-action alternative.

3.9 Project Costs and Financial Efficiency

3.9.1 Introduction

The Pacific Northwest Region published the programmatic *Pacific Northwest Region Invasive Plan Program Preventing and Managing Invasive Plants FEIS* in April 2005 and a Record of Decision (ROD) for Invasive Plant Program Management on October 11, 2005. This decision amended all Forest Plans in the Region, adding new direction for the containment, control, or eradication of invasive plant species. The Forest Plan calls for using prevention practices, various mechanical and hand treatments, and an updated list of herbicides to effectively address invasive plant threats (USDA 2005a; USDA 2005b).

In addition to the direction provided above, the 1990 Land and Resource Management Plan for the Umatilla National Forest includes the following goals tied to the social and economic environment:

- "Provide land and resource management that achieves a more healthy and productive forest and assists in supplying lands, resources, uses, and values which meet local, regional, and national social and economic needs."
- "Promote human resources, civil rights, and community development within the zone of influence of the Forest. Promote cooperation and coordination with individuals, groups, landowners, Forest users, Native American tribes, and state and Federal agencies in forest management, and community and economic development."

Methodology

The Project Area is the ten counties most directly influenced by the Umatilla National Forest. Four counties in southeast Washington; and six counties are in northeast Oregon. The time frame used for the analysis of direct, indirect, and induced economic effects is approximately seventeen years. This is the estimated period of time required to achieve purpose and need based on projections developed using the assumptions described below.

Projected Costs

In order to compare the alternatives, implementation costs were estimated based on a uniform set of assumptions. The cost estimates displayed in this report should not be assumed to be exact. They are an approximation intended to provide a method for comparing alternatives. Regardless of which alternative is selected, costs will vary from year to year based on factors such as annual budget allocations, the annual operating plan, the conditions present in the sites scheduled for treatment, opportunities for cost savings afforded by partnerships with Forest stakeholders, and the availability of external funding.

The area to be treated annually is generally constrained by budget allocations. For the analysis purposes, annual treatments were estimated to average 4,000 acres. However, the cost of treatments at various levels was estimated to determine annual and long-term costs should budget levels vary from those projected. Many variables affect the cost of treatment activities, including: treatment methods (e.g., mechanical, manual, herbicide, etc.); method of herbicide application (e.g., aerial, broadcast spraying, spot application, etc.); species, and site conditions. Many of the sites to be treated are likely to require repeated entries; the phenology of individual invasive species and the effectiveness of a given treatment influence the number of entries that may be needed. It is expected that in some cases, multiple treatment methods may be employed on the same site. For example, a site with multiple species may be treated with spot application of herbicide to address one species, and physical treatments, such as hand pulling to address other species. In some cases a combination of treatment options are proposed, such as manual, mechanical, and/or herbicide. On these acres, one treatment method may be utilized initially, with another method used for follow-up treatments, such as herbicide treatments applied in year one followed by manual treatments in year two.

To estimate cost impacts, two analyses were conducted. The first estimate is the total undiscounted cost to treat all affected acres one time together with the cost of associated monitoring. For this estimate, no effort was made to approximate the acres of re-treatment, acres of spread, or Early Detection Rapid Response (EDRR). While the dollar value developed should not be construed as the total project cost, it is useful for the purposes of comparing alternatives. The result of this calculation was then divided by the estimated number of acres effectively treated. Treatment effectiveness under Alternative A was estimated at 25 percent of acres treated based forest experience utilizing the current treatment strategy. Treatment effectiveness under the action alternatives was estimated at 80 percent of acres treated based on commercially acceptable standards.

The second cost estimate examines the discounted annual and long-term costs and the projected time to achieve control of all inventoried sites at the projected annual treatment level of 4,000 acres. A discount rate of 4 percent was assumed. To address the potential of unanticipated funding changes, a variety of other annual treatment levels greater than and less than 4,000 acres were also estimated. Annual inventory and monitoring costs were incorporated as well. Because the time required to attain containment or control of inventoried infestations would vary, depending on the level of annual treatment, the net annual equivalent cost is displayed to provide a comparison between various treatment levels and time horizons among the alternatives.

- The average efficacy of the more limited suite of treatment methods available under the no action alternative (Alternative A) was estimated at 25 percent based on the assessment of past treatment activities on the Forest
- Average efficacy of the suite of treatment methods available for use under the action alternatives (Alternatives B, C, and D) was assumed to be 80 percent based on commercially acceptable standards
- The weeds that survive the first round of treatments are retreated in the next and succeeding years, with the same rate of efficacy
- Weed spread was assumed to be 10 percent on untreated sites and 5 percent once treatment activities were begun.
- Under Alternative A, the application of treatment methods on acres identified for treatment using manual, mechanical, and/or herbicide is approximated based on the five-year average. From 2001 through 2005, 65 percent of treatments utilized manual and mechanical methods and 35 percent utilized herbicide ground applications (see Table 68).
- Under Alternatives B, C, and D, acres identified for treatment using manual, mechanical, and/or herbicide were projected to be treated primarily with herbicides initially and as population size is decreased, manual and mechanical methods would be used. Treatment costs per acre were estimated based on an assumption of 90 percent herbicide and 10 percent manual or mechanical (see Table 68).
- Costs per acre for treatment activities are estimated using regional averages adjusted for local costs variances and are displayed in Table 68:

Table 68 - Cost per acre of invasive species treatment methods

Treatment Method	Cost per Acre
Manual/Mechanical Treatments	$340
Biological Treatments	$70
Aerial Herbicide Treatments	$42
Ground Broadcast and Spot Herbicide Treatments (Avg.)	$100
Ground Spot Herbicide Treatments only	$125
Manual/Mechanical and/or Herbicide Treatments – Alternatives B, C, and D	$124
Manual/Mechanical and/or Herbicide Treatments – Alternatives A*	$256
Inventory and Monitoring	$47

* Because of restrictions on the use of herbicides under the no action alternative, the cost to treat acres identified for manual, mechanical, and or herbicide treatment methods is higher than would occur under the action alternatives as described above.

These costs represent estimated open market costs and do not necessarily equate to actual Forest Service expenditures. In some cases, actual Forest Service costs per acre may be lowered through the use of Forest Service crews, cooperative agreements, partnerships, and external funding. The use of these alternative approaches can only be determined on a case by case basis, taking into consideration available funding, funding sources, and the areas and species to be treated from year to year. It is not possible to accurately anticipate the scale of cost savings that may be achieved. Use of the costs listed above provides a "worst case" scenario that allows for a consistent, relative comparison of costs between the alternatives.

Jobs and Income

Estimates of total industry output and jobs potentially supported under each alternative are calculated through the use of IMPLAN, using data for 2003. IMPLAN is an economic modeling program originally developed by the Forest Service in cooperation with the Federal Emergency Management Agency and the Bureau of Land Management. IMPLAN has since been privatized and is now provided by Minnesota IMPLAN Group (MIG). IMPLAN utilizes a database of basic economic statistics constructed by MIG. Information for this database was obtained from major government sources such as the Bureau of Economic Analysis, County Business Patterns, REIS, Bureau of Labor Statistics, U.S. Census, etc., and converted to a consistent format using widely accepted methodologies.

An IMPLAN Project Area model was used to determine the employment and income consequences through the economy of one-million-dollar changes for each kind of impact. The results are called response coefficients. Because input-output models are linear, multipliers or response coefficients need only be calculated once per model and then applied to the direct change in output. Effects were estimated by multiplying the response coefficients by estimated cost of treatment activity. Specifications for developing response coefficients and levels of dollar activity are stated below.

Herbicide Treatment - The economic sector (a group of industries or businesses producing the same or similar products or services) which reflects the economic activities associated with invasive plant treatment services is Agricultural Services, designated in IMPLAN as Sector 18. One million dollars of exports were modeled through Sector 18, to determine a response coefficient. The cost of a contract to conduct herbicide treatments was estimated based on the assumptions described above, which was then multiplied by the appropriate response coefficient to determine total economic impact.

Federal Salary Impacts - Forest Service employment costs by alternative were estimated based on the assumptions described above. Salary impacts result from Forest employees spending a portion of their salaries locally. IMPLAN includes a profile of personal consumption expenditures for several income categories. The average annual compensation for employees involved in the implementation of the alternatives is approximately $25,000 to $60,000. Only a portion of which is take home pay. One million dollars was modeled using this expenditure profile to determine a response coefficient.

Federal Expenditure Impacts- An average of Forest obligations by budget object code for actual expenditures in Fiscal Years 2002, 2003, and 2004 were obtained from the National Finance Center through the agency's Inventory and Monitoring Institute to estimate how the budget expenditures would be spent. Non-salary expenditures were determined by using this budget object code information. This profile was input into the IMPLAN model for non-salary expenditures. Purchases by the Federal Government were treated as new money coming into the local economy from outside the model area. Sales to the federal government were treated in the same manner as exports; money coming from outside the model area. As above, one million dollars was modeled using this expenditure profile to determine a response coefficient.

