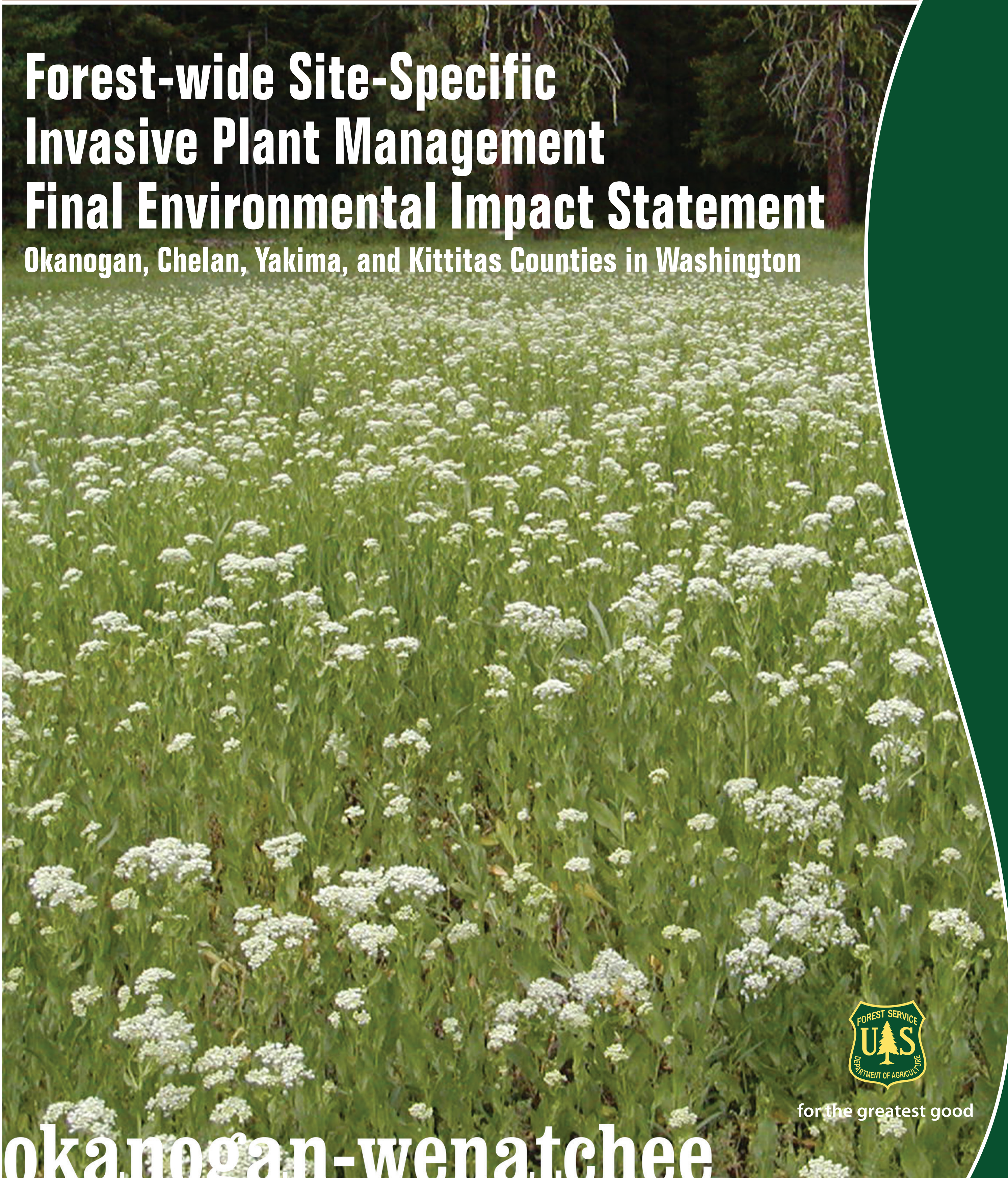
United States Department of Agriculture

Forest-wide Site-Specific Invasive Plant Management Final Environmental Impact Statement

Okanogan, Chelan, Yakima, and Kittitas Counties in Washington



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okanogan-wenatchee NATIONAL FOREST

August 2016

Cover photo: Field of whitetop.

Okanogan-Wenatchee National Forest
Forest-wide Site-Specific Invasive Plant Management
Final Environmental Impact Statement

Okanogan, Chelan, Yakima, and Kittitas Counties in Washington

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The FEIS can be viewed and downloaded from the internet at the website address:

http://www.fs.fed.us/nepa/nepa_project_exp.php?project=24104.

The FEIS is also available as an electronic copy on a CD or as a hard copy upon request.

Abstract: This Final Environmental Impact Statement (FEIS) discloses the effects of treating invasive plants on the Okanogan-Wenatchee National Forest (OKAWEN). Fifty invasive plant species have been mapped on 5,528 sites, covering 16, 281 acres within the OKAWEN. The Forest Service is responding to the need for additional treatment options, including herbicides, to effectively suppress, contain, control and/or eradicate these invasive plant infestations. In addition, there is a need to provide for a Forest-wide system for the early detection and rapid response (EDRR) to new invaders and new infestations. Finally, there is a need to amend the Forest Plans to allow use of a new herbicide (aminopyralid) that reduces risk and increases effectiveness of herbicide treatment. The purpose of the project is to cost-effectively treat invasive plants while minimizing the risks from treatment.

The Proposed Action (Alternative 2), which is the preferred alternative, would authorize and provide guidance for integrated, cost-effective invasive plant treatments for the next 15 years (or more, depending on results over time) on all 16,281 infested acres. Several treatment methods would be approved, including manual, mechanical, cultural, biological, and chemical. Alternative 2 includes EDRR and a Forest Plan amendment to add aminopyralid to the list of available herbicides.

The FEIS discusses two additional alternatives: Alternative 1 is the No Action alternative and Alternative 3 is the Reduced Herbicide Alternative. The No Action alternative would not initiate any new actions for treating invasive plants and a plan amendment would not be authorized. Under Alternative 3, herbicides would be restricted to larger or more aggressive infestations. EDRR, with reduced herbicide use, and a Forest Plan amendment to add aminopyralid to the list of available herbicides are included in Alternative 3.

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Final Environmental Statement Summary

Land managers for the Okanogan-Wenatchee National Forest propose to expand treatment options and expand the treatment area to the entire Forest to better suppress, contain, control, and eradicate invasive plants now and in the future**.** The purpose of the project is to cost-effectively treat invasive plants, while minimizing risks from treatment. Current treatment projects are expiring and are not necessarily consistent with current management direction, and do not provide an adequate range of tools to effectively control invasive plants, while minimizing treatment risks. There is a need to amend the Forest Plans to allow use of a new herbicide that reduces risk and increases effectiveness of herbicide treatment.

Currently, about 16,281 acres containing invasive plants have been mapped on the Forest. Despite our best efforts at prevention, these acres are subject to ongoing spread and without effective treatment, are likely to threaten or degrade valued botanical resources, wildlife and fish habitat, riparian conditions, and scenery. Currently, no Forest-wide mechanism exists to consistently and effectively address new infestations. Thus, there is a need to provide for a Forest-wide system for the early detection and rapid response (EDRR) for finding and treating new invaders and new infestations.

Scoping for this project began officially on August 13, 2009 when the Notice of Intent (NOI) to prepare an Environmental Impact Statement was published in the Federal Register Volume 74, No. 155 on pages 40809-40811. The Proposed Action was posted on the Forest website and a scoping letter, dated August 12, 2009, was sent to 798 individuals and organizations who responded to the original postcard inquiry.

We received 17 comment letters about the proposed action. We identified several public issues based on these scoping comments. The following sections disclose the significant issue that influenced alternative development and the effects analysis. Scoping input letters generally expressed concern about the risk to non-target vegetation, soil and water, fish and wildlife, and human health from herbicide use. Some people expressed concerned about the effectiveness of invasive plant treatments.

We circulated a Draft EIS for comment in April 2016. We received 15 letters containing about 120 comments regarding the project and its impacts. The greatest number of comments expressed opposition to the use of herbicides, specifically glyphosate. However, several comments expressed support for the project. See Appendix F for the comments and our specific responses.

In response to the comments, we prepared a newsletter addressing common questions and concerns and sent it to those who commented on the DEIS. We also met with some people from the Carlton community to hear their concerns. The Forest Service agreed to keep them informed about upcoming treatments and coordinate volunteer efforts in the Libby Creek watershed to help minimize herbicide use there.

We made a few changes to the Final EIS in response to the comment. We added some information about monitoring; clarified the way the annual cap was developed and used in the analysis; and adjusted the prescription on 2.3 acres of knotweed to avoid use of glyphosate as a first choice herbicide.

The EIS contains analysis pertinent to the following issues: Herbicide use and toxicity; treatment effectiveness and financial efficiency; jobs; and scenic quality. The EIS also contains analysis pertinent to meeting laws, regulations, policies and plans that guide invasive plant treatment within the project area.

Three alternatives are discussed in detail in the EIS. Alternative 1 is the No Action alternative. Under No Action, no new invasive plant treatments would be authorized. The purpose and need for action would not be meet. Some of the currently infested areas would continue to be treated under existing decisions, however these would expire over time.

Alternative 2 is the Proposed Action. It would approve the use of appropriate herbicides and other methods throughout the Forest for the next fifteen years or longer. The Proposed Action includes a broad range of methods intended to cost-effectively treat invasive plant species found on the Forest. Alternative 3 includes the same treatment methods; herbicides would generally not be used where on infested sites smaller than one acre (with some exceptions for rhizomatous species or dense infestations where manual treatment would have unacceptable impacts), see details in Chapter 2.2.2). The use of biocontrols would be favored where effective for larger sites. The intent of Alternative 3 is to address issues related to herbicide toxicity and job creation. Under this criteria, herbicide would be used on about 30 percent of the currently infested area (about 4,946 acres). Other methods would be approved on the remaining acres, however the costs may be prohibitive to control invasive plants on some sites.

The following summary tables compare the design of the alternatives.

Alternative Element	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3
Invasive Plant Treatment Methods	No new actions; Forest would complete current projects including about 6,000 acres of integrated projects. All treatment methods are included: manual, mechanical, biological, cultural, chemical. Limited suite of herbicides are currently approved.	All treatment methods would be included: manual, mechanical, biological, cultural, chemical. Herbicide use would be allowed in most situations as part of an integrated prescription on 15,602 acres. Currently, about 679 acres would likely be treated using non-herbicide methods; otherwise, herbicide may be used in combination with other treatment methods.	All treatment methods. About 4,946 acres would include herbicide use. 10,785 acres of current infestations would not meet include herbicide use; these areas would be treated using non-herbicide methods.
Annual Treatment Cap	None	16,281 acres	16,281 acres
Early Detection Rapid Response	No	Yes, future infestations treated according to PDFs	Yes, future infestations treated according to PDFs, herbicide use restricted to criteria
Forest Plan Amendment to Add Aminopyralid to List of Approved Herbicide Ingredients	No	Yes	Yes
How Well Does the Alternative Meet the Need for Action (throughout Chapter 3)	Not at all. Most existing infestations (about 10,000 acres) would not be treated and would continue to spread. Continued and increasing risk to native plant communities, aquatic and riparian areas, and wildlife habitats from invasive plants. This would degrade scenic and recreation values, reduce grazing land condition, and threaten neighboring lands. Would not meet management direction for invasive plants.	Best of the alternatives. Cost-effective treatment methods would be available for all infestations. Alternative 2 has the best chance of abating risk to native plant communities, aquatic and riparian areas, and wildlife habitats from invasive plants and maintain scenic and recreation values and grazing land condition. Risk of invasive plants spreading to neighboring lands would be reduced. Best meets management direction for invasive plants.	Fair to poor. Some infestations would be effectively treated, but the increased treatment cost under this alternative would reduce the number of acres treated under a limited budget. Some infestations would not be treated and would continue to spread. Would meet management direction for invasive plants; however limitations on funding would mean that the program would not likely keep up with objectives.

The following table compares the alternatives in terms of response to the public issues identified from scoping and shows where in the EIS more information on this topic is available.

Issue ID	Element/Indicator (where in EIS to find more information on this topic)	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3
1A	Exposure scenarios that result in hazard quotient values greater than 1 for worker and public health (Chapter 3.9.4)	None, limited use of triclopyr	HQ > 1 for public based on consumption of vegetation contaminated with triclopyr. This is very unlikely to occur, triclopyr is the first choice herbicide for about 90 acres of scotch broom, scattered across 30 sites. People are unlikely to consume contaminated scotch broom.	Same as Alternative 2
1A	Measures to reduce public and worker exposure to herbicides (Chapter 2.2.2)	Existing herbicide use follows applicable laws, policies and plans; limited herbicide use, older chemistry	Limited herbicide use rates; herbicide use buffers near streams, wells and springs; and public notification. Use of aminopyralid poses very low risk, comparable or less relative risk to human health when compared to herbicides used under No Action	Same as Alternative 2, less use of herbicides overall (about one-third of infestations meet criteria).
1A	Human Health Risk Ranking (Chapter 3.9.4)	Very Low Risk – low acreage treated using herbicides and no additional herbicide use	Low Risk – risk abated by project design, adherence to policy, Forest Plan standards	Very Low Risk – low acreage treated using herbicides and risk would be further abated by project design, adherence to policy, Forest Plan standards.
1B	Extent of herbicide use associated with hazard quotient values greater than 1 for Wildlife (Chapter 3.7.4) (Table 2.3) .	HQ > 1 for plausible exposure scenarios for birds and mammals exposed to triclopyr and glyphosate. Limited use of herbicides on small, scattered sites over 6,000 acres.	HQ > 1 for plausible exposure scenarios for birds and mammals exposed to triclopyr and glyphosate. Triclopyr is the first choice herbicide for about 90 acres of scotch broom, scattered across 30 sites. This small amount of selective treatment (no broadcast) is unlikely to result in adverse wildlife exposure. Glyphosate is not the first choice for any acres, and any future use is unlikely to result in adverse wildlife exposure.	Same as Alternative 2, criteria to reduce potential herbicide use by only using herbicide on larger infestations and specific target species.
1B	Measures to reduce wildlife exposure to herbicides (Chapter 2.2.2)	Existing herbicide use follows applicable laws, policies and plans; limited herbicide use, older chemistry	Project design features for riparian protection (ARBO II); limited herbicide use rates; managing chemical persistence in the soil; maintaining refugia in lake and wetland habitats; herbicide use buffers near streams, wells and springs; protection of non-target plants; minimizing disturbance to wildlife	Same as Alternative 2, criteria to reduce potential herbicide use by only using herbicide on larger infestations and specific target species.

Issue ID	Element/Indicator (where in EIS to find more information on this topic)	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3
1B	Wildlife Risk Ranking (Chapter 3.7.4)	Very Low Risk, Lowest Benefit (low acreage treated, highest potential for spread)	Low Risk, Greatest Benefit (PDFs protect wildlife, most cost-effective treatment)	Low Risk, Moderate to Low Benefit (PDFs protect wildlife, less cost-effective treatment)
1B	Effects on special status species (Chapter 3.7.5)	No new effects, no new consultation	This project may affect (but is not likely to adversely affect) the following federally listed species: wolf, lynx, bear, owl and murrelet. This project may impact (but not jeopardize viability of) several special status invertebrate species.	Same as Alternative 2
1C	Measures to reduce risk to non-target plants (Chapter 2.2.2)	All existing projects include measures to protect non-target plant species.	Project Design Features I-2 and I-3 protect non-target plants, particularly species of botanical concern.	Same as Alternative 2
1C	Botanical Resource Risk Ranking (Chapter 3.2.4) (Chapter 3.3.4)	Risk to native plants and plant communities greater from invasive plants than treatment, thus no action with least effective treatment poses greatest risk to botanical resources.	Greatest potential benefit to native plants and plant communities via effective treatment of invasive plants. Low risk of harm from treatment methods.	Moderate potential benefit to native plants and plant communities where treatments are effective; however less than Alternative 2 because it is less likely to be cost-effective and fewer acres would be treated assuming a limited budget.
1D	Measures to prevent herbicides from building up in soil (Chapter 2.2.2)	No issues with herbicide build up in soil observed as a result of implementing existing treatments.	PDF's provide guidance on treatment frequency to reduce potential for herbicide to build up in soil.	Same as Alternative 2, less herbicide use overall
1D	Relative risk to soils biology (Chapter 3.5.4)	No impact to soil biology observed as a result of implementing existing treatments.	Low risk to soil biology due to methods and herbicide ingredients approved and PDFs; likely no impact.	Same as Alternative 2
1D, E	Measures to prevent herbicide from entering water and affecting beneficial uses and aquatic organisms (Chapter 2.2.2)	Herbicide use buffers are associated with treatment of existing infestations	Alternative incorporates herbicide use buffers and other design features associated with ARBO II, limiting broadcast and use of herbicides posing higher risk to the riparian/aquatic environment near streams. In addition, PDFs protect wetlands, lakes, ponds springs and wells.	Same as Alternative 2, less herbicide use in riparian and other areas

Issue ID	Element/Indicator (where in EIS to find more information on this topic)	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3
1D	Relative risk to beneficial uses of water (Chapter 3.6.4)	Current treatments have not resulted in adverse effects to beneficial uses.	Low to no risk to beneficial uses; drinking water, aesthetic value and fisheries protected	Same as Alternative 2, less herbicide use in riparian and other areas
1E	Relative Risk to Fish (Chapter 3.7.4)	Glyphosate, picloram and triclopyr are all associated with greater risk to fish. These herbicides are approved in current NEPA documents. Current treatments have not resulted in adverse effects to fish or the aquatic environment. Completing current projects is unlikely to adversely affect the aquatic environment.	Low to no risk to the aquatic environment. Following ARBO II terms and conditions would minimize risk of adverse effects to fish. Glyphosate, picloram and triclopyr are all associated with greater risk to fish. These would be used less frequently compared to other herbicides. Invasive plant treatments within the range of federally listed fish species fall under a class of actions that may affect and are likely to adversely affect the listed species (LAA). The ARBO II covers expected take and all activities in this project would be conducted consistent with ARBO II terms and conditions. Effects to critical habitat of listed fish species is expected to be negligible.	Same as Alternative 2, less herbicide use in riparian and other areas
2A	Known Acres that may not be effectively treated given limitations on herbicide use or NEPA coverage (Chapter 3.2.4)	16,281	679	10,785
2A	Known Acres where All Tools are Available	6,000	15,602	4,946
2A, B	Acres Remaining after Five Years with Unlimited Funding (Chapter 3.2.4) (Chapter 3.12.4)	12,960	27	337 Please note that this alternative costs over 3 times as much as Alternative 2. Assuming current funding levels, this alternative would take 20 years to accomplish.

Issue ID	Element/Indicator (where in EIS to find more information on this topic)	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3
2A, B	Years to Meet Treatment Objectives (Known Sites) Assuming Current Funding (Chapter 3.2.4) (Chapter 3.12.4)	Treatment objectives would not be met on the majority of known sites.	Given current budgets, the Proposed Action would take at least 6 years or longer to achieve all goals. The initial years of implementation, only a portion of the existing infestations would likely be treated, especially if treatment of new infestations takes priority. However, over the life of the project, the objectives for invasive plant treatment could be met.	Given current budgets, Alternative 3 could take 20 years or longer to achieve treatment objectives. Without additional funding, the objectives for invasive plant treatment would not likely be met over the life of the project. The project effectiveness would be commensurate with no action if treatments are not affordable.
2B	Estimated cost of fully treating existing infestations assuming unlimited funding (Chapter 3.2.4) (Chapter 3.12.4)	$1,199,900 for 6,000 acres covered under current NEPA. 10,281acres would be left untreated.	$2,055,500 for all 16,281 acres	$7,115,400 for all 16,281 acres
2B	Estimated Average Cost Per Fully Treated Acre (includes re-treatment) (Chapter 3.2.4) (Chapter 3.12.4)	$200	$126	$437
3	Number of seasonal jobs to treat all acres in a single year (unlimited funding) (3.12.4)	14	39	86
4	Ranking of alternatives relative to scenic value (3.11.4)	Short term, least browning of target plants visible along roads and in special areas. Long term, most risk of degradation of scenic quality from spread of invasives.	Short term, most likely to result in browned target plants visible along roads and in special areas. Long term, best chance of restoration of native vegetation and maintenance of scenic quality.	Similar to Alternative 1 under a limited budget, Similar to Alternative 2 under an unlimited budget.

CHAPTER I: Purpose of and Need for Action

1.1 Introduction

Land managers for the Okanogan-Wenatchee National Forest propose to expand treatment options and expand the treatment area to the entire Forest to better suppress, contain, control, and eradicate invasive plants now and in the future. Invasive plants are defined here as “non-native plants whose introduction does or is likely to cause economic or environmental harm or harm to human health” (Executive Order 13112). Invasive plants are distinguished from other non-native plants by their ability to spread (invade) into native ecosystems.

This Final Environmental Impact Statement (FEIS) is organized into four chapters:

- *Chapter 1. Purpose and Need for Action*: The chapter includes information on the background, purpose of and need for the project and the proposed action. This section also details how the Forest Service informed the public and other agencies of the proposal and the issues identified through public scoping.
- *Chapter 2. Alternatives, including the Proposed Action*: This chapter provides a more detailed description of the agency’s refined proposed action as well as alternative methods for meeting the need for action. These alternatives were developed based on issues raised by the public and other agencies and have embedded project design features that mitigate impacts of the proposal. This chapter also provides a summary table of how each alternative meets the purpose and need and addresses the issues.
- *Chapter 3. Affected Environment and Environmental Consequences*: This chapter describes the existing resource conditions, including those that are at risk from invasive plants on the Okanogan-Wenatchee National Forest. It also details the environmental effects of implementing the refined Proposed Action and other alternatives.
- *Chapter 4. Consultation and Coordination*: This chapter provides a list of preparers and agencies and people consulted during the development of the environmental impact statement.

This FEIS summarizes and incorporates by reference specialist input and analysis completed for botany, soils, hydrology, fisheries, wildlife, range, recreation and scenery and heritage resources, as well as for socio-economic effects and effects to human health. The analysis files contain records of interagency and public correspondence, including documents related to Section 7 Endangered Species Act Consultation with National Marine Fisheries Service (NMFS or NOAA Fisheries) and the United States Fish and Wildlife Service (USFWS or FWS).

This FEIS is tiered to the broader scale Pacific Northwest Region Invasive Plant Program Final Environmental Impact Statement (USDA 2005a, referred to herein as the R6 PNW FEIS). Agencies are encouraged to tier their environmental impact statements to eliminate repetitive discussions of the same issues and to focus on the actual issues ripe for decision at each level of environmental review (36 CFR 1508.28). This “subsequent statement” need only summarize issues discussed from the R6 PNW FEIS and incorporate discussions from it by reference, then concentrate on site-specific issues. The R6 PNW FEIS incorporated the best available scientific information from herbicide risk assessments and other reliable scientific sources.

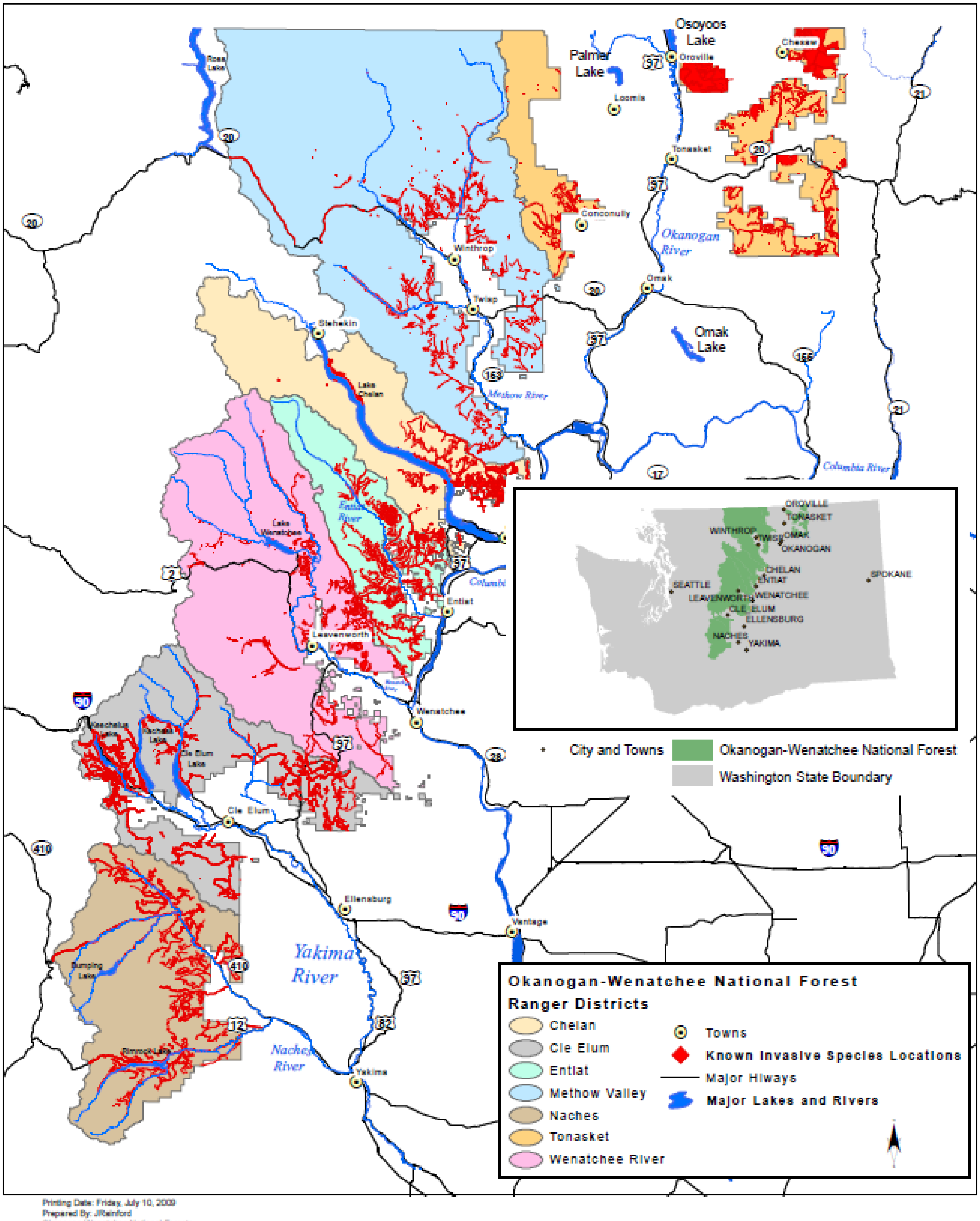
The R6 PNW Record of Decision (R6 PNW ROD, 2005b) amended the both the Okanogan and Wenatchee National Forest Land and Resource Management Plans by adding management direction for] invasive plant prevention, treatment, restoration of treated sites, and inventory and monitoring. This project would authorize treatments on the ground that comply with the 2005 management direction and current agency policy.

In 2005, invasive plants were thought to spread at an average rate of 8 to12 percent per year; and, with the emphasis on prevention required by the R6 PNW ROD, spread would be reduced to about 6 percent per year (R6 PNW FEIS, Chapter 4.22). The applicable standards and guidelines from higher order plans that relate to the need for this project are summarized in the Purpose and Need (Chapter 1.4) below.

1.2 Project Area

The project area includes the entire 4.1 million acre Okanogan-Wenatchee National Forest (see Vicinity Map) within Okanogan, Chelan, Kittitas and Yakima Counties and a small portion of Skagit County. The Forest provides for a large diversity of plant communities and habitats. Okanogan-Wenatchee National Forest lands west of the Cascade crest are included in the project area including the area along Highway 20 west of the Cascade crest and east of Ross Lake that is administered by the Okanogan-Wenatchee National Forest and located in Skagit County. In addition, this FEIS also includes acreage east of the Cascade crest within Yakima County that are administered by the Mount-Baker Snoqualmie National Forest.

Vicinity Map – Okanogan-Wenatchee National Forests Known Invasive Species Locations



1.3 Laws, Regulations, Policies and Plans

Invasive plant treatment is subject to many environmental regulations. This project follows the National Forest Management Act (NFMA), and the National Environmental Policy Act (NEPA), and it's Council on Environmental Quality implementing regulations. Executive Order 13112 (1999) directed federal agencies to reduce the spread of invasive plants. Prevention, early detection and rapid response, invasive plant control measures, restoration and organizational collaboration are all addressed in the Forest Service 2900 Invasive Species Management Manual. Forest Service Manual (FSM 2150) and Forest Service Handbook (FSH 2109) provide direction on safe use of pesticides, including direction on storage and transport, and development of safety plans and emergency spill plans.

The R6 PNW ROD provided desired future condition, goals, objectives, standards and a monitoring framework that are now integrated into the Okanogan-Wenatchee National Forest Land and Resource Management Plans (Forest Plans).

The project is planned to be consistent with all applicable Federal, State and local laws, regulations and agreements, including (but not limited to):

- **The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and the Cooperative Forestry Assistance Act.** The Forest Service is authorized by FIFRA and the Cooperative Forestry Assistance Act to use pesticides for multiple-use resource management and maintenance of the quality of the environment as long as the actions comply with the National Environmental Policy Act and the Council on Environmental Quality regulations. Forest Service Manual (FSM 2150) and Forest Service Handbook (FSH 2109) provide direction on safe use of pesticides, including direction on storage and transport, and development of safety plans and emergency spill plans.
- **Wild and Scenic Rivers Act.** Treatment of invasive plants is consistent with preservation of the scenery and natural character of a Wild and Scenic river.
- **Wilderness Act.** Invasive plant treatment within wilderness would preserve wilderness character. Treatments using mechanized equipment and broadcast herbicide spraying are not proposed in wilderness.
- **Roadless Rule.** Invasive plants are currently mapped primarily along roads. The proposed treatments would be consistent with roadless area management direction.
- **Endangered Species Act.** The Forest Service is consulting with the US Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS) to ensure that the proposed invasive plant treatments would not jeopardize the continued existence of federally listed species (or species proposed or considered candidates for listing).
- **Clean Water Act.** A Clean Water Act National Pollution Discharge Elimination System (NPDES) permit is required for herbicide use that may directly enter streams. Treatment along stream banks or for target plants that emerge from or overhang water bodies likely would require a permit. Clean Water Act compliance includes use of Best Management Practices (BMPs). Specific BMPs are required for chemical use on National Forests (National BMP Technical Guide - USDA Forest Service 2012). The Project Design Features (PDFs) in Chapter 2.3.2 integrate the national BMPs. Core objectives for chemical uses on National Forests are provided in the technical guide. These include:
    - Use the planning process to develop measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from chemical use on NFS lands.

- Avoid or minimize the risk of soil and surface water or groundwater contamination by complying with all label instructions and restrictions required for legal use.
- Avoid or minimize the risk of chemical delivery to surface water or groundwater when treating areas near water bodies.

- **The Migratory Bird Treaty Act (MBTA)/Landbird Conservation Plan (Presidential Executive Order 13186, and FS/FWS MOU, Jan. 2001).** This act requires federal agencies to assess project actions that may affect avian species covered by these doctrines and their habitats. The MBTA outlines responsibilities of federal land management agencies relative to landbird conservation, and the MOU provides interim direction on implementation of the MBTA. The Forest Service will collaborate with the U.S. Fish and Wildlife Service, as needed, if project actions produce measurable impacts to avian resources.
- **Grizzly Bear Recovery Memorandum of Understanding (MOU).** A MOU between Forest Service and U.S. Fish and Wildlife Service stipulates that there is to be no net loss of core grizzly bear habitat (1997).
- **National Bald Eagle Management Guidelines (U.S Fish and Wildlife Service).** Even though bald eagles are delisted, they are still protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. These Acts require some measures to prevent bald eagle or golden eagle "take" resulting from human activities.
- **Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1801 et seq.), as amended by the Sustainable Fisheries Act of 1996, and its implementing regulations (50 CFR Part 600).** The Magnuson-Stevens Fishery Conservation and Management Act as amended by the Sustainable Fisheries Act of 1996, requires Federal action agencies to consult with the Secretary of Commerce (via the NMFS) regarding certain actions. Consultation is required for any action or proposed action authorized, funded, or undertaken by the agency that may adversely affect essential fish habitat (EFH) for species managed in Federal Fishery Management Plans. The Pacific Coast Salmon Plan applies to Chinook, coho, and sockeye salmon. EFH regulations, 50 CFR section 600.920(a)(1), enable Federal agencies to use existing consultation and environmental review procedures to satisfy EFH consultation requirements.
- **The Antiquities Act of 1906.** The Antiquities Act (P.L. 59-209, 16 U.S.C. 431-433) authorizes a permit system for investigation of archaeological sites on federal lands and allows the President to establish national monuments on federal lands in order to protect them.
- **Historic Sites Act of 1935 (16 USC 461).** The Historic Sites Act declares national policy to preserve for public use historic sites, buildings, and objects of national significance for the inspiration and benefit of the people of the United States.
- **The National Historic Preservation Act of 1966, as amended (NHPA).** The NHPA (P.L. 102-575; 16 U.S.C. 470) extends the policy of the Historic Sites Act to state and local historic sites as well as those of national significance. The Okanagan Wenatchee National Forest fulfills its responsibilities under the NHPA through a programmatic agreement (USDA Forest Service 1997) regarding cultural resources management on National Forests in the state of Washington, developed in consultation with the Advisory Council on Historic Preservation (ACHP) and the State Historic Preservation Office (SHPO), pursuant to Section 800.13 of the regulations (36 CFR 800 [1986]).
- **Native American Policies.** The Forest Service's Native American polices are described in Forest Service Manual 1563 and Forest Service Publication FS-446 and FS-600. These policies include maintaining a governmental relationship with federally-recognized tribal governments,

implementing programs and activities in a way that honors Indian treaty rights and fulfills legally-mandated trust responsibilities to the extent that they apply to National Forest system lands. Additional policies are described in Chapter 3.11.

- Recently, the Forest Service published a National Strategic Framework for Invasive Species Management (FS-1017, August 2013). The framework is intended to increase the effectiveness of Forest Service invasive species management and improve the health and productivity of forests and grasslands. The framework acknowledges that invasive species are among the most important environmental and economic threats facing public lands. The framework notes that estimated economic damage from invasive species has totaled more than $1.4 trillion worldwide, about 5 percent of the world's economy. Early detection and rapid response to new detections, effective control of invasive species, and restoration of treated sites are important objectives of the framework.

1.4 Purpose and Need for Action

The Okanogan-Wenatchee National Forest needs to expand treatment options and expand the treatment area to the entire National Forest to effectively suppress, contain, control and/or eradicate invasive plant species.[1] The purpose of the project is to cost-effectively treat invasive plants, while minimizing risks from treatment.

Current treatment projects are expiring and are not necessarily consistent with current management direction, and do not provide an adequate range of tools to effectively control invasive plants, while minimizing treatment risks. There is a need to amend the Forest Plans to allow use of a new herbicide that reduces risk and increases effectiveness of herbicide treatment.

In addition, there is a need to provide for a Forest-wide system for the early detection and rapid response (EDRR) for finding and treating new invaders and new infestations. There is currently no Forest-wide mechanism to effectively address new infestations.

Invasive plant treatment is intended to help meet the following Desired Future Condition (2005 R6 PNW ROD):

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

Currently, invasive plants on the Forest are displacing native plants, reducing forage and habitat for wildlife and livestock, threatening native plant communities; contributing to increased soil erosion and reduced water quality; altering the physical and biological properties of soil, affecting the intensity and frequency of fires, and degrading the quality of recreational experiences.

Fifty different invasive plant species are known to occur within the boundaries of the Okanogan-Wenatchee National Forest. Existing infestations vary in size and extent across the Forest; some

[1] Eradication" means that invasive plants are completely removed from a site. "Control" means that invasive plants have been reduced to low levels on a site. "Containment" means that an invasive plant treatment site is not growing larger. "Suppress" means that seed production has been thwarted so that even if acres are not changing, the target population will not become more dense or larger.

infestations occupy small areas of less than an acre while others involve hundreds of acres. Currently, 5,528 invasive plant sites have been mapped, covering 16,281 acres (or 0.4% of the total Forest acres). The target species of greatest concern include (in no particular order): Dalmatian toadflax, common crupina, yellow starthistle, whitetop, St. John's wort, Japanese and Bohemian knotweed, hawkweeds, houndstongue, hoary alyssum and spotted and diffuse knapweed. A full listing of invasive plant species mapped on the Okanogan-Wenatchee National Forest can be found in Chapter 3.2, Invasive Plant Management and Treatment Effectiveness.

Additional infestations have likely not yet been discovered, and these, as well as known sites, will continue to expand and spread every year without effective treatment. New infestations can be discovered at any time; new infestations are high priority for treatment. R6 PNW ROD Standard 16 lists 10 herbicides approved for use on the Forest (see 1.7 below). Standard 16 also allows consideration of new herbicides as needed to meet program goals.