3.9.2 Affected Environment

The impact of invasive plants is many and varied. They can poison livestock and pets, contribute to increased fire hazards, compete with desirable plants, reduce the suitability of wildlife habitats, and change the nature and composition of plant communities. The cost of controlling these invaders impacts both private and public budgets. A report prepared for the Oregon Department of Agriculture by The Research Group in 2000, estimated that 21 of the 99 weeds listed as noxious in Oregon reduced the State's total personal income by about $83 million. This was equated to approximately 3,329 annual jobs lost to Oregon's economy. It was estimated that these 21 species cost the citizens of Oregon a total of about $100 million per year at that time. The effect of all 99 noxious weeds was likely significantly greater (The Research Group 2000). This analysis addresses the treatment of 24,649 acres of invasive plant species on the Umatilla National Forest. Eleven species present on the Forest were included in the Oregon study.

The Forest most directly influences ten counties: Asotin, Columbia, Garfield, and Walla Walla in Washington; and Grant, Morrow, Umatilla, Union, Wallowa, and Wheeler in Oregon. The local economy and lifestyle tend to revolve around agriculture, ranching, government, and the timber industry. Portions of Umatilla and Morrow counties along the Columbia River in Oregon are more industrialized (USDA 1990). The population in these counties is displayed in Table 69 (US Census Bureau 2000).

Table 69 - Project Area Population by County (2000 Census)

Location	Population
Grant County, OR	7,935
Morrow County, OR	10,995
Umatilla County, OR	70,548
Union County, OR	24,530
Wallowa County, OR	7,226
Wheeler County, OR	1,547
Asotin County, WA	20,551
Columbia County, WA	4,064
Garfield County, WA	2,397
Walla Walla County, WA	55,180
Project Area Total Population	204,973

As displayed in Table 70, the majority of Project Area residents (83 percent) are White, followed by Hispanic or Latino (11.9 percent), and American Indian (1.7 percent) (US Census Bureau 2000).

Table 70 - Race and Ethnicity by County (2000 Census)

Location	White	Black or African Am.	Am. Indian or Alaska Native	Asian	Native Hawaiian & Other Pacific Islander	Some Other Race	Two or More Races	Hispanic or Latino*
Grant County, OR	94.6%	0.1%	1.6%	0.2%	0.04%	0.08%	1.4%	2.1%
Morrow County, OR	71.9%	0.1%	1.3%	0.4%	0.08%	0.4%	1.4%	24.4%
Umatilla County, OR	77.5%	0.7%	3.2%	0.7%	0.07%	0.2%	1.5%	16.1%
Union County, OR	93.1%	0.4%	0.8%	0.8%	0.6%	0.4%	1.4%	0.2%
Wallowa County, OR	95.7%	0.03%	0.7%	0.2%	0.04%	0.1%	1.4%	1.8%
Wheeler County, OR	92.5%	0.06%	0.5%	0.3%	0%	0%	1.6%	5.1%
Asotin County, WA	94.5%	0.2%	1.2%	0.5%	0.02%	0.08%	1.6%	2.0%
Columbia County, WA	90.7%	0.2%	0.8%	0.4%	0.05%	0%	1.5%	6.4%
Garfield County, WA	96.1%	0%	0.4%	0.6%	0.04%	0.04%	0.8%	2.0%
Walla Walla County, WA	78.8%	1.6%	0.7%	1.1%	0.2%	0.2%	1.7%	15.7%
Project Area	83.0%	0.8%	1.7%	0.8%	0.2%	0.2%	1.5%	11.9%

* Hispanic or Latino persons may be of any race.

Per capita incomes in the counties of the Project Area range from a low of $15,803 in Morrow County, OR to a high of $17,748 in Asotin County, WA.

This is lower than the 2000 per capita incomes for both Oregon and Washington at $20,940 and $22,973 respectively. The percentage of the Project Area population with incomes below poverty level is displayed by race in Table 71. Poverty levels are highest among minority populations.

Table 71 - Project Area Population below Poverty Level by Race, 2000 Census

Race/Ethnicity	Percentage Below Poverty Level
White	12.4%
Black or African American	22.3%
American Indian & Alaska Native	21.5%
Asian	15.1%
Native Hawaiian & Other Pacific Islander	32.1%
Some Other Race	26.9%
Two or More Races	23.7%
Hispanic or Latino*	26.2%

*Hispanic or Latino may be of any race.

Although many members of the public desire commodity uses of the National Forest, increasingly, forest users are placing a greater importance on non-commodity values such as the aesthetic, recreational, and spiritual aspects of the forest. Visual resource qualities not only attract visitors, but are appreciated by local residents as an aesthetic value that enhances the local lifestyle and culture. Likewise, the recreation opportunities afforded by the National Forest attract visitors and residents. A variety of special places such as scenic areas, scenic byways, wild and scenic rivers, wilderness areas, and research natural areas contribute to the educational, interpretive, and other recreational experiences available within the Umatilla National Forest (USDA 2004). These opportunities contribute to the desirability of the area as a place to live and also attract visitors who support the local tourism industry.

Invasive species are threatening native plant communities throughout the forest. Currently, over half of the watersheds on the forest have a high risk of noxious weed invasion and spread (USDA 2004). Noxious weed infestations are of concern to both those who desire commodity uses and those who place a higher value on non-commodity uses. Both groups want a healthy ecosystem; however, some members of the public believe that the use of herbicides presents an unacceptable risk to the health of non-target native plants, wildlife, and humans. Concern has also been expressed that the use of herbicides is too costly relative to agency budgets and the value of the lands treated.

Tribal Interests

The Umatilla maintains government to government relations with numerous American Indian tribes who have treaty reserved or Executive Order rights on the Forest. These rights include fishing, hunting, gathering, and trapping. The tribes with rights on the Umatilla National Forest include:

- Confederated Tribes of the Umatilla Indian Reservation
- Confederated Tribes of the Warm Springs
- Nez Perce Tribe
- Confederated Tribes and Bands of the Yakama Indian Nation of the Yakama Reservation
- Burns Paiute Tribe
- Shoshone-Bannock, Shoshone-Paiute Tribes of the Duck Valley Reservation
- Fort McDermitt Paiute and Shoshone Tribes

- Fort Bidwell Indian Community of Paiute Indians
- Klamath Tribes
- Joseph Band of Nez Perce-Colville Confederated Tribes (USDA 2004)

Tribal members utilize native plant species for a variety of cultural uses such as food, medicine, dress, basketry, and ceremonial purposes. Wildlife and fish are harvested for subsistence and traditional cultural uses. Invasive plants may interfere with rights granted to Native American Tribes. Invasive plants can crowd out plants traditionally gathered and can impact wildlife and fish. Additionally, the potential for human health impacts through contact with or consumption of plants and animals exposed to herbicides as a result of treatment activities are a concern. There is also a potential for treatment activities to impact traditional cultural properties or grave sites.

3.9.3 Environmental Consequences

Alternative A – No Action Alternative

The Umatilla National Forest has been treating invasive plants under direction found in the 1995 decision implementing the *Umatilla National Forest Environmental Assessment for the Management of Noxious Weeds*. This program of treatment would continue under the No Action Alternative. The treatment methods recommended in the 1995 EA took a conservative approach, requiring years of manual or mechanical treatments on a site prior to the use of herbicides. It did not provide the ability to respond quickly to new infestations because the process only applied to those sites known at the time of the 1995 decision. The 1995 decision identified approximately 3,154 acres for treatment. Estimated acres by treatment method are displayed in Table 72.

Table 72 - Alternative A Estimated Acres by Treatment Method

Treatment Methods	Acres
Manual and/or mechanical and/or Chemical (broadcast and/or spot) – Upland areas	1,252
Chemical Treatment in Riparian Habitat Conservation Areas (spot only – includes wicking and wiping)	522
Biocontrol – All areas	1,339
Manual only – All areas	41
Total Acres Treated	**3,154**

Herbicide applications in the 1995 decision approved the use of glyphosate, dicamba, or picloram, and no herbicide applications were allowed within 100 feet of streams or standing water. Picloram was prohibited from use in riparian areas, and dicamba could only be used on drier sites or transitional uplands further than 100 feet from water. Aerial applications were not approved.

Although, the 2005 Regional Invasive FEIS ROD approved a list of ten herbicides for use in Region 6, it restricted the use of Dicamba.

Direct and Indirect Effects of Alternative A

Under this alternative, invasive treatment activities would continue to utilize a conservative approach as authorized under the 1995 decision for the management of noxious weeds. Priority would be placed on the use of physical treatment methods. The use of herbicides would be limited to Glyphosate or Picloram and would be utilized only after other methods of treatment have failed. Treatments would be applied to the 3,154 acres analyzed in the 1995 decision.

Past experience with these treatment methods has resulted in a rate of effectiveness of only 25 percent (Laufman 2006). The potential for spread from these areas would remain unchanged from the existing condition. Additionally, the remaining inventoried acres of invasive species would go untreated and would likely continue to spread at an estimated rate of 4 to 6 percent per year.

Those opposed to the use of herbicides due to concerns about impacts to non-target native plant communities, wildlife, and human health would favor this alternative over the action alternatives, however; many stakeholders would perceive adverse effects. Those who value commodity values and uses of the Forest would see declining resource conditions and biodiversity as invasive species continue to spread. Invasive species can drastically reduce livestock carrying capacity (Asher and Spurrier 1998). Likewise, those who place a higher worth on non-commodity resources would also see a decline in the values they seek. Forage production on Forest rangelands would be reduced, adversely impacting habitat capability to support wildlife as well as reducing forage available for domestic livestock. In a report to the Governor of Idaho Weed Summit in 1998, Jerry Asher and Carol Spurrier of the Bureau of Land Management cite numerous studies that found that populations of native wildlife species declined as habitats became dominated by non-native plant species (Asher and Spurrier, 1998). Scenic areas, scenic byways, wild and scenic rivers, wilderness areas, and research natural areas are adversely affected as invasive species spread, resulting in the loss of native species and biological diversity. These impacts may reduce the recreational and/or educational value of these areas to some users. In severe cases, some users may relocate their activities to other areas of the forest or to other public lands (Asher and Spurrier 1998).

Neighboring private and public lands would be adversely impacted as invasive species populations spread to their lands from the Umatilla National Forest. Land values would be reduced (Asher and Spurrier 1998)and costs to control infestations for neighboring land owners or administrative agencies (federal, state, and local governments) would be increased.

American Indian Tribes with interests in the Umatilla National Forest would be adversely impacted. Populations of native plant species used for cultural purposes such as food, medicine, dress, basketry, or ceremonial activities may be reduced as a result of the spread of invasive species. The spread of invasive species (Asher and Spurrier 1998) from the Forest to Tribal trust lands would adversely impact Tribal interests. In the long-term, invasive species populations may threaten traditional gathering areas. The potential for the exposure of tribal members to herbicides is lowest under this alternative. Approximately 2,774 acres could potentially be treated with herbicides. This represents approximately 0.2 percent of the National Forest system lands administered by the Umatilla National Forest.

Economic Effects

Assumptions used for the development of cost estimates are described under “Methodology” above. The undiscounted cost of implementing treatments on all affected acres one time in one year is estimated at $641,695 in 2006 dollars. This estimate includes inventory and monitoring costs. It is estimated that treatments would be effective on 25 percent of treated acres. The average cost per effectively treated acre is the highest under this alternative at an estimated $814 per acre.

Discounted annual treatment costs at various levels of annual treatment are provided in Table 73 below. A variety of annual treatment levels were analyzed in order to assess required levels of funding, should the funding level of future budgets change. In the case of the No Action Alternative, annual treatment levels could not exceed 3,154 acres. At this level of annual treatment, discounted net annual equivalent costs, including inventory and monitoring, are estimated at $133,700.

Because treatments would be limited to the same 3,154 acres each year, other inventoried infestations would remain untreated and would continue to spread, therefore the existing invasive plant populations on the Forest would never be contained or controlled under this alternative. Without treatment, the remaining inventoried infestations would likely spread at an estimated annual rate of 8 to 12 percent (Laufmann 2007). At an average of 10 percent annually, by year 20, infested acres could increase by more than 525 percent of the currently affected acres. As the scope and size of the infestation continues to grow, future costs to contain or control the growing population of invasive species would continue to escalate.

Table 73 - Years to contain or control forest-wide infestations and annual treatment costs under Alternative A in 2006 dollars – (Shaded line represents the projected annual treatment level)

Annual Acres Treated	Net Annual Equivalent Cost (Discounted)	Years to Contain or Control Inventoried Infestations and Discounted Total Cost Average Rate of Spread = 10 percent on untreated sites and 5 Percent once treatgments begin	
		Years	Cost ($1000s)
2,500	$132,920	Would not achieve	Unlimited
3,000	$126,115	Would not achieve	Unlimited
3,154	**$133,700**	**Would not achieve**	**Unlimited**

1 For the purposes of analysis, projections assumed 25% effectiveness of treatments, and a 10% rate of spread from untreated acres. Infestations were considered controlled when projections for remaining inventoried acres reached 0 acres.
2 Using the assumptions regarding treatment effectiveness and rate of spread described earlier under "Methodology" it was estimated that the acres approved for treatment under the 1995 EA would be controlled in 31 years at a total discounted cost of $3,296,350 at projected annual treatment levels. However, remaining inventoried sites would not be treated and would continue to spread. As a result, potential costs to contain or control would continue to grow until future containment action is initiated.

Some annual costs may be covered through external funding sources, which historically have averaged approximately $120,000. This level of external funding has largely been dependent on Title II funding, which terminated in 2006. Currently, proposals have been initiated in Congress to extend this funding and an extension was proposed in the President's budget. However, if Title II funding is not extended by Congress, external funding sources would likely total approximately $25,000 annually. The balance of expenditures would need to be covered through appropriated funding.

The economic activity potentially stimulated through implementation of Alternative A is estimated in the form of jobs and income. In addition to direct impacts, each economic sector produces indirect and induced effects, in varying degrees, depending on the spending patterns within each industry. A sector's total economic impact is made up of its direct, indirect, and induced effects, as well as other factors.

Businesses that provide invasive plant treatment services response to the demand for the services they provide by employing a sufficient number of positions to produce the appropriate level of service needed to meet demand. The services or output produced and the employment required to produce that level of output are the direct effects of that business on the economy. In order to produce the output included in the direct effects, the businesses providing invasive plant treatment must purchase supplies and services from other industries. The output and employment stimulated in other industries by these purchases are indirect effects. In addition to the direct and indirect effects, induced effects represent the output and employment stimulated throughout the local economy as a result of the expenditure of new household income generated by direct and indirect employment.

Part of the monies spent by businesses such as those providing invasive plant treatment services may be spent outside of the local economy. The money expended outside the local economy is often referred to as leakage as the dollars spent outside the local area "leak" out of the local economy. By the same token economic activity is introduced when goods and services produced within the local economy are exported. In other words those from outside the area purchase goods and services produced within the local area, thereby bringing new money into the local economy.

IMPLAN attempts to estimate these complex economic relationships in order to approximate the effects on the economy as a whole. Multipliers were developed as a means to estimate the change in direct, indirect, and induced effects as a result of the level of demand for invasive plant treatment services. These multipliers also take into account the effects of leakage and exports.

The following table displays the potential employment and income that may be supported within the local economy as a result of implementing Alternative A. The figures displayed in the second column (Total to Contain/Control Acres Proposed for Treatment) represent the total impact over the life of the alternative. The estimated average annual impact is displayed in the third column. The impact of inventory and monitoring activities are included. The employment figure presented represents potential full-time, part-time, and/or seasonal positions.

Table 74 - Alternative A Estimated Job and Income Impacts

Impact	Total to Contain/Control Acres Proposed for Treatment[1]	Average Annual Impact
Jobs	105	3
Labor Income ($1,000s)	$2,673	$86

1 Using the assumptions regarding treatment effectiveness and rate of spread described earlier under "Methodology" it was estimated that the acres approved for treatment under the 1995 EA would be controlled in 31 years.

Many other anticipated economic costs and benefits are not easily converted to dollar amounts. In addition to job and income benefits, there would be additional intangible and difficult to quantify economic benefits and costs. Some of those include

- Maintenance of biodiversity on those acres successfully treated
- Loss of biodiversity on those acres not treated or on which treatments are ineffective
- Reduced forage for wildlife as well as domestic cattle grazing as a result of the spread of invasive species
- Spread to adjacent lands as discussed above
- Increased future costs to the Forest Service to treat invasive species infestations that have continued to spread unchecked

Other potential benefits and costs under this alternative are discussed in detail in specialist reports for other affected resources.

Environmental Justice

Alternative A was assessed to determine whether there would be a disproportionately adverse impact to minority or low-income populations in accordance with Executive Order 12898 (President 1994). No concerns relative to disparate impacts to minority or low income populations were identified through scoping. However, American Indian tribes may be disproportionately affected because they are dependent on native plants for cultural and traditional uses. The racial composition of work crews implementing treatment activities are expected to be generally similar to that of the Project

Area population, with a potential for a slightly higher percentage of minorities. Work crews may experience injury during manual treatments or may be exposed to chemical treatments.

The National Visitor Use Monitoring survey asked visitors to categorized themselves into one of seven race/ethnicity categories. The results for the Umatilla indicated that of Forest visitors sampled from October 2002 through September 2003, showed that 96.9 percent of visitors indicated they were white. Approximately 3.5 percent of visitors sampled indicated Native American, 1.8 percent indicated Asian, 0.8 percent indicated Hispanic or Latino, and 0.4 percent indicated Pacific Islander (USDA 2004a).

Native American plant areas are likely at greater risk due to the spread of invasive species under Alternative A than under the other alternatives. Native plants important for cultural uses could potentially be crowded out of some areas forcing Native American users to seek these resources in other areas of the forest or on other land ownerships. Populations of culturally important plants could be decreased to the point of being insufficient to meet demand. Visitors from other racial or ethnic backgrounds or low income visitors seeking to supplement family incomes may also be impacted as areas important for berry picking, mushroom gathering, or other gathering activities would be adversely impacted by the spread of invasive species.