On the Forest, there is a need to consider use of aminopyralid to better meet R6 PNW ROD Goal 3 to protect the health of people (and to)…..identify, avoid, or mitigate potential human health effects from invasive plants and treatment, and Goal 4 to implement invasive plant treatment strategies that protect sensitive ecosystem components….while minimizing adverse effects from treatment projects. An Herbicide Risk Assessment was prepared by an independent contractor "Syracuse Environmental Research Associates, Inc." (SERA). The Risk Assessment for aminopyralid (SERA 2007) indicates that use of this herbicide would reduce risks associated with some of the other herbicides approved in the R6 PNW ROD.

1.5 Proposed Action in Brief

The Proposed Action (also referred to as Alternative 2) would provide authority and guidance for integrated, cost-effective invasive plant treatments on national forest system lands on the Okanagan Wenatchee National Forest for the next 15 years (or more, depending on results over time). Several treatment methods would be approved, including manual, mechanical, cultural, biological, and chemical. The treatments would follow Project Design Features (PDFs) that limit the potential for adverse effects on non-target vegetation, soils, water quality, fish and wildlife, recreation opportunities and human health. The design features limit the amount of land that may be treated with herbicides annually and over the life of the project.

The Proposed Action would also amend the Forest Plans, specifically to allow for use of the herbicide aminopyralid (this herbicide was not available in 2005 when the R6 PNW ROD was signed; Standard 16 (see Chapter 1.7 below) allows for authorizing use of new herbicides with appropriate risk assessment and analysis as is proposed.

1.6 Decision Framework

The focus of this project-level EIS is on the treatment of invasive plants, including post-treatment restoration. The Responsible Official for this proposal is the Forest Supervisor of Okanogan-Wenatchee National Forest, who will decide, in a Record of Decision for this EIS:

- Which alternative will most effectively treat invasive species at reasonable costs and with minimal risk?
- Would the Invasive Plant Project be implemented as proposed, as modified by an alternative, or not at all?

- Would the Forest Plans be amended?
- What project design features and monitoring would be required to implement the project?

The Responsible Official will base the decision on review of the environmental impact statement and the following factors: 1) How well the alternative meets the need for action; 2) How each alternative responded to the issues raised during scoping; and 3) The cost-effectiveness of the alternatives.

1.7 Invasive Plant Treatment Standards and Guidelines

R6 PNW ROD standards and guidelines relevant to the use of herbicides in this project are as follows:

#15: Application of any herbicides to treat invasive plants will be performed or directly supervised by a State or Federally licensed applicator. All treatment projects that involve the use of herbicides will develop and implement herbicide transportation and handling safety plans.

#16: Select from herbicide formulations containing one or more of the following 10 active ingredients: chlorsulfuron, clopyralid, glyphosate, imazapic, imazapyr, metsulfuron methyl, picloram, sethoxydim, sulfometuron methyl, and triclopyr. Mixtures of herbicide formulations containing 3 or less of these active ingredients may be applied where the sum of all individual Hazard Quotients for the relevant application scenarios is less than 1.0. All herbicide application methods are allowed including wicking, wiping, injection, spot, broadcast and aerial, as permitted by the product label. Chlorsulfuron, metsulfuron methyl, and sulfometuron methyl will not be applied aerially. The use of triclopyr is limited to selective application techniques only (e.g., spot spraying, wiping, basal bark, cut stump, injection). Additional herbicides and herbicide mixtures may be added in the future at either the Forest Plan or project level through appropriate risk analysis and NEPA/ESA procedures.

#17: When herbicide treatments are chosen over other treatment methods, document the rationale for choosing herbicides.

#18: Use only adjuvants (e.g. surfactants, dyes) and inert ingredients reviewed in Forest Service hazard and risk assessment documents such as SERA, 1997a, 1997b; Bakke, 2003.

#19: To minimize or eliminate direct or indirect negative effects to non-target plants, terrestrial animals, water quality and aquatic biota (including amphibians) from the application of herbicide, use site-specific soil characteristics, proximity to surface water and local water table depth to determine herbicide formulation, size of buffers needed, if any, and application method and timing. Consider herbicides registered for aquatic use where herbicide is likely to be delivered to surface waters.

#20: Design invasive plant treatments to minimize or eliminate adverse effects to species and critical habitats proposed and/or listed under the Endangered Species Act. This may involve surveying for listed or proposed plants prior to implementing actions within un-surveyed habitat if the action has a reasonable potential to adversely affect the plant species. Use site-specific project design (e.g. application rate and method, timing, wind speed and direction, nozzle type and size, buffers, etc.) to mitigate the potential for adverse disturbance and/or contaminant exposure.

#23: Prior to implementation of herbicide treatment projects, National Forest system staff will ensure timely public notification. Sign treatment areas to inform the public, and forest workers of herbicide application dates and herbicides used. If requested, individuals will be notified in advance of spray dates.

Additional Forest Plan guidance for invasive plants includes:

- Okanogan Forest-wide standard and guidelines 12-1 to 12-3 require that noxious weeds be controlled to the extent practical with first priority for eradication be given to new infestations, and emphasis be given to prevention, particularly in unroaded and wilderness areas (p. 4-45). In wilderness, noxious weeds may be controlled when they threaten lands outside wilderness or are spreading within wilderness as long as control is possible without causing serious adverse impacts to wilderness values (MA 15A-12A p. 4-89 and MA15B-12A, p. 4-96).

- Wenatchee Forest-wide standards and guidelines require that the Forest cooperate with state, county and local agencies to identify, locate, and prevent spread of noxious weeds. Action plans are required to inventory and monitor weed populations, and weeds are to be suppressed, contained, controlled or eradicated as budget allows, prioritized by Class A, B, C and Class B designate noxious weeds. Wenatchee Forest Plan (p. IV-89).

1.8 Tribal Consultation and Scoping

The National Environmental Policy Act (NEPA) process and the associated Forest Service implementation regulations (36 CFR 220) provide for an open public involvement process. The NEPA phase of a proposal begins with public and agency scoping. "Scoping" is the term used to describe how the Forest Service collects public input. Through scoping, the public is notified of, and asked to comment on a proposed action. Comments provided by other agencies and members of the public help to identify issues that may modify the proposed action, identify additional alternatives, and/or identify resource concerns to consider in the analysis or project design.

The scoping record (available on file) includes government-to-government consultation with American Indian tribes. Prior to the initiation of public scoping, government-to-government consultation letters were sent to the Yakama Nation and Confederated Tribes of the Colville Reservation on August 10, 2009. Neither government raised any concerns relating to the project.

The scoping record also contains records of our discussions with other agencies, and documents ongoing opportunities for public input. Approximately 1,700 postpaid postcards were mailed out asking if the recipient wished to be included on the e-mail or hard copy mailing list for the project. Approximately 800 people responded and indicated an interest in the project. This project has first published in the quarterly "Schedule of Proposed Actions" for the Okanogan-Wenatchee National Forest (April, May, and June 2008) edition, and has appeared in each successive edition up to the present.

Scoping began officially on August 13, 2009 when the Notice of Intent (NOI) to prepare an Environmental Impact Statement was published in the Federal Register Volume 74, No. 155 on pages 40809-40811. The Proposed Action was posted on the Forest website and a scoping letter, dated August 12, 2009, was sent to 798 individuals and organizations who responded to the original postcard inquiry.

We received 17 comment letters about the proposed action. We identified several public issues based on these scoping comments. The following sections disclose the significant issue that influenced alternative development and the effects analysis.

Scoping input letters generally expressed concern about the risk to non-target vegetation, soil and water, fish and wildlife, and human health from herbicide use. Some parties expressed concerned about the effectiveness of invasive plant treatments. These issues are addressed by adherence to the standards in the R6 PNW ROD and other Forest Plan management direction and discussed in the Chapter 3 effects analysis. We also developed alternatives to help further resolve these issues (see Chapter 2 for details about the alternatives).

1.8.1 Herbicide Use and Toxicity

Issues related to herbicide toxicity influenced the development of an alternative that reduces potential exposure from herbicide use to people and the environment. The Forest Service has addressed concerns about herbicide toxicity by limiting the herbicide application rate, the method of application, the herbicide formulation selected for use, and annual the extent of herbicide use. However, herbicide toxicity and risk to people and the environment remains an issue of high public interest. The No Action alternative would not authorize any new use of herbicides within the project area beyond what is covered in existing projects. The Proposed Action (Alternative 2) would authorize use of herbicides to increase cost-effectiveness of treatment while minimizing risks to people and the environment, in compliance with the R6 2005 ROD. Alternative 3 would authorize some herbicide use, however there would be much less than in the Proposed Action.

Issue Statement 1A: Herbicide exposure can adversely affect human health.

Some scoping input expressed that herbicide testing has not identified all conceivable risks, and herbicides should be used cautiously. Testing has not been done for long-term impacts, bioaccumulation, interactions between herbicides, or for use in the physical conditions within the project area. The R6 PNW ROD and this project level EIS discuss uncertainties related to herbicides. The threshold of concern has been set at a very low level and risks are minimized through project design features. This EIS relies on scientific herbicide risk assessments prepared by a third party toxicologist. Project design features are proposed to ensure that workers and the public are not exposed to chemicals used in this project, but social acceptance may remain an issue.

Issue Indicators:

- Total maximum acres of herbicide use annually
- Exposure scenarios that result in hazard quotient values greater than 1 for worker and public health
- Measures to reduce exposure to herbicides
- Qualitative risk ranking (human health)

Issue Statement 1B: Herbicide exposure can adversely affect wildlife and their habitats.

Herbicide exposure may adversely affect wildlife, including sub-lethal effects such as weight loss or reduced breeding. Herbicides can affect animals throughout the food chain, including pollinators, macroinvertebrates, and sensitive wildlife species. Herbicides can remove or reduce the quality of wildlife habitat.

Issue Indicators:

- Extent of herbicide use associated with hazard quotient values greater than 1 for Wildlife
- Measures to reduce exposure to herbicides
- Qualitative risk ranking (wildlife)
- Effects on special status species

Issue Statement 1C: Herbicides can kill non-target plants, including sensitive plants and plants with cultural significance.

Herbicides may kill some non-target plants via overspray, drift, run-off or mistaken identity.

Issue Indicators:

- Total maximum acres of herbicide use annually
- Measures to reduce risk to non-target plants
- Botanical Risk Ranking

Issue Statement 1D: Herbicides can persist in soil and cause harm to soil biology. Herbicides can be transported through soil to ground and surface water.

The fate of herbicides in the environment is influenced by soil characteristics and the amount of precipitation expected soon after treatment. Project design features are proposed to ensure that 1) soil biology is not adversely affected; 2) persistence of herbicides in the soil is managed; and 3) water quality and beneficial uses of water are protected.

Issue Indicators:

- Measures to prevent herbicides from building up in soil
- Relative risk to soils biology
- Measures to prevent herbicide from entering water and affecting beneficial uses
- Relative risk to beneficial uses of water

Issue Statement 1E: Herbicides may adversely affect aquatic ecosystems and aquatic organisms.

Herbicides may enter streams and other water bodies and adversely affect fish and other aquatic organisms. Aquatic plants and other elements of the aquatic ecosystem and food chain may be harmed.

Issue Indicators:

- Measures to prevent herbicides from entering surface water
- Relative risk of herbicides to fish

1.8.2 Treatment Effectiveness and Financial Efficiency

Some people expressed concern that the limitations imposed on herbicide use based on responding to toxicity issues may reduce potential effectiveness and increase costs. Treatment effectiveness is directly correlated with the range of tools available for use. The more herbicides and herbicide families available for any given infestation, the more likely an effective option exists. If herbicide options are too limited, target plants that are resistant to certain herbicides may not be effectively controlled or eradicated.

Effective invasive plant treatment may be possible even with the extra limitations in Alternative 3 (intended to reduce reliance on herbicides); however the increase in cost per acre of treatment would result in fewer acres treated in a given year, assuming the same level of funding. Other limitations may result in the need for additional treatments over time to reach the desired condition. Some limitations may reduce our ability to eradicate or control target species.

The Proposed Action is the most effective alternative by design and allows for the widest possible range of treatment methods   Analysis of this issue will allow comparison of the trade-offs between measures to reduce exposure to herbicide and the cost-effectiveness of proposed treatments.

Issue Statement 2A: Limitations on Herbicide Use May Reduce Treatment Effectiveness.

Alternative 2 is designed to provide as much treatment flexibility as possible, which increases potential effectiveness and decreases cost. Limitations on herbicide use or acres available for treatment (Alternatives 1 and 3) reduce the potential cost-effectiveness of treatment.

Chapter 3 discusses how treatment flexibility influences cost-effectiveness (Chapters 3.2 and 3.12). If treatments are not cost-effective, invasive plants would continue to threaten native plant communities, wildlife habitats, riparian areas and aesthetic values. The consequences of ineffective treatments are discussed throughout Chapter 3: on botanical resources (Chapter 3.3), wildlife (Chapter 3.7), riparian (Chapters 3.5 and 3.6) and aesthetic values (Chapter 3.10).

Issue Indicators:

- Known Acres that may not be effectively treated given limitations on herbicide use or NEPA coverage.
- Known Acres where full range of effective tools are allowed[2]
- Acres remaining after 5 years assuming unlimited funding
- Years to Meet Treatment Objectives (Known Sites) Assuming Current Funding

Issue Statement 2B: If treatment costs are increased by limitations on herbicide use, fewer acres may be effectively treated on a fixed budget.

Treatment costs and effectiveness can vary depending on method. Alternative 3 relies on more expensive and/or less effective non-herbicide methods on about 67 percent of currently infested acreage.

Issue Indicators:

- Estimated cost of fully treating all known acres assuming unlimited funding (including re-treatments)
- Average Cost Per Acre
- Acres remaining after 5 years assuming unlimited funding
- Years to Meet Treatment Objectives (Known Sites) Assuming Current Funding

1.8.3 Jobs

Issue Statement 3: Manual and mechanical treatment methods are more labor intensive than other methods and may create more job opportunities.

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[2] "Full range" means that several herbicides and other methods are available. Full range does not include use of grazing animals, prescribed fire or heavy equipment for invasive plant management. Full range includes treatment methods discussed in the proposed action.

Some commenters stated the Forest Service should take the opportunity to provide jobs by considering more manual and mechanical methods of treatment. Manual treatments tend to be more labor-intensive and employ more workers than herbicide treatment methods. This issue is addressed through the development of Alternative 3, which has the greatest relative proportion of manual treatments compared to the other alternatives.

Issue Indicators:

- Number of seasonal jobs to treat all acres in a single year (unlimited funding)

1.8.4 Scenic Quality

Issue Statement 4: Treated invasive plants may be unsightly and reduce scenic quality along roads and within recreation, special interest and wilderness areas.

Invasive plant treatments may temporarily reduce scenic value if aesthetically pleasing invasives (or common non-target plants) become brown and unsightly or if bare ground is exposed. Invasive plant treatments may affect visual quality along road corridors and in recreation, special interest and wilderness areas. This impact is short-term and related to all treatment methods, especially herbicide. However, effective treatments would improve long term scenic quality by helping maintain native vegetation.

Issue Indicators:

- Ranking of alternatives relative to scenic value

1.8.5 Issues Eliminated from Detailed Study

The Council of Environmental Quality requires the USDA Forest Service to identify and eliminate from detailed study the issues that are not significant (40 CFR 1501.7). Issues are eliminated from further analysis when the issue is outside the scope of the EIS; is already decided by law, regulation, Forest Plan, or other higher level decision; is not clearly relevant to the decision to be made; or is conjectural and not supported by credible scientific or factual evidence.

The Forest Supervisor for the Okanogan-Wenatchee National Forest determined that the following public issues would be eliminated from detailed study. The public concern and reason that the issue was dismissed follows:

- ☐ Suggestion to restore natural processes like hydrology to wetlands or riparian sites, returning a stream to its natural stream channel, reintroducing fire, creating conditions where natural processes occur for all activities.

These types of actions are outside the scope of the purpose and need to provide a rapid and more comprehensive, up-to-date approach to control and eradicate invasive plants on the Forest, although control and eradication of invasive plants may result in accomplishing some of these objectives.

- ☐ Concern that some spraying has already occurred before public comment

Spraying currently occurring is being done under existing integrated weed management decisions; activities under this document will not be implemented until a Record of Decision is signed.

- ☐ Suggestion to use recreation fees to treat weeds

Determining funding sources is beyond the scope of this analysis. However, the primary intent of Recreation Fees is to maintain and improve developed recreation sites, and use of Recreation Fees may be appropriate in those limited sites, Use of recreations fees is regulated by the Interim Implementing Guidelines (April 22, 2005) for the Federal Lands Recreation Enhancement Act (PL 108-447).

- ☐ Restrictions on road construction, livestock grazing, prescribed burning and timber harvest until after weeds are controlled.

The R6 PNW ROD already includes prevention standards that are required for every project on the Forest and requires pre-treatment in some instances. Site-specific projects that cause soil disturbance, manage the road system and/or manage forest vegetation are required to include relevant prevention, restoration and treatment standards from the R6 PNW ROD.

- ☐ Including prevention as a first priority, washing of machines, managing livestock, requiring use of weed free seed, using weed-free hay, increasing communication between ranger district resource specialists, including staff training to identify weeds, notifying adjacent land owners, establishing a list of current and future unwanted invaders.

These measures were already included as management direction in the R6 PNW ROD that must already be included in project level analysis where applicable. There is no need to “re-adopt” them in this EIS and ROD.

CHAPTER 2: Alternatives Including the Proposed Action

2.1 Introduction

Chapter 2 describes the process used to develop alternatives, including the proposed action. Alternatives selected for analysis are described and differences between alternatives are defined. This chapter provides a summary of the effects of implementing alternatives and displays how they are responsive to the Purpose and Need for action, and issues identified during public scoping. The analysis of the no action alternative measures the existing condition, provides a baseline for comparison with the other alternatives, and is considered on the same basis as all action alternatives. Alternatives considered but not analyzed in detail are also presented in this chapter.

The proposed action was developed by an interdisciplinary team (IDT) through a process that identified existing resource concerns, inconsistencies with established standards and guidelines and foreseeable future conflicts associated with the current management of invasive species. The IDT considered existing laws and regulations, policy requirements, agency directives, current land and resource management plans, and environmental protection and species recovery plans to define issues and opportunities associated with invasive species treatment. Principle cause-effect relationships were identified to describe issues and develop PDFs to reduce or eliminate adverse effects. Several alternatives were considered but eliminated from detailed study; these can be found in Chapter 2.3 below.

Alternatives to the proposed action were identified by the interdisciplinary team and through scoping of interested publics, and through consultation with State, County, and Federal agencies, and Tribal governments. Alternatives developed were first examined to assess feasibility and to determine whether they fell within the scope of the project, had already been decided by law, rule or regulation, or were unsupported by science or evidence (see Chapter 1 issues). The original proposed action that was scoped with the public was refined because of both comments received on the proposed action and because of IDT input, and that original proposed action was dropped. A set of alternatives, which includes the refined proposed action, a reduced-herbicide alternative, and the no action alternative, were selected for detailed analysis.

All of the alternatives involve some level of invasive plant management, but they vary by the land area that may be treated and the treatment methods that would be approved.

2.2 Alternatives Considered in Detail

2.2.1 Alternative 1 (No Action)

The No Action Alternative 1 serves as a baseline for comparison of the effects of the alternatives. The No Action alternative would not initiate any new actions for treating invasive plants and a plan amendment would not be authorized. Invasive plant sites that are not currently mapped would not be treated.

Invasive plant treatments are currently occurring from several Forest-wide and individual invasive plant treatment NEPA decisions and treatment decisions connected to other projects (e.g., vegetation management and restoration). Under No Action, some invasive plant treatments would continue to be conducted under these existing decisions. The Forest-wide treatment projects would be phased out and within a couple years, existing individual projects and connected actions would be completed. Under No

Action, invasive plant treatments would not otherwise be conducted except as authorized under future NEPA decisions.

On the Okanogan National Forest, invasive plant treatment has occurred via three Forest-wide decisions (1997, 1999 and 2000) approving use of picloram and glyphosate on specific sites. On the Wenatchee National Forest, invasive plant treatment has occurred via one Forest-wide decision approving dicamba, picloram, triclopyr, glyphosate on specific sites. Please note that the use of dicamba was discontinued when the R6 PNW ROD was signed.

In addition, several site specific invasive plant treatments have been approved either as stand-alone or actions connected to other vegetation, fuels management and restoration projects. Table 2.1 lists the past documents considering invasive plant treatment; some of these are still being implemented. Most of the existing infestations are not covered by these documents. All of these were environmental assessments (EA) except for the common crupina environmental impact statement (EIS).

Table 2.1: Existing NEPA Covering Invasive Plant Treatment

Year	Unit
1997 Okanogan National Forest Integrated Weed Management	Okanogan National Forest
1998 Wenatchee National Forest Noxious Weed	Wenatchee National Forest
1999 Okanogan National Forest Integrated Weed Management	Okanogan National Forest
2000 Okanogan National Forest Integrated Weed Management	Okanogan National Forest
Boomer Vegetation Mgt Project	Naches
Elderberry Vegetation Mgt Project	Naches
Rattle Vegetation Mgt Project	Naches
2003 Common Crupina EIS	Chelan
2003 A to A Ecosystem Restoration	Chelan
2007 Canteen Ecosystem Restoration	Naches
2007 Iron Restoration Project	Cle Elum
2008 Roaring Thin	Cle Elum
2008 Blue Buck Hawkweed	Methow
2009 Liberty Environmental Assessment	Cle Elum
2009 Russell Ridge Vegetation and Fuels Management Project	Naches
2008 Teanaway Fuel Reduction	Cle Elum
2010 Gold Spring Restoration Project	Naches
2011 Glass Angel	Naches

All totaled, invasive plant treatments have been considered across about 60,000 acres of analysis areas since 1997. Within these analysis areas, about 6,000 acres still need treatment and would continue to be treated as appropriate under the existing decisions. We have been able to treat about 3,500 infested acres annually. Under No Action, this would continue until treatments on acreage covered by existing NEPA documents were no longer needed.

The R6 PNW ROD Prevention Standards (2005b) and Okanogan-Wenatchee Weed Prevention Strategy (2002) would continue to be followed.

By definition, No Action would not meet the Purpose and Need described in Chapter 1.4. Opportunities to use more cost-effective treatment methods would be forgone and new herbicides would not be approved for Forest-wide use. In some cases, No Action would include the continuance of herbicide use under existing project authority, and in some cases, this would mean using a less effective or potentially more toxic herbicide than under the action alternatives.

2.2.2 Action Alternatives

Two action alternatives have been developed, the Proposed Action (Alternative 2) and Alternative 3. Both of these alternatives were developed to respond to the need for action by expanding herbicide ingredient choices and authorizing treatment anywhere within the project area for 15 years or more.

The Proposed Action includes a broad range of methods intended to cost-effectively treat invasive plant species found on the Forest. Alternative 3 includes the same treatment methods; however, herbicides would generally not be used on infested sites smaller than one acre (with some exceptions, see details below). The intent of Alternative 3 is to address issues related to herbicide toxicity and job creation.

Integrated weed management (IWM) forms the foundation for both action alternatives. Treatment methods would be used in combination to increase their effectiveness. Prevention, detection and education are important aspects of IWM that are not specifically considered in the action alternatives but would occur as a matter of Forest Service policy and management direction in the Forest Plans. The R6 PNW Prevention Standards (2005) and Okanogan Wenatchee Weed Prevention Strategy (2002) would continue to be followed.

The species characteristics, size of infestation, density of infestation, location, environmental factors, management objectives, accessibility, timing of treatments, logistics, and treatment costs all factor into the choice of treatment method(s). Treatment priorities would be determined on each Ranger District based on broader scale and local considerations. The treatment method, extent and intensity would vary depending on local site conditions and treatment history. Treatment prescriptions would be fine-tuned and adapted to field conditions and treatment history over time. Appropriate project design features would be applied to the treatments to ensure that effects remain within scope of the selected alternative.

The analysis in this EIS assumes that under the action alternatives, all 16,281 mapped infested acres would be treated in a single year, and then re-treated each year until objectives are met. This level of treatment is unlikely to be implemented in any one year due to funding limitations, however it allows for a consistent analysis assuming the most ambitious conceivable program based on treatment of the existing mapped infestations in a single year.

Most of the components of the two action alternatives are similar and are discussed together throughout this section. Differences between the alternatives are highlighted where relevant. The main difference between the alternatives is that Alternative 2 allows for the most cost-effective treatment to be selected, as long as the project design features, herbicide use buffers and other limitations are followed. In contrast, under Alternative 3, the majority of smaller infestations would be treated by more expensive and labor intensive manual or mechanical methods.

Alternative 2 (Refined Proposed Action)

The refined Proposed Action would authorize the treatment of all 16,281 infested acres across the Okanogan-Wenatchee National Forest. It would also allow treatment of invasive plants that are not currently mapped as long as the area treated (known and new sites) does not exceed 16,281 acres in any one year.

The proposed invasive species treatments are scheduled to begin in 2017. Invasive plants would be treated using one or a combination of manual, mechanical, biological, cultural and chemical methods and may require multiple treatments over time. These treatment types are discussed in the Treatment Methods Considered section below. APHIS approved biological controls (that meet R6 PNW ROD standard 14) could occur on any invasive species population large enough to support the life cycle of the agents.

Under the Proposed Action, most of the 16,281 infested acres would be treated using herbicides in combination with other methods. Herbicides would be used where cost-effective in accordance with project design features. Currently, assuming project design features and buffers (see below) are followed, herbicide use would not be approved for about 679 acres of existing infestations

Table 2.2 characterizes the treatments that would be authorized under Alternative 2 for the 16,281 acres of known sites. About 682 acres contain lower priority species that are not likely to be treated unless they are within or directly adjacent to populations of priority species.

Table 2.2: Alternative 2 Treatments Methods and Acres by Target Species

Target Species	Method	Infested Acres
Japanese knotweed, leafy spurge, rush skeletonweed, sulphur cinquefoil, whitetop, orange/meadow hawkweed, baby's breath, Canada thistle, common crupina, oxeye daisy , purple/yellow loosestrife, Russian knapweed, Scotch broom, common tansy, Dalmatian/yellow toadflax, diffuse knapweed, hoary alyssum, houndstongue, kochia, meadow knapweed, puncture vine, Scotch/musk thistle, spotted knapweed, St. John's wort, tansy ragwort, yellow starthistle, common burdock, bull thistle, Russian thistle	All integrated weed management (IWM) methods proposed: manual, mechanical, cultural, biological and chemical	14,920
Same species as above	Restricted to manual, mechanical, cultural or biological treatments (no herbicides)	679
Cheatgrass, bulbous bluegrass, shepherd's purse, common fiddleneck, biennial wormwood, purple foxglove, reed canarygrass, old man-in-the-Spring, common mullein, stinking willie, chicory, Himalayan blackberry, scentless false mayweed, Queen Anne's lace, and black henbane.	Infested acres of non-priority species that are not likely to be treated unless they are within or directly adjacent to populations of priority species.	682
	Total Acres	**16,281**

Alternative 3 (Reduced Herbicide Alternative)

This alternative was developed to respond to issues surrounding the toxicity and use of herbicides and a desire expressed by some people favoring more labor intensive treatment methods (job creation).

Herbicides would not be used on infested sites less than an acre except where manual treatment might cause ground disturbance from extensive digging with hand tools, or where the target species is known to require herbicide for effective treatment (e.g., rhizomatous species). Biocontrols would be favored on sites over an acre (where effective), however herbicides would be used if no effective biocontrols were available. Applying these criteria to the current inventory, herbicides would be used on 5,496 acres. The

EDRR process described below would apply to Alternative 3. However, herbicides would only be used on new infestations under the conditions described in the paragraphs above. The number of acres of herbicide use could vary from year to year, and the treatments may be the same on some larger, high priority sites, but overall, herbicide use would be considerably less than under Alternative 2.

This alternative would replace current Forest-wide decisions for actions relating to treatment of invasive species. There may be continued implementation of currently approved invasive plant treatments beyond 2016, however these would eventually be completed or phased out, and future treatments within or outside currently infested sites would be treated using the herbicide criteria associated with Alternative 3. Table 2.2 characterizes the treatments that would be authorized under Alternative 3 for the 16,281 acres of known sites.

Table 2.3: Alternative 3 Treatments Methods and Acres by Target Species

Target Species	Method	Currently Mapped Treatment Acres
Japanese knotweed, leafy spurge, rush skeletonweed, sulphur cinquefoil, whitetop, orange/meadow hawkweed, oxeye daisy	**Herbicides** used regardless of infestation size because all other methods are ineffective.	1,684
Baby's breath, common crupina, common tansy, kochia, puncture vine, Scotch/musk thistle, bull thistle, hairy catsear, hoary alyssum, hounds tongue, Russian knapweed, Russian thistle	**Herbicides** used when sites are greater than one acre and no biocontrol is approved and available under the R6 PNW ROD, or when manual/mechanical treatment is undesirable because manual/mechanical treatment of the infestation would result in excessive disturbance to native species, or excessive cost. Cultural, manual, and mechanical methods could be used in combination with herbicide, if effective.	3,812
Baby's breath, Canada thistle, common crupina, purple/yellow loosestrife, Russian knapweed, Scotch broom, common tansy, Dalmatian/yellow toadflax, diffuse knapweed, hoary alyssum, houndstongue, kochia, meadow knapweed, puncture vine, Scotch/musk thistle, spotted knapweed, St. John's wort, tansy ragwort, yellow starthistle, common burdock, bull thistle, and Russian thistle, hairy catsear	**Non-herbicide** (manual, mechanical, cultural and biological) methods only, when sites are less than one acre.	659
Dalmatian/yellow toadflax, diffuse and spotted knapweed, meadow knapweed, St. John's wort, tansy ragwort, yellow starthistle, Russian thistle, Canada thistle, purple/yellow loosestrife, Russian knapweed, and scotch broom	**Biological** controls used on sites greater than one acre, in combination with manual/mechanical and cultural. Manual/mechanical methods would likely be used on perimeter as part of a containment strategy.	9,443
Cheatgrass, bulbous bluegrass, shepherd's purse, common fiddleneck, biennial wormwood, purple foxglove,	Infested acres not likely to be treated unless they are within or directly adjacent	682

Target Species	Method	Currently Mapped Treatment Acres
reed canarygrass, old man-in-the-Spring, common mullein, stinking willie, chicory, Himalayan blackberry, scentless false mayweed, Queen Anne's lace, black henbane	populations of priority species because they are non-priority invasive species	
Total Acres – Herbicide Approved		5,496
Total Acres – Non-herbicide only		10,785

Invasive Plant Treatment Methods and Project Design Features Common to Action Alternatives

The following section describes the integrated treatment methods and project design features that would be approved in both action alternatives. These methods are commonly used and have been ongoing for years within and outside the project area.[3]

Manual Methods

Manual control methods include non-mechanized treatments, such as hand pulling or using hand tools, to remove plants by cutting, digging, and removing seed heads. Tools could include handsaws, axes, shovel, rakes, machetes, grubbing hoes, mattocks, brush hooks, and hand clippers or other non-mechanized tools. To meet control objectives or reduce the risk of activities spreading invasive plants, seed heads and flowers would be removed and disposed of using proper disposal methods.

Manual treatments are labor intensive and would be repeated as needed during the growing season, depending on the species. These treatments can be effective for some annual and tap-rooted invasive plants (See Table 2.5). Manual treatments are typically used to treat small infestations and to avoid herbicide use in sensitive areas.

Mechanical Methods

Mechanical methods include handheld power and heat tools such as: power saws, mowers, brushers, weed whackers, and steam or infrared tools. Treatment method selection depends on the characteristics of undesired species present (e.g., density, stem size, brittleness, and sprouting ability), the location of the infestation (e.g., in a gravel pit, along a roadside, inside or outside a riparian area, not in wilderness), and soil or topographic considerations. Mechanical treatments would typically occur along roadsides, inside or around rock sources, or in other confined disturbed or dispersed use areas.

Mowing and cutting would be used to reduce or remove above ground biomass. Treatment would be timed to occur before seeds are present. Cut fragments of species capable of re-sprouting from stem or root segments would be collected and properly disposed of to prevent them from spreading into un-infested areas.

Biological Agents

Biological agents, parasites, predators, or pathogens (often insects), are natural control agents for specific invasive plant species. Biological control is generally used when invasive species populations are large

[3] The No Action Alternative uses these treatment methods, however, herbicide choices, project design features/buffers, and the processes for dealing with new sites differ from those described in this section.

and difficult to control with other methods until those populations are reduced to a size where other methods can be used efficiently. Control agents reduce the competitive ability and reproduction of an invasive species with the goal of making it a minor component of the plant community over time. Once released, biological control agents may disperse to new areas on their own. The programmatic analyses of the environmental effects of using biological control agents have already been completed under documents developed by Agricultural Plant Health and Insect Service (APHIS) for approval of their use. The completed environmental assessments are available at: http://www.aphis.usda.gov/plant_health/ea/index.shtml.

Biological control activities could include collection of insects, transporting, and transplanting parasitic insects, and supplemental stocking of populations. In some situations, a complex of biological control agents is needed to reduce invasive plant density to a desirable level. As an example; a mixture of five or more biological control agents may be needed to attack flower or seed heads, foliage, stems, crowns and roots all at the same time or during the plant's life cycle. Typically 15 to 20 years are needed to substantially reduce populations. Bio-control agents are transported in containers that enclose the agent until release.

R6 maintains a list of approved biological controls that meet the R6 PNW ROD standard. Agents found to harm native plants would not be redistributed.

Cultural Methods/Restoration

Cultural methods include competitive planting and seeding, and mulching with a variety of materials. Cultural treatments would be prescribed when they are known to be effective for the undesired species of concern. Cultural treatments, such as mulching with black plastic, hay, straw, or wood chips, is feasible only for relatively small areas with no non-target plants, and is not effective to control perennial invasives with extensive food reserves. Mulching would not be used when it may have undesired results to native plant species.

The action alternatives both include the restoration of treatment sites to prevent re-infestation and promote establishment of desirable vegetation after treatments. Restoration may be active or passive (allowing adjacent native plants to fill in gaps in vegetation created by treatments). Passive restoration is most appropriate where native plant cover is sufficient to re-colonize the site. If invasive plant treatments result in large areas of bare ground, or if no or few native plants are present to establish on the site, active restoration may be used.

Active restoration methods would be non-ground disturbing, including hand-seeding of native species and hand application of mulch. The majority of treatment sites on the Forest would not require active restoration because an adequate component of native plant species is present in or adjacent to the sites. In some cases, active restoration would not be appropriate even if large areas of bare ground resulted as a consequence of treatment activities approved in this document – for example, edges of heavily used roads and active gravel pits.

Herbicide Methods

Herbicide methods include the use of herbicides, adjuvants (additives) such as surfactants or dyes, and inert ingredients in accordance with the R6 PNW ROD standards. Adjuvants are material added to spray mix that improve its performance (aid or modify the action of an herbicide or the physical properties of the mixture). They can either enhance the activity of the herbicide's active ingredient or offset any problems associated with its application. Project Design Features (PDFs) have been developed to reduce potential impacts from adjuvants and list restrictions on herbicide use that pertain to action Alternatives 2 and 3. Inert compounds are also intentionally added to a formulation, but have no herbicidal activity and do not affect the herbicidal activity. Inert additives facilitate the herbicide's handling, stability, or mixing. Surfactants and dyes are the most likely adjuvants to be used; neither NPE nor POEA surfactants are approved for use in this project. Surfactants (surface-active agents) improve the emulsifying, dispersing, spreading, or wetting properties of an herbicide. Most of the formulations of the nine proposed herbicides recommend addition of a surfactant unless the formulation already contains surfactants. Dyes would also be added to the spray mix so that spray coverage is visible (see PDF E-2). In accordance with R6 PNW ROD Standard 18, only adjuvants reviewed in Forest Service hazard and risk assessment documents would be used.

Proposed herbicides would include one or more of the following active ingredients: chlorsulfuron, clopyralid, glyphosate, imazapic, imazapyr, metsulfuron methyl, picloram, triclopyr, and aminopyralid.[4] Most of the formulations of the nine proposed herbicides recommend addition of a surfactant, unless the formulation already contains one. Although sethoxydim and sulfometuron methyl were approved for use in Region 6, they are not proposed for use because they are not needed to treat the types of invasive plants found or expected to occur on the Forest.