The potential for human exposure to herbicides is lowest under this alternative for all user groups due to the limitations on the implementation of chemical treatment activities. However, herbicide treatments over the last five years have averaged approximately 2,600 acres annually, including the re-treatment of some acres. Similar treatments would continue under Alternative A. These acres of treatment represent approximately 0.2 percent of the National Forest System (NFS) lands administered by the Umatilla National Forest. Herbicide application methods would be selected to not only ensure effective results, but to minimize movement offsite in soil, water, or wind.

The R6 ROD amended the Umatilla Forest Plan to incorporate standards for the implementation of herbicide treatment activities. The R6 ROD and FEIS (USDA 2005a; USDA 2005b) found that the potential for adverse human health and safety impacts from herbicide use would be adequately resolved through adherence these standards. Additionally, the R6 ROD amended the Umatilla Forest Plan (USDA 1990; USDA 2005b) to incorporate requirements to ensure timely public notification and that signs are posted to inform the public and forest workers of herbicide application dates and the name of herbicides used. If requested, individuals may be notified in advance of spray dates. These measures would provide visitors who wish to avoid any potential for herbicide exposure with the information they need to do so.

Worker exposure to herbicides and risks associated with physical treatment methods would be minimized through strict adherence to health and safety requirements for all workers. Application of any herbicides to treat invasive plants would be performed or directly supervised by a State or Federally licensed applicator. Herbicide transportation and handling safety plan would be developed and implemented for all treatment activities.

Based on the above analysis, American Indian tribes may be disproportionately affected because they are dependent on native plants for cultural and traditional uses. No other disproportionate adverse impacts to minority or low income groups are anticipated under this alternative.

Cumulative Effects of Alternative A

Although private land owners and federal, state, and local governments administering lands adjacent to the Forest will continue invasive plant treatment activities, implementation of Alternative A would allow continued increase in the occurrence and spread of infestations on these lands.

Untreated infestations on the Forest would lead to a long-term decline in the health and sustainability of native plant communities. The resulting decrease in biological diversity and reduction in the economic and social returns natural plant communities provide adversely impacts all stakeholders.

Costs incurred by adjoining land ownerships to treat invasive plant infestations would likely continue to escalate as a result of the increasing likelihood and scale of the spread of these species from untreated areas of the Umatilla National Forest. Additionally, deferring the treatment of invasive plant populations would result in increased future costs to the Forest Service and thus to tax payers to treat larger, more widespread populations that would continue to develop over time.

Alternative B – Proposed Action

Alternative B proposes to control, contain, or eradicate invasive plants on existing sites or newly discovered infestations. Various types of treatments would be used including the use of herbicides, physical, and biological methods. Treatments are proposed for existing or new infestations including new plant species that currently are not found on the Forest. The preferred treatment method would be determined using a decision matrix based on local (District) priority plant species and site location, and input from local weed managers. Species priority and treatment response is based on:

- Previous and ongoing efforts made to control the species
- The invasive nature of the species
- Newly detected infestations

Current inventory indicates there are approximately 24,649 acres of invasive plant infestations on the Forest. The actual locations of treatment would typically include rangelands, timber harvest areas, roads, and road rights-of-way, along trail routes, dispersed and developed recreation sites, and other disturbed sites (for example; fires, flood events, and rock sources). Treatments may include seeding with desirable grass and forb species to assist site rehabilitation. Restoration treatments requiring ground disturbing activities would necessitate additional site specific analysis. The determination of actual treatment methods applied at each site is displayed in Chapter2, Figure 1, The Decision Tree.

Ongoing inventory and monitoring would look for new infestations of invasive plants, or new locations of existing weeds. Newly discovered infestations or sites would likely receive a high priority for treatment to eradicate the invasive plants while the infestation is small and easily treatable (See Treatment Decision Tree, Figure 1). This strategy of detecting and treating new infestations is called Early Detection Rapid Response.

The estimated acres by treatment method are detailed in the following table.

Table 75 - Alternative B Estimated Acres by Treatment Method

Treatment Methods	Acres
Manual and/or mechanical and/or Chemical (broadcast and/or spot) – Upland areas	14,456
Chemical Treatment in Riparian Habitat Conservation Areas (broadcast)	3,022
Chemical Treatment in Riparian Habitat Conservation Areas (spot only – includes wicking and wiping)	2,538
Biocontrol – All areas	3,917
Manual only – All areas	41
Aerial only	675
Total Acres Treated	**24,649**

The number of acres proposed for treatment in any given year would depend on funding and the success of past treatments. On-going monitoring of the site would provide the information needed to decide the follow-up treatment methods required. In any given year it is anticipated that approximately 4,000 acres would receive treatment with herbicide, manual, mechanical, or biocontrol methods.

Direct and Indirect Effects of Alternative B

Under this alternative, invasive treatment activities would include herbicides, physical (hand pulling, hand tools, and mechanical treatments), and biological methods. Herbicides utilized would be those approved for use in the R6 ROD (USDA 2005b). These include herbicide formulations containing one or more of the following ten active ingredients: chlorsulfuron, clopyralid, glyphosate, imazapic, imazapyr, metsulfuron methyl, picloram, sethoxydim, sulfometuron methyl, and triclopyr. All herbicide application methods are allowed including wicking, wiping, injection, spot, and broadcast, as permitted by the product label. Only chlorpyralid would be applied aerially. Additional herbicides and herbicide mixtures may be added in the future at either the Forest Plan or project level through appropriate risk analysis and NEPA/ESA procedures.

Treatment effectiveness under this alternative would be expected to approach 80 percent or higher. All acres inventoried for treatment would eventually be treated, however expected budget allocations would limited treatment activities to approximately 4,000 acres annually. Priority sites determined to be high would be treated first. As infestations are effectively treated, management would be initiated on new acres each year. Herbicides could potentially be applied to approximately 20,690 acres, or approximately one percent of National Forest system lands administered by the Umatilla National Forest. However, annual estimated treatment activities (approximately 4,000 acres) represent 0.3 percent of National Forest system lands annually.

Effects of herbicides permitted under this alternative to non-target plant species, wildlife, and human health and safety were evaluated in the Pacific Northwest Region Invasive Plant Program Preventing and Managing Invasive Plants Final Environmental Impact Statement (R6 FEIS) (USDA 2005a). The R6 FEIS approved a limited number of herbicides for use and found that the potential for harm to non-target plants, plant pollinators, wildlife, and human health and safety would be adequately resolved by adherence to the standards incorporated in the Umatilla Forest Plan through amendment by the R6 ROD. The findings of that analysis are incorporated by reference. Nonetheless, perceptions of the potential for harm are likely to persist among many members of the public. Prior to implementation of herbicide treatment projects, National Forest system staff would ensure timely public notification. Treatment areas would 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. Regardless, those opposed to the use of herbicides would likely oppose this alternative.

Many stakeholders would perceive beneficial effects under this alternative. Treatments of invasive species are expected to be considerably more effective than have been experienced under the existing program (No Action Alternative). Those who place importance on the commodity values and uses of the Forest would benefit from improved resource conditions and biodiversity as invasive species are effectively treated. Likewise, those who place a higher worth on non-commodity resources would also see an improvement in the values they seek. Forage production on Forest rangelands would be maintained and gradually increased as the occurrence of invasive species is reduced.

Habitat capability to support wildlife and provide forage for domestic livestock would gradually improve following implementation of this alternative.

The important native species and biological diversity within scenic byways, wild and scenic rivers, wilderness areas, and research natural areas would be maintained and improved as implementation progresses. The recreational and/or educational values of these areas would be maintained or improved.

Neighboring private and public lands would be benefited because the likelihood for spread of invasive species from the Umatilla National Forest would be reduced. The potential for adverse impacts to land values as a result of infestations of invasive species would be reduced and costs to control infestations for neighboring land owners or administrative agencies (federal, state, and local governments) would likely decrease over time with the reduced potential for spread from National Forest system lands.

The potential for invasive plant species to adversely impact populations of native plant species used for cultural purposes such as food, medicine, dress, basketry, or ceremonial activities would be reduced through implementation of Alternative B. The potential for spread of invasive species from the Forest to Tribal trust lands would be reduced.

The potential for the exposure of tribal members to herbicides is highest under this alternative. However, per the analysis and findings of the R6 FEIS as discussed above, no adverse human health impacts are anticipated (USDA 2005a). Nonetheless, perceptions of the potential for harmful effects would likely persist. Project Design Features (Chapter 2 EIS) require public notification prior to implementation of treatment activities and posting of signs with the dates of treatment and herbicides used will aid those who desire to avoid herbicide exposure.

Economic Effects

The cost of this alternative was calculated as though all acres were to be treated one time within one year. The estimated undiscounted cost of implementing treatments on all affected acres one time is estimated at $3,887,460 in 2006 dollars. This estimate includes inventory and monitoring costs. At the estimated rate of effectiveness of 80 percent of treated acres, the average cost per effectively treated acre is the lowest of the alternatives considered at an estimated $197 per acre under this alternative.