Herbicide application methods include:

- Spot spraying: This method targets individual plants and is usually applied with a backpack sprayer. Spot spraying can also be applied using a hose attached to a truck-mounted or ATV-mounted tank.
- Wicking: This hand method involves wiping a sponge or cloth that is saturated with herbicide over the plant. This is used in sensitive areas, such as near water, to avoid getting any herbicide on the soil, in water, or in contact with non-target vegetation.
- Stem injection: A hand application technique where the herbicide is injected directly into the stem of the plant.
- Boom broadcast: This involves using an applicator with either a single fan-shaped nozzle or multiple nozzles along an "arm" or extension attached to a truck or ATV. Herbicide is supplied from a tank mounted on the truck or ATV. Herbicide is applied to cover an area of ground rather than individual plants. This method is used in areas where invasive plants occupy a large percentage of cover on the site and the area to be treated makes spot spraying impractical. This technique is typically confined to road edges, parking areas and heavily disturbed sites such as rock quarries.

Table 2.4 displays our best estimate of how different herbicide ingredients would be used on priority target species, based on current mapped invasive plant sites.

[4] Higher risk formulations using glyphosate, as defined by the SERA 2011 Glyphosate Risk Assessment would not be used. Also, only triclopyr acid (triclopyr TEA) would be used; triclopyr BEE (ester) formulations would not be used.

Table 2.4: Acres of known sites where each herbicide would be effective, in order of preference

Selected Herbicide and (Brand Names)	*Acres of known sites where this herbicide would be most effective			*Number of sites where this herbicide would be most effective		
	Preference for use			Preference for use		
	1st	2nd	3rd	1st	2nd	3rd
Aminopyralid (Milestone)	9,311	1410	0	3417	431	0
Chlorsulfuron (Telar, Glean, Corsair)	156	4176	0	71	424	0
Clopyralid (Transline)	0	8315	3.9	0	3185	10
Glyphosate (Roundup, Rodeo, Accord XRT, Aquamaster)	0	6.4	7784	0	4	1732
Imazapic (Plateau)	0	0	0	0	0	00
Imazapyr (Arsenal, Arsenal AC, Chopper, Stalker, Habitat)	8.7	2.3	151	1	3	69
Metsulfuron methyl (Escort XP)	4000	156	491	541	71	413
Picloram (Tordon K, Tordon 22K)	1586	6534	4014	337	2316	449
Triclopyr TEA (acid) (Garlon 3A, Tahoe 3A, Confront, Redeem)	89	0	0	30	0	0

*The totals represent the acres and number of sites where the herbicide would be effective. Because some invasive plants can be controlled by more than one herbicide, some sites have been counted more than once.

Mix of Treatment Methods in the Alternatives

The Alternative Treatment Methods table (Table 2.5) displays the acreages and number of sites infested with each priority species, the range of effective treatment options, the preferred selected method or combination of methods by alternative and site-specific considerations important to the final prescription. The Alternative Treatment Methods table is based on "Common Control Methods" Appendix B, R6 PNW FEIS; information in Pacific Northwest Weed Management Handbook, Extension Services of Oregon State University, Washington State University, and the University of Idaho, 2008; and Nature Serve (www.natureserve.org).

Of the 9 herbicides proposed for use in this project, imazapic is not listed in the Alternative Treatment Measures table (Table 2.5) because currently, the Forest does not have an invasive plant species where imazapic would be the preferred herbicide. Imazapic would still be approved should a species which requires its use (such as leafy spurge) be located in the future. Other herbicides are not expected to be needed for current target species or likely new invaders.

Prior to treatment, a treatment prescription would be developed considering the target species and location. The appropriate integrated treatment methods, including herbicide ingredient and application methods, would be determined and appropriate design features would be incorporated into the prescription.

Alternatives 2 and 3 are contrasted in this table to show how the criteria associated with Alternative 3 would change the treatment method within known sites.

Table 2.5: Alternative Treatment Methods – Range of Effective Treatment Options and Site Specific Considerations by Target Species

Target Species Common Name (USDA PLANTS database code)	Alt. 2 Acres and Number of Sites	Alt. 3 Acres and Number of Sites	Range of Effective Treatment Options
Baby's Breath (GYPA) *Gysophila paniculata* *Perennial*	All effective (IWM) methods available. Herbicide treatment is the preferred method: .2 acres 2 sites	Manual/mechanical methods on sites less than one acre .2 acres 2 sites Herbicide treatment on sites greater than one acre: 0 acres 0 sites	Manual/Mechanical treatment can be effective on small populations by severing the crown from the roots by cultivation or hand-cutting to several inches below the soil. No biocontrols are available. Herbicide treatment is most effective with following priority: 1. Triclopyr TEA and Clopyralid 2. Glyphosate (aquatic formulation) **Riparian acres: 0** Effective herbicides within the aquatic influence zone: Aquatic Glyphosate
Bull Thistle (CIVU) *Cirsium vulgare* *Biennial*	All effective IWM methods available. Herbicide is the preferred method 491 acres 413 sites	Non-herbicide methods only: 83.5 acres 322 sites Herbicide on sites over 1 acre: 407.5 acres 91 sites	Manual, mechanical and herbicide control are effective. Eliminating seed production is the most effective manual/mechanical control technique. Close mowing or cutting twice during the growing season or cutting plants with a sharp shovel at 1" to 2" below the soil surface before flowering is effective. Biological controls exist but are very limited in Washington. Not expected to be available. Herbicide treatment is most effective. 1. Aminopyralid 2. Picloram or Clopyralid 3. Metsulfuron methyl

Target Species Common Name (USDA PLANTS database code)	Alt. 2 Acres and Number of Sites	Alt. 3 Acres and Number of Sites	Range of Effective Treatment Options
			Riparian areas: 30 acres within 234 sites are proposed for chemical treatment in riparian areas. Effective herbicides within the aquatic influence zone: Aminopyralid, Aquatic Glyphosate
Canada Thistle (CIAR4) *Cirsium arvense* *Perennial*	All effective IWM methods available. Herbicide is the preferred method: 960 acres 425 sites	Manual/mechanical methods on sites less than one acre: 75 acres 258 sites Biocontrol treatment on sites greater than one acre: 885 acres 167 sites	The only effective manual technique is hand cutting of flower heads, which only suppresses seed production. Covering with a plastic tarp may also work for small infestations. Biocontrols are available but with limited effectiveness. Herbicide treatment is most effective. 1. Aminopyralid 2. Clopyralid **Riparian areas:** 73 acres within 275 sites are proposed for chemical treatment in riparian areas. Effective herbicides within the aquatic influence zone: Aminopyralid, Aquatic Glyphosate
Common burdock ((ARLA3) (ARMI2) *Arctium minus* *Biennial*	All effective IWM methods available. Herbicide is the preferred method: 3 acres 23 sites	Non-herbicide methods only: 3 acres 23 sites	Seedlings may be dug when the taproot is small. Seeds must be bagged or burned. No biocontrols are currently available. 1. Metsulfuron methyl 2. Picloram **Riparian areas:** 1.1 acres within 14 sites are proposed for chemical treatment in riparian areas. Effective herbicides within the aquatic influence zone: Metsulfuron methyl, Aquatic Glyphosate
Common Crupina (CRVU2) *Crupina vulgaris*	All effective IWM methods available. Herbicide is the preferred method:	Manual/mechanical methods on sites less than one acre: 2 acres 7 sites	Manual/Mechanical – hand-pulling is effective on small infestations prior to seed set. No biocontrols are available.

Target Species Common Name (USDA PLANTS database code)	Alt. 2 Acres and Number of Sites	Alt. 3 Acres and Number of Sites	Range of Effective Treatment Options
Annual	93 acres 15 sites	Herbicide treatment on sites greater than one acre: 91 acres 8 sites	Herbicide treatment is preferred for dense infestations. 1. Aminopyralid 2. Clopyralid 3. Picloram **Herbicide Treatment in Riparian areas:** 3.1 acres within 4 sites. Effective herbicides within the aquatic influence zone: Aminopyralid, Aquatic Glyphosate
Common Tansy (TAVU) *Tanacetum vulgare* *Perennial*	All effective IWM methods available. Herbicide is the preferred method: 76 acres 84 sites	Manual/mechanical methods on sites less than one acre: 13 acres 69 sites Herbicide treatment on sites greater than one acre: 63 acres 15 sites	Repeated tillage or digging can be effective, but must be done frequently. . Effective manual control requires complete removal of the roots when soil is loose or moist. No biocontrols are available at this time. Herbicide treatment is most effective. 1. Metsulfuron methyl 2. Aminopyralid **Riparian areas:** 7.1 acres within 43 sites are proposed for chemical treatment in riparian areas. Effective herbicides within the aquatic influence zone: Metsulfuron methyl, Aminopyralid.
Dalmatian/ Yellow Toadflax (LIDA) (LIVU2) *Linaria dalmatica, Linaria vulgaria* *Perennial*	All effective IWM methods available. Herbicide is the preferred method: Biocontrols may be used on larger sites in combination with herbicide use on the perimeters. 1589 acres 337 sites	Non herbicide methods only on sites less than one acre: 57.8 acres 220 sites Bio-control on sites greater than one acre: 1528 acres	Hand-pulling or digging can be effective. Cutting stems in spring or early summer would eliminate plant reproduction through seed, but not the infestation. To be effective non-herbicide treatments require long term persistence and are only feasible on relatively small infestations. Biocontrols are available. Herbicide treatment is most effective. 1. Picloram 2. Chlorsulfuron

Target Species Common Name (USDA PLANTS database code)	**Alt. 2 Acres and Number of Sites**	**Alt. 3 Acres and Number of Sites**	**Range of Effective Treatment Options**
Hairy cat's ear (HYRA3) *Hypochaeris radicata* L. *Perennial*	All effective IWM methods available. Herbicide is the preferred method: 448 acres 57 sites	Manual/mechanical methods on sites less than one acre: 9 acres 32 sites Herbicide treatment on sites greater than one acre: 439 acres 25 sites	Hand-pulling or digging is difficult as this plant has a deep taproot with several fibrous roots. No known biological controls currently available. Herbicide treatment is most effective. 1. Aminopyralid 2. Clopyralid 3. Glyphosate (aquatic formulation) **Riparian areas:** 30 acres within 38 sites are proposed for chemical treatment in riparian areas. Effective herbicides within the aquatic influence zone: Aminopyralid, Aquatic Glyphosate
Hoary alyssum (BEIN2) *Berteroa incana* *annual, winter annual, biennial, or a short-lived perennial*	All effective IWM methods available. Herbicide is the preferred method: 135 acres 13 sites	Non-herbicide methods only on sites less than one acre: **2.7** acres 7 sites Herbicide use on sites over 1 acre 133.9 acres 6 sites	Hand-pulling or digging prior to flowering may be effective for small infestations. No known biological controls currently available. Herbicide treatment is most effective. 1. Chlorsulfuron 2. Metsulfuron methyl 3. Imazapyr **Riparian areas:** 5.8 acres within 9 sites are proposed for chemical treatment in riparian areas. Effective herbicides within the aquatic influence zone: Metsulfuron methyl, Aquatic Glyphosate
Hounds tongue (CYOF) *Cynoglossum officinale* *Biennial*	All effective IWM methods available. Herbicide is the preferred method: 2,588 acres 87 sites	Non-herbicide methods only on sites less than one acre: 9.7 acres 36 sites Herbicide on sites greater than 1 acre. 2578.3 acres 51 sites	Digging root crown 1-2 inches below soil surface can be effective. Cutting stems prevents seed production. No biocontrols are currently available in the United States. Herbicide treatment is most effective. 1. Metsulfuron methyl 2. Chlorsulfuron 3. Picloram 4. Glyphosate (aquatic formulation) **Riparian areas:** 132 acres within 60 sites are proposed for chemical treatment in riparian areas. Effective herbicides within the aquatic

Target Species Common Name (USDA PLANTS database code)	Alt. 2 Acres and Number of Sites	Alt. 3 Acres and Number of Sites	Range of Effective Treatment Options
			influence zone: Metsulfuron methyl, Aquatic Glyphosate
Japanese knotweed (POCU6) **Cultivated knotweed (POPO5)** **Bohemian knotweed** *Polygonum cuspidatum* *Perennial*	All effective IWM methods available. Herbicide treatment part of initial method on all sites. 2.3 acres 3 sites	Non-herbicide methods alone are ineffective. Herbicide treatment on all sites: 2.3 acres 3 sites	Cutting in combination with herbicide, or herbicide stem injection is most effective. No biocontrols are available. 1. Imazapyr 2. Glyphosate (aquatic formulation) **Riparian areas:** 0.1 acres within 1 site are proposed for chemical treatment in riparian areas. Effective herbicides within the aquatic influence zone: Imazapyr, Aquatic Glyphosate
Knapweeds **Spotted knapweed** (CEBI2, CEMA4) *Centaurea biebersteinii* **Diffuse knapweed** (CEDI) *Centaurea diffusa* **Meadow knapweed** (CEPR2, CEDE5, CENI3) *Centaurea debeauxii* *Tap rooted Biennials, or Perennials*	All effective IWM methods available. Herbicide is the preferred method, may be used in combination with biocontrols on larger sites. CEBI2, CEMA4: 963 acres 285 sites CEDI: 4835 acres 1295 sites CEPR2, CEDE5, CENI3: 137 acres 35 sites	Non-herbicide methods only on sites less than one acre: CEBI2 54 Acres CEDI 237 Acres CEDE5 5.5 Acres CEBI2 161 Sites CEDI 748 Sites CEDE5 21 Sites Bio-control on sites greater than one acre where effective: CEBI2 – 963 acres CEDI – 4835 acres CEDE5 – 131.5 acres	Hand pulling/digging before seed production may be effective for small populations, however the entire root crown or the taproot must be removed. Digging rosettes in the spring can be effective. Biocontrols available for some knapweed species (R6 PNW FEIS Appendix H and White Paper-Spiegel, 2006) Herbicide with manual and mechanical treatment. Revegetate with desirable species, at high priority sites when possible. 1. Aminopyralid 2. Clopyralid, or Picloram 3. Glyphosate (aquatic formulation) **Riparian areas:** 543 acres within 1051 sites are proposed for chemical treatment in riparian areas. Effective herbicides within the aquatic influence zone: Aminopyralid, Aquatic Glyphosate
Kochia (KOSC) (BASC5)	All effective IWM methods available.	Non-herbicide methods only on	Pull or hoe prior to seed set. Mowing may be effective on smaller plants if all the above ground tissue is

Target Species Common Name (USDA PLANTS database code)	**Alt. 2 Acres and Number of Sites**	**Alt. 3 Acres and Number of Sites**	**Range of Effective Treatment Options**
Kochia scoparia *Annual*	Herbicide is the preferred method: 1 acre 1 sites	sites less than one acre: 1 acre 1 site	removed. No biocontrols are available. Herbicide treatment is most effective. 1. Chlorsulfuron 2. Metsulfuron methyl **Riparian acres: 0** Effective herbicides within the aquatic influence zone: Metsulfuron methyl, Aquatic Glyphosate
Leafy Spurge (EUES) *Euphorbia esula* *Rhizomatous perennial*	All effective IWM methods available. Herbicide treatment is the preferred method on all sites. 0 acre 0 sites	Herbicide treatment on all sites: 0 acre 0 sites	Hand pulling is usually ineffective even for small isolated infestations. Repeated mowing or hand cutting may be used as a control of seed production, but it must be used in conjunction with herbicides for adequate control of stand expansion. Grazing by domestic goats or sheep may help control leafy spurge when long term grazing is a possibility. Biocontrols are available. Herbicide treatment is most effective. It is possible to eradicate small early detected populations with herbicides. Larger well established populations would require a long-term integrated management program requiring a combination of chemical, cultural, and biocontrol. Multiple treatments per year are required. 1. Picloram (initial treatment) 2. Glyphosate or Imazapic (follow up treatments) **Riparian acres: 0** Effective herbicides within the aquatic influence zone: Aquatic Glyphosate
Orange Hawkweed (HIAU) (HIPR) *(Hieracium pratense)* **Meadow Hawkweed**	All effective IWM methods available. Herbicide treatment on all sites: HIAU 161 acres	Non-herbicide methods ineffective. Herbicide treatment on all sites: HIAU	Manual control is ineffective. Hand seed with native species. No biocontrols are available. Herbicide treatment is most effective. 1. Aminopyralid 2. Clopyralid 3. Glyphosate

Target Species Common Name (USDA PLANTS database code)	Alt. 2 Acres and Number of Sites	Alt. 3 Acres and Number of Sites	Range of Effective Treatment Options
(HICA10) *Hieracium caespitosum* *Perennial*	62 sites HICA 102 acres 53 sites	161 acres 62 sites HICA 102 acres 53 sites	**Riparian areas:** 8 acres within 27 sites are proposed for chemical treatment in riparian areas. Effective herbicides within the aquatic influence zone: Aminopyralid, Aquatic Glyphosate
Oxeye Daisy (LEVU) *Leucanthemum vulgare* *Perennial*	All effective IWM methods available. Herbicide treatment on all sites: 901 acres 341 sites	Manual/mechanical methods on sites less than one acre: 62 acres 254 sites Herbicide treatment on sites greater than one acre: 839 acres 87 sites	Repeated hand pulling, digging, or mowing is effective to prevent seed production. Mowing must be repeated in the same growing season. Herbicide treatment or a combination of manual and herbicide treatment can be effective. No biocontrols are available. 1. Aminopyralid 2. Clopyralid **Riparian areas:** 80 acres within 199 sites are proposed for chemical treatment in riparian areas. Effective herbicides within the aquatic influence zone: Aminopyralid, Aquatic Glyphosate
Puncture vine (TRTE) *Tribulus terrestris* *Annual*	All effective IWM methods available. Herbicide is preferred method: 0 acres 0 sites Bio-control on larger sites. 0 acres 0 sites	Non-herbicide methods only on sites less than one acre: 0 acres 0 sites Bio-control on sites greater than one acre: 0 acres 0 sites	Manual, mechanical or herbicide application can be effective. Biocontrol available. 1. Chlorsulfuron 2 Imazapic 3. Glyphosate **Riparian areas:** 0 Effective herbicides within the aquatic influence zone: Aquatic Glyphosate
Purple loosestrife (LYSA2) *Lythrum salicaria* **Yellow loosestrife (LYSIM)**	All effective IWM methods available. Herbicide treatment on all sites, in combination with bio-control on larger sites:	Manual/mechanical methods on sites less than one acre: 0 acres 0 sites	Hand-removal is only recommended for small populations or isolated stems as the entire rootstock must be pulled out. A combination of manual/mechanical and herbicide treatments is most effective. Biocontrols available. 1. Imazapyr

Target Species Common Name (USDA PLANTS database code)	Alt. 2 Acres and Number of Sites	Alt. 3 Acres and Number of Sites	Range of Effective Treatment Options
Lysimachia sp. *Perennial*	6 acres 1 site	Biocontrol on sites greater than one acre: 6 acres 1 site	2. Glyphosate (aquatic formulation) **Riparian acres: 6** Effective herbicides within the aquatic influence zone: Aquatic Imazapyr, Aquatic Glyphosate
Rush Skeletonweed (CHJU) *Chondrilla juncea* *Perennial*	All effective IWM methods available. Herbicide treatment on all sites. 0 acres 0 sites	Non-herbicide methods ineffective. Herbicide treatment on all sites: 0 ac 0 sites Bio-control on larger sites: 0 acres	Mechanical damage to plants stimulates new growth resulting in satellite plants. Manual, methods are not recommended. Rush skeletonweed is a deep rooted, rhizomatous perennial considered tolerant to herbicides. Therefore, an aggressive follow up program with repeated applications would be necessary. Difficult to apply herbicides because of small leaves. Biocontrols available. 1. Aminopyralid 2. Clopyralid **Riparian areas: 0** Effective herbicides within the aquatic influence zone: Aminopyralid, Aquatic Glyphosate
Russian Knapweed (CERE6) (ACRE3) *Acroptilon repens* *Perennial with adventitious shoots*	All effective IWM methods available. Herbicide in combination with mechanical, manual, and competitive planting is preferred method: 4 acres 10 sites	Manual/mechanical methods on sites less than one acre: 3 acres 9 sites Herbicide treatment on sites greater than one acre: 1 acre 1 site	Hand pulling is very difficult due to the extensive root system, but can be effective for small infestations during the establishment year only when the soil is wet and before seeds have formed. Lasting control requires an integration of techniques: mechanical, manual, herbicide and competitive plantings. No biocontrols are currently available. 1. Aminopyralid 2. Picloram 3. Clopyralid **Riparian areas:** 0.2 acres within 3 sites are proposed for chemical treatment in riparian areas. Effective herbicides within the aquatic influence zone: Aminopyralid, Aquatic Glyphosate

Target Species Common Name (USDA PLANTS database code)	Alt. 2 Acres and Number of Sites	Alt. 3 Acres and Number of Sites	Range of Effective Treatment Options
Russian thistle (SATR12 or SAIB) *Salsola tragus* *Annual*	All effective IWM methods available. Herbicide is the preferred method: 4 acres 1 site	Non-herbicide methods only on sites less than 1 acre. Herbicide on sites over 1 acre 4 acres 1 site	Manual or mechanical removal of plant prior to seed set can be effective in small populations. Repeat visits to areas previously infested likely required. Herbicides are the most effective treatment. No effective biocontrols are available. 1. Chlorsulfuron 2. Metsulfuron methyl **Riparian acres: 0** Effective herbicides within the aquatic influence zone: Metsulfuron methyl, Aquatic Glyphosate
Scotch Broom (CYSC4) *Cytisus scoparius* *Perennial woody shrub*	All effective IWM methods available. Herbicide is the preferred method, with bio-control on larger sites 89 acres 28 sites	Manual/mechanical methods on sites less than 1 acre. 5 acres 23 sites Biocontrol on sites greater than one acre 83 acres 5 sites	Hand pulling may be used to destroy seedlings or plants up to 1.5 meters tall after a rain when the soil is loose when the root system can be removed in its entirety. Where herbicides are used, manual treatments could be used for follow-up. Re-vegetate with desirable species. Biocontrols available. 1. Hand application of Triclopyr TEA 2. Picloram **Riparian areas:** 3.5 acres within 10 sites are proposed for chemical treatment in riparian areas. Effective herbicides within the aquatic influence zone: Aquatic Glyphosate
Scotch/Musk Thistle (ONAC)/(CANU4) *Onopordum acanthium* *Biennial*	All effective IWM methods available. Herbicide is the preferred method: 143 acres 237 sites	Non-herbicide methods only on sites less than one acre 48 acres 201 sites Herbicide on sites greater than one acre 95 acres 36 sites	Mowing can be effective when combined with revegetation of native species. Repeated mowing, in combination with other management methods, often is necessary for long-term control. Manual removal is effective when entire above ground plant growth is removed. No biocontrols are currently available in United States. Herbicide treatment is the most effective control. 1. Aminopyralid 2. Clopyralid

Target Species Common Name (USDA PLANTS database code)	Alt. 2 Acres and Number of Sites	Alt. 3 Acres and Number of Sites	Range of Effective Treatment Options
			Riparian areas: 7.8 acres within 34 sites are proposed for chemical treatment in riparian areas. Effective herbicides within the aquatic influence zone: Aminopyralid, Aquatic Glyphosate
St John's Wort (HYPE) *Hypericum perforatum* *Perennial*	All effective IWM methods available. Herbicide is the preferred method, used with bio-control on larger sites 1334 acres 347 sites	Non-herbicide methods only on sites less than one acre: 44.9 acres 224 sites Bio-control on sites greater than one acre: 1289 acres	Hand pulling or digging of young plants in small, isolated infestations may be effective. Repeated treatments would be necessary because lateral roots can give rise to new plants. Pulled or dug plants must be removed from the area and burned to prevent vegetative re-growth. Mowing is ineffective, but may discourage the spread of the plant if done before seeds form. Biocontrols available. Herbicide treatment is the most effective control. 1. Metsulfuron methyl 2. Aminopyralid 3. Picloram **Riparian areas:** 113 acres within 183 sites are proposed for chemical treatment in riparian areas. Effective herbicides within the aquatic influence zone: Metsulfuron methyl, Aminopyralid
Sulphur cinquefoil (PORE5) *Potentilla recta* *Perennial*	All effective IWM methods available. Herbicide treatment is the preferred method on all sites: 501 acres 224 sites	Non-herbicide methods ineffective. Herbicide treatment on all sites: 501 acres 224 sites	Hand-pulling and mowing are not effective. No biocontrols are available. Herbicide treatment is the only effective control. 1. Aminopyralid 2. Picloram **Riparian areas:** 36 acres within 114 sites are proposed for chemical treatment in riparian areas. Effective herbicides within the aquatic influence zone: Aminopyralid, Aquatic Glyphosate
Tansy ragwort (SEJA)	All effective IWM methods available. Herbicide	Non-herbicide methods only on sites less than one acre:	Hand pulling is effective if done when soils are moist and the hole left behind is mulched. Mowing can

Target Species Common Name (USDA PLANTS database code)	Alt. 2 Acres and Number of Sites	Alt. 3 Acres and Number of Sites	Range of Effective Treatment Options
Senecio jacobaea and other *Senecio* spp. *Tansy: Biennial or short-lived perennial* *Woodland: Annual*	treatment on all sites, used in combination with bio-control on larger sites 18 acres 19 sites	4.3 acres 16 sites Bio-control on sites greater than one acre where effective: 13.2 acres 3 sites	prevent flowering, but may also increase rosette density Biocontrols available. Herbicide treatment is most effective. 1. Aminopyralid 2. Clopyralid **Riparian areas:** 0.6 acres within 9 sites are proposed for chemical treatment in riparian areas. Effective herbicides within the aquatic influence zone: Aminopyralid, Aquatic Glyphosate
Whitetop (CADR) *Cardaria draba* *Perennia*l	All effective IWM methods available. Herbicide treatment is the preferred method on all sites: 16 acres 56 sites	Non-herbicide methods ineffective. Herbicide treatment on all sites: 16 acres 56 sites	Hand pulling of above ground plant parts is ineffective. No biocontrols are available. Herbicide treatment is most effective. Revegetate with desirable species. 1. Chlorsulfuron 2. Metsulfuron methyl 3. Imazapyr (aquatic formulation) **Riparian areas:** 1.8 acres within 28 sites are proposed for chemical treatment in riparian areas. Effective herbicides within the aquatic influence zone: Metsulfuron methyl, Aquatic Glyphosate
Yellow starthistle (CESO3) *Centaurea solstitialis* *Annual*	All effective IWM methods available. Herbicide is the preferred method. 1.5 acres 3 sites	Non-herbicide methods only on sites less than one acre. 1.5 acres 3 sites Bio-control on sites greater than one acre: 0 acres	Manual removal is only effective in small patches or in maintenance programs where plants are sporadically located. All above ground stem material must be detached. The best time for manual removal is after plants have bolted but before they produce viable seed (early flowering). Mowing can be useful but timing is critical. Biocontrol available. Revegetate high priority sites if needed with desirable species. Herbicide treatment is most effective. 1. Aminopyralid

Target Species Common Name (USDA PLANTS database code)	Alt. 2 Acres and Number of Sites	Alt. 3 Acres and Number of Sites	Range of Effective Treatment Options
			2. Clopyralid or picloram **Riparian acres: 0** Effective herbicides within the aquatic influence zone: Aminopyralid, Aquatic Glyphosate

Changes to treatment methods within known invasive plant sites are expected over time. Different combinations of treatment may be appropriate depending on the site conditions and treatment strategy at the time of treatment. Some sites may grow in size or density if treatment is deferred or is ineffective; other sites presumably would be reduced in size or density due to effective treatment. Field conditions at the time of treatment influences the choice of integrated treatment method. As long as the treatment method has been described in this EIS and the project design features, herbicide use buffers, and annual treatment caps are properly applied, treatments within or outside currently infested areas anywhere on the Forest may be treated under both action alternatives. Treatment caps would include treatment of existing and new sites.

New species of invasive plants may be located in the project area in the future. As long as treatment methods described above are effective, and the project design features are appropriately applied, new species (within existing or new sites) may be treated in both action alternatives.

Widespread species such as cheatgrass would not be prioritized for treatment and are not included in the acreage estimates. However, these species would not be considered non-target species and may be treated as long as all other project design features are followed and annual caps are observed. This would likely occur in special areas such as wilderness, or in conjunction with adjacent invasive plant treatments for higher priority target species.

Project Design Features (Mitigation Measures)

The Project Design Features (PDFs) were developed to minimize the potential adverse impacts of invasive plant treatments in Alternatives 2 and 3, and provide a framework for the EDRR strategy.

PDFs define a set of conditions or requirements that an activity must meet to avoid or minimize potential effects on sensitive resources. The PDFs were designed to mitigate impacts as a result of site-specific resource conditions within currently infested areas. PDFs are an integral component of both action alternatives, except where specifically noted, and therefore, when conditions dictate, implementation would be mandatory. Under the EDRR strategy, the applicable PDFs would also be applied to newly discovered infestations that are treated. The PDFs provide sideboards to ensure that the effects of treating new sites are similar to the effects of treating existing sites. The Okanogan-Wenatchee National Forest Herbicide Safety Plan (2005) would continue to be followed for all treatments.

Chemical label requirements and common best management practices for herbicide applicators are assumed to be followed and are not repeated herein.

ARBO II Design Features

The Aquatic Restoration Biological Opinion (II) was issued in 2013 (ARBO II, USFWS, NMFS); this document includes specific direction for invasive plant treatments that may affect critical riparian and aquatic habitats for species listed under the Endangered Species Act. This project incorporates ARBO II in full, although not all of the project design criteria and reporting requirements are repeated in this section. Unless otherwise indicated, these design features apply to the entire project area (as indicated below)

Project design features that are covered within the ARBO II include:

1. Use herbicides only in an integrated weed or vegetation management context where all treatments are considered and various methods are used individually or in concert to maximize the benefits while reducing undesirable effects. Non-native invasive plant control projects will not exceed 10% of acres within a Riparian Reserve under the Northwest Forest Plan (USDA and USDI 1994a) or RHCA under PACFISH/INFISH (USDA and USDI 1994b) within a 6th field watershed annually.

2. Carefully consider herbicide impacts to fish, wildlife, non-target native plants, and other resources when making herbicide choices.

3. Treat only the minimum area necessary for effective control. Herbicides may be applied by selective, hand-held, backpack, or broadcast equipment in accordance with state and federal law and only by certified and licensed applicators to specifically target invasive plant species.

4. Herbicide application rates will follow label direction, unless site- specific analysis determines a lower maximum rate is needed to reduce non-target impacts.

5. An herbicide safety/spill response plan is required for all projects to reduce the likelihood of spills, misapplication, reduce potential for unsafe practices, and to take remedial actions in the event of spills. Spill plan contents will follow agency direction.[5]

6. Pesticide applicator reports must be completed within 24 hours of application.

7. Herbicide adjuvants – When recommended by the label, an approved aquatic surfactant would be used to improve uptake. When aquatic herbicides are required, the only surfactants and adjuvants permitted are those allowed for use on aquatic sites, as listed by the Washington State Department of Ecology: http://www.ecy.wa.gov/programs/wq/pesticides/regpesticides.html. (Oregon Department of Agriculture also often recommends this list for aquatic site applications). The surfactants R-11, Polyethoxylated tallow amine (POEA), and herbicides that contain POEA (e.g., Roundup) will not be used. More information about adjuvants is in Chapter 3.1.[6]

8. Herbicide carriers – Herbicide carriers (solvents) are limited to water or specifically labeled vegetable oil.

9. Herbicide mixing – Herbicides will be mixed more than 150 feet from any natural waterbody to minimize the risk of an accidental discharge. Impervious material will be placed beneath mixing areas in such a manner as to contain any spills associated with mixing/refilling. Spray tanks shall be washed further than 300 feet away from surface water. All hauling and application equipment shall be free from leaks and operating as intended.

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[5] See the 2004 Forestwide Okanogan and Wenatchee Forest Herbicide Application Safety Plan in the project record.
[6] Please note that R-11 is a surfactant that contains NPE. NPE is not proposed for use anywhere within the project area. POEA is also not proposed for use anywhere within the project area. Additional surfactants beyond those approved for aquatic use on the Washington state list may be used in upland areas.

10. Herbicide application methods – Liquid forms of herbicides will be applied as follows:

    a) Broadcast spraying using booms mounted on ground-based vehicles.

    b) Spot spraying with hand held nozzles attached to back pack tanks or vehicles and hand-pumped sprayers to apply herbicide directly onto small patches or individual plants.

    c) Hand/selective through wicking and wiping, basal bark, frill (“hack and squirt”), stem injection, or cut-stump.

    d) Dyes or colorants, (e.g., Hi-Light, Dynamark) will be used to assist in treatment assurance and minimize over-spraying within 100 feet of live water.

11. Minimization of herbicide drift and leaching – Herbicide drift and leaching will be minimized as follows:

    a) Do not spray when wind speeds exceed 10 miles per hour to reduce the likelihood of spray/dust drift. Winds of 2 mph or less are indicative of air inversions. The applicator must confirm the absence of an inversion before proceeding with the application whenever the wind speed is 2 mph or less.

    b) Be aware of wind directions and potential for herbicides to affect aquatic habitat area downwind.

    c) Keep boom or spray as low as possible to reduce wind effects.

    d) Avoid or minimize drift by utilizing appropriate equipment and settings (e.g., nozzle selection, adjusting pressure, drift reduction agents). Select proper application equipment (e.g., spray equipment that produces 200-800 micron diameter droplets [Spray droplets of 100 microns or less are most prone to drift]).

    e) Follow herbicide label directions for maximum daytime temperature permitted (some types of herbicides volatilize in hot temperatures).

    f) Do not spray during periods of adverse weather conditions (snow or rain imminent, fog, etc.). Wind and other weather data will be monitored and reported for all pesticide applicator reports.

    g) Herbicides shall not be applied when the soil is saturated or when a precipitation event likely to produce direct runoff to fish-bearing waters from a treated site is forecasted by NOAA National Weather Service or other similar forecasting service within 48 hours following application. Soil-activated herbicides can be applied as long as label is followed. Do not conduct any applications during periods of heavy rainfall.

12. Herbicide buffer distances – The following no-application buffers— which are measured in feet and are based on herbicide formula, stream type, and application method—will be observed during herbicide applications (Table 2.6). Herbicide applications based on a combination of approved herbicides will use the most conservative buffer for any herbicide included. Buffer widths are measured as map distance perpendicular to the bank full for streams, the upland boundary for wetlands, or the upper bank for roadside ditches. A buffer of 0 means that there is no buffer.

Table 2.6: Herbicide Use Buffers from ARBO II

Herbicide	Perennial Streams and Wetlands, and Intermittent Streams and Roadside Ditches with flowing or standing water present			Dry Intermittent Streams, Dry Intermittent Wetlands, Dry Roadside Ditches		
	Broadcast Spraying	Spot Spraying	Hand Selective	Broadcast Spraying	Spot Spraying	Hand Selective
	Distance from surface water in feet					
Labeled for Aquatic Use						
Aquatic	100	*waterline*	*waterline*	50	0	0
Aquatic Imazapyr	100	*waterline*	*waterline*	50	0	0
Aquatic Triclopyr-TEA	***Not allowed***	15	*waterline*	***Not Allowed***	0	0
Low Risk to Aquatic Organisms						
Aminopyralid	100	waterline	waterline	50	0	0
Imazapic	100	15	*bankfull elevation*	50	0	0
Clopyralid	100	15	*bankfull elevation*	50	0	0
Metsulfuron-methyl	100	15	*bankfull elevation*	50	0	0
Moderate Risk to Aquatic Organisms						
Imazapyr	100	50	*bankfull elevation*	50	15	*bankfull elevation*
Chlorsulfuron	100	50	*bankfull elevation*	50	15	*bankfull elevation*
High Risk to Aquatic Organisms						
Picloram	100	50	50	100	50	50

Additional Project Design Features

Project design features have been in development for several years and have been refined over the years based on learning from other projects and incorporation of the 2013 ARBO II. However, the intent of the design features remains consistent and focused on meeting the R6 PNW ROD standards associated with invasive plant treatment.

The numbering conventions have been retained where possible for ease of tracking earlier iterations. Gaps in numbering have occurred where previous PDFs have been removed (generally because they are redundant with ARBO II or have been combined/refined based on regional experience).

[7] Lower risk formulations of glyphosate that do not contain POEA need not be labeled for aquatic use for infestations further than 100 feet of streams or other water bodies as defined in this table.

B-1. Coordination with Others

To ensure that neighbors are fully informed about nearby treatments (particularly herbicide use) and to increase the effectiveness of treatments being undertaken on adjacent ownerships, work with owners and managers of neighboring lands to respond to invasive plants that occur across multiple ownerships. Coordinate treatments within appropriate distances based on invasive plant species reproductive characteristics, and current use of area. Enlist cooperation of permittees and discuss treatment plans on active allotments before treatment.

C-1. Invasive Plant Prevention

Clean vehicles and equipment that will leave the road prism before entering National Forest. Ensure that invasive plant materials are not transported between treatment areas.

E-2. Mechanical Equipment

Fueling of gas-powered equipment with tanks would not occur inside the RHCAs or Riparian Reserves (RRs) unless there is no other alternative.

F-4. Herbicide Use Rates

Table 2.7 lists the maximum rates of herbicide active ingredient that may be used. This provides the upper limit for the analysis in Chapter 3. The amount of herbicide applied to any given acre is likely to be less than this maximum depending on the size and density of the target species in the area. Local knowledge will be used to determine appropriate rates for each situation.

Table 2.7: Maximum Rate per Acre for Each Herbicide Active Ingredient

Active Ingredient	Pounds per Acre Maximum (per year)
Aminopyralid	0.09
Chlorsulfuron	0.09
Clopyralid	0.50
Glyphosate	4.00
Imazapic	0.13
Imazapyr	1.25
Metsulfuron methyl	0.075
Picloram	1.00
Triclopyr	2.00

H-5. Manage Herbicide Persistence in Soil

Do not use more than one application of imazapyr, metsulfuron methyl, or picloram on a given area in any two calendar years, except to treat areas missed during the initial application. Aminopyralid would not be broadcast in any area more than once per year. This would ensure that more persistent herbicides will not build up in the soil.

H-6. Lakes and Ponds

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 provides some untreated areas for some organisms to use as refugia.

H-7. Wetlands

Wetlands would be treated when soils are driest. If herbicide treatment is necessary when soils are wet, use aquatic labeled herbicides. Favor wicking or wiping treatment methods where effective and practical. No more than 10 contiguous acres or fifty percent of individual wetland areas would be treated in any 30-day period. This provides some untreated areas for some organisms to use as refugia.

H-8. Wells and Springs

Herbicide use would not occur within 100 feet of domestic wells or 200 feet of domestic spring developments. Use wicking, wiping or spot treatments within 100 feet of the water source for stock tanks. This protects water quality and grazing animals.

I-2. Surveys for Botanical Species of Concern

The Regional Forester's Special Status Species (RFSSS) list (2011) includes federally listed, federally proposed, sensitive and strategic species. In addition, many Northwest Forest Plan Survey and Manage species occur on the Forest. Together, RFSSS and Survey and Manage species are sometimes referred to as botanical species of concern, or special status species. Surveys would be conducted prior to treatment within suitable habitat for botanical species of concern. If surveys are not conducted, suitable habitat would be managed assuming the species of concern was present.

This is intended to meet policy for protecting native plants as per Forest Service Manual 2670 and applicable federally listed recovery plans; and the Northwest Forest Plan as amended.

I-3. Buffers for Botanical Species of Concern

Precautions would be taken to avoid any contact with botanical species of concern. Minimize trampling of native vegetation, especially within habitat for botanical species of concern. Herbicide would not be applied using the broadcast method within 100 feet of botanical species of concern. No spot treatment would be permitted within 10 feet of botanical species of concern (limited hand application may be approved). This is intended to meet Forest Service Manual 2670; recovery plans for federally listed species; and the Northwest Forest Plan, as amended.

These buffers are expected to fully protect botanical species of concern. The buffers will be monitored and increased if damage to special status species is observed. See monitoring section below.

I-4. Picloram Use within 50 Feet of Botanical Species of Concern

Picloram would not be used within 50 feet of botanical species of concern to ensure protection of emerging seedlings and potential non-target plant root uptake due to herbicide soil persistence.

J-1. Wolves, Lynx and Grizzly Bears

Treatments within 1 mile of active wolf and lynx dens would be timed to occur outside the season of occupancy (wolf-April 1 through June 30; lynx-May 1 through August 30). Treatments within 0.50 mile of occupied wolf rendezvous sites would be timed to occur outside the season of occupancy (April 1 through August 31) unless treatment activity is within acceptable ambient noise levels and human presence would not cause wolves to abandon the site (as determined by a local specialist). In grizzly bear core area, motorized vehicle (including ATVs) use will only be permitted on open system roads. This PDF would minimize disturbance/impacts to wolves, lynx and bears.

J-2 Northern Spotted Owl

Project activity that creates noise above ambient levels (i.e. weed-eaters, mowers, etc.) would not take place within ¼ mile of a northern spotted owl nest site or an activity center whose status is unknown or un-surveyed nesting habitat within ¼ mile of maintenance level 1 roads between March 1 and July 31. Local knowledge may be used to adjust dates to site-specific conditions. This condition may be waived in a particular year if nesting or reproductive success surveys reveal that spotted owls are not nesting or no young are present that year (as determined by a local specialist). Waivers are valid only until March 1 of the following year. This would minimize disturbance to nesting spotted owls and protect eggs and nestlings.

J-3 Marbled Murrelet

Project activity that creates noise above ambient levels (i.e. weed-whackers, mowers, etc.) would not take place within ¼ mile of a marbled murrelet nest site or an activity center whose status is unknown or un-surveyed nesting habitat within ¼ mile of maintenance level 1 roads between April 1 and September 15. Local knowledge may be used to adjust dates to site-specific conditions. This condition may be waived in a particular year if nesting or reproductive success surveys reveal that marbled murrelets are not nesting or no young are present that year. Waivers are valid only until April 1 of the following year.

J-4 Bald Eagle

Treatment of areas generally within 450 meters of bald eagle nests would be timed to occur outside the nesting/fledgling season, which is generally January 1 to August 15. Local knowledge may be used to adjust dates, size and shape of distance buffers, to site-specific conditions. This only applies to treatment activity that creates noise above ambient levels and human presence that would cause eagles to abandon the nest (as determined by a local specialist). Occupancy of nest sites would be determined each year prior to treatment. This would minimize disturbance to nesting bald eagles and protect eggs and nestlings

Noise-producing activity above ambient levels would not occur between October 31 and March 31 during early morning or late afternoon within 450 meters of known bald eagle winter roosts and concentrated foraging areas. Disturbance to daytime winter foraging areas would be prohibited. This would minimize disturbance and reduce energy demands during stressful winter season.

J-5 Peregrine Falcon

Within 1.5 miles of nest sites, clopyralid and picloram use would be limited to once per year and once every other year respectively. This is intended to minimize risk of exposure to hexachlorobenzene (HCB).

Treatment of areas generally within 0.5 mile of peregrine nest would be timed to occur outside the nesting/fledgling period, which is generally March 1 through June 30. Local knowledge may be used to adjust dates, size and shape of distance buffers, to site-specific conditions. This only applies to treatment activity that creates noise above ambient levels and human presence that would cause peregrines to abandon the nest (as determined by a local specialist). Occupancy of nest sites would be determined each year prior to treatment. This would minimize disturbance to nesting peregrine falcons and protect eggs and nestlings.

J-7 Larch Mountain Salamander (*Plethodon larselli*), Puget Oregonian (*Cryptomastix devia*), Shiny Tightcoil (*Pristiloma wascoense*) Chelan Mountain snail (*Oreohelix* n. sp.) Grand Coulee Mountain snail (*Orehelix juni*)

Within mapped high potential suitable habitat for Larch Mountain salamanders, Puget Oregonians, Shiny tightcoils, Chelan Mountain snails and Grand Coulee Mountain snails, do not broadcast spray herbicide;

rather, utilize wiping, wicking and spot spraying methods. No broadcasting within ¼ mile of suitable un-surveyed habitat, rocky outcrops and talus.

Do not apply herbicides within occupied habitat for Larch Mountain salamanders, Puget Oregonians, Shiny tightcoils, Chelan Mountain snails and Grand Coulee Mountain snails (USDA Forest Service and USDI Bureau of Land Management 2008 and Burke 1999a and b).

These criteria are intended to reduce herbicide exposure to amphibians and mollusks.

Limit time of year invasive plant treatment occurs in occupied and un-surveyed habitat for Larch Mountain salamanders, Puget Oregonians, Shiny tightcoils, Chelan Mountain snails and Grand Coulee Mountain snails to when species are subterranean (restrict season to cold and dry times). This is intended to avoid trampling and applies to all treatment methods.

J-8 Masked Duskysnail (*Lyogyrus* n. sp. 2) Zigzag Darner (*Aeshna sitchensis*) and Subarctic Darner (*Aeshna subarctica*)

Do not broadcast spray herbicides within 100 feet of Fish Lake on the Wenatchee River Ranger District. Coordinate treatment method, timing annually with local biologist prior to invasive plant treatment in occupied habitat. This is intended to minimize herbicide exposure and trampling.

J-10 Mardon Skipper, Peck's Skipper, Tawny-edge Skipper, Meadow Fritillary, and Great Basin Fritillary

Do not use of ester formulations of herbicide and do not broadcast any herbicide in known Mardon, Peck's and tawny-edge Skippers, and meadow and Great Basin fritillary habitat. Use herbicides on no more than 50% of known sites in any one year. Coordinate treatment method, timing, locations, amount of habitat treated annually with local biologists. This is intended to minimize exposure to herbicides, surfactants, and trampling while effectively protecting and improving habitat.

J-11 Raptors

Active raptor nest sites should be protected from disturbance above ambient noise levels during the dates specified. Local biologists would determine appropriate distances for planned operations prior to implementation. This is intended to prevent disturbance to nesting raptors during the following periods:

Golden eagle	February 15 – September 1
Osprey	April 1 – August 31
Red-tailed hawk	March 1 – August 31
Northern goshawk	March 1 – September 31
Cooper's hawk	April 1 – August 31
Sharp-shinned hawk	April 1 – August 31
Prairie falcon	March 1 – June 30
Great gray owl	March 1 – July 31
Long-eared owl	April 1 – July 15

Great horned owl	February 15 – July 15

K-1 Public Notification

Notify the public about upcoming herbicide treatments via one or more of the following techniques: newspaper; Forest Service website, individual contact with sensitive individuals on the state list as requested; and signs posted in picnic areas, roadsides and campgrounds near treatment sites. Extra postings would occur when triclopyr is being applied in areas suspected to be special forest product or wild food gathering areas. This is intended to meet public notification requirements regarding herbicide use on National Forest and to specifically minimize inadvertent (and unlikely) public exposure to triclopyr (see Chapter 3.8).

L-1 Heritage Resources

A Forest Heritage Resource Specialist would assess whether manual or mechanical treatments have the potential to affect heritage resources on a site basis. Unless previously surveyed or in an area of previous ground disturbance, field inventories would be conducted in accordance with the Forest's heritage resource probability model and/or where heritage resources have been documented. Manual or mechanical treatments within the boundary of a heritage resource site would be monitored and documentation of each project would be in accordance with the Forest's 1997 Section 106 programmatic agreement. This is intended to avoid adverse impacts to heritage resources from manual and mechanical treatments.

Early Detection and Rapid Response Approach Common to Action Alternatives

Under both action alternatives, new sites would be treated using integrated methods, anywhere within the project area, over the life of the project, according to the project design features and herbicide use buffers described in Chapter 2.2.2.Invasive plants are expected to spread at a rate that would theoretically result in an additional 17,566 acres of invasive plant infestations on the Forest over the next 15 years, for a cumulative total of 33,847 acres (when added to the existing mapped inventory).

Most spread is expected to occur near known infestations; however invasive species may spread to other locations on the Forest. The location of new sites is not predictable, however, the effects of treatment are predictable because similar treatments on similar sites would be expected to have similar effects, and the project design features, herbicide use buffers, and annual caps provide sideboards on the extent and intensity of treatment.

Combined treatment of known sites and sites added through EDRR would not exceed 16,281 infested acres per year, which are the current known acres of infestation. Defining this acreage "cap" allows the analysis in the EIS to proceed within well-defined parameters.

In both action alternatives, new infestations would be recorded and documented as discovered. Treatment methods for new infestations would be the same as those described for known infestations. Newly discovered infestations or sites would receive a high priority for treatment for eradication while the infestation is small and treated most effectively.

New invasive species that are not currently found may be detected within or outside currently infested areas. Treatment of new species may occur as long as the treatment method is similar to those described in this EIS for known species and PDFs/buffers are followed.

Treatments of new sites or species would be within scope of this project as long as the type of treatment has been analyzed and PDFs can be effectively applied.

Forest Plan Amendment Common to Action Alternatives

The action alternatives would amend the first sentence of treatment and restoration standard 16 from the R6 PNW ROD to add aminopyralid to the list of allowed herbicides on the Okanogan-Wenatchee National Forest only, thereby amending both the Okanogan-Wenatchee National Forest's Forest Plans to allow use of aminopyralid under this decision.

Adding aminopyralid through a non-significant forest plan amendment[8] is consistent with the goals of the R6 PNW ROD and was anticipated by standard #16, which states that "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."

An herbicide risk assessment was completed in 2007 for aminopyralid (SERA 2007). Aminopyralid is one of the most effective herbicide on many target plants in the composite family, and has a lower potential for environmental and human health effects than the other broadleaf selective herbicides approved in the R6 PNW ROD (Bautista and Bulkin 2011).

Monitoring and Adaptive Management Common to Action Alternatives

Both action alternatives would implement the inventory and monitoring framework included in the R6 PNW ROD. This framework describes the monitoring needed to assure that desired future conditions and treatment strategies are achieved. The framework includes implementation/compliance and effectiveness monitoring components. In addition, water quality best management practices for chemical uses near streams would be monitored according to national protocols. Monitoring would include the effectiveness of the treatments and their potential adverse effects. Various methods and combinations of methods may be tried over time until invasive plants are effectively treated and treatment sites are appropriately restored. Treatment prescriptions would be adjusted if unexpected adverse impacts are observed.

Implementation Planning

The following outlines the process that will be used to ensure that the selected alternative is properly implemented. It applies to invasive plant sites known and identified for treatment in the EIS as well as new sites found during inventory (Early Detection/Rapid Response). An invasive plant assessment review team will be assembled on each Ranger District as needed to ensure consistent and effective treatment is applied, appropriate Project Design Features are implemented, and necessary monitoring and reporting are completed. Team members and a team leader will be assigned by the District Rangers, and will include fish and wildlife biologists, range conservationists and botanists as needed.

In order to find new invaders and new infestations each District will annually inventory road, trails, and vulnerable and disturbed areas. Employees would be trained to identify invasive plants and asked to report them to the invasive plant managers. Invasive plant surveys would be conducted project areas with planned ground disturbance, and in burned areas. New infestations would be recorded in the USFS NRIS database. Creation of volunteer weed watcher programs would be encouraged. Information about invasive plant infestations would be requested and collected from all Forest users including grazing permittees, recreationists, and hunters. Invasive plant managers would work closely with county weed boards to be kept apprised of infestations on private lands that could spread onto the forest.

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[8] This plan amendment is considered non-significant based on criteria in the 1982 Planning Rule (see chapter 3.13.5). The 2012 Planning Rule allows for amendment procedures that were initiated before May 2015 to be completed under the 1982 procedures.

For new sites to be treated under EDRR, describe density, type and number of species, and their extent using NRIS data forms. Ensure new invasive plant sites are entered into the NRIS database. Ensure that treatment prescriptions and site conditions are similar to those analyzed in this EIS.

For all treatment sites, identify and implement pre-treatment surveys as needed (e.g. survey and manage or TES plants). Develop prescriptions based on: Criteria associated with the selected alternative including limitations on herbicide use (e.g., Alternative 3); Size of infestation, treatment history and response to past treatments; Proximity to sensitive species or habitats; Proximity to streams, lakes, or wetlands; Soil conditions; Domestic water intakes or position in municipal watershed; Recreation or special forest product uses, and Mineral Material source (in use or planned for use).

Early on, consider if active restoration (seeding of native species) will be required. The need for active restoration will be re-assessed during post-treatment monitoring. For active restoration sites, ensure acceptable plant are available before implementation.

Implementation/Compliance Monitoring

Implementation/compliance monitoring answers the question, "Did we do what we said we would do?" At the forest level, this would entail tracking of compliance with R6 PNW ROD treatment and restoration standards, compliance with the PDFs in this document, and implementation of the EDRR screening process. Monitoring steps include:

- Maintain and update the Forest inventory in the NRIS (or replacement) database.
- Document the EDRR evaluation and review process for new sites.
- Prepare a project work plan and pesticide use proposal (Form FS2100-2) as described in FSH 2109.14.
- Ensure contracts and agreements include appropriate prescriptions, herbicide ingredients and application rates label requirements, R6 PNW ROD standards 16 and 18, and PDFs.
- Obtain National Pollution Discharge Elimination System (NPDES) permits as needed to comply with the Clean Water Act.
- Document acres treated in riparian areas (total and as a percent of each 6^{th} field watershed) and total acres treated each year on the Forest.
- Document invasive plant treatment accomplishments, implementation monitoring and herbicide use and certified applicator information in the National Pesticide Use Database, via the FACTS (or replacement) database.

Compliance monitoring would occur before implementation to ensure that prescriptions, contracts and agreements integrate appropriate Project Design Features. This would be done via a pre-work review.

Implementation monitoring would occur to ensure Project Design Features are implemented as planned. Contract administration mechanisms would be used to correct deficiencies. Pesticide use reports would be filed as required.

Effectiveness Monitoring and Adaptive Response

Effectiveness monitoring answers the question, "Were treatment and restoration activities effective?" At the Forest level, post treatment reviews would be used to determine whether invasive plant site objectives (eradicate, control, contain, or suppress) are being met, and whether passive or active restoration has occurred as expected.

At the Regional level, sample monitoring would evaluate the effectiveness of various measures, including R6 PNW ROD standards and PDFs designed to reduce potential adverse effects that pose a high risk to federally listed species. High risk projects are defined as those using aerial application of herbicide and the use of heavy equipment or broadcast application in riparian areas containing, or connected to, habitat for listed fish species, or in proximity to listed plants or butterfly habitat. No aerial treatment, heavy equipment use, or broadcast within 100 feet of streams is proposed in this project, therefore treatments meeting the high risk criteria would not occur. Limitations on annual extent of treatment and the scattered nature of the infestations further reduce risk as defined in the R6 PNW ROD Monitoring Framework and subsequent Monitoring Plan (USFS 2012).

The target for post-treatment monitoring is 50% of the acres treated. Treatments and treatment effectiveness would be recorded in the FACTS database. Forest-level monitoring also includes maintaining and updating the Forest inventory in the NRIS database, which would help track if infestations are spreading and if new infestations are found.

Retreatment and active restoration would be implemented based on post-treatment results. Changes in herbicide or non-herbicide methods would occur based on results. For instance, an invasive plant population treated with a broadcast herbicide may be retreated with a spot spray, or later manually pulled, once the size of the infestation is sufficiently reduced following the initial treatment.

Effectiveness monitoring would occur to ensure treatments have been effective and non-target vegetation was not impacted. Monitoring would occur before, during and after treatment to determine whether invasive plants are being effectively controlled and to ensure non-target vegetation, especially botanical species of concern are adequately protected. Treatment buffers would be expanded for the monitored site and all future treatment sites if damage or mortality is found.

Additional monitoring may be done as part of the R6 effectiveness monitoring program, Okanogan-Wenatchee National Forest annual monitoring plan, or other ongoing programs such as state water quality monitoring.

2.3 Alternatives Considered but Eliminated from Detailed Study

2.3.1 Original Proposed Action

Some changes have been made to the Proposed Action since 2009, when scoping began:

- The 2009 proposal capped total treatment acres at 31,694 per year. In the current Alternative 2, the maximum acres treated per year were reduced by almost half (to 16,281 per year) including both existing populations and those treated under EDRR. This is because there is no reasonable basis for analyzing treatment of nearly double the existing infested area, especially considering that current funding covers treatment of about 3,500 acres annually.

- Sethoxydim, sulfometuron, and triclopyr BEE, were dropped from the proposed action after it was determined these herbicides are not needed for effective treatment of the invasive plants found, or likely to occur, in the project area. Triclopyr TEA, which is labeled for aquatic use and poses less risk to human health, wildlife, and fish, is proposed for use.

- Two classes of surfactants (additives to herbicide mixes which reduce the surface tension of the liquid, thereby increasing the herbicide’s contact with the plant surface) were also dropped because other surfactants were as or more effective with fewer environmental and human health concerns: polyoxyethylenealkylamines (POEA) and nonylphenol ethoxylates (NPE). No higher risk formulations of glyphosate as defined by the 2011 risk assessment would be used.

- A cap of 10% percent of acres treated annually with herbicides in riparian areas within 6th field watersheds was added to the refined proposed action and Alternative 3 at the suggestion of EPA and the ARBO II ESA Section 7 Consultation Biological Opinion.

2.3.2 Rely Solely on Non-Herbicide Treatments

Some public comments indicated substantial concern over the use of herbicides and suggested that the Okanogan-Wenatchee National Forest not use any herbicides in favor of treatment limited to manual, mechanical, cultural and biological methods.

This approach would not adequately meet the purpose and need for action to treat known and newly discovered invasive plant infestations in a manner consistent with the standards, objectives, and goals of the R6 PNW ROD. As noted in Chapter 1, the Forest Service is responding to an underlying need for eradication, containment, control, and/or suppression of invasive plants on the Okanogan-Wenatchee National Forest, so that desired conditions such as healthy native plant communities may be achieved.

For some invasive plant sites, the size of the population, density of the population, and/or nature of the invasive species requires the application of herbicides for effective treatment. For example, Canada thistle, St. Johnswort, and the toadflaxes have extensive lateral root systems. Digging in these areas leaves behind root fragments from which new plants can sprout. Although sometimes used to prevent seeding, manual control at these types of sites on the Forest in the past has resulted in little change in the size or density of the infestations (see Chapter 3.2 for more information on effectiveness of treatments).

The Regional Forester, as reported in the R6 PNW ROD, considered making available to the Forest a more restrictive list of herbicides, but concluded that those limited herbicides would not be fully effective in treating invasive plant species known in the Region and would increase treatment costs over other alternatives (R6 PNW ROD, p. 24).

This site-specific treatment proposal for the Okanogan-Wenatchee National Forest employs herbicides as part of an integrated weed management approach. Local conditions, objectives, and concerns would be assessed to ensure treatment is effective, adverse effects are minimized or eliminated, and the use of herbicides is reduced over time. At this time, the purpose and need for this project cannot be met without use of herbicides (on the majority of sites, assuming an unlimited budget, non-herbicide methods could be effective. However, on some sites, herbicides are necessary for effective treatment. On most sites, herbicides help decrease the cost and time needed to contain, control or eradicate a given infestation (see Chapter 3.2 and 3.12 for more information about cost-effectiveness).

Two herbicides and one herbicide formulation were dropped from the original Proposed Action because other herbicides were deemed as effective with lower potential for adverse environmental effects.

Public comments expressed concern about potential adverse effects to humans from releasing chemicals into the environment. This issue is addressed by following label requirements, by following R6 PNW ROD standards for herbicide use, and by using appropriate application methods (see Chapter 3, Section 3.9 Human Health). Only herbicides with completed SERA risk assessments are included for use in this project. Public notification, buffers for riparian areas, and other project design features minimize potential for exposure (see Chapter 2.2.2 for PDFs). Both action alternatives incorporate PDFs to protect the public beyond the label instructions.

2.3.3 Prescribed Burning and Grazing

Prescribed burning can be an effective tool in managing invasive plants, especially when combined with other methods (Common Control Measures for Invasive Plants of the Pacific Northwest, Appendix B, R6 PNW FEIS). However, the timing of the burning required (typically the hot and dry season) for weed control often makes its use as a tool difficult, with unacceptable risk of fire spread outside the burn area and unacceptable damage to residual vegetation within the burn area. Opportunities to use fire as a tool would be considered in separate NEPA documents if an appropriate situation developed where this tool could be effectively used.

Grazing (for instance with goats) may also be an effective cultural treatment method, however it is expensive and generally applied on small high value sites that can be readily accessed and managed. No sites are proposed for grazing and additional analysis would occur before grazing would be used as a specific treatment method.

Measures to manage prevention of the spread of invasive plants is integrated into burning and grazing plans (see Appendix E: Okanogan & Wenatchee National Forest Weed Management & Prevention Strategy and Best Management Practices). In this context, treatment of invasive plants may occur as a connected action to ongoing or future actions.

2.3.4 Aerial Application of Herbicide

Some groups, including the Okanogan County Weed Board, were concerned that the proposed action did not treat enough acres and suggested that aerial application would be more efficient and cost effective. Aerial application of herbicides was considered, but eliminated from detailed study because there are few situations on the Forest where it could be efficiently used without impacting non-target species. Areas of dense infestations can be controlled efficiently and effectively through selective hand application or boom broadcast spraying; these techniques would drastically reduce the amount of herbicide release. Those sites treated through EDRR (which focuses on small, new infestations) are anticipated to be reasonably treated with spot spraying, manual or mechanical methods. See effects analysis for Alternatives 2 and 3 in Chapter 3.

2.3.5 Using Boom Sprayers on Mules in Wilderness

One respondent to scoping felt that mules with boom sprayers should be used in wilderness. Because of the small size of populations, and the rugged terrain, in the wilderness, boom spraying is unnecessary and impractical. These populations can be effectively treated with backpack spraying or manual methods which have fewer impacts than using mules or boom spraying.

2.3.6 Use Herbicides Other Than Those Proposed

Some members of the public suggested that additional herbicide ingredients be considered for use on the project. This alternative was dismissed from detailed study because the additional herbicides are not currently authorized for use on the Forest, based on the R6 PNW ROD.[9]

2.3.7 Use Home Remedies

[9] Aminopyralid was not available when the R6 PNW FEIS was written. It is proposed for use now because it has been found to be more effective on many target species within the project area and adverse effects are the same or less than the herbicides approved in the R6 PNW ROD.

One respondent to scoping felt that home remedies should be used to treat weeds. If a product or recipe claims to kill pests (weeds) it is legally considered to be a pesticide and must be registered under the Federal Insecticide, Rodenticide and Fungicide Act (FIRFA), or have a specific exemption from registration. Vinegar (acetic acid), for example, specifically is NOT exempt from registration as a pesticide under FIFRA. The types of home remedies suggested by the respondent are not approved for use as herbicides unless registered, are non-selective and may cause more impacts to human health and the environment than those approved for use in USFS Region 6. For example, acetic acid concentrations over 11% cause burns upon skin contact, and eye contact can result in severe burns and permanent corneal injury (Fact Sheet PIC-01002, Daniels and Fults 2002).

According to the Washington State University Pesticide Information Center (http://picol.cahe.wsu.edu/LabelTolerance.html) there are three products containing acetic acid that are approved for use as an herbicide in Washington State (2014): Vinagreen –Organic Production (20% acetic acid), Pharm Solutions Weed Pharm/Organic Production (20%) acetic acid, and Grotek Elimaweed Weed and Grass Killer R-T-U (7.15% acetic acid). None of these products are labeled for use on any of the priority weeds identified in this document.

In testing by the USDA-ARS (2002, http://www.barc.usda.gov/anri/sasl/vinegar.html) solutions of 5% vinegar did not provide reliable weed control but solutions of 10, 15 and 20% provided 80-100% control of certain annual weeds (foxtail, lambsquarters, pigweed, and velvet leaf, none of which are priority weeds for this project) (http://picol.cahe.wsu.edu/LabelTolerance.html). Tests in Washington State found that 7% solutions were not any more effective than 5% solutions Fact Sheet PIC-01002, Daniels and Fults 2002).

Salt and soap are other common non-selective components of home remedies. Salt will kill plants by drawing moisture out of the leaves but it remains in the soil and can prevent growth of desirable vegetation. Soap is often used in home remedies to help the spray stick to the leaves of waxy or hairy plants. Soaps often contain oils, which can kill plants if used at higher concentrations. The recipes for home remedies vary widely, making it difficult to predict their effect on invasive plants and the environment, and none are approved for use under the R6 PNW ROD.

2.4 Alternatives Compared

Table 2.8 compares the alternatives based on the issues described in Chapter 1.8.

Table 2.8: Alternative Comparison Table

Issue ID	Element/Indicator (where to find more information on this topic)	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3
--	Invasive Plant Treatment Methods	No new actions; Forest would complete current projects including about 6,000 acres of integrated projects. All treatment methods are included: manual, mechanical, biological, cultural, chemical. Limited suite of herbicides are currently approved.	All treatment methods would be included: manual, mechanical, biological, cultural, chemical. Herbicide use would be allowed in most situations as part of an integrated prescription on 15,602 acres. Currently, about 679 acres would likely be treated using non-herbicide methods; otherwise, herbicide may be used in combination with other treatment methods.	All treatment methods. About 4,946 acres would include herbicide use. 10,785 acres of current infestations would not meet include herbicide use; these areas would be treated using non-herbicide methods.
--	Early Detection Rapid Response	No	Yes, future infestations treated according to PDFs	Yes, future infestations treated according to PDFs, herbicide use restricted to criteria
--	Forest Plan Amendment to Add Aminopyralid to List of Approved Herbicide Ingredients	No	Yes	Yes

Issue ID	Element/Indicator (where to find more information on this topic)	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3
--	How Well Does the Alternative Meet the Need for Action (throughout Chapter 3)	Not at all. Most existing infestations (about 10,000 acres) would not be treated and would continue to spread. Continued and increasing risk to native plant communities, aquatic and riparian areas, and wildlife habitats from invasive plants. This would degrade scenic and recreation values, reduce grazing land condition, and threaten neighboring lands. Would not meet management direction for invasive plants.	Best of the alternatives. Cost-effective treatment methods would be available for all infestations. Alternative 2 has the best chance of abating risk to native plant communities, aquatic and riparian areas, and wildlife habitats from invasive plants and maintain scenic and recreation values and grazing land condition. Risk of invasive plants spreading to neighboring lands would be reduced. Best meets management direction for invasive plants.	Fair to poor. Some infestations would be effectively treated, but the increased treatment cost under this alternative would reduce the number of acres treated under a limited budget. Some infestations would not be treated and would continue to spread. Would meet management direction for invasive plants; however limitations on funding would mean that the program would not likely keep up with objectives.
1A,B,C	Total maximum acres of herbicide use annually (Chapter 2.2.2)	6,000 acres (until current projects expire, then none)	16,281 acres	5,946 acres (based on current inventory). Herbicide use under EDRR would be driven by criteria described above, and would not exceed 16,281 acres annually.
1A	Exposure scenarios that result in hazard quotient values greater than 1 for worker and public health (Chapter 3.9.4)	None, limited use of triclopyr	HQ > 1 for public based on consumption of vegetation contaminated with triclopyr. This is very unlikely to occur, triclopyr is the first choice herbicide for about 90 acres of scotch broom, scattered across 30 sites. People are unlikely to consume contaminated scotch broom.	Same as Alternative 2
1A	Measures to reduce public and worker exposure to herbicides (Chapter 2.2.2)	Existing herbicide use follows applicable laws, policies and plans; limited herbicide use, older chemistry	Limited herbicide use rates; herbicide use buffers near streams, wells and springs; and public notification. Use of aminopyralid poses very low risk, comparable or less relative risk to human health when compared to herbicides used under No Action	Same as Alternative 2, less use of herbicides overall (about one-third of infestations meet criteria).

Issue ID	Element/Indicator (where to find more information on this topic)	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3
1A	Human Health Risk Ranking (Chapter 3.9.4)	Very Low Risk – low acreage treated using herbicides and no additional herbicide use	Low Risk – risk abated by project design, adherence to policy, Forest Plan standards	Very Low Risk – low acreage treated using herbicides and risk would be further abated by project design, adherence to policy, Forest Plan standards.
1B	Extent of herbicide use associated with hazard quotient values greater than 1 for Wildlife (Chapter 3.7.4) (Table 2.3) .	HQ > 1 for plausible exposure scenarios for birds and mammals exposed to triclopyr and glyphosate. Limited use of herbicides on small, scattered sites over 6,000 acres.	HQ > 1 for plausible exposure scenarios for birds and mammals exposed to triclopyr and glyphosate. Triclopyr is the first choice herbicide for about 90 acres of scotch broom, scattered across 30 sites. This small amount of selective treatment (no broadcast) is unlikely to result in adverse wildlife exposure. Glyphosate is not the first choice for any acres, and poses very low risk to wildlife.	Same as Alternative 2, criteria to reduce potential herbicide use by only using herbicide on larger infestations and specific target species.
1B	Measures to reduce wildlife exposure to herbicides (Chapter 2.2.2)	Existing herbicide use follows applicable laws, policies and plans; limited herbicide use, older chemistry	Project design features for riparian protection (ARBO II); limited herbicide use rates; managing chemical persistence in the soil; maintaining refugia in lake and wetland habitats; herbicide use buffers near streams, wells and springs; protection of non-target plants; minimizing disturbance to wildlife	Same as Alternative 2, criteria to reduce potential herbicide use by only using herbicide on larger infestations and specific target species.
1B	Wildlife Risk Ranking (Chapter 3.7.4)	Very Low Risk, Lowest Benefit (low acreage treated, highest potential for spread)	Low Risk, Greatest Benefit (PDFs protect wildlife, most cost-effective treatment)	Low Risk, Moderate to Low Benefit (PDFs protect wildlife, less cost-effective treatment)
1B	Effects on special status species (Chapter 3.7.5)	No new effects, no new consultation	This project may affect (but is not likely to adversely affect) the following federally listed species: wolf, lynx, bear, owl and murrelet. This project may impact (but not jeopardize viability of) several special status invertebrate species.	Same as Alternative 2

Issue ID	Element/Indicator (where to find more information on this topic)	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3
1C	Measures to reduce risk to non-target plants (Chapter 2.2.2)	All existing projects include measures to protect non-target plant species.	Project Design Features I-2 and I-3 protect non-target plants, particularly species of botanical concern.	Same as Alternative 2
1C	Botanical Resource Risk Ranking (Chapter 3.2.4) (Chapter 3.3.4)	Risk to native plants and plant communities greater from invasive plants than treatment, thus no action with least effective treatment poses greatest risk to botanical resources.	Greatest potential benefit to native plants and plant communities via effective treatment of invasive plants. Low risk of harm from treatment methods.	Moderate potential benefit to native plants and plant communities where treatments are effective; however less than Alternative 2 because it is less likely to be cost-effective and fewer acres would be treated assuming a limited budget.
1D	Measures to prevent herbicides from building up in soil (Chapter 2.2.2)	No issues with herbicide build up in soil observed as a result of implementing existing treatments.	PDF's provide guidance on treatment frequency to reduce potential for herbicide to build up in soil.	Same as Alternative 2, less herbicide use overall
1D	Relative risk to soils biology (Chapter 3.5.4)	No impact to soil biology observed as a result of implementing existing treatments.	Low risk to soil biology due to methods and herbicide ingredients approved and PDFs; likely no impact.	Same as Alternative 2
1D, E	Measures to prevent herbicide from entering water and affecting beneficial uses and aquatic organisms (Chapter 2.2.2)	Herbicide use buffers are associated with treatment of existing infestations	Alternative incorporates herbicide use buffers and other design features associated with ARBO II, limiting broadcast and use of herbicides posing higher risk to the riparian/aquatic environment near streams. In addition, PDFs protect wetlands, lakes, ponds springs and wells.	Same as Alternative 2, less herbicide use in riparian and other areas
1D	Relative risk to beneficial uses of water (Chapter 3.6.4)	Current treatments have not resulted in adverse effects to beneficial uses.	Low to no risk to beneficial uses; drinking water, aesthetic value and fisheries protected	Same as Alternative 2, less herbicide use in riparian and other areas

Issue ID	Element/Indicator (where to find more information on this topic)	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3
1E	Relative Risk to Fish (Chapter 3.7.4)	Glyphosate, picloram and triclopyr are all associated with greater risk to fish. These herbicides are approved in current NEPA documents. Current treatments have not resulted in adverse effects to fish or the aquatic environment. Completing current projects is unlikely to adversely affect the aquatic environment.	Low to no risk to the aquatic environment. Following ARBO II terms and conditions would minimize risk of adverse effects to fish. Glyphosate, picloram and triclopyr are all associated with greater risk to fish. These would be used less frequently compared to other herbicides. Invasive plant treatments within the range of federally listed fish species fall under a class of actions that may affect and are likely to adversely affect the listed species (LAA). The ARBO II covers expected take and all activities in this project would be conducted consistent with ARBO II terms and conditions. Effects to critical habitat of listed fish species is expected to be negligible.	Same as Alternative 2, less herbicide use in riparian and other areas
2A	Known Acres that may not be effectively treated given limitations on herbicide use or NEPA coverage (Chapter 3.2.4)	16,281	679	10,785
2A	Known Acres where All Tools are Available	6,000	15,602	4,946
2A, B	Acres Remaining after Five Years with Unlimited Funding (Chapter 3.2.4) (Chapter 3.12.4)	12,960	27	337 Please note that this alternative costs over 3 times as much as Alternative 2. Assuming current funding levels, this alternative would take 20 years to accomplish. .