Discounted annual treatment costs at various levels of annual treatment are provided below in Table 76. Because future budgets could increase or decline, a variety of annual treatment levels were analyzed in order to assess the effects on long-term costs as well as the time required to achieve the purpose and need. At the target annual treatment level of 4,000 acres, the discounted net annual equivalent cost is estimated at $539,030. After assuming an estimated rate of spread of 10 percent, with 80 percent effectiveness of treatments, the projected time required to control existing populations is 17 years at a total discounted cost of approximately $6,823,790 dollars.

Table 76 - Years to contain or control forest-wide infestations and annual treatment costs under Alternative B in 2006 dollars (Shaded line represents the projected annual treatment level)

Annual Acres Treated	Net Annual Equivalent Cost (Discounted)	Years to Contain or Control Inventoried Infestations and Discounted Total Costs Average Rate of Spread = 10 Percent	
		Years	Discounted Cost ($1000s)
2,500	$408,600	Would not achieve	N/A
3,000	$475,960	41	$9,516
4,000	**$539,030**	**19**	**$6,824**
5,000	$568,140	15	$6,317
6,000	$616,040	13	$5,782
7,000	$632,500	12	$5,541

*For the purposes of analysis, projections assumed 80% effectiveness of treatments, and a 10% rate of spread from untreated acres. Infestations were considered controlled when projections for remaining inventoried acres reached 0 acres.

Projections were carried out until estimated infestations were reduced to zero for the purposes of analysis. In actual practice, it is very unlikely that all invasive species could be completely eliminated. A certain level of infestation is likely to remain, requiring continuing control efforts. However, much lower levels of ongoing treatment would be required to allow for the continued containment and control of remaining infestations.

Early detection, rapid response (EDRR) would be utilized to address new infestations of currently occurring species or new species at an estimated average cost of $199 per effectively treated acre. Only methods proposed and analyzed through the EIS would be utilized, however, aerial application methods would not be used for EDRR treatments. Implementation of EDRR would reduce future costs and environmental impacts by eliminating or controlling new infestations before they could become established.

As described under Alternative A, some annual costs may be covered through external funding sources, which historically have averaged approximately $120,000. If Title II funding is not extended by Congress, external funding sources would likely drop to a total of approximately $25,000 annually. The appropriated funding would be required to cover the balance of annual expenditures.

The following table displays the potential employment and income that may be supported within the local economy as a result of implementing Alternative B. The figures displayed in the second column (Total to Contain/Control Acres Proposed for Treatment) represent the total impact over the life of the alternative. The estimated average annual impact is displayed in the third column. The impact of inventory and monitoring activities are included. The employment figure presented represents potential full-time, part-time, and/or seasonal positions.

Table 77 - Alternative B Estimated Job and Income Impacts

Impact	Total to Contain/Control Acres Proposed for Treatment[1]	Average Annual Impact
Jobs	326	17
Labor Income ($1,000s)	$8,338	$439

1 Using the assumptions regarding treatment effectiveness and rate of spread described earlier under "Methodology" it was estimated that the acres approved for treatment under Alternative B would be controlled in 19 years.

In addition to job and income impacts, there would be additional intangible and difficult to quantify economic benefits and costs. Some of those include maintenance or improvement of biodiversity, improved forage for wildlife and domestic cattle grazing, and prevention of spread to adjacent lands. Other potential benefits and costs under this alternative are discussed in detail in the specialist reports for other affected resources.

Environmental Justice

Alternative B was assessed to determine whether there would be a disproportionately adverse impact to minority or low-income populations in accordance with Executive Order 12898 (President 1994). No concerns relative to disparate impacts to minority or low income populations were identified through scoping.

The 2004 report of the National Visitor Use Monitoring Results (NVUM) for the Umatilla National Forest estimated that approximately 652,000 people visit the Forest annually, plus or minus 18.6 percent at the 80 percent confidence interval. Of the of Forest visitors sampled from October 2002 through September 2003, 96.9 percent indicated they were white. Approximately 3.5 percent of visitors sampled were Native American, 1.8 percent were Asian, 0.8 percent were Hispanic or Latino, and 0.4 percent were Pacific Islander (USDA 2004a). Of these minority groups, as stated above, Native American visitors may have the greatest potential to be impacted by herbicide applications, however visitors from other racial or ethnic backgrounds or low income visitors seeking to supplement family incomes, also engage in berry picking, mushroom gathering, or other gathering activities on the Umatilla National Forest.

The NVUM survey results indicated that of those surveyed, approximately 23 percent indicated that they participate in gathering forest products, 17 percent engage in fishing, and 28 percent participate in hunting activities at some time during the year.

Risk to Native American cultural plant gathering areas as well as other forest product gathering sites as a result of the spread of invasive species is lowest under Alternative B. The higher rate of effective containment, control, or eradication of invasive species anticipated under this alternative would help to protect native plant areas important to Native Americans and other visitors by reducing the threat of invasive species. There is concern that herbicides treatments could adversely impact non-target, culturally important plants, or wildlife species. Treatments applied to each site would consider the minimization of exposure to non-target species through such means as the method of herbicide application and timing. The R6 FEIS and ROD found that the potential for herbicides to harm non-target plants, plant pollinators, or terrestrial and aquatic wildlife were likely to be resolved by adherence to the standards incorporated in the Umatilla Forest Plan through that decision. In addition, site specific Project Design Features would be in place at the time of treatment to further reduce potential for harm to non-target species.

Some users have expressed concern about the potential for human exposure to herbicides. Low income populations who may hunt, fish, or gather forest products for subsistence or income purposes would have a potential risk of exposure through contact with or consumption of forest products or wildlife exposed to herbicides. The potential for human exposure to herbicides in treatment areas is higher under this alternative than under Alternative A due to the larger number of acres to be treated. However, annual treatments would be limited to approximately 4,000 acres per year, which represents 0.3 percent of the National Forest system lands administered by the Umatilla National Forest.

In total, the area to be treated across the forest through implementation of this alternative represents less than two percent of the acres administered by the Umatilla National Forest. Herbicide application methods would be selected to not only ensure effective results, but to minimize movement offsite in soil, water, or wind.

The R6 ROD amended the Umatilla Forest Plan to incorporate standards for the implementation of herbicide treatment activities. The R6 ROD and FEIS (USDA 2005a; USDA 2005b) found that the potential for adverse human health and safety impacts from herbicide use would be adequately resolved through adherence to these standards. Additionally, the R6 ROD amended the Umatilla Forest Plan (USDA 2005b USDA 1990;) to incorporate requirements that ensure timely public notification and that signs be posted to inform the public and forest workers of herbicide application dates and the name of herbicides used. If requested, individuals may be notified in advance of spray dates. These measures would provide visitors who wish to avoid any potential for herbicide exposure with the information they need to do so.

The racial composition of work crews implementing treatment activities are expected to be generally similar to that of the Project Area population, with a potential for a slightly higher percentage of minorities. Work crews may experience injury during manual treatments or may be exposed to chemical treatments. Worker exposure to herbicides and risks associated with physical treatment methods would be minimized through strict adherence to health and safety requirements for all workers. Application of any herbicides to treat invasive plants would be carried out or directly supervised by a State or Federally Licensed Applicator. Herbicide transportation and handling safety plan would be developed and implemented for all treatment activities.

Based on the above analysis, no disproportionate adverse impacts to minority or low income groups are anticipated under this alternative.

Cumulative Effects of Alternative B

Alternative B would contribute to efforts by private land owners and federal, state, and local governments administering lands adjacent to the Forest to reduce the occurrence and spread of invasive species on these lands. Treatment of infestations on the Forest would lead to long-term improvements in the health and sustainability of native plant communities. Maintenance or improvements in biological diversity would contribute to economic and social returns provided by natural plant communities benefiting all stakeholders. Costs incurred by adjoining land ownerships to treat invasive plant infestations would likely be reduced in the long-term as a result of the reduced likelihood and scale of the spread of invasive species from National Forest system lands. Effective treatment of invasive plant populations would result in decreased future costs to the Forest Service and thus to tax payers as the occurrence of invasive species is reduced and controlled over time.

Alternative C

This alternative is the same as the Proposed Action except that no broadcast spraying of herbicides would be allowed in Riparian Habitat Conservation Areas.

Invasive plant treatment in these areas could be accomplished by spot or hand application of herbicides, or any other non-herbicide treatment method. Estimated acres by treatment method are displayed in Table 78.

Table 78 - Alternative C Estimated Acres by Treatment Method

Treatment Methods	Acres
Manual and/or mechanical and/or Chemical (broadcast and/or spot) – Upland areas	14,456
Chemical Treatment in Riparian Habitat Conservation Areas (spot only – includes wicking and wiping)	5,560
Biocontrol – All areas	3,917
Manual only – All areas	41
Aerial only	675
Total Acres Treated	**24,649**

Direct and Indirect Effects of Alternative C

Direct and indirect effects resulting from the implementation of Alternative C would be the same as described above under Alternative B, except as noted below.