Issue ID	Element/Indicator (where to find more information on this topic)	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3
2A, B	Years to Meet Treatment Objectives (Known Sites) Assuming Current Funding (Chapter 3.2.4) (Chapter 3.12.4)	Treatment objectives would not be met on the majority of known sites.	Given current budgets, the Proposed Action would take at least 6 years or longer to achieve all goals. The initial years of implementation, only a portion of the existing infestations would likely be treated, especially if treatment of new infestations takes priority. However, over the life of the project, the objectives for invasive plant treatment could be met.	Given current budgets, Alternative 3 could take 20 years or longer to achieve treatment objectives. Without additional funding, the objectives for invasive plant treatment would not likely be met over the life of the project. The project effectiveness would be commensurate with no action if treatments are not affordable.
2B	Estimated cost of fully treating existing infestations assuming unlimited funding (Chapter 3.2.4) (Chapter 3.12.4)	$1,199,900 for 6,000 acres covered under current NEPA. 10,281acres would be left untreated.	$2,055,500 for all 16,281 acres	$7,115,400 for all 16,281 acres
2B	Estimated Average Cost Per Fully Treated Acre (includes re-treatment) (Chapter 3.2.4) (Chapter 3.12.4)	$200	$126	$437
3	Number of seasonal jobs to treat all acres in a single year (unlimited funding) (3.12.4)	14	39	86

Issue ID	Element/Indicator (where to find more information on this topic)	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3
4	Ranking of alternatives relative to scenic value (3.11.4)	Short term, least browning of target plants visible along roads and in special areas. Long term, most risk of degradation of scenic quality from spread of invasives.	Short term, most likely to result in browned target plants visible along roads and in special areas. Long term, best chance of restoration of native vegetation and maintenance of scenic quality.	Similar to Alternative 1 under a limited budget, Similar to Alternative 2 under an unlimited budget.

Chapter 3. Affected Environment and Environmental Consequences

3.1 Introduction

3.1.1 Best Available Science

Chapter 3 of this Environmental Impact Statement (EIS) summarizes the environments of the affected project area (existing conditions) and the potential changes to those environments due to implementation of the alternatives discussed in Chapter 2 (environmental consequences). It also presents the scientific and analytical basis for the comparison of alternatives presented. For ease in presentation and comparison, the analysis discussions are separated into individual resources areas.

This EIS incorporates by reference (as per 40 CFR 1502.21) the Project Record, including specialist reports and other technical documentation used to support our analysis and conclusions. The record documents our public outreach efforts. Analysis was completed for treatment effectiveness, human health, botany, soils, water resources, fisheries, wildlife, recreation and scenery and heritage resources. Records of Endangered Species Act Section 7 consultation are on file.

The best available science is considered in preparation of this EIS. However, what constitutes best available science might vary over time and across scientific disciplines as new science is brought into play. Chapter 3 of this EIS and the accompanying Project Record identify methods used, references reliable scientific sources, discusses responsible opposing views, and discloses incomplete or unavailable information, scientific uncertainty, and risk (See 40 CFR, 1502.9 (b), 1502.22, 1502.24).

This project tiers to the R6 PNW FEIS and incorporates the Syracuse Environmental Research Associates, Inc. (SERA) Risk Assessments and other documents associated with the 2005 planning effort. Concerns about the EPA pesticide registration process, about chemical use at higher rates, or about different pesticide formulations cannot be addressed in this project level document. This document does not reconsider findings and decisions made in the R6 PNW FEIS and ROD; however, it does incorporate findings from SERA risk assessments that were updated in 2007 (aminopyralid) and 2011 (glyphosate, imazapyr, picloram and triclopyr). See Chapter 3.1.4 below for links to risk assessments and other information about the risk assessment process.

The project record is located at the Okanogan-Wenatchee National Forest Headquarters office in Wenatchee, Washington.

3.1.2 Treatment Priorities

This project would be implemented for at least 15 years as funding allows, or until conditions have changed to where treatment under this EIS is no longer needed or can no longer occur. 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, and/or new invasive plants could invade the project area.

Table 3.1 displays how invasive plant sites would be prioritized for treatment. Other management considerations may also affect treatment priority, and these factors may change over time. For example, sites located in areas proposed for ground-disturbing management activities may be treated prior to project implementation to prevent spread, and priority may be given to treatment and restoration of sites where considerable time and money has already been spent. Opportunities for special funding or cooperative projects with other landowners, agencies, and organizations may also be considered in prioritization.

Table 3.1: Treatment Priorities

Priority	Description
High	• Sites of species new (EDRR) or uncommon on the Forest or District. Sites in or near unique plant habitats, or areas of high diversity (e.g., meadows, stream-sides, wetlands, fens, botanical areas, Research Natural Areas). • Washington State Class A and B Noxious Weeds, as designated for control by County • Sites that could impact Threatened, Endangered, or Sensitive plant, fish and wildlife habitat. • Sites along the Forest Boundary or in Wilderness • Sites in or adjacent to commodity producing and agricultural areas • Sites adjacent to disturbed areas (for example, in recently burned areas, active pits and quarries, roads, high use recreation sites, trailheads, horse camps, fire camps, parking lots) • Sites within or adjacent to visually sensitive areas
Medium	• Washington State Class C Noxious Weeds, as designated for control by County • Existing large infestations of priority species with a focus on containment within the boundaries of the infestation.
Low	• Sites of non-priority species already widespread on the Forest or District. • Sites with low risk of spread that are expected to decline with forest succession. • Invasive plants not listed by the Washington State Noxious Weed Control Board and already widespread on the Forest.

3.1.2 Types of Infested Sites

Each infested area is associated with a type of site based on the surrounding landscape. Table 3.2 totals infested acre by the type of site.

Table 3.2: Infested Acres by Type of Site

Site Type Number	Site Type	Infested Acres	Percent of Known Infestations
1	Roads, trails, campsites, and other high traffic areas.	10,499	65%
2	Special Botanical Management Areas (RNA and botanical special interest areas)	12	<1%
3	Special Status Plant and Wildlife Species sites	1,595	9%
4	Municipal Watershed	0	0%
5	Riparian and Wetlands (not included site types 1-4)	297	2%
6	Upland terrestrial habitat	3.878	24%
Total		**16,281**	**~100%**

3.1.3 Treatment Analysis Areas

The 5,528 invasive plant sites (16,281 acres) have been grouped into 146 Treatment Analysis Areas (TAAs) which includes the current mapped sites and surrounding areas most likely to become infested and need to be treated in the future. Existing conditions within the TAAs were evaluated to make sure that PDFs are adequate to address potential resource concerns that may not be evident within the currently mapped sites, but may be encountered during the course of project implementation. The TAAs cover more than 2 million acres on the Forest. While some new infestations may be located outside the TAAs, conditions are likely to be similar to those assessed in this EIS, and a project consistency assessment would be conducted to ensure this is the case.

Maps of invasive plant infestations within the TAAs are available on project website at: http://www.fs.fed.us/nepa/nepa_project_exp.php?project=24104. Appendix A includes examples of treatment analysis area maps and tabular information about each treatment area and the resource conditions.

The actual number, density, and distribution of the invasive plants vary; some sites are patchy and others are dense, and in some cases, sites have single plants scattered widely. Therefore, mapped infested acres incorporate far more land than what actually supports an invasive plant, and fewer acres than the total site acres would actually be treated for invasive species. TAA boundaries were drawn to include likely areas of spread from known infestations, considering such factors as vectors of spread, similar and adjacent habitats to known infestations. The effects estimates in this EIS are based on the environmental conditions in the TAAs.

Infested polygons have been mapped within the TAAs and these polygons were overlaid with habitat and other landscape elements to determine degree of risk from invasive plants and from treatment to various resources. Approximately 16,281 acres of invasive plants occur within the mapped polygons.

For analysis consistency, we assumed that all 16,281 acres would be treated in 2017, using a range of treatment methods as described in Chapter 2 for both action alternatives. We assumed that the effects of these treatments could be repeated annually for several years. We assumed that PDFs would be fully implemented. Additional assumptions relevant to the analysis in Chapter 3 include:

- Herbicide treatment would precede non-herbicide treatment because manual and mechanical treatments are more effective when populations have been substantially reduced through the use of herbicides. In some cases, manual and mechanical treatments would occur in advance of herbicide treatments to reduce the amount of herbicide needed or the biomass left on site or for other reasons.

- The most ambitious treatment scenario for analysis purposes would be for all sites to have an initial treatment in the first year. The benefits and adverse impacts of treatment are likely to be less than predicted for the most ambitious scenario because funding and other constraints would limit the amount treated in any one year.

- Broadcast application refers to foliar application on dense (greater than 70 percent coverage) invasive plant populations. Spot/selective herbicide application means that backpack and hand equipment would be used to treat foliage or stems (e.g. cut stump, injection). Spot and selective treatments would generally occur where invasive plants cover less than 70 percent of a given acre.

- The choice of treatment method(s) would be based on site-specific conditions including, the biology of the particular invasive species, the location and size of infestation, environmental factors, including the site's proximity to water and other sensitive resources (values at risk), management objectives, accessibility, and treatment costs.

- Infested acres would be treated with an initial prescription, and retreated in subsequent years, until control objectives are met.

- Spills are unlikely to occur and would be of small scale. The type of spills modeled in SERA risk assessments for the upper bound hazard quotient estimates (i.e. 200 gallons of herbicide mix spilling into a small pond) are not possible because the 2004 Okanagan-Wenatchee National Forest Herbicide Application Safety Plan includes measures for transportation and use to prevent spills from occurring or becoming large. Over many years of herbicide use, one documented spill (incident 109403) occurred on the Forest occurred (Tonasket Ranger District in 1994) on the Tonasket Ranger District. In that incident a total of 5 gallons of an aquatic glyphosate (Rodeo) tank mix spilled into Nicholson Creek when a truck rolled over. No reportable spills have occurred on similar projects in Region Six (Desser 2013).

3.1.4 Herbicides and Additives

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. Risk assessments were completed by Syracuse Environmental Research Associates, Inc. (SERA) using peer-reviewed articles from the open scientific literature and current Environmental Protection Agency (EPA) documents, including Confidential Business Information to which SERA had clearance. Information from laboratory and field studies of herbicide toxicity, exposure, and environmental fate was used to characterize the risk of adverse effects to non-target organisms.

The risk assessments consider a variety of exposure scenarios including accidental exposures and application at maximum rates over relatively large areas. Although the risk assessments have limitations (see R6 PNW FEIS pages 3-95 through 3-97), they represent the best science available. “After 30 years of use and refinement, this risk-assessment paradigm has become scientifically credible, transparent, and consistent; can be reliably anticipated by all parties involved in decisions regarding pesticide use; and clearly articulates where scientific judgment is required and the bounds within which such judgment can be applied. The process is used for human-health and ecological risk assessments and is used broadly throughout the federal government. Thus, the committee concludes that the … risk assessment … process is singularly appropriate for evaluating risks posed to ecological receptors, such as listed species, by chemical stressors, such as pesticides” (NAS 2013).

The risk assessments provide a range of human health and ecological impact results including lower, central and upper estimates. The upper value in the range would generally correspond to a “worst-case” value unlikely to actually occur for this project. For instance, workers would have to be exposed to maximum rates over the course of an 8-hour day; 200 gallons of herbicide would have to be spilled into a pond for accidental drinking water exposure scenarios; a woman would have to eat a pound of contaminated fruit; an animal would have to feed on nothing but contaminated vegetation over the course of a day; a fish would be exposed to herbicide following 10 acres of broadcast spray at maximum rates directly adjacent to a small stream. The central estimates also include assumptions that are unlikely to actually occur given the PDFs associated with this project and the scattered nature of invasive plant applications.

Risk assessments have a high degree of uncertainty in interpretation and extrapolation of data. Uncertainty may result from a study design, questions asked (and questions avoided), data collection, data interpretation, and extreme variability associated with aggregate effects of natural and synthesized chemicals on organisms, including humans, and with ecological relationships. Due to data gaps, assessments rely heavily on extrapolation from laboratory animal tests (USFS 2005a).

Regardless of disadvantages and limitations of ecological and human health risk assessments, risk assessments can determine (given a particular set of assumptions) whether there is a basis for asserting that a particular adverse effect is possible. The bottom line for all risk analyses is that absolute safety can never be proven and the absence of risk can never be guaranteed (SERA 2007). Limited information on surfactants, adjuvants, and inert ingredients is available in Bakke 2007 and various risk assessments. Since risk assessments have not been completed for most surfactants, adjuvants and inert ingredients, information regarding the toxicity and effects of these chemicals is largely unavailable.

Herbicide risk assessments are available online at http://www.fs.fed.us/foresthealth/pesticide/risk.shtml and herbicide labels are available at http://www.fs.fed.us/foresthealth/pesticide/labels.shtml. Table 3.3 displays the risk assessment references associated with each herbicide proposed for use and table 3.4 displays their properties and risks.

Table 3.3 Herbicide Risk Assessment References

Herbicide	Date Final	Risk Assessment Reference
Aminopyralid	June 28, 2007	SERA TR-052-04-04a
Chlorsulfuron	November 21, 2004	SERA TR 04-43-18-01c
Clopyralid	December 5, 2004	SERA TR 04 43-17-03c
Glyphosate	March 25, 2011	SERA TR-052-22-03b
Imazapic	December 23, 2004	SERA TR 04-43-17-04b
Imazapyr	December 16, 2011	SERA TR-052-29-03a
Metsulfuron methyl	December 9, 2004	SERA TR 04-43-17-01b
Picloram	September 29, 2011	SERA TR-052-27-03a
Triclopyr	May 24, 2011	SERA TR 052-25-03a

Table 3.4: Herbicide Properties and Risks

Active Ingredient Selected Herbicide Brand Names and Mode of Action	Properties	Risks
Aminopyralid (Milestone®, Milestone VM®) Mimics Auxin Plant growth hormone	Selective for most broadleaf species. Post emergent herbicide. Grasses are tolerant.	Potential to kill non-target broadleaf plants. Low risk to aquatic organisms. Milestone® formulations contain no inert ingredients other than water and triisopropanolamine (active ingredient in aminopyralid).
Chlorsulfuron (Telar®, Glean®, Corsair®) Sulfonylurea-Interferes with enzyme acetolactate synthase with rapid cessation of cell division and plant growth in shoots and roots.	Glean -Selective pre-emergent or early post-emergent Telar – Selective pre- and post-emergent. Both are for many annual, biennial and perennial broadleaf species. Safe for most perennial grasses, conifers. Some soil residue.	Moderate risk to aquatic organisms.
Clopyralid (Transline®) Synthetic auxin -Mimics natural plant hormones.	A highly trans-located, selective herbicide active primarily through foliage of broadleaf species. Little effect on grasses.	Contains hexachlorobenzene (persistent carcinogen) in amounts below a threshold of concern; this chemical is ubiquitous in the environment. Highly mobile, but does not degrade in water. Lower risk to aquatic organisms.
Glyphosate (35 formulations, including RoundUp®, Rodeo®, Accord XRT®, Aquamaster®, etc.) Inhibits three amino acids and protein synthesis.	A broad spectrum, non-selective trans-located herbicide with no apparent soil activity. Adheres to soil which lessens or retards leaching or uptake by non-targets.	Non-selective. Greater risk to aquatic organisms.

Active Ingredient Selected Herbicide Brand Names and Mode of Action	Properties	Risks
Imazapic (Plateau®) Inhibits the plant enzyme acetolactate, which prevents protein synthase.	Used for the control of some broadleaf plants and some grasses.	More potential to kill non-target vegetation. Lower risk to aquatic organisms.
Imazapyr (Arsenal®, Arsenal AC®, Chopper®, Stalker®, Habitat®) Inhibits the plant enzyme acetolactate, which prevents protein synthesis.	Broad spectrum, non-selective pre- and post-emergent for annual and perennial grasses and broadleaved species.	More potential to kill non-target vegetation. Moderate risk to aquatic organisms. Human health hazard associated with higher label rates. More mobile.
Metsulfuron methyl (Escort XP®) Sulfonylurea -Inhibits acetolactate synthesis, protein synthesis inhibitor, and block formation of amino acids.	Used for the control of many broadleaf and woody species. Most susceptible crop species in the lily family (i.e. onions). Safest sulfonylurea around non-target grasses.	More potential to kill non-target vegetation. Lower risk to aquatic organisms.
Picloram (Tordon K®, Tordon 22K®) Restricted Use Herbicide Synthetic auxin - Mimics natural plant hormones.	Selective, systemic for many annual and perennial broadleaf herbs and woody plants.	Most mobile, but persistent in soil. Contains hexachlorobenzene (persistent carcinogen) in amounts below a threshold of concern; this chemical is ubiquitous in the environment. More potential to kill non-target vegetation. Greater risk to aquatic organisms. Human health hazard associated with higher label rates.
Triclopyr TEA (Garlon 3A®, Garlon 4®, Forestry Garlon 4®) Synthetic auxin - Mimics natural plant hormones.	A growth regulating selective, systemic herbicide for control of woody and broadleaf perennial invasive plants. Little or no impact on grasses.	Greatest risk to aquatic organisms; use of aquatic formulations (TEA) reduces risk compared to BEE. Exposure may exceed thresholds of concern for workers and the public.

Herbicide Risk Reduction Framework

Alternatives 2 and 3 incorporate a risk reduction framework to ensure the safe and effective use of herbicides. Figure 1 below displays the layers of caution that are integrated into risk reduction framework for herbicide use in the United State Department of Agriculture (USDA) Forest Service, Pacific Northwest Region.

First, label requirements, federal and state laws, and the EPA approval process provide an initial level of caution regarding herbicide use. Next, the Syracuse Environmental Research Associates (SERA) Risk Assessments (2001, 2003a, 2003b, 2003c, 2004a, 2004b, 2004c, 2004d, 2004e, 2004f, 2007, 2011) determine the hazards associated with worst-case herbicide scenarios (maximum exposure allowed by the label). The R6 PNW FEIS included a margin of safety by reducing the level of herbicide exposure considered to be of concern to humans, fish and wildlife. At the project level, we avoided higher risk application methods such as aerial spray, and specific herbicide ingredients and additives (e.g., triclopyr BEE, POEA surfactant) to further abate risk, noting that we could still have an effective spray program without them.

The next layer of caution was establishing the project specific Project Design Features (PDF, referred to as Project Design Criteria in the figure) in Chapter 2 of this EIS which limit the rate, type, and method of herbicide application, further reducing the risks associated with herbicide treatments. PDFs are often based on the findings of the SERA assessments or other studies, or upon site-specific resource conditions within the treatment areas. These resource conditions include, but are not limited to, the location of known invasive plant sites, the presence of threatened, endangered, or sensitive species and their habitats, proximity to water, potential for herbicide delivery to water, and the social environment. A “white paper” in the project file “Source and Effectiveness of Project Design Features/Criteria for Herbicide Use in Invasive Plant Treatment Projects Forest Service Region Six” (Desser 2008, updated in 2015) provides additional source and predicted effectiveness information regarding PDFs.

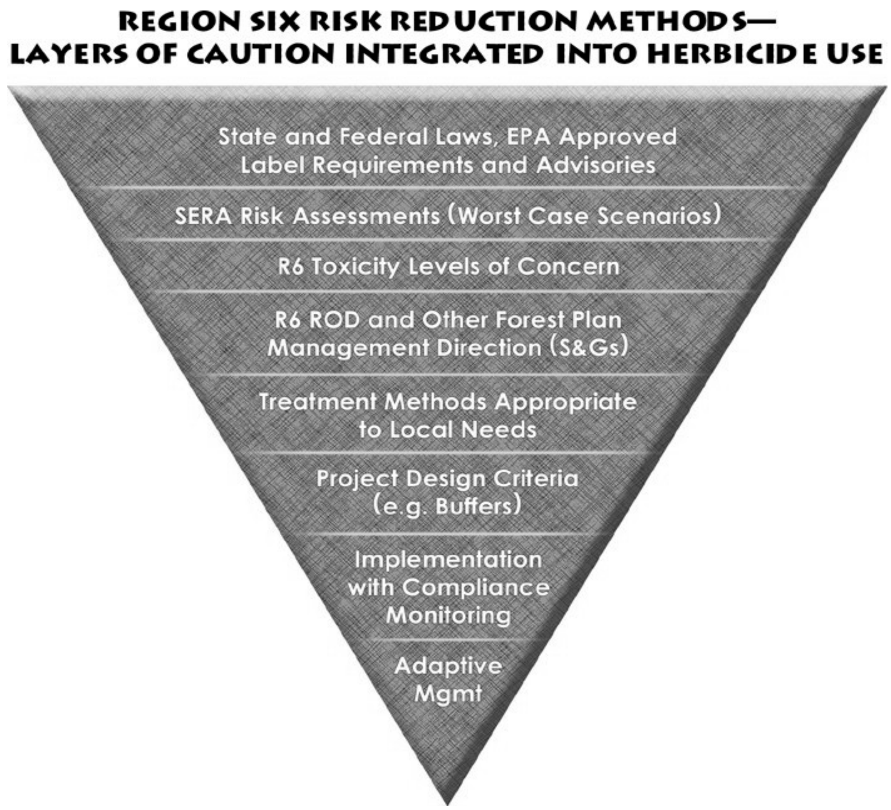

Figure 1. Layers of Caution Integrated into Herbicide Use in R6

Impurities, Metabolites, Inert Ingredients, and Adjuvants

Forest Service risk assessments also include evaluated studies of potential hazards of other substances associated with herbicide applications: impurities, metabolites, inert ingredients, and adjuvants such as food coloring dyes. 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).

Information on adjuvants and surfactants is tiered to the R6 PNW FEIS and incorporates updated information from Analysis of Issues Surrounding the Use of Spray Adjuvants with Herbicides (Bakke 2002, 2007), and the Summary of Aquatic Acute Toxicity Data for Spray Adjuvants Allowed for Use on Aquatic Sites in Washington (WSDA 2009).

The SERA risk assessments also include information about additives that are part of herbicide formulations. NPE-based surfactants would not be used for this project, however alkylphenol ethoxylate ingredients may be used in oil and/or silicone blends. POEA surfactants would not be used.

Incomplete and Unavailable Information Related to Herbicides

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

Each rigorous laboratory test conducted to determine the toxicity of a chemical to an animal is extremely expensive. If we add to this data required to more adequately address synergistic, additive, or antagonistic effects from chemical combinations, it is not possible to obtain all data that would be relevant to making a decision.

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

For risk assessments considering adjuvants, surfactants and inert ingredients in herbicide mixtures, the information within the risk assessment may not be complete. SERA (2007) discussed how the risk assessments apply generally accepted scientific and regulatory methodologies to encompass these uncertainties in predictions of risk. SERA risk assessments identify and evaluate incomplete and unavailable information that is potentially relevant to human health and ecological risks. Each risk assessment identifies and evaluates missing information for that particular herbicide and its relevance to risk estimate. Such missing information may involve any of the three elements needed for risk assessments: hazard, exposure, or dose-response relationships. A peer-review panel of subject matter experts reviewed the assumptions, methodologies and analysis of significance of any such missing information. The SERA Risk Assessments incorporate the findings of this peer review.

The Forest Service responds to this uncertainty by:

1. Assuming adverse effects to organisms occur at doses well-below lethal levels

2. Using the best available models for predicting herbicide concentrations in water

3. Using worst case scenarios

4. Relying on widely used and accepted risk assessment methodology

5. Including PDFs that restrict certain applications

6. Monitoring effects of higher risk treatments

Human Health

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

Botanical Resources

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

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

Soil and Water Resources

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

In response to this uncertainty, the current analysis uses the best available scientific information on soil mapping, watershed analysis, water monitoring, and the best available predictive models for potential contamination and drift. In addition, Project Design Features (PDFs) are applied to action alternatives to restrict herbicide ingredients, application method, and/or rate on certain soils and in proximity to water.

Terrestrial and Aquatic Organisms (Fish and Wildlife)

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

- Information about herbicide effects to reptiles, amphibians and butterflies found in Region Six is limited.

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

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

However, because of the dynamic nature of wildlife and their habitat (behavior, weather, nutrient availability, contaminant presence, etc.), significant uncertainties would remain for predicting short- and long-term reactions to herbicide presence in natural settings even if more laboratory data were available.

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

3.1.5 Climate Change and Invasive Plants

Global climate change is predicted to alter precipitation and seasonal temperature patterns, as a result of increased levels of atmospheric carbon dioxide (CO2) and other factors (Mote 2004). Most recent studies on the interaction between climate change and invasive plants conclude that climate change is likely to favor invasive plant species to the detriment of native plant species for individual ecosystems (Chornesky et al. 2005, Climate Change Science Program 2008, Dukes and Mooney 1999, Hellmann et al. 2008, Pyke et al. 2008). In some studies, invasive plant species have demonstrated increased growth rates, size, seed production, and carbon content in the presence of elevated CO2 levels (Rogers et al. 2008, Rogers et al. 2005, Smith et al. 2000, Ziska 2003). Warming climates may remove elevational barriers to invasive plant distribution that currently exist. For instance, cheatgrass is becoming established in dry forests in the Intermountain West, particularly after wildfires and fuels reduction projects. After these events, native perennial grasses are lost, leaving potential cheatgrass habitat, which can increase fire frequency (Tausch 2008).

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

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

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

Current science is insufficient to precisely determine a cause and effect relationship between climate change and the Proposed Action for the project area. A general conclusion, based on the preponderance of current literature, suggests that “most of the important elements of global change are likely to increase the prevalence of biological invaders” (Dukes and Mooney 1999, Bradley et al. 2010). The Forest will likely become more vulnerable to the establishment of invasive plant infestations, actual acreage affected by invasive plants could increase, and control strategies may become more difficult. Recommended management responses to these predictions are early detection (resulting from regularly scheduled monitoring) followed by a rapid response to eradicate initial infestations (Hellmann et al. 2008, Joyce et al. 2008, Tausch 2008).

Many of the invasive species on the Forest have originated in Eurasia and tend to thrive in warm sunny microsites (e.g. species in the sunflower family, *Asteraceae*). Given that action alternatives include control of invasive plants with an early detection/rapid response component, and the large uncertainties regarding effects of climate change at any specific location over the time frame of this project, there is insufficient information to discern any meaningful differences between alternatives. Both action alternatives are consistent with recommendations for management response in the face of potential influences of climate change on invasive plants. Alternative 1 would not provide a response to potential changes in climate.

3.1.6 Introduction to the Cumulative Effects Analysis

Each resource section in Chapter 3 discusses the direct, indirect and cumulative effects of the alternatives. The baseline for comparison of impacts is the current condition.

Cumulative effects are project impacts that overlap with impacts from other projects on or off National Forest. This project involves treating relatively small and scattered infestations of invasive plants and the spatial and temporal effects of treatment at any one site are minimal. However, this EIS covers the entire Forest for a 15 year period (or longer), thus there is high potential for overlap of invasive plant projects with other projects. The cumulative effects analysis area extends through the entire Forest (the analysis area includes all ownerships within watersheds that have some National Forest System lands) and the project is likely to be implemented over a period of 15 years or more, however the adverse effects of the project are likely to occur on a very small scale (less than 5 percent of any sub watershed), and have a short duration (less than one year).

Thus, the cumulative effects spatial analysis area for all resources includes all of the Forest lands and the non-Forest land in-holdings within and adjacent to the Okanogan-Wenatchee National Forest boundary. The time frame extends for next 20 years.

This analysis generally relies on current environmental conditions as a proxy for the impacts of past actions.[10] Past actions have resulted in conditions conducive to the spread of invasive plants (see site types above). Roads, burned areas, logged areas, grazed areas, and other disturbed zones continue to act as vectors for the spread of invasives. The analysis of treatment effectiveness recognizes the potential for invasive plant spread (see Chapter 3.2.4). The lingering impacts of past actions are discussed in terms of the vectors of invasive plant spread. Invasive plant prevention measures are intended to slow the spread of invasive plants on these vectors.

Invasive Plant Treatments

The public has expressed concern about the potential for herbicide use within the Forest and surrounding lands to combine and cause cumulative effects. This section discusses current and ongoing herbicide use as part of the integrated invasive plant management programs within the project area and adjacent lands.

There are several reasons why the likelihood of cumulative effects of herbicide use are low (this will be discussed at length in the resources sections of chapter 3). As stated in the R6 PNW FEIS page 4-2:

> *The proposed use of herbicides could result in cumulative doses of herbicides to workers, the general public, non-target plant species, and/or wildlife. Cumulative doses of the same herbicide result from (1) additive doses via various routes of exposure resulting from a single invasive plant treatment project and (2) additive doses if an individual is exposed to a herbicide treatment conducted under this EIS, and to another herbicide treatment. 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 people and animals and do not significantly bio-accumulate. Additional sources of exposure include private use of herbicides.*
>
> *The potential for synergistic effects (where exposure to a combination of two or more chemicals could result in impacts that are greater than the sum of the effects of each chemical alone) were considered. Combinations of chemicals in low doses have rarely demonstrated synergistic effects. Based on the limited data available on chemical combinations involving the herbicides considered in this EIS, it is possible, but unlikely, that synergistic effects could occur as a result of exposure to the herbicides considered in this analysis. Synergistic or additive effects, if any, are expected to be insignificant.*

Existing Invasive Plant Treatments on National Forest System Lands within the Project Area

As discussed under No Action (Chapter 2.2.1), of the acres approved for treatment under existing project decisions, about 6,000 acres remain infested and would continue to be treated under the auspices of the existing decisions until it no longer makes sense to do so.

Treatments under these decisions have averaged about 3,500 acres per year across the project area, including initial and additional treatment entries.

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[10] The Council on Environmental Quality (CEQ) issued an interpretive memorandum on June 24, 2005 regarding analysis of past actions, which states, " agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions."

- For Alternative 1, there would be no cumulative effects from ongoing invasive plant treatments that were not considered in the previous NEPA documents. The 6,000 acres that still need treatment would be treated under the auspices of existing decisions until the need is met or conditions have changed so much that the treatments no longer make sense.
- For Alternative 2, there would be no cumulative effects from ongoing invasive plant treatments because the 6,000 acres of existing approved treatments would be fully replaced by the new approach outlined in the alternative.
- For Alternative 3, existing decisions would continue to be implemented as long as they still made sense, even if they did not follow the herbicide use criteria associated with this alternative. This means that of the approximately 16,000 acres that are currently infested, at least 10,000 would be treated using the new criteria under this alternative, and up to 6,000 would be treated under the auspices of existing decisions. Thus, there could be cumulative effects from ongoing treatments that occur at the same time as or adjacent to newly approved treatments in Alternative 3.

Herbicide Treatments on Intermingled and Adjacent Lands

The Okanogan-Wenatchee National Forest is intermingled with other federal, state, county, and private ownerships. Herbicides are used by these other landowners for agriculture, landscaping, and invasive plant management. The Forest Service maintains pesticide use data; otherwise, no central source exists for compiling invasive plant management within Washington State (R6 PNW FEIS, 4-1). The National Center for Food and Agricultural Policy compiles an Agricultural Pesticide Use Database by state; the most recent in (1997) is available online at www.ncfap.org/database/state.php. This project's herbicide use is very small when compared to the statewide agricultural totals, and would not be measurable when added to other herbicide use in the state. Herbicide application would have to occur the same time as, or adjacent to, Forest Service treatments for additive impacts to occur.

Herbicide application on private lands within the National Forest boundary would most likely occur to treat invasive plants around private residences, on utility corridors, and where county roads are within the Forest boundary. Some treatment of invasive plants may occur on private timber or grazing lands. About 266,395 acres that are not administrated by the Forest Service are within the Forest boundaries (primarily private land – 229,438 acres; also state land – 35,941 acres; Bureau of Land Management – 176 acres; USFWS – 715 acres and public utility district land – 124 acres).

Invasive plant treatments also occur on state highways within the National Forest boundary. The Washington State Department of Transportation (WADOT) uses integrated weed management tools including a variety of appropriate herbicides and herbicide mixes to treat invasive plants and other vegetation on highways within and outside the forest boundary. The Forest Service does not control these treatments; however, coordination occurs, especially if sensitive areas are adjacent to the highways. WADOT treats about 227 acres of highway right of way within the project area, including along US 2, US 12, I-90, SR 20, and SR 212.

With the exception of the WADOT, the extent of invasive plant treatment on non-Forest land within the National Forest boundary is unknown. No central source exists for compiling invasive plant management information off National Forests within Washington State. No requirement for landowners or counties to report invasive plant treatment information exists. Herbicide use in proximity to treatments considered in this project cannot be precisely predicted, especially given the long life and uncertain budgets which could influence the implementation schedule for the project. However, the small portion of any one watershed likely to be treated each year limits potential for accumulation of herbicides in streams or groundwater.

Current, Ongoing and Foreseeable Future Projects (Other than Invasive Plant Projects)

Table 3.5 displays information about Forest projects that are foreseeably going to be implemented at the same time as invasive plant treatments within the project area. Overlap between these and other projects that have not yet been defined with the proposed invasive plant treatments is likely throughout the life of the project.

However, the potential for the effects of invasive plant treatment to overlap with the effects of other projects and cause cumulative effects is low, mainly because the effects of concern from invasive plant treatments are of a different nature than effects of concern from other projects. Since chemicals are not widely used for other Forest Service projects (except those described above), the potential for chemical interactions with herbicides used for this project is non-existent. Each of the resource sections in Chapter 3 discusses potential for cumulative effects from invasive plant treatment and other projects.

Table 3.5: Projects Likely to Overlap with Invasive Plant Treatment

Project Name	Project Type	Project Description	NEPA Status	General Location
2014 West Side Recreation Projects	Recreation	Trailhead improvement, new trailheads	In progress	Tonasket Ranger District (R.D.) – Salmon Meadows C.G., Irongate trailhead
Bear Cove Boat Club Special Use Permit	Recreation	Bear Cove use permit	In progress	Naches R.D. – near Rimrock Lake
Cascade Crest Endurance Run	Recreation	Road and trail run	In progress	Cle Elum R.D. – Silver Creek Basin to Easton
Chelimar Club Special Use Permit	Recreation	Club site with cabins	In progress	Naches R.D. – near Rimrock Lake
Chewuch Transportation Plan	Transportation	Identify road maintenance levels, road closure, and re-routes	In progress	Methow Valley R.D. – Upper and lower Chewuch watersheds
Conconully Campground Disposal	Infrastructure	Remove USFS compound	In progress	Tonasket R.D. - Conconully
Eightmile Ranch Coho Acclimation Site	Fisheries	Construct at coho acclimation site at an administrative site	In progress	Methow Valley R.D. – eight miles north of WIntrop
Ferris Hard Rock mining	Mining	Underground mine using an existing adit	In progress	Cle Elum R.D. – Cougar Gulch
Flagg Mtn. Mineral Exploration	Mining exploration	Copper exploration on up to 15 sites	In progress	Methow Valley R.D. – Flagg Mountain
Recreation special event permits	Recreation	5-year permits for 11 recurring recreation events	In progress	Naches R.D.

Project Name	Project Type	Project Description	NEPA Status	General Location
Lake Chelan Prince Creek Dock replacement	Recreation	Replace the floating dock at the Prince Creek campground	In progress	Chelan R.D. – Prince Creek
Light Restoration Project	Vegetation management	Timber harvest, thinning, and fuels treatments	In progress	Tonasket R.D. – 15 miles east of Tonasket
Little Crow Restoration Project	Vegetation management, road management, recreation	Timber harvest, thinning, prescribed burning, stream treatments, road closure and improvement, native species planting, trailhead improvement, motorized trail construction,	In progress	Naches R.D. – Little Naches watershed
Meadow Creek Reroute	Recreation	Trail reroute and bridge replacement	In progress	Chelan R.D. – Meadow Creek
Motorized travel management	Transportation, Recreation	Designate roads/trails/areas open to motorized use	In progress	Forest-wide
Outfitter and Guide special use permits	Recreation	Issue and reissue outfitter guide and special use permits	In progress	Naches R.D. – Bumping Lake, White Pass
Number two canyon trail system EA	Recreation	Non-motorized trail system construction	In progress	Wenatchee River District – Number 2 Canyon, Twin Peaks
Pacific Northwest Navy range special use permit	Special use	Navy training exercise	In progress	Tonasket R.D.
Ravens Roost Communications site	Special use	Issue 20 year permit	In progress	Naches R.D. – Ravens Roost com. site
Recreation Residence and organization camp maintenance	Recreation	Repairs and alternations	In progress	Naches R.D. – Recreation residences and YMCA Camp Dudley.
Recreation Residences and Resort Projects	Recreation	Permits for alterations to private structures.	In progress	Naches R.D. – Andy Creek, Bear Cove, Bumping Lake, and Indian Flats tracts. Chelminar grotto club and Rimrock Lake Resort.
Recreation Residences	Recreation	Improvement and maintenance	In progress	Naches R.D. - Gold Creek and Bear Cove

Project Name	Project Type	Project Description	NEPA Status	General Location
improvement and maintenance projects				
Recreation event permits	Recreation	Event permit	In progress	Naches R.D. – Little Naches
Silver Beach Resort permit reissuance	Recreation	Permit	In progress	Naches R.D. – Rimrock Lake
Ski Hill Improvements EA	Recreation	Building repair, tower installation, regrade slope	In progress	Wenatchee River R.D. – Leavenworth Ski Hill
Sons of Norway Sno-Cat Use and Parking	Recreation	Permit for sno-cat parking and use	In progress	Cle Elum R.D. – Crystal Springs sno-park
Southern Star Mining Plan of Operation	Mining	Portal reconstruction, ore, waste rock, and hazard tree removal	In progress	Cle Elum R.D. - Swauk
Stillwaters/Stormy Fish Habitat Improvement	Fisheries	Large wood placement, side channel reconnection	In progress	Entiat R.D. – Entiat River
Swauk Pine Restoration	Vegetation Management, road closure, maintenance relocation, improvement Stream channel restoration	Thinning, burning, road actions, stream channel repair.	In progress	Cle Elum R.D. - Swauk
Taneum 25K and 50K trail run	Recreation	Special use permit for trail run event	In progress	Cle Elum R.D. - Taneum
Tillicum Watershed Restoration	Vegetation Management, road closure and improvement	Thinning, burning, road closure, road improvement	In progress	Entiat R.D. – Tillicum Creek watershed
Wish Poosh Hazard Tree Management	Vegetation Management	Hazard tree removal	In progress	Cle Elum R.D. - Wish Poosh Campground
Yakima Valley Boat Club	Recreation	Special use permit for boat moorage	In progress	Naches R.D. – Rimrock Lake
Yakima Valley Ski Club	Recreation	Special use permit for ski lodge	In progress	Naches R.D. – White Pass
Annie Restoration Project	Vegetation Management	Timber harvest, thinning, fuels treatments	Analysis completed	Tonasket R.D. – Upper Bonaparte drainage
Bannon, Aeneas, Revis, Tunk grazing allotments	Grazing	Revise management plans	Analysis completed	Tonasket R.D.