Perceptions of the potential for harm to non-target plant species, wildlife, and human health may be slightly lower than would occur under Alternative B among some members of the public due to the use of more selective herbicide application methods within riparian areas. However, as is true of Alternative B, a limited number of herbicides have been approved for use in the R6 FEIS, which found that the potential for harm to non-target plants, plant pollinators, wildlife, and human health and safety would be adequately resolved by adherence to the standards incorporated in the Umatilla Forest Plan through amendment by the R6 ROD (USDA 2005a; USDA 2005b), and to site specific Project Design Features. The findings of that analysis are incorporated by reference. As under Alternative B, perceptions of the potential for harm would be likely to persist among many members of the public.

Economic Effects

The estimated cost of implementing treatments on all affected acres one time is estimated at $3,616,050 in 2006 dollars. This estimate includes inventory and monitoring costs. At the estimated rate of effectiveness of 80 percent of treated acres, the average cost per effectively treated acre is $201 under Alternative C; this is the highest cost of the action alternatives considered, but lower than Alternative A.

Discounted annual treatment costs at various levels of annual treatment are provided in Table 12 below. Because future budgets could increase or decline, a variety of annual treatment levels were analyzed in order to assess the effects on long-term costs as well as the time required to achieve the purpose and need At the target annual treatment level of 4,000 acres, the net annual equivalent cost is estimated at $549,790. The projected time required to control existing populations, including an estimated rate of spread of 10 percent, with 80 percent effectiveness of treatments is 19 years at a total discounted cost of approximately $6,959,940 dollars.

Projections were carried out until estimated infestations were reduced to zero for the purposes of analysis. In actual practice, it is very unlikely that all invasive species could be completely eliminated. A certain level of infestation is likely to remain, requiring continuing control efforts. However, much lower levels of ongoing treatment would be required to allow for the continued containment and control of remaining infestations.

As described under Alternative A, some annual costs may be covered through external funding sources, which historically have averaged approximately $120,000. If Title II funding is not extended by Congress, external funding sources would likely drop to a total of approximately $25,000 annually. The appropriated funding would be required to cover the balance of annual expenditures.

Table 79 - Years to contain or control forest-wide infestations and annual treatment costs under Alternative C in 2006 dollars. (Shaded line represents the projected annual treatment level.)

Annual Acres Treated	Net Annual Equivalent Cost (Discounted)	Years to Contain or Control Inventoried Infestations and DiscountedTotal Cost Average Rate of Spread = 10 Percent	
		Years	Cost ($1000s)
2,500	$429,165	Would not achieve	N/A
3,000	$485,310	41	$9,703
4,000	**$549,790**	**19**	**$6,960**
5,000	$579,290	15	$6,441
6,000	$628,610	13	$5,900
7,000	$645,550	12	$5,665

*For the purposes of analysis, projections assumed 80% effectiveness of treatments, and a 10% rate of spread from untreated acres. Infestations were considered controlled when projections for remaining inventoried acres reached 0 acres.

Early detection, rapid response (EDRR) would be utilized to address new infestations of currently occurring species or new species at an estimated cost of $203 per effectively treated acre. Only methods proposed and analyzed through the EIS would be utilized, however aerial treatment methods would not be utilized to for EDRR treatments. Implementation of EDRR would reduce future costs and environmental impacts by eliminating or controlling new infestations before they can become established.

The following table displays the potential employment and income that may be supported within the local economy as a result of implementing Alternative C. The figures displayed in the second column (Total to Contain/Control Acres Proposed for Treatment) represent the total impact over the life of the alternative. The estimated average annual impact is displayed in the third column. The impact of inventory and monitoring activities are included. The employment figure presented represents potential full-time, part-time, and/or seasonal positions.

Table 80 - Alternative C Estimated Job and Income Impacts

Impact	Total to Contain/Control Acres Proposed for Treatment[1]	Average Annual Impact
Jobs	335	18
Labor Income ($1,000s)	$8,550	$450

1 Using the assumptions regarding treatment effectiveness and rate of spread described earlier under “Methodology” it was estimated that the acres approved for treatment under Alternative c would be controlled in 19 years.

In addition to job and income impacts, there would be additional intangible and difficult to quantify economic benefits and costs. Some of those include maintenance or improvement of biodiversity, improved forage for wildlife and domestic cattle grazing, and prevention of spread to adjacent lands. Other potential benefits and costs under this alternative are discussed in detail in the specialist reports for other affected resources.

Environmental Justice

Alternative C was assessed to determine whether there would be a disproportionately adverse impact to minority or low-income populations in accordance with Executive Order 12898 (President 1994). Effects under this alternative are the same as described above under Alternative B. Based on the above analysis no disproportionate adverse impacts to minority or low income groups are anticipated.

Cumulative Effects of Alternative C

Cumulative effect under Alternative C would be the same as described above under Alternative B.

Alternative D

This alternative is the same as the Proposed Action except that aerial application of herbicides would not be allowed. Some areas excluded from aerial application of herbicide may not be treated with other methods due to remoteness, terrain, and worker safety issues. Estimated acres by treatment method are displayed in Table 81.

Table 81 - Alternative D Estimated Acres by Treatment Method

Treatment Methods	Acres
Manual and/or mechanical and/or Chemical (broadcast and/or spot) – Upland areas	15,131
Chemical Treatment in Riparian Habitat Conservation Areas (broadcast)	3,022
Chemical Treatment in Riparian Habitat Conservation Areas (spot only – includes wicking and wiping)	2,538
Biocontrol – All areas	3,917
Manual only – All areas	41
Total Acres Treated	**24,649**

Direct and Indirect Effects of Alternative D

Direct and indirect effects resulting from the implementation of Alternative D would be the same as described above under Alternative B, except as noted below.

Perceptions of the potential for harm to non-target plant species, wildlife, and human health may be slightly lower than under Alternative B among some members of the public due to the elimination of aerial application of herbicides and would be similar to those likely to occur under Alternative C. However, as is also true under Alternatives B and C, a limited number of herbicides have been approved for use in the R6 FEIS, which found that the potential for harm to non-target plants, plant pollinators, wildlife, and human health and safety would be adequately resolved by adherence to the standards incorporated in the Umatilla Forest Plan through amendment by the R6 ROD (USDA 2005a; USDA 2005b), and to site-specific Project Design Features. The findings of that analysis are incorporated by reference. As under Alternatives B and C, perceptions of the potential for harm would be likely to persist among many members of the public.

Economic Effects

The estimated undiscounted cost of implementing treatments on all affected acres one time is estimated at $3,942,840 in 2006 dollars. This estimate includes inventory and monitoring costs.

At the estimated rate of effectiveness of 80 percent of treated acres, the average cost per effectively treated acre is $200 under Alternative D. This represents an effective cost per acre that is slightly higher than Alternative B, slightly lower than Alternative C, and considerably lower than Alternative A.

Discounted annual treatment costs at various levels of annual treatment are provided in Table 15 below. Because future budgets could increase or decline, a variety of annual treatment levels were analyzed in order to assess the effects on long-term costs as well as the time required to achieve the purpose and need. At the target annual treatment level of 4,000 acres, the net annual equivalent cost is estimated at $546,950. The projected time required to control existing populations, including an estimated rate of spread of 10 percent, with 80 percent effectiveness of treatments is 17 years at a total discounted cost of approximately $6,924,045 dollars.

Projections were carried out until estimated infestations were reduced to zero for the purposes of analysis. In actual practice, it is very unlikely that all invasive species could be completely eliminated. A certain level of infestation is likely to remain, requiring continuing control efforts. However, much lower levels of ongoing treatment would be required to allow for the continued containment and control of remaining infestations.

As described under the other alternatives, some annual costs may be covered through external funding sources, which historically have averaged approximately $120,000. If Title II funding is not extended by Congress, external funding sources would likely drop to a total of approximately $25,000 annually. The appropriated funding would be required to cover the balance of annual expenditures.

Table 82 - Years to contain or control forest-wide infestations and annual treatment costs under Alternative D in 2006 dollars. (Shaded line represents the projected annual treatment level.)

Annual Acres Treated	Estimated Annual Cost	Years to Contain or Control Inventoried Infestations and Discounted Total Cost Average Rate of Spread = 10 percent on untreated sites and 5 percent after treatments begin	
		Years	Cost ($1000s)
2,500	$427,120	Would not achieve	N/A
3,000	$482,790	41	$9,652
4,000	**$546,950**	**19**	**$6,924**
5,000	$576,315	15	$6,408
6,000	$625,240	13	$5,868
7,000	$641,990	12	$5,624

*For the purposes of analysis, projections assumed 80% effectiveness of treatments, and a 10% rate of spread from untreated acres. Infestations were considered controlled when projections for remaining inventoried acres reached 0 acres.

EDRR would be utilized to address new infestations of currently occurring species or new species at an estimated average cost of $200 per effectively treated acre. Only methods proposed and analyzed through the EIS would be utilized. Implementation of EDRR would reduce future costs and environmental impacts by eliminating or controlling new infestations before they can become established.