Project Name	Project Type	Project Description	NEPA Status	General Location
Bonaparte Lake and Lost Lake Campgrounds	Recreation	Campground improvements	Analysis completed	Tonasket R.D.
Buck Forest and Fuels	Vegetation Management, Road Management	Timber harvest, thinning, prescribed burning, road system management	Analysis completed	Methow Valley R.D. – Lower Chewuch watershed
Chewuch River Restoration	Fisheries	Large wood placement, off channel habitat enhancement	Analysis completed	Methow Valley R.D.
Mills Canyon Wildfire Restoration	Vegetation Management	Planting trees and shrubs	Analysis completed	Entiat R.D. – Mills Canyon
Nason Creek Aquatic Restoration	Fisheries	Large wood placement, side channel reconnection, riparian vegetation improvement	Analysis completed	Wenatchee River R.D. – Nason Creek
Tieton River Whitewater permit	Recreation	Special use permit for whitewater rafter guides	Analysis completed	Naches R.D. – Tieton River
South Summit Forest and Fuels	Vegetation Management, Roads	Timber harvest, thinning, fuels treatment, road system management	Analysis completed	Methow Valley R.D. – Lower Beaver Creek, Frazer Creek, Summit Creek, Chiliwist Creek, Benson Creek, Alder Creek, Texas Creek, French Creek, Swamp Creek subwatersheds

These projects and other activities that occur in and around National Forest may create conditions that favor invasive plants and influence their rate of spread. The following list includes acreages related to actions that are previously authorized that may be ongoing. The projects in table 3.5 would have similar context and intensity as the ongoing projects described categorically below.

Livestock grazing – The Forest has 1,061,551, acres in active sheep and cattle grazing allotments. An additional 490,189 acres of allotments are inactive, and 78,521 acres of grazing allotments have been closed. Future grazing is likely to be similar to current active levels, or lower, because of the reduction in the markets, especially for sheep grazing. Livestock may spread invasive plants by moving seeds, either on their bodies or by passing them through their digestive systems. Grazing removes native plant cover, allowing growing space for invasive plants. Livestock may also physically alter sites in ways that favor invasive plants, for example through trampling, disturbing soil crusts, creating bare soil, and adding nitrogen to the soil through urine and feces.

Grazing projects would be required to meet the R6 PNW ROD requirements for prevention of invasive species. This invasive plant treatment EIS would allow treatment before, during and after these projects to control any invasives brought in by the project.

Restoration and Fuels Reduction Projects – Restoration and fuels reduction is proposed or occurring on approximately 140,000 acres within the project area. These projects also would close or decommission 219 miles of road. These projects are expected to improve forest health and fuel loads, and reduce open road mileage.

Logging creates patches of open habitat which are susceptible to invasive plants. Logging roads, skid trails, landings, and other areas with associated soil disturbance create areas more vulnerable to invasive plants. Equipment use along roads can also spread invasive species.

Thinning of dense forests creates open habitat, which may be more vulnerable to invasion. Prescribed fires, especially spring burns, provide the open space, greater sunlight, and darker surface area favored by invasive winter annuals (Hulbert 1988; Sans and Masalles 1995). However, fuel reduction may reduce future fire intensity and allow a fire regime more likely to benefit native plant communities, making them less vulnerable to invasion. All of these projects would be required to meet the R6 PNW ROD requirements for prevention of invasive species. This invasive plant treatment EIS would allow treatment before, during and after these projects to control any invasives brought in by the project.

Wildfire and Fire Suppression - From 1987 to 2007 (21 years) the Forest averaged 125 fires per year, and on average 39,430 acres per year burned. In the last decade (2000 to 2009) there were more fires (136 acres per year average) and more average acres burned per year (58,405). Based on this trend, it is likely that large fires would continue to burn that would require suppression. After fires, sites are often more vulnerable to invasive plants (Milberg and Lamont 1995). Fire creates many of the conditions favored by invasive plants: increased light, bare ground, reduced competition, and available water and nutrients. Fire lines constructed to suppress or contain fires are vulnerable to invasive plant invasion and become potential vectors for spread. Wildfire emergencies are specifically exempt from the R6 PNW ROD standards and guidelines and may result in invasive species that could then be treated under this EIS.

Aquatic Habitat Restoration – these projects are expected to improve aquatic habitat in each project area. This could have a cumulative beneficial impact because invasive plant removal within riparian habitats also would improve aquatic habitat. Some restoration projects like adding wood to streams has the potential of bringing in exotic species however prevention measures such as washing equipment and monitoring disturbed areas is expected to minimize potential for harm.

Road Construction – The general trend on the Forest is fewer and fewer permanent roads constructed, although temporary roads are still constructed on a regular basis. Where new roads are constructed they are almost always closed to vehicular traffic after completion of the project; all temporary roads are required to be closed. However, use of these new roads during projects can provide new vectors of spread. All of these projects would be required to meet the R6 PNW ROD requirements for prevention of invasive species. This invasive plant treatment EIS would allow treatment before, during and after these projects to control any invasives brought in by the project.

Road Management (closing, building, and maintaining roads, including culvert replacement) – There are 8,317 miles of road on the Forest; approximately 2,000 miles of open roads are maintained each year. Roads and roadside habitat are particularly susceptible to invasive plants because of the lack of plant cover and the continual disturbance through road maintenance (grading, etc.). Roads are a primary vector for spread of invasive species. All of these projects would be required to meet the R6 PNW ROD requirements for prevention of invasive species. This invasive plant treatment EIS would allow treatment before, during and after these projects to control any invasives brought in by the project.

Mining, Special Uses – Special use permits for permits such as water lines and roads, communication sites (like repeaters) and mining projects all result in at least some amount of soil disturbance which can create areas for invasive species spread. All of these projects would be required to meet the R6 PNW ROD requirements for prevention of invasive species. This invasive plant treatment EIS would allow treatment before, during and after these projects to control any invasives brought in by the project.

Trail Management/ Recreational Use – The Okanogan-Wenatchee National Forest has 4,587 miles of trails and 174 developed campgrounds and picnic areas. Trail maintenance and reconstruction can cause disturbed soils conducive to invasive species but any such projects must follow the prevention standards in the R6 PNW ROD. Forest recreational users may spread invasive plant seeds – on gear, clothing, tires, or boots. Horses and pack animals may also transport seeds, on their bodies or through their digestive systems; packers are required to use weed free or pelletized feed under the R6 PNW ROD requirements for prevention of invasive species. This invasive plant treatment EIS would allow treatment before, during and after these projects to control any invasives brought in by these activities.

Transportation Management Projects – Several transportation management projects are proposed to reduce open road density by closing or decommissioning approximately 170 miles of road. The overall result would be a decrease in open road mileage in the project area. Closure and decommissioning can cause disturbed soils conducive to invasive species but any such projects must follow the prevention standards in the R6 PNW ROD. This invasive plant treatment EIS would allow treatment before, during and after these projects to control any invasives brought in by the project.

Travel Management – The Okanogan-Wenatchee National Forest is in the process of closing portions of the Forest to cross country motorized travel. This could help slow the spread of invasive species on the Forest, and along with effective invasive plant treatment, help restore native plant communities.

Non-Forest Service Projects – Many projects are planned on adjacent lands including road maintenance and management, forest improvement treatments, recreation planning and development, aquatic restoration, timber sales, mining projects, management plans, wildlife and fish enhancement projects, range and livestock management projects, and water resource and ecosystem management projects. These all potentially have soil disturbance and utilize roads that can introduce or spread invasive species. Because they are not generally on National Forest System lands, they are not required to follow the R6 PNW ROD requirements.

3.2 Invasive Plant Management and Treatment Effectiveness

3.2.1 Introduction and Regulatory Framework

This section discusses the invasive plant target species proposed for treatment and compares the treatment effectiveness of the alternatives. This section addresses public issues about treatment effectiveness (see cite chapters 1 and 2).

The cost and effectiveness of treatments are interdependent and influenced by the allowable methods for each situation. These impacts compound over time because fewer acres may be treated by higher costs methods (assuming a fixed budget) and because less effective methods may require more treatment entries.

Issue Indicators:

- Known Acres that may not be effectively treated given limitations on herbicide use or NEPA coverage.
- Known Acres where full range of effective tools are allowed[11]
- Acres remaining after 5 years assuming unlimited funding
- Years to Meet Treatment Objectives (Known Sites) Assuming Current Funding

Chapter 1.3 outlines the primary regulatory framework and management direction for invasive plants. Forest Service Manual 2080.2 directs the Forest Service to use an integrated weed management (IWM) approach to control and contain the spread of noxious weeds on National Forest System (NFS) lands and from NFS lands to adjacent lands. IWM is defined as an interdisciplinary pest management approach for selecting methods for preventing, containing and controlling noxious weeds in coordination with other resource management activities to achieve optimum management goals and objectives."

The Okanogan-Wenatchee National Forest adopted the Okanogan-Wenatchee National Forests Weed Management and Prevention Strategy in 2002, which establishes a series of prevention measures and best management practices to be used when planning projects. This strategy was developed from the Forest Service Guide to Noxious Weed Prevention Practices (USDA Forest Service 2001). The primary elements are:

Project level risk assessment and prevention analysis - A risk assessment and noxious weed prevention analysis is required for every project. This would identify measures necessary to prevent weeds from spreading due to project activities.

Education and information - This element includes informing Forest Service personnel, partners, and the general public about noxious weed identification, threats to the ecosystem, and spread prevention. Wide spread understanding of weed issues would help prevent spread and help with infestation mapping.

Minimize ground disturbance and re-vegetate - - Minimizing ground disturbance would help prevent creation of conditions favorable to invasive plants. Re-vegetation helps establish desirable plant cover, reducing available habitat for weeds. Some sites may require active re-vegetation including seeding, planting or mulching.

Minimize Weed Seed Production and Spread - The strategy directs managers to at least minimize weed seed production if circumstances do not allow treatment, especially for weeds along vectors for spread. Prevention of reproduction through seed production is a primary step in weed management.

Partnerships with other Landowners - The strategy encourages the Forest Service to cooperatively control invasive plants across land ownership boundaries. This would help prevent continuous spread across boundaries and allow treatment of an entire infestation regardless of land ownership (maximizing treatment effectiveness).

Monitoring -Monitoring would help us improve effectiveness over time by refining treatment methods in response to outcomes in the field.

In 2003 the Chief of the Forest Service identified invasive plants as one of four nationwide threats to ecosystem function and biodiversity on the National Forests and Grasslands and launched an Invasive Species strategy in 2004. The invasive species action identified is to protect forest and rangeland

[11] Full range" means that several herbicides and other methods are available. Full range does not include use of grazing animals, prescribed fire or heavy equipment for invasive plant management. Full range includes treatment methods discussed in the proposed action

ecosystems by preventing the release of non-native species and by controlling the spread, or eradicating, invasive species.

In 2005, the R6 PNW ROD was signed, adding invasive plant management direction to the Okanogan- and Wenatchee National Forest Plans.

Management direction at the national, regional, and forest levels provide the rationale supporting the need for action and the need for sideboards to minimize adverse effects.

3.2.2 Analysis Methods

Information in this section is based on the best science contained in the R6 PNW FEIS, SERA risk assessments, scientific publications, and the experience, professional knowledge and judgment, and site-specific monitoring observations of the Okanogan-Wenatchee National Forest and county weed experts.

The analysis includes several perspectives to show differences between alternatives regarding cost-effectiveness. The most effective approach is to have a full range of available options, flexibility at the landscape scale, and the ability to rapidly respond to new detections. These items are factored into a model that provides a way to quantify the impacts of restrictions on the range of treatment methods allowed and limitations on the land base that may be treated.

Acres where "all tools are available" are assumed to reduce population by 80 percent each entry. Acres where all tools are not available are assumed to reduce population by 50 percent each entry (Desser, 2006).

3.2.3 Affected Environment

Invasive Plant Species

To date, 50 different invasive plant species within about 5,528 individual sites (infested areas) are known to occur within the project area. Table 3.6 lists the invasive plant species that are currently mapped.

Table 3.6: Invasive Plants known to occur on the Okanogan-Wenatchee National Forest

Common Name	Scientific Name	Code
Common fiddleneck	*Amsinckia menziesii*	AMMEI2
Greater burdock	*Arctium lappa*	ARLA3
Absinthium	*Artemisia absinthium*	ARAB3
Biennial wormwood	*Artemisia biennis*	ARBI2
Hoary alyssum	*Berteroa incana*	BEIN2
Cheatgrass	*Bromus tectorum*	BRTE
Shepherd's purse	*Capsella bursa-pastoris*	CABU2
Whitetop	*Cardaria draba*	CADR
Spiny plumeless thistle	*Carduus acanthoides*	CAAC
Nodding plumeless thistle	*Carduus nutans*	CANU4
Spotted knapweed	*Centaurea biebersteinii*	CEBI2
Meadow knapweed	*Centaurea debeauxii*	CEDE5
Diffuse knapweed	*Centaurea diffusa*	CEDI3
Russian knapweed	*Centaurea repens*	CERE6
Yellow star-thistle	*Centaurea solstitialis*	CESO3
Chicory	*Cichorium intybus*	CIIN
Canada thistle	*Cirsium arvense*	CIAR4

Common Name	Scientific Name	Code
Bull thistle	*Cirsium vulgare*	CIVU
Common crupina	*Crupina vulgaris*	CRVU2
Gypsyflower	*Cynoglossum officinale*	CYOF
Scotch broom	*Cytisus scoparius*	CYSC4
Queen Anne's lace	*Daucus carota*	DACA6
Purple foxglove	*Digitalis purpurea*	DIPU
Baby's breath	*Gysophila paniculata*	GYPA
Orange hawkweed	*Hieracium aurantiacum*	HIAU
Meadow hawkweed	*Hieracium caespitosum*	HICA10
Black henbane	*Hyoscyamus niger*	HYNI
Common St. Johnswort	*Hypericum perforatum*	HYPE
Hairy catsear	*Hypochaeris radicata*	HYRA3
Kochia	*Kochia scoparia*	KOSC
Butter and eggs	*Lanaria vulgaria*	LIVU2
Oxeye daisy	*Leucanthemum vulgare*	LEVU
Dalmatian toadflax	*Linaria dalmatica*	LIDA
Yellow loosestrife	*Lysimachia sp.*	LYSIM
Scentless false mayweed	*Matricaria perforata*	MAPE2
Eurasian watermilfoil	*Myriophyllum spicatum*	MYSP2
Scotch cottonthistle	*Onopordum acanthium*	ONAC
Reed canarygrass	*Phalaris arundinacea*	PHAR3
Bulbous bluegrass	*Poa bulbosa*	POBU
Japanese knotweed	*Polygonum cuspidatum*	POCU6
Cultivated knotweed	*Polygonum polystachyum*	POPO5
Sulphur cinquefoil	*Potentilla recta*	PORE5
Himalayan blackberry	*Rubus discolor*	RUDI2
Russian thistle	*Salsola kali*	SAIB
Stinking willie	*Senecio jacobaea*	SEJA
Woodland ragwort	*Senecio sylvaticus*	SESY
Old-man-in-the-Spring	*Senecio vulgaris*	SEVU
Field sowthistle	*Sonchus arvensis*	SOARA2
Common tansy	*Tanacetum vulgare*	TAVU
Common mullein	*Verbascum thapsus*	VETH

Virtually all of these plants are annual, biennial, or perennial forbs – none of the plants are woody trees and one is a woody shrub: Scotch broom. Other invasive plants not yet detected may occur in the project area.

Annual species germinate, flower, set seed and die within one year. Biennial species have vegetative growth the first year, often forming basal rosettes. The second year the plants develop flowering stalks, set seed, and die. Biennials often have deep taproots. The goal of treatment for annual and biennial species is to prevent seed production. Perennial species persist and produce seed for more than one year. Many perennial invasive species have creeping lateral roots or underground stems called rhizomes that allow the plant to spread, forming dense clones. Such plants often regenerate from small root or rhizome fragments. Some plants spread via above ground stems called stolons, similar to strawberry plants. Perennial plants are generally more difficult to kill than annuals or biennials.

Invasive species often have the ability to produce abundant seeds as well as seeds that persist in the soil for several years. Some species produce both seeds that germinate quickly, and seeds with delayed germination that sprout when conditions are most favorable; these accumulations of seed in the soil are referred to as seed banks (Sheley and Petroff 1999). Large, dense, or persistent invasive plant infestations can develop considerable seed banks, resulting in increased time and effort needed to control a site.

Although biological traits of individual invasive plant species vary, most possess one or more of the following characteristics that enable them to rapidly colonize new areas and displace native vegetation:

- Ability to spread vegetatively via creeping roots, rhizomes, or stolons
- Early maturation and rapid growth, (i.e., invasive plants grow and reproduce earlier in the year than do many native plants, and many are able to germinate in the fall)
- Tolerant of a wide range of environmental conditions
- Able to compete intensely for water and nutrients
- Able to self-pollinate (i.e., produce seed without cross-pollination by another plant)
- Produce compounds that negatively affect growth of other plants (R6 PNW FEIS p. 3-11).

Invasive Plant Introduction and Spread

The majority of invasive plant seeds tend to fall within short distances of the parent plant. Long-distance dispersal of invasive species into new areas can occur via wind, water, birds, animals, and human activities. Some species produce seeds and fruits with special adaptations that aid in long-distance dispersal, such as hooks, wings, plumes, or bladders. Human activities can also spread root and rhizome fragments (Sheley and Petroff 1999).

Many invasive plants were introduced from other countries as ornamental and medicinal plants, for forage or erosion control, or inadvertently as contaminants of seed or feed. Human activities that likely contributed to the introduction of invasive species in the planning area include use of contaminated logging or road maintenance equipment; contaminated gravel or fill; contaminated hay or livestock feed; or via the livestock themselves.; Seed source for erosion control and re-vegetation plantings have been contaminated. Other mechanisms of dispersal include dispersal by heavy equipment or vehicular traffic, including recreational and off-road vehicles (R6 PNW FEIS p. 3-9 to 3-26).

The Forest Service began recognizing the problems with invasive species in the 1980s, and began requiring their treatment in Forest Plans (1989, 1990) but lawsuits prevented the use of herbicides for many years. As a result, invasive species control really didn’t start in earnest until the late 1990s when both Forests approved the use of herbicides in several Forest wide EAs and decisions; prior to this control was limited to manual, mechanical and cultural treatments with limited effectiveness, allowing widespread weed establishment.

Current practices involve prevention of spread of weeds by limiting ground disturbance and maintaining native vegetation, using weed-free products, working with range permittees to avoid spreading weeds, washing equipment, and other measures as required by policy and the Forest Plans.

3.2.4 Environmental Consequences

Introduction

This section describes treatment effectiveness related to each treatment type proposed in this EIS (as tiered to the R6 PNW FEIS). Forest-wide, 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 (EDRR) to newly discovered infestations also increases treatment effectiveness by treating infestations when they are small and easy to control and reduces potential effects of herbicide treatment on non-target vegetation because less herbicide is needed to control smaller infestations. The effectiveness of an alternative to treat the diverse group of invasive plants depends on the variety of tools available. With some treatment methods, only suppression or containment is possible, therefore they are less effective than a method which can achieve control. Thus, alternatives that limit the variety of tools also limit the effectiveness of treatments.

Strategies such as integrated weed management, prevention, EDRR and site restoration and re-vegetation practices all contribute to optimizing treatment effectiveness and apply (to some degree) to both action alternatives proposed in this EIS and are described in this section.

Treatment effectiveness can be considered at two scales. The first is at the scale of the actual infested site. Factors such as the species present; the size and density of the infestation; the size and persistence of the seed bank; and site characteristics determine which treatment methods are likely to be effective in meeting the control objectives, and the amount of time and money needed. Having a choice of treatment methods at a site increases the ability to match the treatment to the site conditions and improves effectiveness.

Second, at the landscape or project area scale, treatment effectiveness is the relative ability to meet the purpose and need of the project and overall invasive plant management objectives. At this level, consideration of factors such as the ability to respond rapidly to new infestations; the ability to achieve the management objective for the invasive plant species; flexibility to package treatments and coordinate treatments with other projects and programs; ability to respond to changing conditions and opportunities; and cost are important in evaluating effectiveness.

The annual invasive plant treatment budget has averaged about $350,000, which has allowed us to treat about 3,500 acres per year. Treatments range in cost from less than $50 per acre for some chemical and biological methods to $1000 per acre for some manual and cultural methods; the R6 PNW FEIS (Chapter 4-2) displays the range of costs associated with different methods. Over the years, treatment costs have averaged about $100 per acre (Ranne personal communication 2015).

This section focuses on treatment effectiveness, whether or not treatments can meet our objectives, and the length of time needed to meet objectives. Cost can be a factor in treatment effectiveness because it affects the acres that may be treated under a constant budget. Information about the cost of treatment and assumptions made in the economic analysis are in Chapter 3.12.

Effectiveness of Treatment Methods

Treatment strategies and methods are described in Chapter 2 of this EIS. Treatment strategies include “suppress,” “contain,” “control” and “eradicate,” and the treatment methods are manual, mechanical, cultural, biological, and chemical.

The effectiveness of treatment is influenced by many factors, including the life cycles of individual plants. Having a variety of herbicide options including different chemical families, and modes of operation reduces potential for herbicide resistance and allows for more flexibility to respond to site-specific variations.

On many sites, the use of herbicides would be expected to decline in subsequent entries and the amount of herbicide applied would greatly diminish as the infestations are contained, controlled or eradicated.

Infested acres would be treated with an initial prescription, and retreated in subsequent years, until control objectives are met.

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.

When new invasive species infestations are detected, prompt treatment of these small infestations can reduce risk of environmental impacts and cost of treatment. EDRR is one of the four primary elements in the Forest Service National Strategy and Implementation Plan for Invasive Species (USDA 2004) and implementation at any scale would reduce negative impacts to native plant biodiversity. While Alternative 3 allows for EDRR, the restrictions in herbicide use would increase cost of treatment and reduce potential EDRR effectiveness.

The effectiveness of the different treatment methods increases with the number of treatment options available and the percentage of infested lands that may be treated. Thus, the range of treatment methods available to be used in combination is also a measure of Treatment Effectiveness. Rapid response to newly discovered infestations also increases treatment effectiveness.

Manual Methods

Manual methods can be effective for controlling or eradicating small infestations of annuals or biennials if the entire root is removed. If the entire root cannot be removed manual treatment may only achieve suppression or containment of the invasive plant. Manual methods are not effective for suppression, containment, control or eradication of deep-rooted or rhizomatous perennials because of their aggressive root systems. For example, orange hawkweed plants can grow from buds on small root fragments, so pulling or digging orange hawkweed, which would likely break roots into small pieces, would stimulate reproduction. Hand-pulling or hoeing disturbs the soil surface, which may increase susceptibility of a site to reinvasion by weeds (Brown et al. 2001). Manual methods are labor-intensive and usually ineffective for the treatment of large, well-established infestations of perennial invasive plants with long term viable seed such as knapweeds (Brown et al. 2001). Local efforts where larger community support or funding for hand crews exists do show promise, if efforts can be sustained. Consistent hand pulling efforts by a local contract crew has successfully controlled diffuse knapweed (*Centaurea diffusa*) on the Twisp River within the Okanagan-Wenatchee National Forest.

Mechanical Methods

Mechanical treatments alone are ineffective in eradicating or controlling invasive plants because the roots of the plants are not affected and the plants are not killed. Mechanical treatments may provide suppression or containment of an infestation by preventing seed production and weakening the plant by removing the above-ground parts. Mechanical treatments are best used in combination with other treatment methods to increase overall treatment effectiveness. For example, mowing can reduce vegetation biomass and therefore reduce the amount of herbicide needed for treatment. Mowing can stimulate new growth making some herbicides more effective, and/or can remove and dispose of propagule source (seeds or other vegetative material capable of re-introducing invasives). The majority of mechanical treatments involve using weed-whackers and mowers. Motorized weed-whacking in combination with herbicide treatment can be effective to achieve eradication or control of orange hawkweed. Like dandelion, orange hawkweed has the ability to flower and produce seed quickly and flowering plants can produce viable seed even after treatment with herbicides. Hawkweed flower stocks can be removed by weed-whacking just prior to herbicide application, halting seed production, and increasing the effectiveness of both methods. Mowing or cutting is more effective on tap-rooted (with a dominant central root) perennials such as spotted knapweed than on rhizomatous perennials (with creeping roots that may produce shoots and roots from nodes along their length) (Brown et al. 2001). Cutting or mowing plants can reduce seed production if conducted at the right growth stage. For example, a single mowing at late bud growth stage can reduce the number of seeds produced on spotted knapweed (Watson and Renny 1974). Mowing can also weaken an invasive plant's competitive advantage by depleting root carbohydrate reserves, but mowing must be conducted several times a year for consecutive years to reduce the competitive ability of the plant.

Because invasive plants flower throughout the summer, it is difficult to time mechanical treatments to prevent flowering and seed production. Repeated mechanical treatment too early in the growing season can result in a low growth form that is still capable of producing flowers and seed (Benefield et al., 1999; Sheley and Goodwin, 2001). Mechanical treatments on some rhizomatous weeds, such as leafy spurge, can encourage sprouting and result in an increase in stem density (Sheley and Goodwin 2001).

Cultural Methods/Restoration

Cultural methods covered in this project include planting or seeding with native grass and forb species in order to minimize re-invasion after treatment, and mulching. Planting and seeding would hasten recovery of desirable plants, reducing potential habitat for invasive plants.

Mulching with plastic or organic materials can be used on relatively small areas (less than 0.25 acre). Mulching prevents seeds and seedlings from receiving sunlight necessary to survive and grow, and can smother some established invasive plants, but may also stunt or stop growth of desirable native species. Hay mulch was used in Idaho to reduce flowering of Canada thistle (Tu et al. 2001), but most rhizomatous perennial invasive plants cannot be controlled by this method or by competitive planting because extensive root reserves allow regrowth through and around mulch or shade materials.

In treated areas where native plants are not likely to recolonize on their own native plants may be seeded consistent with Treatment Restoration Standard 13 (R6 PNW ROD,) which directs that native plants materials are the first choice in re-vegetation for restoration and rehabilitation where timely natural regeneration of the native plant community is not likely to occur. On degraded sites where reproducing individuals of desirable species are absent or in low abundance, seeding with native grasses and forbs can be used to accelerate plant community recovery and achieve site management objectives in a reasonable timeframe (Sheley et al. 1996 in Erickson et al. 2003). By accelerating native plant recovery conditions favorable to invasive plants are reduced, reducing available habitat for infestation. Restoration and re-vegetation projects that would include ground disturbing activities such as disking or plowing are not proposed or analyzed.

Biological Methods

Biological control is used when sites are too large, or in too difficult of terrain, to be sprayed with herbicides or treated with other methods, and when an approved biological control agent is available for the invasive plant species. Biocontrols may achieve suppression or containment treatment objectives, but when used alone would not result in control or eradication. It typically takes at least 3 years for the impacts of biocontrols to be evident. Biological agents would spread to other infestations before completely removing their host plants (the invasive species) from the release site. Biocontrols may affect seed production by laying their larvae in seed heads, affect circulation within the plant by using the stem for food and shelter, or by boring into the roots and reducing the energy reserves of the invasive plant.

The Dalmatian toadflax stem weevil, *Mecinus janthinus*, and the knapweed weevil, *Larinus minutus*, are reducing infestations in central Washington. The knapweed weevils are a good example of how biocontrols can prevent or reduce reproduction and reduce the vigor of invasive plants. The adult females lay their eggs in knapweed flower heads. The larvae emerge and burrow into the flower head where they feed on the developing seeds. The larvae damage the plant by reducing seed production (all of the seeds of diffuse knapweed and 25-100% of spotted knapweed (Lang et al. 1996) and the adult defoliates the plant as it feeds on the leaves prior to flowering (Norton et al. 2008). Adult weevils also feed on flowers (Blair 2008).

Biological methods are less costly than other methods because the agents can disperse themselves. The agents can be moved to accelerate their distribution into infested areas. Biological methods would likely result in containment or suppression of existing infestations; however, opportunities to control or eradicate would be forgone.

Herbicide Methods

Herbicides are an effective tool for quickly controlling numerous invasive weed species (Crone et al. 2009). Herbicide treatment can achieve control or eradication of annuals, biennials, and perennial species –including those with rhizomes or creeping roots, on species where non-herbicide methods have been shown to be ineffective, on sites along roadsides, on sites in rocky or compacted soil areas where manual control is difficult, and on dense infestations. It may be used as a sole treatment or in combination with other methods.

Effective treatments are defined as those that reduce the extent of invasive plants so that the area can reach its desired condition (R6 PNW FEIS, 4-8). Selective herbicides and selective herbicide application methods help prevent damage to not-target plants, therefore maintaining desirable native plant cover. For example, clopyralid is extremely selective for broadleaves, and is especially effective on the *Asteraceae* (sunflower) family. It does not affect conifers and its use would reduce potential for non-target mortality of native plants in conifer dominated environments.

Herbicide effectiveness varies substantially depending on the invasive species physiology, treatment timing, rate of application, and environmental factors. Different herbicides vary in effectiveness and length of control on different invasive plants, and herbicide application techniques can vary in effectiveness, environmental effects, and costs.

All of the proposed herbicides are systemic, meaning they are absorbed by the foliage and moved by the vascular system of the plant. Systemic herbicides are moved to the growing parts of the plant or to storage organs like the roots, allowing them to kill the whole plant. The seedling or young rosette stage is usually the easiest to kill, because as plants mature, they develop thicker wax layers on the leaf surfaces, reducing herbicide absorption. Additionally, spray coverage is generally easier to achieve on small plants, and less herbicide is needed. Established invasive plants are most susceptible to herbicide control during periods of active growth, such as the bud and early flowering stage, or during fall re-growth when carbohydrates are being stored in the roots.

Approved surfactants would be used to increase the effectiveness herbicides on mature plants, by improving the dispersing/emulsifying, absorbing, spreading, sticking, and/or penetrating properties of the spray mixture. Dyes would be added to the tank mix to allow the applicator to see where spray has been applied to ensure adequate spray coverage and avoid duplicate spray. Also, dye is important as a safety precaution to easily identify leaks and spills, and to see where the spray mix has accidentally contacted skin or clothing.

All of the proposed herbicides except glyphosate have residual soil activity. This means that plants not directly sprayed can be killed if they absorb herbicide through their roots. Residual activity increases herbicide effectiveness. Depending on application rate and site conditions, herbicides with residual activity can continue to control germinating seedlings or re-sprouting shoots through one or two growing seasons. Broadcast application using maximum label rates would provide the most effective residual control. However, these methods would also result in more damage to non-target vegetation than application at lower rates, or spot spraying and wicking. Spot spraying would be the primary application method used in the project area, with broadcast application occurring only on previously severely disturbed sites that are dominated by invasive plants and have little native vegetation.

All of the proposed herbicides except glyphosate are selective, killing only certain types of plants when applied within recommended label rates. Selectivity can improve effectiveness by causing less impact to competing non-target vegetation. Even a non-selective herbicide (glyphosate), can be applied in a selective manner, by using methods such as spot application and wicking, by timing treatments to occur when non-target vegetation is dormant or less susceptible, or by using a low rate that would affect the weed (typically this works with annual weeds) but not harm most non-target plants.

The amount of herbicide used typically decreases over time as invasive plants are controlled. Monitoring on the Forest has shown that most sites treated with herbicides and/or a combination of herbicides plus manual treatments consistently reduced invasive plant populations and, therefore, result in the use of less herbicide at specific sites due to treatment effectiveness (FACTS database). There is some yearly fluctuation in invasive plant populations and herbicide use can vary from year to year. Generally, the amount of herbicide use decreases with each treatment. For instance, one study (McFetridge 2011) found that herbicide use had dropped by 78 percent (from 829 to 106 gallons in a year) over a four year period (2007-2010) due to effective treatments on priority target species on the Okanogan-Wenatchee National Forest.

When herbicides are part of the integrated treatment prescription, the time needed to effectively treat an acre is often reduced, compared to areas where herbicides are prohibited.

Treatment Effectiveness of Alternative 1

Except for implementing currently authorized treatments, no new invasive plant treatments would occur under this alternative. About 6,000 of the approximately 16,000 acres of known sites would be treated under currently authorized treatments. However, our ability to meet objectives to eradicate, control or contain invasive plants would be severely limited on the majority of sites due to the limitations in the existing NEPA documents and the lack of adequate coverage of known sites. Some ongoing treatments have been successful in meeting objectives and would continue as long as they still are effective and make sense.

Under Alternative 1, the 6,000 acres currently under NEPA may be successfully treated by 2021. However, nearly 10,000 acres of invasive plants would remain untreated and opportunities to treat new infestations while they are small would be foregone. Based on the assumptions in the R6 PNW FEIS about spread rate, in 2021, about 13,000 acres are predicted to occupy sites on the Forest.

In the event of a large disturbance, such as a wildfire, infestations could greatly increase in a short period. Invasive plants would continue to displace native plant species, thereby decreasing vegetative diversity, and serving as additional seed sources for new infestations, both on and off federal lands. Thus, our ability to treat on new and high priority infestations, and meet treatment objectives would be severely compromised.

Treatment Effectiveness of Alternative 2

Alternative 2 would allow consideration of the full range of treatment methods and herbicide choices on all acres, except for those excluded by PDFs. With the ability to use herbicide (the most effective method) on most sites, the treatment objectives of control and eradication would be possible. The use of all treatment methods, combined with prevention and restoration methods (IWM), would decrease existing invasive species populations and prevent new infestations over time. The availability of all treatment methods and herbicide choices would increase the ability to match treatments to the species and conditions at a site, and improve the ability to effectively control invasive plants.

Under Alternative 2, any flush of new plants would be treated with the most effective methods to efficiently kill the plant and stop seed production. For example, a high precipitation year may stimulate weed seeds in the seed bank to germinate resulting in a population flush of invasive plants that can be treated before they produce more seed.

Alternative 2 maximizes flexibility to manage invasive plants at the landscape-scale. It allows treatment of nearly all known sites across the Forest using the full range of treatment options. Alternative 2 provides for EDRR and also allows optimum effectiveness for on-going and new Coordinated Weed Management Areas under cooperative agreements to ensure treatment across land ownership boundaries.

Alternative 2 would facilitate packaging of treatments to minimize contract costs and increase treatment efficiency, and allow adjustment of timing and location of treatments to coordinate with other projects and programs on the Forest. For example, all sites in a timber sale area could be treated prior to ground disturbing activities to limit the potential for spread. Alternative 2 also has flexibility to take advantage of special projects or funding opportunities, and respond to changing conditions. For example, all sites in/near an area burned by a recent wildfire could be treated with the most effective method to prevent spread into any newly created high-risk (disturbed) habitat. Given the 15-year (or longer) timeframe of this project and the high mobility of invasive plants, having maximum flexibility to make adjustments and adapt to changes adds to the effectiveness of Alternative 2.

Having nine different herbicides to choose from would increase the flexibility to effectively substitute one herbicide for another reducing the potential for herbicide resistance to develop. The additional herbicides (compared to Alternative 1) would increase selectivity, residual soil activity, and effectiveness in controlling broad-leaved invasive plants at lower concentrations. Some invasive plants may be more effectively controlled with an herbicide that has higher residual soil activity, like picloram. Sulfonylurea herbicides (not included in Alternative 1) are the most effective type of chemical for use on target species in the mustard family (e.g., whitetop and hoary alyssum).