The following table displays the potential employment and income that may be supported within the local economy as a result of implementing Alternative D.

The figures displayed in the second column (Total to Contain/Control Acres Proposed for Treatment) represent the total impact over the life of the alternative. The estimated average annual impact is displayed in the third column. The impact of inventory and monitoring activities are included. The employment figure presented represents potential full-time, part-time, and/or seasonal positions.

Table 83 - Alternative D Estimated Job and Income Impacts

Impact	Total to Contain/Control Acres Proposed for Treatment[1]	Average Annual Impact
Jobs	332	17
Labor Income ($1,000s)	$8,493	$447

1 Using the assumptions regarding treatment effectiveness and rate of spread described earlier under “Methodology” it was estimated that the acres approved for treatment under Alternative D would be controlled in 19 years.

In addition to job and income impacts, there would be additional intangible and difficult to quantify economic benefits and costs. Some of those include maintenance of biodiversity or improvement of biodiversity, improved forage for wildlife and domestic cattle grazing, and prevention of spread to adjacent lands. Other potential benefits and costs under this alternative are discussed in detail in the specialist reports for other affected resources.

Environmental Justice

Alternative D was assessed to determine whether there would be a disproportionately adverse impact to minority or low-income populations in accordance with Executive Order 12898 (President 1994).

Effects under this alternative are the same as described above under Alternative B. Based on the above analysis no disproportionate adverse impacts to minority or low income groups are anticipated under this alternative.

Cumulative Effects of Alternative D

Cumulative effect under Alternative D would be the same as described above under Alternative B.

Summary of Effects

Although Alternative A has the lowest net annual equivalent cost among the alternatives analyzed, the average cost per effectively treated acre of $814, is over four times as much as that proposed under the action alternatives. Additionally, approximately 87 percent of currently inventoried infestations would remain untreated under Alternative A allowing the continued spread of invasive species. Therefore, until future action could be taken to arrest the spread of these species, potential long-term costs are unlimited under the no action alternative as existing infestations continue to spread at a rate of 8 to 12 percent annually (Laufmann 2007). For example, in twenty years, assuming an average rate of spread of 10 percent and no treatment efforts beyond those currently authorized, infested acres could grow to approximately 525 percent of current infestations. Deferring treatment for that period of time would result a similar growth in the required future expenditures needed to manage the larger infestation.

Among the action alternatives, Alternative B has the lowest net annual equivalent cost followed by D and then C. Each of the action alternatives are projected contain or control existing inventoried infestations and prevent the spread of invasive species on the Umatilla National Forest. Future treatment costs are minimized under all action alternatives relative to Alternative A.

The analysis of various annual treatment levels reveals that under all alternatives, long-term costs are reduced by implementing as large an annual treatment program as possible within budgetary constraints. Even though annual costs under larger treatment levels increase, long-term costs are reduced because containment and control can be achieved in a shorter period of time, reducing the need for future investments in treatment activities.

Table 84 - Summary of Effects by Alternative

Indicator	Alternative A	Alternative B	Alternative C	Alternative D
Total Cost, One-time Treatment, All Acres	$641,695	$3,887,460	$3,963,010	$3,942,840
Cost per Effectively Treated Acre	$814	$197	$201	$200
Jobs potentially supported to contain or control acres proposed for treatment (total that would occur over life of project)	105	326	335	332
Average Annual Jobs potentially supported	3	17	18	17
Income potentially supported to contain or control acres proposed for treatment, $1,000s (total that would occur over life of project)	$2,673	$8,338	$8,550	$8,493
Annual average Income potentially supported, $1,000s	$83	$439	$450	$447
Projected time to contain or control currently inventoried infestations	Containment or control would not be achieved	19 Years	19 Years	19 Years
Net annual equivalent cost of target treatment program (Discounted)	$133,700	$539,030	$549,790	$546,950
Estimated discounted cost to contain or control currently inventoried infestations ($1,000) at target annual treatment level	Unlimited	$6,824	$6,960	$6,924

Untreated acres under Alternative A would continue to spread resulting in an increasingly rapid decline in resource conditions and biodiversity across the forest and on neighboring lands. Commodity and non-commodity values would continue to decline at ever escalating rates as more and more native species succumb to invasive species. Future efforts to treat invasive species may require increasingly aggressive measures in order to achieve containment or control. The potential costs and socio-economic effects of these future efforts would continue to mount until action is taken to successfully arrest the spread of these species.

The programs of treatment proposed under Alternatives B, C, and D, are projected to result in declining populations of invasive species, allowing the biodiversity of native species to be maintained and enhanced. The adverse economic effects of non-native invasive species would be contained and reduced as the treatment programs proposed reduce the occurrence of these species.

3.10 Heritage Resources

Section 106 of the National Historic Preservation Act (NHPA) requires Federal agencies to consider the potential effects their undertakings may have on historic properties. The definition of undertaking encompasses all agency decision-making actions including the approval of land management plans such as the Umatilla National Forest Invasive Plants Treatment Draft Environmental Impact Statement (DEIS). The NHPA also compels agencies to consult tribes in determining whether the undertaking has potential to pose an effect on historic properties. Government-to government tribal consultation has been initialized for the Invasive Plant Treatment Plan and will be on-going during project implementation. Under the Programmatic Agreements among the United States Department of Agriculture Forest Service Pacific Northwest Region (Region 6), the Advisory Council on Historic Preservation, and the Oregon (signed June 2004) and Washington (signed April 1997) State Historical Preservation Officer Regarding Cultural Resource Management, yearly Section 106 review of proposed treatments will take place to determine if any protection measures are necessary. Tribes will be notified of annual treatments areas, as stated in Chapter 2, Table 6 - Project Design Features, M1. A **no effect** determination has been made for the Invasive Plant Treatment DEIS. Documentation to this affect will be forwarded to the Oregon and Washington SHPO, in compliance with the National Historic Preservation Act of 1966 (as amended), and the Oregon and Washington Programmatic Agreements.

3.11 Impacts to Cultural Uses and Treaty Rights

3.11.1 Introduction

The following is a summary of information provided by the tribes on their internet sites and/or taken from information and maps prepared for the Interior Columbia Basin project. The intent of the section is to characterize use and interests of the lands managed by the National Forest and in no way is intended to indicate differences between tribal use and culture.

3.11.2 Affected Environment

Confederated Tribes of the Umatilla Indian Reservation: The Cayuse (Weyiiletpuu), Walla Walla (Waluulapan), and Umatilla (Imatalamlama) tribes make up the members of this reservation. Their reservation lands are adjacent to the Umatilla and Wallowa Whitman National Forests and the city of Pendleton, Oregon. Their interest area includes the Malheur River and Malheur and Harney Lakes to the south, the Grande Ronde and lower Snake River in the east and north, the Yakima, John Day, and Umatilla Rivers and the Columbia River from Vantage, Washington, to west of the Dalles, Oregon. Important fisheries rivers include the Grande Ronde, Imnaha, John Day, Tucannon, Walla Walla, Wallowa, Touchet, Umatilla, Columbia, and Minam along with their tributaries. The Tribe has been active with salmon restoration in the Umatilla and Walla Walla Rivers. They have worked locally with several agencies to return water to these two streams in order to maintain migratory routes.

Confederated Tribes of the Warm Springs Reservation: The Wasco Bands, the Warm Springs Bands and the Northern Paiutes are members of the reservation. Their area of interest includes Malheur and Harney Lakes in the southeast to the headwaters of the Deschutes River in the southwest, crossing Mount Hood to west of Portland, Oregon and along the Columbia River to the mouth of the Snake River along with the John Day system. There are historic family connections with the Umatillas and since the co-location of other tribes to the reservation, other family connections have developed. Important streams are the Columbia, Crooked, Deschutes, Hood, and John Day River and Fifteen Mile Creek. Their Treaty ceded the majority of the John Day system to the United States.

Nimi'ipuu (Nez Perce): Their treaty established a reservation for the Nez Perce tribe. The reservation is located along the Clearwater River, east of Lewiston Idaho. Their area of interest includes lands east of the Snake River as far north as Coeur d'Alene, Idaho. It extends westward including the Snake and Palouse Rivers and the Columbia to The Dalles. To the south it includes the North Fork of the John Day to the confluence of the Malheur and Snake Rivers. Important streams include the Clearwater, Grande Ronde, Imnaha, Powder, Rapid, Salmon, Lower Snake, Lochsa, Selway, and Columbia Rivers.

Deep canyons were the traditional Nez Perce lands. They traveled with the seasons relying on the rivers, mountains and prairies for sustenance. In early spring, the women traveled to the lower valleys to dig root crops and the men traveled to the Snake and Columbia rivers to intercept the early salmon runs. In mid-summer all the people of the village moved to higher mountainous areas setting up temporary camps to gather later root crops, fish the streams, and hunt big game. By late fall they settled back into their traditional villages along the Snake, Clearwater, and Salmon rivers. Salmon and other fish, game, dried roots and berries provided winter foods.