Aminopyralid, a broadleaf selective herbicide, is the first choice of herbicide wherever it can be effective because it has the lowest risk of effects to non-target species (including aquatic species) and the environment. It can be applied with spot spray to the water's edge (see Chapter 2.2.2, Project Design Features), and is especially effective on species in the aster (sunflower) family; the dominant invasive plant group on the forest (includes spotted and diffuse knapweed, Canada thistle, common crupina, hawkweed, and musk thistle).

Aminopyralid would be used where the broadleaf selectivity is needed to minimize the effects to riparian grasses and sedges, increasing treatment options available in this common habitat type. Aminopyralid is effective at very low application rates; the application rate for glyphosate would be 45 times greater than aminopyralid when applying both at the highest application rate.

Alternative 2 would use most of the new herbicides programmatically approved by the R6 PNW ROD, plus one additional herbicide with a completed risk assessment (aminopyralid). The herbicides vary in selectivity, residual soil activity, and their effectiveness in controlling broad-leaved invasive plants at low concentrations. Each herbicide would be used where it would provide the most effective treatment (and is allowed by label or alternative design restrictions) with the least potential environmental effects, depending on the invasive species and environmental conditions present at the site. Using the most effective herbicide would reduce the number of repeat treatments needed, and minimize the total cost of treatment.

Multiple years of herbicide treatment, or herbicide treatment in combination with other methods, would likely be needed to accomplish a control or eradicate management objective. Given current budgets, Alternative 2 would take at least 6 years or longer to achieve treatment objectives. Only a portion of the existing infestations would likely be treated each year and treatment of new infestations would often take priority. However, over the life of the project, the objectives for invasive plant treatment could be met.

Treatment Effectiveness of Alternative 3

Alternative 3 would allow the full range of treatment methods on a minority of current sites; however herbicide use would not occur on the majority of infestations. Under Alternative 3, fewer acres could be treated, given a constant budget.

Alternative 3 would facilitate packaging of treatments to minimize contract costs and increase treatment efficiency, and allow adjustment of timing and location of treatments to coordinate with other projects and programs on the Forest. Given the 15-year (or longer) timeframe of this project and the high mobility of invasive plants, having maximum flexibility to make adjustments and adapt to changes adds to the effectiveness of Alternative 3.

Having nine different herbicides to choose from would increase the flexibility to effectively substitute one herbicide for another reducing the potential for herbicide resistance to develop. The additional herbicides (compared to Alternative 1) would increase selectivity, residual soil activity, and effectiveness in controlling broad-leaved invasive plants at lower concentrations.

Multiple years of herbicide treatment, or herbicide treatment in combination with other methods, would likely be needed to accomplish a control or eradicate management objective. Given current budgets, Alternative 3 could take 20 years or longer to achieve treatment objectives. Without additional funding, the objectives for invasive plant treatment would not likely be met over the life of the project.

Alternatives Compared

Table 3.7: Treatment Effectiveness Alternative Comparison

	Alternative 1	Alternative 2	Alternative 3
Known Acres that may not be effectively treated given limitations on herbicide use or NEPA coverage.	16,281	679	10,785
Known Acres where full range of effective tools are allowed	0	15,602	5,496
Acres remaining after 5 years assuming unlimited funding	12,960	27	337 Current funding levels would have to be

	Alternative 1	Alternative 2	Alternative 3
			sustained over at least 20 years to achieve treatment objectives.
Years to Meet Treatment Objectives (Known Sites) Assuming Current Funding	Treatment objectives would not be met on the majority of known sites.	Given current budgets, the Proposed Action would take at least 6 years or longer to achieve all goals. The initial years of implementation, only a portion of the existing infestations would likely be treated, especially if new infestations are detected and prioritized for treatment. However, over the life of the project, the objectives for invasive plant treatment could be met.	Given current budgets, Alternative 3 could take 20 years or longer to achieve treatment objectives. Without additional funding, the objectives for invasive plant treatment would not likely be met over the life of the project. The project effectiveness would be commensurate with no action if treatments are not affordable.

Cumulative Effects – Treatment Effectiveness

The condition of neighboring lands can increase or reduce the effectiveness of this project. Treatments done on lands adjacent to the project area, off National Forest, may have a cumulative beneficial impact by increasing the effectiveness of treatments accomplished as a part of this project. Adjacent populations of invasive plants that are not effectively removed can result in delays or an inability to meet treatment objectives associated with this project. While coordination occurs at multiple scales, and sometimes treatments on multiple land ownerships may occur via Cooperative Weed Management Areas or other agencies and interest groups, the Forest Service has limited influence on the priorities or methods used on lands off National Forest.

The following section discusses activities that are ongoing that may influence treatment effectiveness of this project. Other projects and land use activities on and adjacent to national forest may influence the land's susceptibility to invasive plants.

The relationship between OHV trail use, travel management, and the introduction, establishment and spread of invasive plants was discussed in the R6 PNW FEIS (Chapter 3.1.3, Mechanisms of Invasion), and recognized that OHV use can influence the spread of invasive plants by disturbing soil and carrying seed several orders of magnitude greater than 'conventional' dispersal methods (R6 PNW FEIS p. 3-15).

Closing roads could help slow the spread of invasive species on the Forest, and along with effective invasive plant treatment, help restore native plant communities. The effects of this action will aid in the prevention of the spread and introduction of invasive plants, and thus the need for treatment. Several projects are proposed to reduce open road density by closing or decommissioning approximately 170 miles of road. The overall result would be a decrease in open road mileage in the project area. Closure and decommissioning can cause disturbed soils conducive to invasive species but any such projects must follow the prevention standards in the R6 PNW ROD. This invasive plant treatment EIS would allow treatment before, during and after these projects to control any invasives brought in by the project.

Vegetation and associated fuel reduction projects can create an environment that elevates the risk of invasive plant introduction and spread by reducing canopy closure and creating bare ground, which can stimulate spread of existing plant populations and also provide a seedbed for new starts. Logging creates patches of open habitat which are susceptible to invasive plants. Logging roads, skid trails, landings, and other areas with associated soil disturbance create areas more vulnerable to invasive plants. Equipment use along roads can also spread invasive species. Cleaning equipment, protecting weed sites from disturbance, and reseeding skid trails and landings have reduced the amount of aggressive invasive plant species seen on the Forests.

Grazing on Forest Service land will continue and is expected to increase the spread and introduction of invasive plants, especially on rangeland, which could result in longer duration of treatments compared to other site types, such as road shoulders. The R6 PNW FEIS Appendix D summarizes cattle cause-effect relationship with invasive plants in two ways: 1) spread of invasive plant seeds, and 2) altering plant succession by favoring palatable species, thus increasing susceptibility to invasion. However, invasive plants occur with or without grazing.

Forest Service projections suggest recreation use of roads and trails, both motorized and non-motorized will continue to increase in the long-term, and will continue to be conduits for the distribution of invasive plants. Other Forest Service projects (such as aquatic habitat restoration) and adjacent activities such as logging and grazing off National Forest have the potential to spread invasive plants but are done in a manner that considers prevention of conditions that are susceptible to invasive plants (for example, bare ground). Wildfire and wildland fire management have the potential to spread invasive plants.

3.2.5 Consistency Findings

Alternative 1 is not consistent with Executive Order 13112, the Forest Plans, the R6 PNW ROD goals and objectives, or FSM 2080 because it would not allow effective treatment on the majority of invasive plant acreage.

Alternative 2 is consistent with Executive Order 13112, the Okanogan Forest Plan and the Goals and Objectives of the R6 PNW ROD (Appendix 1) because it would “control new invasive plant infestations promptly, suppress or contain expansion of infestations where control is not practical, conduct follow-up inspection of treated sites to prevent reestablishment.”

It is consistent with FSM 2080 because an Integrated Weed Management Approach is used. The addition of aminopyralid meets this goal by minimizing the amount of herbicide needed to treat target invasive plants.

Alternative 2 would allow for complementary effective treatments adjacent to other infested lands, allowing for better ability to cooperate with other agencies and landowners to identify, locate, prevent and prevent spread of noxious weeds.

Alternative 3 would not violate any standards, and would minimally meet national policy, but would deviate from integrated weed management concepts by eliminating some necessary tools for effective treatment. It would allow for complementary treatments adjacent to other infested lands, however the restrictions on herbicide use would increase cost or decrease effectiveness of the treatments.

3.3 Botanical Resources

3.3.1 Introduction and Regulatory Framework

This section addresses direct, indirect and cumulative effects of invasive plant treatments on native plant communities, plants on the Regional Forester's Special Status Species (RFSSS) list (2011), which includes federally listed, federally proposed, and sensitive and strategic species. In addition, this section addresses Northwest Forest Plan Survey and Manage species. All together, these are sometimes referred to as botanical species of concern, or special status species. This section incorporates by reference and supplements the Botany Biological Evaluation (BE) found in the project analysis file.

Principal laws and higher level plans that influence how botanical resources are analyzed and protected for this project include the Endangered Species Act (ESA), the R6 PNW ROD, the Northwest Forest Plan, and specific guidance within the Okanogan and Wenatchee National Forest Land and Resource Management Plans (Forest Plan).

Endangered Species Act

The Endangered Species Act (ESA) requires that the Forest Service conserve endangered and threatened species. The sensitive species program was developed to ensure that species do not become threatened or endangered because of Forest Service actions. As part of the NEPA process the Forest Service is required to review programs and activities through biological evaluation, to determine their potential effect on sensitive species. Management "…must not result in the loss of species viability or create significant trends toward Federal listing" (FSM 2670.5). A viable population "…has the estimated numbers and distribution of reproductive individuals to ensure the continued existences of the species throughout its existing range within the planning area" (FSM 2670.5) The Region 6 Sensitive Species list was last updated in 2015.

R6 PNW ROD

The following R6 PNW ROD standards apply specifically to botanical resources (emphasis in original); the project has been designed to comply with these standards (see Chapter 3.3.5 below).

12. Develop a long-term site strategy for restoring/revegetating invasive plant sites.

13. Native plant materials are the first choice in revegetation for restoration and rehabilitation where timely natural regeneration of the native plant community is not likely to occur. Non-native, non-invasive plant species may be used in any of the following situations: 1) when needed in emergency conditions to protect basic resource values (e.g., soil stability, water quality and to help prevent the establishment of invasive species), 2) as an interim, non-persistent measure designed to aid in the reestablishment of native plants, 3) if native plant materials are not available, or 4) in permanently altered plant communities. Under no circumstances will non-native invasive plant species be used.

19. To minimize or eliminate direct or indirect negative effects to non-target plants, terrestrial animals, water quality and aquatic biota (including amphibians) from the application of herbicide, use site-specific soil characteristics, proximity to surface water and local water table depth to determine herbicide formulation, size of buffers needed, if any, and application method and timing. Consider herbicides registered for aquatic use where herbicide is likely to be delivered to surface waters.

20. Design invasive plant treatments to minimize or eliminate adverse effects to species and critical habitats proposed and/or listed under the Endangered Species Act. This may involve surveying for listed or proposed plants prior to implementing actions within un-surveyed habitat if the action has a reasonable potential to adversely affect the plant species. Use site-specific project design (e.g., application rate and method, timing, wind speed and direction, nozzle type and size, buffers, etc.) to mitigate the potential for adverse disturbance and/or contaminant exposure.

Northwest Forest Plan

All of the Wenatchee National Forest and part of the Okanogan National Forest lies within the range of the northern spotted owl and is managed under the Northwest Forest Plan (NWFP) which amended both Forest Plans in 1994. The Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines (USDA 2001) contains direction for mitigating effects to certain species of vascular plants, bryophytes, lichens, and fungi within the Northwest Forest Plan lands. This project uses the January 2001 ROD standards and guidelines and the associated January 2001 species list, as modified by the 2011 Settlement Agreement (Conservation Northwest v. Sherman).

Also applicable within the entire NWFP area is one of the main intents of the Northwest Forest Plan: to maintain a healthy forest ecosystem with habitat that will support populations of native species (R6 PNW ROD, p. A-1). The Northwest Forest Plan includes an Aquatic Conservation Strategy; the relevant objectives for botany in this project are to "8. Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands…" and "9. Maintain and restore habitat to support well-distributed populations of native plant…species."

In addition to the intents of the NWFP, Survey and Mange requirements and ACS requirements that apply throughout the NWFP area, two land allocations have allocation specific management direction relevant to invasive plants:

> In the LSR land allocation, non-native species (plant and animal) should generally not be introduced into LSRs. If proposed, an assessment of the impacts must be completed and introduction must avoid retarding or preventing achievement of LSR objectives.
>
> In the Riparian Reserve land allocation, herbicides and other toxicants, and other chemicals shall be applied in a manner that avoids impacts to retard or prevent attainment of the ACS objectives.

Okanogan National Forest Land and Resource Management Plan

Three Forest-wide standards and guidelines apply to botany for this project (page 4-36):

- 6-17 requires that threatened and endangered species be managed according to recovery plans, and that management be coordinated with the USFWS and WDFW.
- 6-18 requires that consultation with USFWS be initiated when threatened or endangered species may be affected by resource proposals, and
- 6-19 states that sensitive plants and animals should be protected.

Wenatchee National Forest Land and Resource Management Plan

The Wenatchee National Forest Plan has several Forest-wide Standards and Guidelines that apply to plants (pages IV-78, IV-89, IV-92):

- Threatened, endangered and sensitive species will be identified and managed in cooperation with the [USFWS, WDFW, DNR] and Washington Natural Heritage Program (plants) for all projects.
- All proposed projects that may involve significant habitat disturbances or changes, or have the potential to alter habitat of [TES] plant…species, shall be inventoried to determine if any of these species are present.

- Biological evaluations that indicate an activity may have an impact on [TES] species should be reviewed with the state agency that is responsible for the species and recommendations considered in finalizing mitigation requirements for a project proposal.

- All Project Environmental Analyses will evaluate the effects of the project on [TES] species.

- Habitat for existing federally classified threatened and endangered species shall be managed to achieve objectives of recovery plans.

- Where a threatened or endangered species or suitable habitat is present in a project area, follow the Biological Assessment Process and the Consultation Procedures.

- When sensitive species are present in a project area, follow the objectives in the Species Management Guide.

- [S]ensitive species will receive special management consideration under Forest Service policy. All necessary actions will be taken to assure that management activities do not jeopardize the continued existence of a sensitive species through adverse modifications of their essential habitat until their status is determined.

- Contain, control or eradicate existing [weed] populations as budget allows. Give priority as follows: 1. Projects that are next to… federally listed threatened endangered and sensitive species.

3.3.2 Analysis Methods

This analysis focuses on the effects of invasive plants and treatment of invasive plants on native plant communities and botanical species of concern. Locations containing invasive plants were compared to with known botanical species of concern and their habitats and overlaps were identified. Project Design Features (PDFs) were developed to address plausible conflicts and ensure that invasive plant treatments protect special status plants and their habitats. .

3.3.3 Affected Environment

Native Plant Communities

Native plant communities on the Forest range from low elevation dry grassland and shrub steppe to alpine. Each community includes vascular and non-vascular plants (bryophytes and lichens), and fungi. Most vulnerable to invasive plants are the dry habitats, and areas with substantial ground disturbance. Many factors can influence susceptibility to invasion including disturbance levels, plant community structure, and the ecological and biological traits of the invader species. In general, grasslands, shrub steppes, and dry, open forests have frequent gaps in plant cover or additional growing space, which favor plant invasion, and some areas have disturbance from past and recurrent livestock grazing. All dry plant communities on the Forest experience disturbance from wild and prescribed fire. These communities are adapted to fire, but if non-native invasive species are present they may be able to establish and out-compete natives, thereby influencing ecosystem function and resilience.

The moist and highest elevation forests have relatively closed plant cover or little available growing space, or have extreme climate or soils which are tolerated by fewer invasive species. Mid-elevation forests typically have higher native plant cover than dry forests but often have increased levels of disturbance from recreation and forest management. Wildfires are less frequent but more intense than on drier sites. Invasive plants tend to colonize disturbed ground along and around developments such as roads, highways, utility corridors, recreation residences, trails, campgrounds and quarries.

Plant communities can be classified by a variety of factors including vegetation structure, site moisture, overstory dominants, and understory associates. The R6 PNW FEIS used broad potential vegetation groups (PVGs) to rate the susceptibility of vegetation. Table 3.8 provides a summary of major vegetation types on the Okanogan-Wenatchee National Forest and their susceptibility to invasion.

Table 3.8: Extent and Susceptibility Rating for Vegetation Types on the Forest

Vegetation Type	Description	Susceptibility to Invasion rating	Acres	Percent of Forest
Low-elevation grassland	Native bunchgrasses dominate	High	175,030	4%
Dry shrub steppe	Dominated by dry shrubs like sagebrush and bitterbrush, with bunchgrasses and forbs	High	141,233	4%
Montane herbaceous and shrub	Non-forested herb and shrub lands at mid elevations	High	336,157	8%
High elevation forest, herbaceous and shrub	Includes parkland and alpine	Low	837,772	20%
Dry forest	Mostly ponderosa pine, Douglas fir, lodgepole pine, and grand fir	Moderate to High	911,742	21%
Moist forest	Dominant overstory trees are Douglas fir, grand fir, and includes transitional areas between lower and higher elevation forests	Moderate to High	1,219,830	28%
Cold forest	Subalpine fir, Engelmann spruce, lodgepole pine	Low	335,685	8%
Riparian and deciduous, aquatic emergent	Cottonwood, aspen, and riparian shrubs dominate	High	68,489	1%
Non-Forest	Rock, ice, and non-vegetated openings within forests	Moderate to Low	243,672	6%

All native plant communities include mycorrhizae (soil fungi which form mutualistic relationships with vascular plants through their roots). These have been shown to be essential for maintaining plant health in many ways including improving nutrient and water uptake, improving root and plant growth, and reducing drought stress (Read 1991). Invasive plants are currently impacting mycorrhizae by displacing their native plant partners and/or causing changes to microsites (reduction in soil moisture, soil cover, changes in soil chemistry, reduction of shade) that are unfavorable to either the mycorrhizae or the native plant leading to reduced health and cover of native plants.

Native plant communities are being adversely affected by invasive plants through direct competition and allelopathy (suppression of growth of a plant by a toxin released from nearby plants), loss of growing space, competition for water and resources, changes in microhabitat, and direct suppression and mortality.

Regional Forester Special Status Species (RFSSS)

The Regional Forester's Special Status Species (RFSSS) list includes federally listed, federally proposed, sensitive, and strategic species. The Regional Forester Sensitive Species List (2011) identifies 81 vascular plant and one bryophyte taxa as documented on the Okanogan-Wenatchee National Forest (see Appendix C for more information).

Two federally listed endangered plants are documented on the Forest: *Hackelia venusta* (showy stickseed) and *Sidalcea oregana* var. *calva* (Wenatchee Mountain checkermallow). The recovery plans for both list invasive species as threats, and reasons for listing (U.S. Fish and Wildlife Service 2004 and 2007). Invasive plants are not known to grow within 100 feet of documented endangered plant sites; however, diffuse and spotted knapweed; and Dalmatian toadflax have been found relatively close and without treatment, could impact the showy stickseed. These invasive plant species may already be hindering the stickseed from colonizing in some locations by competing for resources. Knapweeds are allelopathic.

Nine vascular plant species federally listed as Species of Concern occur on the Forest: *Botrychium ascendens. Botrychium crenulatum, Botrychium paradoxum, Castilleja cryptantha, Cypripedium fasciculatum, Delphinium viridescens, Petrophytum cinerascens, Phacelia minutissima, Silene seelyi, and Trifolium thompsonii*.

Of the documented RFSSS plants, 26 taxa currently occur within 100 feet of an invasive plant infested sites (see Table 3.9). Nineteen taxa grow in habitats at high risk of weed invasion, and forty-five at mid-level risk (Appendix C includes the full list of RFSSS that may be affected by expansion of invasive plants through loss of growing space, competition for water and resources, changes in microhabitat, and direct suppression and mortality). For example, Thompson's clover (*Trifolium thompsonii*) occurs within 100 feet of spotted and diffuse knapweed and Dalmatian toadflax; these species compete for growing space and knapweeds are allelopathic. .

Table 3.9: Invasive Plants within 100 feet of Botanical Species of Concern

Botanical Species	**Invasive Plants Mapped within 100 ft. of population**	**Treatment Analysis Area(s)**
Agoseris elata Tall agoseris	Common tansy, sulphur cinquefoil, oxeye daisy, St. John's wort, orange hawkweed, houndstongue, chicory, Canada thistle, spotted knapweed, diffuse knapweed, absinthe wormwood	Cle Elum - Lion Rock
Astragalus arrectus Palouse milkvetch	Dalmatian toadflax	Entiat - Swakane
Botrychium ascendens Trianglelobe moonwort	St. John's wort, houndstongue, diffuse knapweed	Tonasket - Myers
Botrychium crenulatum Scalloped moonwort	Musk thistle, sulphur cinquefoil, oxeye daisy, St. John's wort, houndstongue, diffuse knapweed, hoary alyssum, spotted knapweed	Methow Valley – Cub Creek, 8 Mile, Buttermilk Tonasket – N.Fork Salmon Crk., Lower Myers, Lower Nicholson, Myers

Botanical Species	Invasive Plants Mapped within 100 ft. of population	Treatment Analysis Area(s)
***Carex comosa* –** Longhair sedge	Yellow loosestrife	Wenatchee River -Nason Crk.
Carex heteroneura Different nerve sedge	Orange hawkweed, common tansy	Methow Valley – Granite, Upper Boulder
Carex sychnocephala Manyhead sedge	Diffuse knapweed, Canada thistle, houndstongue, St. John's wort	Tonasket – N.Fork Salmon Crk.
***Carex vallicola* –** Valley sedge	Diffuse knapweed, Canada thistle, St. John's wort	Tonasket - N.Fork Salmon Crk, W Fork Salmon Creek, Omak Creek
Chryosplenium tetrandrum Northern golden saxifrage	Musk thistle, spotted knapweed diffuse knapweed, houndstongue, orange hawkweed	Tonasket - Myers
Chaenactis thompsonii Thompson's pincushion	Diffuse knapweed, spotted knapweed, Canada thistle, bull thistle, St. John's wort, oxeye daisy, Dalmatian toadflax, butter and eggs	Cle Elum – Huckleberry Mtn., Entiat -– Swakane
Cicuta bulbifera Bulbet-bearing water hemlock	Yellow loosestrife, reed canary grass	Wenatchee River – Nason Crk.
Cypripedium fasciculatum Clustered lady's slipper	Absinth wormwood, spotted knapweed, diffuse knapweed, Canada thistle, chicory, bull thistle, houndstongue, St. John's wort, oxeye daisy, butter and eggs, sulphur cinquefoil, common tansy	Cle Elum – Mineral Springs Wenatchee River – Greater Chumstick, Icicle Crk., Beehive
Delphinium viridescens Wenatchee larkspur	Diffuse knapweed, Canada thistle, bull thistle, oxeye daisy	Wenatchee River – Greater Chumstick, Icicle Crk.
Iliamna longisepala Long-sepal globemallow	Diffuse knapweed, spotted knapweed, Canada thistle, bull thistle, St. John's wort, baby's breath, Dalmatian toadflax, sulphur cinquefoil, woolly mullein	Entiat – Tyee, Swakane, Roaring Creek, Tillicum, Mud Potato Wenatchee River – Chiwawa, Greater Chumstick, Nason Crk., Beehive
Mimulus pulsiferae Candelabrum monkeyflower	Diffuse knapweed	Methow Valley – Lower Chewuch River

Botanical Species	Invasive Plants Mapped within 100 ft. of population	Treatment Analysis Area(s)
Pellaea brachyptera Sierra cliffbrake	Cheatgrass, diffuse knapweed, spotted knapweed, common crupina	Chelan – Crupina
Pedicularis rainierensis Mt. Rainier lousewort	Diffuse knapweed, chicory, bull thistle, hairy cat's ear, St. John's wort, oxeye daisy, Dalmatian toadflax, woolley mullein	Naches – Corridor
Plantanthera obtusata Blunt-leaved orchid	Hoary alyssum, musk thistle, spotted knapweed, diffuse knapweed, Canada thistle, houndstongue, orange hawkweed, meadow hawkweed, St. John's wort, oxeye daisy, stinking willie, sulphur cinquefoil	Tonasket – Tonasket Crk., Lower Myers,Lower Nicholson, Beaver, Antione, Cobey, Little Bonaparte
Plantanthera sparsiflora Sparse-flowered bog orchid	Diffuse knapweed, Canada thistle, bull thistle, St. John's wort, oxeye daisy	Naches – South Fork/Crow
Pyrrocoma hirta* var. *sonchifoli Tacky goldenweed	Diffuse knapweed, Canada thistle	Cle Elum – Huckleberry Mtn., Lion Rock
Salix glauca Grayleaf willow	Oxeye daisy	Tonasket – S. Fork Toats
Sanicula marilandica Maryland sanicle	Diffuse knapweed, common tansy	Methow Valley – Lower Chewuch
Sidalcea oregana* var *calva Oregon checkerbloom	Diffuse knapweed, oxeye daisy	Wenatchee River - Greater Chumstick
Sisyrinchium septentrioale Northern blue-eyed grass	Musk thistle, spotted knapweed, diffuse knapweed, houndstongue, sulphur cinquefoil	Tonasket – Tonasket Crk., Cobey, Aeneas, Crawfish
Spiranthes porrifolia Creamy lady's tresses	Cheatgrass, diffuse knapweed, Canada thistle, chicory, common crupina, oxeye daisy	Chelan- Crupina Naches-Milk/Rock
Trifolium thompsonii Thompson's clover	Diffuse knapweed, Dalmatian toadflax	Entiat- Swakane

The Northwest Forest Plan requires identification and protection of certain vascular and non-vascular plant species associated with late-successional and old-growth forest within the range of the northern spotted owl. Non-vascular plants include the bryophytes (mosses, lichens, and liverworts) and fungi. Intact old-growth habitats are at low risk for infestation by invasive plants, which generally prefer early seral conditions. However, roads or other disturbances through old-growth habitat may provide opportunities/corridors for invasion. Twenty-four survey and manage taxa are known to occur on the Forest. Mapped survey and manage plant locations were overlaid with known invasive plant sites in the

Forest's Geographic Information System (GIS). Those known survey and manage plants within 100 feet of an invasive plant site, along with which Treatment Area(s) they occur in, are displayed in Table 3.9.

The Okanogan-Wenatchee National Forest compiled a list of survey and manage species documented or suspected on the Forest (Appendix C). The list includes those vascular and non-vascular plant species with pre-disturbance survey requirements (Category A or C species), with Equivalent Effort pre-disturbance survey requirements, including Category B lichen and bryophytes and Category B fungi species and any Category B, D, E, or F species. Documented sites are from the Natural Resource Information System (NRIS) database.

Survey and manage plant species may be affected by invasive plants in the same ways as the RFSSS plants (through loss of growing space, competition for water and resources, changes in microhabitat, and direct suppression and mortality). However, non-vascular plants growing on tree boles and branches are less likely to be directly affected by invasive species – all of the known invasive plants on the Forest grow on soil.

3.3.4 Environmental Consequences

Determination of effects are based on the assumption that label guidance, Forest Plan and R6 PNW ROD standards, and project design features (PDFs) as listed in Chapter 2.2 of this EIS are properly implemented. Botany Project Design Features (PDFs I-2, I-3, I-4) were developed to minimize effects from invasive plant treatments to botanical species of concern and native plant communities.

Each alternative is evaluated in terms of the effects of the proposed treatments and the effects of untreated or ineffectively treated invasive plants on native plant communities and botanical species of concern.

Direct and Indirect Effects of Alternative 1

No new treatment of invasive plants would occur under this alternative. Because there are no new treatments under this alternative there would be no direct or indirect treatment-related effects to native plant communities, RFSSS and survey and manage plants that have not been disclosed in previous documents. No significant effects to botanical resources were found from treatments under these previous documents, and the ongoing projects would be phased out within a few years. Therefore, only the effects of untreated (or ineffectively treated) invasive plant infestations are discussed below.

Native Plant Communities

Those native plant communities most vulnerable to invasive plants (dry forest and shrub steppe) and those near very aggressive invasive plants (such as Bohemian knotweed) would be most adversely affected through direct competition and allelopathy (suppression of growth of a plant by a toxin released from nearby plants), loss of growing space, competition for water and resources, changes in microhabitat, and direct suppression and mortality. Expansion of these invasive plant infestations would likely occur without any new ground-disturbing activities. Native plant diversity would decrease as invasive plants replace native species. Shifts from diverse native plant communities to non-native invasive plant dominance in dry habitats could alter fire behavior, intensity, extent, and season of burning resulting in long term adverse effects to fire-adapted native plant communities (Brooks, et. al. 2004). Invasive expansion in less vulnerable communities would still occur, but a slower pace than in the dry habitats and probably in conjunction with ground disturbing activities.

Botanical Species of Concern

Botanical species of concern would be affected by expansion of invasive plants through loss of growing space, competition for water and resources, changes in microhabitat, and direct suppression and mortality. For example, Thompson's clover (*Trifolium thompsonii*) occurs within 100 feet of spotted and diffuse knapweed and Dalmatian toadflax (table 3.8). Toadflax is able to spread rapidly without any new ground disturbance; in addition to sprouting from vegetative buds on very long roots, each plant may produce half a million seeds (Robocker 1970). Toadflax would likely move quickly into Thompson's clover populations. Diffuse and spotted knapweeds secrete chemicals from their roots which inhibit North American plants (allelopathy) (Callaway and Ridenour 2004). The expansion of knapweeds into the Thompson's clover habitat would be gradual as native plants adjacent to existing knapweed are suppressed.

A federally listed plant, showy stickseed, is currently threatened by diffuse and spotted knapweed and Dalmatian toadflax (see table 3.8). Without treatment these invasive plants would likely invade and threaten the population. The Wenatchee checkermallow population does not currently have an adjacent invasive infestation but under this alternative no new invaders would be treated, leaving the population vulnerable to future competition from invasive plants. The most likely vector of infestation is the road system leading into the population.

Shifts from diverse native plant communities to non-native invasive plant dominance could alter fire behavior, intensity, extent, and season of burning (Brooks, et. al. 2004). Sensitive plants which grow in dry sites (such as Thompson's clover and long-sepal globemallow) are adapted to frequent, dry season fires and may be adversely affected by changes in fire frequency, intensity, and timing as a result of infestations of invasive plants. For example, a late spring fire fueled by dry cheatgrass might prevent reproduction of a sensitive plant which is adapted to late summer fires occurring after seed production.

Most of the non-vascular sensitive and survey and manage plants are found in late successional, undisturbed habitats which less typically have invasive plant infestations. However, it is likely that if invasive species continue to spread across the Forest, as is likely under this alternative, habitats for these species could invade and displace native plants.

Habitat for those sensitive plants growing in habitats most at risk for invasion (dry forest, grasslands, shrub steppe, Appendix C) would be reduced as invasive plants altered native plant communities. Some sensitive plant populations could be extirpated and some species could be moved toward listing.

Direct and Indirect Effects Common to Alternatives 2 and 3

Manual and Mechanical Methods

Native plant communities and botanical species of concern near invasive species being treated by manual or mechanical methods could be unintentionally damaged or removed by trampling of flowers, fruits, stems, or root systems, but damage should be minimal with properly trained crews (R6 PNW FEIS, p. J-12). Two studies summarized in the R6 PNW FEIS (ibid, p. J-13) found that hand pulling diffuse and spotted knapweed increased the percentage of bare ground (Duncan et al. 2001, and Brown et al. 2001). This bare ground would be vulnerable to re-invasion by invasive species.

Indirect effects to native plant communities and botanical species of concern from manual and mechanical treatments would be due to changes in microsites: reduced soil moisture as soil is exposed to the air through pulling and digging and exposed to direct sunlight once the cover of invasive plant is removed, increase of soil temperature as a result of less shading, and disruption of mycorrhizal connections (as the "fungal root-like structures " are broken) through the physical disturbance of the soil (R6 PNW FEIS, p. J-13). These changes could result in a change of native species composition with the plants most sensitive to microsite changes reduced on the site in the short term, until native plant cover regrows. There could be an increase of invasive plants, if invasive plant seeds in the disturbed soil are stimulated to germinate. Monitoring and follow-up treatments would be required to prevent a long term increase of invasive plants. Manual and mechanical methods around native plant communities and botanical species of concern could improve habitat by increasing growing space, reducing competition for resources, and increase native plant populations by encouraging germination of native plant seed in the soil (ibid, p. J-14).

Cultural/Restoration

The cultural method included in the action alternatives is seeding of native species. Seeding would only occur where natives are not expected to colonize the site in time to out-compete invasive plants. Although seeding of native species to compete with invasive plants could negatively impact native plant communities and sensitive plants through competition for water, light, and nutrients, accidental introduction of weed seeds, seed is carefully selected to avoid this by choosing local, native species, and adjusting seeding rates. In addition, any seed used is required to be certified as noxious weed-free seed. Seeding would positively affect natives by occupying disturbed ground that would otherwise be vulnerable to invasion.

Biological Agents

Only biological agents approved through the USDA Animal and Plant Health Inspection Service (APHIS) would be used under this project. APHIS performs a testing program and completes NEPA on proposed agents before they are approved.

There is a slight risk that an agent could adversely affect non-target plants by using them as host plants despite the APHIS testing process. The R6 PNW FEIS (p. J-14) summarized the few examples of indirect effects of biocontrols on non-target plant species: the reproductive output of native Idaho fescue was reduced when a root moth was released on knapweed, and a biocontrol agent for houndstongue was found to use nine native species in the same plant family, however these native species did not experience the same incidence and degree of attack as the non-native houndstongue (Clerck-Floate and Schwarzlander 2002).

Herbicide Methods

The R6 PNW FEIS summarized herbicide characteristics by active ingredient (pp. 4-26 to 4-33) and specifies use restriction to minimize effects to non-target vegetation. These characteristics are summarized below, with the addition of aminopyralid. Herbicide characteristics were used to develop PDFs (I-2, I-3 and I-4) that minimize potential risks to non-target plants, and PDFs developed for other resources, such as riparian buffers, also provide protection to non-target vegetation.

Acetolactate Synthase (ALS) Inhibitors (chlorsulfuron, metsulfuron methyl, imazapic, and imazapyr). These inhibit the enzyme ALS, which is necessary for plant growth. This group is very potent and the most likely to damage non-target plants. For this reason, herbicides in this group are not the first choice unless other herbicides are ineffective. Metsulfuron methyl is required for the effective treatment of whitetop, for example (Table 2.5: Alternative Treatment Methods – Range of Effective Treatment Options and Site Specific Considerations by Target Species).

Synthetic auxins – (picloram, clopyralid, triclopyr, and aminopyralid). These herbicides mimic auxins (plant hormones) and cause mortality by disrupting normal cell division and growth. Picloram is soluble in water, resistant to environmental degradation, and has potential to leach into groundwater (use near water is restricted on the label). Non-target plants may take up picloram from the soil. Susceptible non-target plants may be killed by off-site transport of picloram, but more tolerant species are not likely to be affected unless directly sprayed. Aminopyralid would replace picloram in most cases because it is as effective with fewer potential environmental effects. Clopyralid is more selective and less persistent than picloram so less likely to cause damage to non-target plants. It is the second choice, after aminopyralid, for many target species in the aster family. Triclopyr is a selective systemic herbicide used on broadleaf and woody species. No broadcast of triclopyr would occur (R6 PNW ROD standard 16), greatly reducing the potential for drift to non-target plants.

Aminopyralid provides broad-spectrum broadleaf control at very low rates compared to the other synthetic auxins. It is systemic and disrupts plant growth. It would kill non-target broadleaf plants if directly sprayed on them.

EPSP Synthase Inhibitors – Glyphosate is the only EPSP synthase inhibitor proposed for use and prevents plants from synthesizing three aromatic amino acids (of which EPSP is the key enzyme). Glyphosate is a non-selective systemic herbicide that can damage all groups or families of non-target plants, mostly from off-site drift. Plants sensitive to glyphosate can be damaged by drift up to 100 feet from the application site at the highest rate of application proposed. However drift at this distance is unlikely given the use of spot-spraying as the primary application method. Less tolerant species are likely to be damaged at distances up to 25 feet (SERA Risk Assessments). Non target species are not likely to be affected by runoff because glyphosate becomes biologically inactive when it contacts organic material in the soil. Glyphosate was found to inhibit growth of three types of ectomycorrhizal fungi associated with conifer roots at concentrations of 1,000 parts per million in laboratory experiments (Esok et al. 1989).

Herbicide Effects to Native Plant Communities

Herbicides have the potential to reduce the diversity of native plant communities by replacing less herbicide-tolerant species with more herbicide tolerant species (R6 PNW FEIS p. 4-27). Herbicides are designed to kill targeted plants and some damage to non-target native plants is likely despite PDFs and careful implementation. Direct effects include mortality to individuals, reduced or prevented reproduction, and abnormal growth patterns (typically for one or two seasons).