The basic roots gathered for winter storage include camas bulb (kehmmes), bitterroot (thlee-tahn), khouse (qawas), wild carrot (tsa-weetkh), wild potato (keh-keet), and other root crops. Fruit collected includes service berries, gooseberries, hawthorn berries, thorn berries, huckleberries, currants, elderberries, chokecherries, blackberries, raspberries, and wild strawberries. Other food gathered includes pine nuts, sunflower seeds, and black moss.

3.11.3 Environmental Consequences

Impacts Common to all Alternatives

Direct and Indirect Effects

Access: Access to the National Forest systems lands would not be impacted by invasive plant treatments. The Forest's Access and Travel Management Plan would not be changed. If an open road or a road permitted for Off Highway Vehicle (OHV) use needs to be closed as part of the effective treatment prescription, a separate analysis would be performed. The proposed invasive plant treatments would not impact access to the forest to exercise treaty rights.

Gathering: (Also see the botany report) When herbicides are used as the selected treatment method, individual tribal members may shift to other locations for gathering cultural plants. Early involvement with the Tribes prior to treatment would allow a schedule to be developed so that gathering could occur prior to treatments or in the case of huckleberries, early enough prior to fruit setting so any residual herbicides would be gone. Most treatments (72 percent of the acres) would occur within 20 feet of a road, disturbed site, or other high use area; occasionally treatments would extend to 100 feet. The areas adjacent to these high use areas do not provide quality habitat for cultural plants and can be easily avoided during gathering. Areas receiving herbicide treatments will be posted with warning signs. Herbicide treatments adjacent to high use areas would have low impacts on the gathering of cultural plants nor would it impact the quantity or quality of the plants collected since the treatment areas can be avoided.

The most extensive invasive plant sites beyond the high use areas have yellowstar thistle. These sites are located in dry grasslands or moist meadows that are potential habitat for cous and camas. Biological control methods are the primary treatment method and would not impact cultural plants or their use. Biocontrol is proposed on approximately 16 percent of the treatment acres. High densities of yellowstar thistle displace native plants and likely would not be strongholds of cultural use plants; these areas are likely to not be used for gathering. Controlling the spread of yellowstar thistle would preserve native plant habitat and reduced yellowstar densities would allow native plants to recover.

If herbicides are used to treat yellowstar thistle, there is an increased possibility of herbicide contact with cultural plants. This can be reduced by the application method. If the site is located in a traditional use area, the treatment could be designed around the target and cultural plant life cycles. If effective, spot treatments could be used; however, the density of yellowstar thistle would normally require broadcast treatments. Since cous and camas normally go dormant between mid July and August on the Forest (depends on elevation and year) it would be possible to treat after the cultural plants are dormant and/or in the fall as yellowstar thistle germinate.

A mixture of methods could be used as well depending on the size of the invasive plant site. For knapweeds growing with lomatiums (cous), it would be possible to pull the knapweed to delay the rosette stage until after the lomatiums are dormant to follow up with herbicide at a later visit. This could be used around rock sources, particularly when other cultural gatherings are planned for the area in early summer.

In the higher elevations where huckleberries are found, the vast majority of invasive plants are associated with roads. Very few invasive plants would be found off the roads because forest cover and herbaceous plants would inhibit invasive plant growth. Any areas treated with herbicide would be posted. Since treatments would be along the road edges and surface, contact with herbicide can be avoided by moving further from the road.

Invasive plant treatments are not expected to impact the gathering of plants, roots, or berries. When herbicides are used, the areas can be avoided. The area treated would be largest the first year with follow-up treatments in later years either covering fewer acres or using non-herbicide methods. Displacement of tribal members would very depending on the success of treatments and the amount of time needed to control or eradicate the target species. Since the treatment is mainly associated with roads and other high use areas, impacts to gathering will be low. Approximately 10 percent of the total acres proposed for herbicide treatment are distant to roads meaning that very little of the Forest landscape outside of high use areas would be impacted by treatments. Informing the tribes of proposed treatments each year would help avoid conflicts and allow the Forest and Tribe to work together if restoration is necessary due to invasive plants displacing cultural plants.

Fish habitat and water quality: Impacts to fisheries habitat are analyzed in the Fisheries Report. The Project Design Features are expected to keep herbicides levels well below levels of concern for fish reproduction or human use. The low levels of herbicide used in riparian areas are not expected to concentrate in fish or create health issues. The Project Design Features would limit activities along stream banks when fish are spawning. Areas of high quality riparian habitat are distant from roads and contain very few sites. These areas would not have any measurable impacts from herbicide use and would continue to function as strongholds for recovery efforts.

Hunting: Impacts to big game are disclosed in the Wildlife Report. Big game or birds are not expected to bioconcentrate herbicides. With the majority of treatments near roads, the potential use of forage treated with herbicide is low.

During the time of treatments, animals would disperse due to the workers being present and noise of equipment. The activity is short duration and would not impact hunting or the populations of game species.

Cumulative Effects

Other than harassing of fish or game from other resource management actions or recreational uses when they occur at the same time as treatment, there would be few cumulative effects expected with other ongoing or reasonable foreseeable future actions. Each action would have its own prevention plan that would reduce the risk for spread of invasive plants. There is a low likelihood of these actions causing a need for additional invasive plant treatments. Other than prescribed fire, very few ground disturbing actions are proposed in the meadow/grassland habitats away from roads. Forest harvest activities would retain cover. Grazing may increase the spread of local invasive plants however allotment management plans reduce this risk by requiring the permittee to inventory and report any new invasive plant sites and taking measures to reduce the risk of carrying invasive plants onto the forest when they turn out in the spring. In some allotments pastures have been closed until the invasive plants can be controlled. These activities will likely cause new invasive plant sites to appear in areas of high use, but the amount is likely much less than 5 percent of the current inventory over the next ten to fifteen years.

Impacts Associated with Alternative C

Direct, Indirect and Cumulative Impacts: Alternative C does not use broadcast spray methods in riparian areas. There would be a slight reduction in the amount of herbicide used near streams but would not be measurable.

More care would be taken to make sure herbicides are applied directly on the target species; however, when target species densities are high, the amount of chemical needed would be similar to broadcast treatments. See the fisheries and water quality reports.

Impacts Associated with Alternative D

Direct, Indirect and Cumulative Impacts: The alternative does not use aerial application methods on 675 acres. There would be little differences in the amount of chemical used when hand treatments are used. Herbicide moving off site by aerial drift would be reduced but immeasurable because Project Design Features already reduce the risk of drift reaching riparian areas. The majority of the sites receiving aerial treatments are small (See map in Appendix B); however, one is approximately 300 acres. Impacts to wildlife that continue to use the 300 acre site after treatments would not change. Hand treatments could break up the site into smaller treatment units, but would extend the amount of time animals are exposed to herbicide. Even with the animals being exposed to chemicals, 300 acres is a small part of their utilizable range which reduces the amount of time animals spend in the area. The site is also remote (this is why the site was proposed for aerial treatment) and not likely to be used for gathering or hunting.

3.12 Irreversible or Irretrievable Use of Resources

No irreversible or irretrievable uses of resources are associated with the Proposed Action of 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 through the implementation of Forest Plan Standards and Project Design Features disclosed in Section 2.3.3. Such effects would not be permanent.

The No Action Alternative is a continuation of the present invasive plant treatment program. To date while some locations have succeeded in controlling weeds, overall the presence and effect of weeds has spread. In time this could have irreversible/irretrievable effects on range resources, range ecology and the management of programs dependent on range.

3.13 Effects of Short-term uses and Maintenance of Long-term Productivity

Positive effects on site productivity would be expected as native vegetation is restored. Some herbicides have potential to reduce soil productivity; Project Design Features are intended to avoid use of such herbicides where soil productivity may be threatened.

3.14 Consistency with Forest Service Policies and Plans

The proposed project is consistent with all Forest Service policies and existing plans. The laws and policies applicable to this project are listed in Section 1.5 of this DEIS. Policy consistency includes following the Forest Plan (1990) as amended by PACFISH (1995) and the Regional Invasive Plant Program FEIS (2005). This latter document details regional policies applicable to all Forests from Forest Service Manual (FSM 2080) and past regional invasive plan program documents. These are discussed in Sections 2.3, 2.4 and 2.5 in the Regional FEIS (2005).

3.15 Conflicts with Other Plans

No conflicts with existing plans have been noted. A recent lawsuit Washington Toxics Coalition et al. v EPA, regarding the lack of Endangered Species Act consultation on use of certain herbicides, was resolved by requiring certain buffers near streams.

Herbicide use on federal land was exempt from the buffer zone requirement because such use already "implements safeguards routinely required" by the regulatory agencies.

3.16 Adverse Effects That Cannot Be Avoided

Most of the important issues are resolved through adherence to Project Design Features that minimize 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 the treatments
- Herbicide toxicity exceeding thresholds of concern are unlikely but possible given an herbicide spill
- Minor to moderate physical injuries due to forestry work are possible
- Local effects on some groups of soil micro-organisms that may be temporarily sensitive to certain herbicide chemicals.
- 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