The potential of herbicides to harm non-target native plants depends on the characteristics (potency, selectivity, and persistence) of the herbicide, as discussed above. Herbicides may reach non-target plants through the air (as drift), in water, or on soil. A persistent herbicide on the soil may impact a sprouting non-target plant; herbicide build up in the soil is managed via PDF H-5.

For all herbicides, the use of spot spraying as the primary application method would minimize harmful effects to non-target plants. Spot spraying allows the applicator to hold the spray wand close to the target plant, minimizing drift to other plants, and minimizing the amount of spray reaching the soil surface. Because of this selective method of application only plants directly adjacent to the target plant are likely to be impacted and no harmful effects to the plant community as a whole would be expected. The benefits of the removal of the invasive plants from the plant community exceed the cons of the potential damage to individual plants. Broadcast spraying would only be used on severely degraded sites that are dominated by invasives with little or no native plant cover. Broadcast spraying in this situation would encourage restoration of native plant communities.

Despite the risk of accidental damage to individual non-target plants from any of these herbicides, invasive plant treatments are more likely to benefit native plant communities in the long term. Careful treatment would reduce competition for resources, eliminate allelopathic damage, and improve and maintain habitat quality. Project Design Features, no use of aerial spraying, and very restricted broadcast spraying would minimize the potential for drift and impacts to non-target species.

Short-term impacts (mortality of individuals or reduction in diversity) could occur. In the long-term, native plant communities are expected to remain healthy and diverse because effective treatment of existing and future invasive plants would prevent harmful effects of invasive plants such as direct competition for resources and allelopathy.

Herbicide effects to RFSSS and survey and manage plants: The potential of herbicides to affect RFSSS plants vary by plant family. Species in the sunflower, legume, or mustard families may be the most sensitive to herbicides in general, and those in the lily family may be more sensitive to some of the sulfonylurea herbicides (R6 PNW FEIS p. 4-130). The proposed herbicides are not designed for treatment of non-vascular plants, but these non-target plants may be affected if they come into contact with herbicides. Those herbicides which are known to affect soil mycorrhizae (picloram, glyphosate, and triclopyr) (R6 PNW FEIS) may damage or kill fungi.

Project Design Features I-2, I-3 and I-4 were developed to minimize or eliminate herbicide treatment effects to botanical species of concern. These features include the following requirements: survey of suitable RFSSS and survey and manage plant habitat before treatment, or 100 foot buffers from suitable habitat, buffers around documented sites, herbicide formulation restrictions, and Botanist supervision of treatments, including cultural methods. Because PDFs are required, they would reduce the likelihood that herbicide would land on non-target plants and increase the likelihood that new populations are located though surveys of suitable habitat before any treatment activity.

Drift associated with spot application is relatively easy to manage through PDFs requiring that spraying only occur at low wind rates and that droplet size be large. Hand application methods do not result in any potential drift. However, even with the PDFs and all the layers of caution integrated into herbicide treatments there is still a very minimal chance that an individual sensitive plant may be damaged by herbicide contact. Because of the buffer and application restrictions any accidental contact would most likely be on an RFSSS and survey and manage individual plant at the edge of a population, or on a plant not previously located. Because the majority of the population would likely not be impacted, the RFSSS and survey and manage plant populations would remain viable and not be damaged in the long-term, and no trend toward federal listing would be expected. Broadcast spraying would not affect RFSSS and survey and manage plant populations because it would not be used within 100 feet of those populations.

Herbicide treatments are likely to benefit botanical species of concern in the long term. By implementing PDFs, careful treatment around populations would effectively reduce competition for resources, eliminate allelopathic effects on native plants from invasive plants, improve and maintain habitat quality, and preserve the potential for special status plant population expansion.

Survey and manage non-vascular plants typically occur in late successional habitats which are less vulnerable to invasion, and therefore less likely to have herbicide treatments. Fungi could be damaged by herbicides known to affect soil mycorrhizae (picloram, glyphosate, and triclopyr) (R6 PNW FEIS) and one study found that glyphosate and triclopyr damaged bryophytes and reduced species diversity (Newmaster et al. 1999). In addition, many non-vascular plants grow on substrates that are elevated (tree boles and branches) or less likely to support invasive species (like rotting wood). These substrates have low potential to be sprayed, and the lack of aerial spraying and primary use of spot spraying (along with PDFs) reduces the potential for drift damage.

Early Detection and Rapid Response (EDRR)

The EDRR component of Alternatives 2 and 3 would benefit native plant communities and botanical species of concern by providing for early treatment of invasive plants before they cause harmful effects. The effectiveness of treatments covered under EDRR would be different under the two action alternatives; this difference will be discussed under Alternatives compared below. All PDFs would apply to EDRR treatments.

Forest Plans Amendment to Add Aminopyralid

The addition of aminopyralid will benefit to native plant communities and botanical species of concern by effectively controlling broadleaf invasive plants with fewer non-target effects than picloram (less water soluble/mobile, lower application rate).

Direct and Indirect Effects Specific to Alternative 2

The flexibility provided by the availability of a full range[12] of tools would allow managers to use the most effective treatments on the priority infestations each year. Should additional funding be made available by Congress or through other mechanisms such as grants, as has happened in the past, the maximum number of acres possible could be treated with those funds. Treatment of the most aggressive invasive plants would benefit native plant communities by removing competition for resources and allelopathic damage.

Accidental damage or death of non-target native species could occur on or adjacent to any treated acres, at a maximum of 16,281 acres yearly. Damage to non-target plants is expected to be minor, short-term and confined to the immediate vicinity of the target plant, based on regional and local monitoring (see Desser 2014 and McFetridge 2016, Ranne 2016, Ogilvie 2010). The benefits of removing invasive plants are likely to far outweigh adverse effects on native plant communities.

Accidental damage to special status plant could occur to 27 sensitive species growing within 100 feet of known invasive plant populations, and the single survey and manage plant within 100 feet of diffuse knapweed. However, PDFs would prevent herbicide from coming into contact with these plants. Given these restrictions to treatments in and around sensitive and survey and manage plants, no long-term adverse effects to these plant populations are expected. Because the most effective methods would be available to treat invasive plants populations, sensitive and survey and manage plants are likely to benefit in the short- and long-term. Careful treatment around sensitive populations would reduce competition for resources, eliminate allelopathic damage from invasive plants, improve and maintain habitat quality, and preserve the potential for sensitive and survey and manage plant population expansion. No threatened or endangered plants are known within 100 feet of invasive species, and therefore treatments would not affect them. If invasive plants are found near threatened or endangered plants in the future, PDFs would protect those plants as described above.

Direct and Indirect Effects Specific to Alternative 3

As described in Chapter 3.2.4, treatments under Alternative 3 would be less effective on many infested sites. Where treatments are not effective, habitat occupied by invasive plants would continue to reduce the amount of habitat available to natives, and invasive plants growing next to native plants would be directly competing for resources.

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[12] Full range" means that several herbicides and other methods are available. Full range does not include use of grazing animals, prescribed fire or heavy equipment for invasive plant management. Full range includes treatment methods discussed in the proposed action

Potential effects and benefits from integrated treatment, including use of herbicide, would be the same as under Alternative 2 for areas where herbicide is used.

Of the 27 RFSSS plant species with invasive plants within 100 feet of the population boundary, 21 are near at least one invasive species that could be treated with herbicide under this alternative (Table 3.9). Invasive plants within 100f t of six special status species could only be treated with non-herbicide methods due to restrictions on the use of herbicide under this alternative. The diffuse knapweed infestation within 100 feet of the survey and manage plant *Botrychium montanum* (mountain moonwort) would not be treated with herbicide under this alternative.

Accidental damage or death from herbicide treatment could occur to these 21 botanical species of concern. However, PDFs I-2, I-3 and I-4 would help prevent accidental damage to these plants by preventing herbicide from coming into contact with them. Spray buffers around rare plants are successful in preventing accidental damage and are recommended in recovery plans. Given these restrictions to treatments in and around special status plants, no long-term effects to these plant populations are expected. Because the most effective methods would be available to treat these invasive plants populations, the sensitive plants near them are likely to benefit in the short- and long-term. Careful treatment around these populations would reduce competition for resources, eliminate allelopathic damage from invasive plants, improve and maintain habitat quality, and preserve the potential for special status plants to expand.

The remaining 17 RFSSS plants and 1 survey and manage plant with current populations of invasive plants nearby would not be treated with herbicides and therefore would be at no risk of accidental damage from herbicide under this alternative, based on known infestations. These plants could be accidentally damaged during manual treatments. PDF I-3 would help minimize accidental trampling damage.

If less effective treatments would be used because herbicides are not allowed, a reduction of habitat, direct competition for resources leading to reduction in health, vigor and reproduction, changes in habitat (shading reduction, soil temperature increase, reduced moisture availability, allelopathy) and possible mortality to botanical species of concern could occur.

Cumulative Effects All Alternatives

Cumulative effects discussed here relate to the incremental effects the implementation of this project along with the effects from other past, present and reasonably foreseeable projects on the spread of invasive plants and on native plant communities and botanical species of concern. Humans have introduced invasive species into the Forest and have created conditions susceptible to the spread of invasive plants. The effects of past actions resulted in the current condition, e.g., the Affected Environment described in the Chapter 3.3.2.

Ongoing and proposed Forest activities are summarized in Chapter 3.1.6 (and table 3.5). Roads and trails eliminate native plant cover and habitat, and are vectors for spread of invasive species. Livestock grazing reduces native plant cover and animals may carry weed seeds into new locations. Fire suppression has altered habitat and changed timing and effects of burning. Forest management, recreation, and other ground disturbing activities alter potential habitat. Invasive plant infestations have increased, and new invasive plant species to the Forest, such as whitetop, have been documented.

Current project planning trends within the Forest are generally leading to reductions in roads and livestock grazing, which would reduce associated impacts to native plants. Fuels treatments including prescribed burning and thinning are expected to increase, these treatments decrease native plant cover allowing typically short term opportunities for invasion. The Forest would continue to provide a variety of recreation opportunities for the public. Roads would continue to be a major vector for the spread of invasive plants but fewer roads would be open to motorized vehicles after the Travel Management Plan is completed in 2015, as both Minimum Roads Analysis NEPA documents and project level document analyze road closures and are implemented. The Travel Management Project would also close the Forest to cross country travel by motorized vehicles except on designated routes, which would reduce the potential for spread of invasive species from off-road travel.

Natural disturbances, such as wildfire, would continue to occur in the future. Most invasive plants are adapted to colonize disturbed sites.   Fire suppression activities disturb the soil and provide opportunities for invasion. Vehicles used in fire suppression can introduce and spread weeds.

Projects and activities would also continue on adjacent state, county, private, and other federal lands. Cumulatively these actions would likely contribute to the introduction, spread, and establishment of invasive plants on National Forest System. Continued implementation of prevention measures in the 2002 Okanogan and Wenatchee National Forests Noxious Weed Prevention Strategy and R6 PNW ROD standards for all Forest projects would help reduce the establishment and spread of weeds. The R6 PNW ROD standards are intended to protect ecosystems from the impacts of invasive plants, and minimize the creation of conditions that favor invasive plant introduction, establishment, and spread during land management actions and land use activities. As a result, current and recently completed project activities are less likely to result in invasives than past ones. However, continued use and management of the Forest does present continued risk for new species to invade and spread, particularly as vehicles pick seeds up off -Forest and deposit them on Forest lands.

Increased spread of invasive plants could result in increased treatment need, however annual caps limit the extent of treatment and the analysis already considers the maximum extent of treatment allowed. The treatments proposed under this project are not likely to contribute to adverse cumulative effects at any scale. The PDFs would be effective in protecting native plant communities and botanical species of concern. Thus, these projects would not combine with other activities to cause cumulative adverse effects to botanical resources.

3.3.5 Consistency Findings

No federally listed threatened or endangered plants are mapped within 100 feet of mapped invasive species. PDFs would protect, and treatments are likely to benefit botanical species of concern and their habitats.

This project is consistent with the Wenatchee and Okanogan Land and Resource Management Plans as amended by the 2001 *Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines* (2001 ROD), as modified by the 2011 Settlement Agreement.

This project is also consistent with one of the main intents of the NWFP to maintain a healthy forest ecosystem with habitat that will support populations of native species (R6 PNW ROD, p. A-1), and ACS factors 8 and 9 because suppressing, containing, controlling and eradicating invasive species would allow for native species to recover in those areas, and PDFs minimize impacts to native plants as described above. Alternative 2 is more likely to more effectively restore native habitat than Alternative 3, and both action alternatives are more likely to restore native habitat than Alternative 1 (no action).

In summary, with the layers of caution built into this project (see figure 1 in Chapter 3.1.4), direct, indirect and adverse cumulative effects are not expected to botanical species of concern. The No Action Alternative would result in a higher risk that invasive plants would continue to spread and degrade native plant communities; these effects would be cumulative over time and are likely to become significant as invasive plant treatment documents reach the end of the lifespan and treatment can no longer occur under them. The oldest documents are the Forest-wide Noxious Weed Treatment EAs; approved acres for treatment under other subsequent project level documents cover about 6.000 acres of the more than 16,000 mapped on the Forest. R6 PNW ROD prevention, treatment and restoration standards are intended to help reduce potential spread, but existing sites must still be contained, controlled or eradicated or they will continue to spread, increasing the risk of adverse impacts from invasive plants to native plant communities and botanical species of concern.

3.4 Soil Resources

3.4.1 Introduction and Regulatory Framework

This section focuses on effects to soils from invasive plants and proposed treatments. Project Design Features (PDFs) were developed to minimize the effects of invasive plant treatments on soils.

Laws and Regulations

The National Forest Management Act of 1976 (NFMA) stresses "…the maintenance of productivity and the need to protect and improve the quality of soil and water resources, and avoid permanent impairment of productive capability of the land."

The Okanogan National Forest Land and Resource Management Plan (Forest Plan, 1989) requires that soil productivity be rehabilitated following any management activities that result in long-term site degradation to meet the goals of the management area (Forest-wide Standard and Guideline 13-7, p 4-46).

The Wenatchee National Forest Land and Resource Management Plan (Forest Plan, 1990) directs that management (page IV-97):

- Leave a minimum of 80 percent of an activity area in a condition of acceptable productivity potential for trees and other managed vegetation following land management activities. Surface soil conditions known to result in reduced productivity or loss of productive land surface are: detrimental compaction; detrimental displacement; detrimental puddling; and severely burned. The total acreage of all detrimental soil conditions should not exceed 20 percent of the total acreage within the activity area, including landings and system roads.
- To meet acceptable levels of soil loss and soil management objectives, the minimum percent effective ground cover following cessation of any soil-disturbing activity should be:
    - o Low erosion hazard class: 20-30% first year; 30-40% second year
    - o Medium erosion hazard class: 30-45% first year; 40-60% second year
    - o High erosion hazard class: 45-60% first year; 60-75% second year
    - o Very high erosion hazard class: 60-75% first year; 75-90% second year
- Sites degraded by management activities shall be rehabilitated.

Invasive plants may result in changed or detrimental soil conditions, however this has not been measured. However, detrimental soil conditions from activities such as logging and grazing may result in susceptibility to invasive plants and places that have heavy infestations

The original Forest Plans above were amended by the R6 PNW ROD (2005) which requires added standards to the Forest Plans, #19 of which is relevant to soils (page 28):

- To minimize or eliminate direct or indirect negative effects to non-target plants, terrestrial animals, water quality, and aquatic biota (including amphibians) from the application of herbicide, use site-specific soil characteristics [among other factors] to determine herbicide formulation, size of buffers needed, if any, and application method and timing.

Policy

To meet the direction in NFMA, Forest Service Manual (FSM) R6 Supplement No. 2500.98-1 directs that National Forest System land be managed "…under ecosystem management principles without permanent impairment of land productivity and to maintain or improve soil and water quality. Plan and conduct land management activities so that soil and water quality are maintained or improved." The FSM direction is for vegetation management projects to leave a minimum of 80 percent of an activity area in an acceptable soil quality condition.

3.4.2 Analysis Methods

This analysis is tiered to the R6 PNW FEIS and incorporates SERA Herbicide Risk Assessments (1999, 2001, 2003, 2004, 2007, and 2011). The effects of herbicide treatments and manual/mechanical treatments described throughout R6 PNW FEIS Chapter 4 and Appendix J served as a starting point for displaying the potential effects of herbicide application and other treatments.

Project design features were developed to minimize or eliminate the risk of adverse effects to soils, based on the site-specific conditions related to soils in the project area and information in the R6 PNW FEIS and SERA herbicide risk assessments. The project design features address potential risks to soils and ensure compliance with standards required in the Okanogan and Wenatchee National Forest Plans (as amended by the R6 PNW ROD). Natural Resource Conservation Service (NRCS) Soil Surveys were used to consider the site-specific soil conditions within the treatment areas.

3.4.3 Affected Environment

Geology and Soils in the Project Area

For much of Okanogan County and the northern portions of Chelan County, the basic geology is dominated by granodiorite and metasedimentary rocks, which have been uplifted and glaciated, forming steep mountain peaks and relatively broad valleys at the higher elevations. Much of Okanogan County was also glaciated by broad, thick ice sheets. The thick sheets of ice created broad mountains and valleys as the ice eroded the high points and deposited glacial tills in the valleys. Therefore, soils across the Forest are derived from glaciation and from ash deposited from volcanos of the North Cascades. Soil texture and productivity varies. In the southern part of the project area, higher precipitation and more productive soils contributed to more productive forests.

Bedrock under the southern half of the Forest is varied. Underlying the Cle Elum River are sandstones and shale interbeds of the Swauk formation. This formation extends as far north as Lake Wenatchee. Other major bedrock formations include metamorphic rocks, granitic intrusions and sequences of volcanic and marine sedimentary rock of the Chumstick formation.

Mass wasting in the form of debris avalanches is common in the glaciated valleys, especially on the Methow Valley, Chelan, Entiat and Wenatchee River Ranger Districts. As the folded and faulted sedimentary rocks and sedimentary rocks interbedded with finer textured volcanic rocks or other sedimentary rocks occur, the occurrence of landslides increases. Most debris failures are confined to the steeper slopes where roads and development were avoided because of the high costs associated with road building and harsh growing sites with low volumes of timber.

Soils in the area are derived from glaciation and from ash deposited from volcanos of the North Cascades. The soil texture and productivity varies. In the southern part of the project area, higher precipitation and more productive soils contributed to more productive forests. Soil disturbance from past activities such as road building, quarries, logging, fuels reduction, recreation, fire suppression, and grazing has created more opportunities for noxious weeds in these disturbed areas.

Detailed information about each soil type can be found in the various soil surveys which cover the Okanogan-Wenatchee National Forest and are provided by the NRCS. These surveys are:

- WA 607 – Chelan County Area, Washington (Parts of Chelan and Kittitas Counties) (USDA NRCS 1975);
- WA 608 – Cashmere Mountain Area, Washington, Parts of Chelan and Okanogan Counties (USDA NRCS 2007);
- WA 649 – Okanogan County Area, Washington (USDA NRCS 1980);
- WA 680 – Wenatchee National Forest, Naches Area, Washington, Parts of Kittitas and Yakima Counties (USDA NRCS 2009); and
- WA 749 – Okanogan National Forest Area, Washington (USDA NRCS 2008).

Soil disturbance that impacts soil productivity from compaction and displacement is produced by natural and anthropogenic processes and exists across the Forest. The most abundant form of natural soil disturbance occurs as mass wasting in the form of debris avalanches and landslides. As folded and faulted sedimentary rocks and sedimentary rocks interbedded with finer textured volcanic rocks and other sedimentary rocks occur, the occurrence of landslides increases. Most debris failures are confined to the steeper slopes. These mass wasting processes are common in the glaciated valleys of the Methow Valley, Chelan, Entiat and Wenatchee River Ranger Districts. Anthropogenic soil disturbance is related to past management activities such as road building, rock and gravel quarries, vegetation treatment including logging operations, fuels reduction practices, recreation sites, fire suppression activities, and livestock management. These activities create have may reduce groundcover, compact and displace soils, and may have reduced soil productivity depending upon the soil type and texture. Where soils have been disturbed, noxious weeds tend to thrive.

Invasive plants can have direct and indirect effects on soil properties; and may cause changes in soil properties such as pH, nutrient cycling and changes in composition or activity of soil microbes. Reduced levels of soil nutrients creates higher competition levels for native, desirable plants and invasive plants. Low nutrient levels may also affect the soil biotic community.

Weed infested sites have reduced or redistributed levels of soil organic matter, because invasive plants tend to have deeper roots and less foliage than native species. Therefore these invasive plants contribute less litter and organic matter at or near the soil surface. Additionally, invasive plants tend to decay more slowly than native species (Olson 1999; Olson and Kelsey 1997) and result in less input of organic matter to the soil.

The rates and volumes of water infiltrated by soils may be reduced on weed infested sites where cover has been reduced (DiTomaso 1999; Olson 1999a). Reduced infiltration may increase surface water runoff, which 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).

Total vegetative cover is generally reduced on weed infested sites, which may result in higher evaporation from exposed mineral soil (Lauenroth et al. 1994, Olson 1999a); and higher transpiration rates (Olson 1999a).

Weed infested soils are more prone to erosion than soils supporting native grass species (Lacey et al. 1989). Rainfall simulator testing results show that soil erosion rates in spotted knapweed-dominated rangeland areas are more than double the erosion rates related to natural bunchgrass/forb grasslands. The erosion rate is related to lower infiltration rates and higher levels of bare ground on the knapweed dominated site compared to the un-infested areas (Lacey and Marlow, 1989). Weeds are less able to dissipate the kinetic energy of rainfall, overland flow, and wind that cause soil erosion, due to the loss of cover provided by native species on site (Torri and Borselli 2000; Fryrear 2000).

Plants and mycorrhizae (fungi which form complex mutualistic relationships with a plant through its roots) 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 fungal community (ibid). These changes could increase the difficulty of reestablishing native vegetation after the invasive plants are removed.

Invasive plants directly limit nutrient availability by out-competing native species for limited soil resources. They 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 (produce chemicals toxic 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 would affect the soil food web and nutrient cycling, and may have impacts on the native plant community.

Soils under invasive understory plants can have pronounced differences in soil properties when compared to soil under native shrubs, including substantially higher pH and extractable nitrate levels (Ehrenfeld, et al., 2001). Invasive plants that increase the availability of nitrate in the soil may be promoting conditions that favor their own expansion at the expense of native plants that can only tolerate lower nutrient levels. Conversely, many non-native species deplete soil nutrients, which can make it difficult for native plants to compete with the invasive plants and may also affect the soil biotic community. Long term shifts from perennial grasslands to annual grasslands has been documented in California (D'Antonio and Vitousek 1992).

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).

All of these potential impacts of invasive plants contribute to the need for action, and are important to consider for context when addressing the potential adverse effects on soils from treatment.

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).

The majority of infested sites identified for treatment are along roads, quarries, trails and recreation sites. The infested areas have highly disturbed soil conditions and often reduced levels of organic matter. Soil structure may be weakened or altered as a result of displacement or disturbance. Altered soil structure and porosity can result from compaction of mineral soil. In general, conditions affecting vegetative growth such as available moisture holding capacities and soil porosity are altered. Many invasive plants prefer disturbed sites, where invasive species can out-compete native species. Invasive species can affect the soil quality on disturbed sites due to their physiologic and morphologic differences from native species. These differences allow them to out-compete native species for water and nutrient resources in the soil (Olson 1999).

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 and typically result in smaller infestation areas. Infested areas not along roads may also be found in vegetation management sites, grazing allotments and other areas where native vegetation was disturbed such as areas in wilderness where pack stock has been concentrated.

3.4.4 Environmental Consequences

Introduction

Invasive plant treatment is likely to have an overall beneficial impact on soils. To the extent that invasive plants are having an adverse effect as described above, treatment would reduce, reverse or eliminate these impacts. Alternatives that allow for effective treatment throughout the project area would have the greatest potential for reducing impacts of invasive plants.

All alternatives allow some level of treatment using all methods, and all methods pose some risks of adverse effects on soils. The potential effects by method are discussed below.

Potential Effects of Manual and Mechanical Treatment on Soils

Manual treatments could expose mineral soil and reduce live vegetative cover, causing accelerated erosion over a small area. The amount of area that would be made bare through manual treatment is small because of the cost of manual treatment limits its application to small areas and native plants are intermixed with invasives so removal of 100 percent of the plants on a slope does not usually occur. Control measures such as pulling plants before flowering so they may be left on site, would be implemented whenever they are feasible to off-set the increased erosion potential.

Manual and mechanical treatments may slightly increase the potential for delivery of fine sediment to streams the year after treatment if the treatment sites are close to streams. 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 (all vehicle use, including ATVs, is restricted to designated open roads, trails, areas, parking areas, dispersed campsites and permitted stock driveways).

Indirect negative impacts related to manual and manual control are produced from the removal of plant roots. The removal of plant roots may consequently may break mycorrhizal hyphae (long, branching, root-like structures in the soil) and may reduce mycorrhizal function at the site of disturbance. 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). Therefore, it may be more difficult to establish native plants after manual or mechanical weed removal in areas of disturbed soils because of the resultant damage to mycorrhizal hyphae.

Localized short-term oil disturbance and removal of groundcover may cause minor and temporary shifts in microsite condition such as reduction in soil moisture, disruption of mycorrhizal associations and cause an increase in surface temperatures. However, as the treatment areas associated with this project are generally in previously disturbed sites, treatment would ultimately improve the condition of the site by allowing reestablishment of native vegetation which would increase long-term mycorrhizal function.

In summary, manual and mechanical treatment of invasive species may have short term effects to the physical and biological properties of the soil resource. However, these effects would be minimized with PDFs and would be short-term due to the expected establishment of more desirable vegetation during the next growing season. The long-term benefits of removing undesirable vegetation considerably outweigh the possible short-term effects.

Potential Effects of Biological Control on Soil

Biological control methods are unlikely to affect soils, except through possible indirect effects resulting from shifts in plant community composition.

Potential Effects of Cultural Treatments on Soil

The risk of harm to soil productivity from hand seeding of native species is low. Hand seeding does not involve soil disturbance and seed applied to bare areas would increase native vegetative cover, which would have a positive impact on the soil biology.

Solarization can harm soil organisms in treated areas. Changes in soil recover rapidly once the solarization media is removed.

Potential Effects of Herbicide Treatments on Soil

Herbicide fate (what happens to the herbicide once in the soil) is determined by herbicide characteristics such as adsorption, solubility, degradation, and volatility. Factors that determine herbicide fate in soil include mobility and degradation. Herbicide degradation over time is a result of physical and chemical processes in soil and water. Soil characteristics such as organic matter, pH, temperature, moisture content, clay content, and microbial degradation 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).

Soil microbes facilitate the degradation of the herbicides by using the herbicides as growth substrate, accumulating, or altering the chemical structure by influencing the pH of the soil environment (Bollag and Liu 1998). The residency times are a gross collective function of average soil types, application timing and frequency, and the unique chemical structure of what herbicide is applied. Favorable microbial growth conditions would speed herbicide degradation.

Herbicide treatment could indirectly affect site productivity in the short-term through changes in total organic production. Herbicide treatments would reduce vegetative cover, which may increase soil surface temperatures and leave the soil surface more susceptible to erosion until vegetation is reestablished. These effects would be most pronounced on sites heavily infested with invasive plants moving toward monocultures. However, herbicide treated plants would die and become incorporated into the soil as organic matter during the first years following treatment. Annual herbicide input in subsequent years would decline as invasive species decline and native vegetation returns to the site. Where few native populations are present, native species would be seeded after treatment under both action alternatives.

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 2001). Similarly, Busse et al (2001) found no long- term impact on microbial communities when using glyphosate on ponderosa pine plantations.

In general, though, the low application rates, method of application, PDF and label restrictions, and type of herbicides proposed are expected to have a low impact on soil organisms. Effects would be short-term and transitory since effects decrease with time and are limited in scope because of the relatively small percentage area proposed for treatment, and rely primarily on spot spraying. Functional groups of microbes that have similar metabolic pathways as the target weeds would be most sensitive to the herbicides. Of the nine herbicides proposed for use, only picloram poses risks to soil microorganisms. It has been shown that picloram can affect organisms at approved application rates (SERA 2004, 2011) and is the most persistent in the soil. To protect soil organisms and therefore protect soil productivity, picloram would only be used once every two years at any specific site to avoid accumulating herbicides in the soils.

The other herbicides have a 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 invasive species were damaged but are re-sprouting.

In summary, herbicide applications are expected to have minimal short-term effects to soil resources mainly due to removal of groundcover. The proposed PDFs would ensure that these areas are not exposed for very long and the return of native vegetation would ensure long-term benefits to the soil resource.

Herbicides, Soil and Groundwater

The persistence of herbicides is affected by the herbicide solubility and absorbance in soil. Herbicides with high water solubility may have a low risk for buildup in soil, but may have a higher risk for leaching into groundwater. Herbicides persist in finer textured soils such as clay loams compared to very well drained sandy soils. These sandy soils can transmit highly mobile herbicides to shallow groundwater. Herbicide persistence in soil also varies according to specific degradation rates.

The primary herbicide routes in soil are leaching, hydrolysis, and 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 vary in the degradation potential based on their chemical structure and the biologic potential of the soil.

Sites where soil characteristics may not be appropriate for application of picloram, clopyralid, and chlorsulfuron herbicides (based on label guidance) were characterized with soil data from the various soil surveys which cover the Okanogan-Wenatchee National Forest. The herbicide picloram was eliminated from treatment options where sites had a high risk for leaching. Clopyralid has slightly less risk for leaching, and thus was only eliminated where soils had extremely well drained conditions. Chlorsulfuron was eliminated for fine grained, clay soils, where runoff and wind translocation risk is high.

Most of the herbicides adsorb to soil within the top 20 inches; below 40 inches, only trace amounts remain (MBS 2015 Invasive Plant FEIS).

Information about the chemical properties of herbicide active ingredients and their behavior in the soil is in the SERA Risk Assessments and in the project record. While there is some unknown information about how herbicides affect soils, this information is not relevant to a reasoned choice between alternatives. There is low likelihood that unknown impacts are significant, based on what is known about herbicide fate and behavior in the soil.

Direct and Indirect Effects of Alternative 1

Alternative 1 would allow for continued treatment within about 6,000 acres covered by current NEPA (see Chapter 2.2.1). On the remaining currently infested acreage, invasive plants would not be treated and would likely continue to spread (see Chapter 3.2.4 for more information).

The trend toward invasive plants causing adverse impacts on soils described previously would continue. The long-term effects of these changes in these from invasive plants are not known and this remains an area of current study. Best available science indicates that long term impacts on organic matter content; relationships between soil, vegetation and water; erosion processes; soil biota; and nutrient cycling and availability can be affected when invasive plants become established on a site. These changes can include increasing the proportion of bare ground, altering the type and amount of available soil nutrients and organic matter in the soil, and changing fire frequency on the site. The presence of invasive plants can also produce toxic chemicals that affect soil organisms.

The continued growth of invasive species is likely to reduce total effective ground cover, and conversely, higher levels of exposed mineral soil, within these areas. This would affect the susceptibility of the soil to erosion during storm events and increase the risk of sediment production in sites hydrologically connected to streams and lakes. This increase in sediment may then affect water quality in these water bodies. Groundwater recharge may also be affected where surface and vegetative conditions reduce the infiltration of storm waters.

Additionally, lower canopy cover of native forbs and grasses, as well as reduced populations of cryptogams (plants that reproduce through spores, such as mosses, lichens, algae and ferns), are likely to occur in untreated areas populated by spotted knapweed (Tyser, 1992). Soil erosion can modify soil functions even with modest losses of surface mineral soil, especially since most of the biologically active organic matter is concentrated in the top 1 to 4 inches of soil.

The absence of treatment on known invasive populations would expose more mineral soil to solar radiation and dry out the surface sooner in the growing season. A dry soil surface hinders seedling establishment and would prevent plants with surface root systems, including many native grasses and forbs, from growing due to lack of water. Exposure of the soil surface causes soil temperatures to be more extreme, due to solar heating during the day and greater radiative cooling at night. These extreme temperatures make seedling establishment more difficult and may affect soil organisms (Sheley and Petroff 1999).

The absence of treatment on known invasive populations would allow adverse chemical and biological conditions including allelopathy and created by invasive plants to continue.

No additional adverse impacts from treatment would occur other than those summarized in previous documents.

Direct and Indirect Effects of Alternatives 2 and 3

Both Alternatives 2 and 3 would help restore native plant communities and the soils that support these communities. Alternative 2 allows for the greatest treatment effectiveness and includes the ability to use herbicides throughout all soil types. This alternative would provide the greatest potential benefit to long-term soil site productivity by restoring native vegetation to more acres and improving soil conditions.

Both alternatives use the same treatment methods, with effects as described in the sections above. Herbicides would be used according to the PDFs. Risks from herbicide use are abated by the PDFs, and serious adverse effects to soils are not expected from treatments in either alternative. Soil restrictions have been identified on about 679 acres where certain herbicides might otherwise be used. These restrictions would apply to about 1,400 acres within treatment analysis areas where invasive species are not currently mapped but are likely to be found. However, effective treatments may still be completed in these areas.

Effects of the proposed herbicide treatments on soils would not be measurable at the Forest scale due to the low percent of area impacted. Impacts are restricted to localized and short-term effects on soil microorganisms and soil productivity, which are addressed by PDFs and therefore unlikely to be serious or lingering. Alternative 3 would tend to result in greater (but still relatively minor) impact to soils from manual and mechanical treatments.

Both alternatives include a Forest Plan amendment to allow use of aminopyralid for invasive plant management. Since aminopyralid is effective on many of the same target species, it will increase options where picloram and clopyralid are not appropriate due to soil texture. No adverse effects on soil organisms are expected from use of aminopyralid.

Both alternatives include treatments according to project design features for new invasive plant species or currently unknown locations. These PDFs would protect soil properties by constraining treatment methods according to site specific conditions to minimize the risk of detrimental effects to soil resources. Therefore, the possible effects to the soil resource from the EDRR treatments would be within the bounds of this analysis. Existing and EDRR treatments would remain at a maximum of 16,281 acres per year.

Cumulative Effects of All Alternatives

Effects on soils are limited to treatment sites and are not likely to combine at larger scales. Thus, the cumulative effects analysis area is the project area. Effects are likely to occur throughout the life of the project. Beneficial effects from removal of invasive plants and restoration of native vegetation may be realized over a long time frame that extends to decades or centuries. These beneficial effects are not predictable and are dependent on the degree of restoration of native vegetation on a site over a long term. Adverse effects from treatments on soils are not expected to linger more than a season or two after treatment.

In the past, present, and reasonably foreseeable future, there have been and will continue to be projects and activities within the planning area that cause changes to soils, both from direct impacts and indirectly through changes in vegetative cover and composition. Projects and activities that reduce native plant cover and disturb soil increase the risk of invasive plant infestation and have occurred at many treatment sites particularly along roads. Some of the infested sites exceed Forest Service Manual direction on detrimental soil conditions because of past activities. Projects and activities include road construction, excavation of quarries, recreation, timber harvest, fuel reduction treatments (underburning, thinning, etc.), fire suppression, grazing, recreational activities and the ongoing invasive plant treatments.

Road construction has permanently changed soil structure and function in parts of the planning area. Loss of organic matter and topsoil, compaction, and in some cases, introduction of road fill has greatly modified soils along roadsides. Excavation of quarries and construction of developed recreation areas has occurred on a much smaller scale than road construction, but has also permanently altered sites. These road construction activities have created sites where invasive plants can, and in many cases do, thrive.

Past timber harvest created areas with open canopy and disturbed soils. In addition to compaction and displacement from logging disturbance, some sites were also ripped prior to planting, mixing soil horizons and bringing large rocks to the surface. Skid trails and landings from past logging often remain compacted with minimal vegetation. Current and planned timber harvest on National Forest System land in the project area are thinning treatments with the objective of maintaining mature forest and improving forest health. These harvests are often combined with understory fuels treatments. These types of activities may use temporary roads and existing landings and skid trails. As a result, they have the potential to cause less large-scale soil disturbance that promotes invasive plant infestation than past timber harvest activities.

Livestock grazing currently occurs and has occurred in the project area for decades. Grazing has likely resulted in changes in soils and plant communities, especially in non-forested areas. Grazing can cause soil compaction, displacement, and alteration of nutrient cycling, generally on a small scale. The degree of impact relates to the timing, duration, and intensity of the grazing action, as well as the individual characteristics of the soils. Grazing can also have an indirect effect on soils through plant biomass removal and shifts in plant species composition. Livestock and livestock management has also caused invasive species by transporting seed and weed parts on fur or vehicles.

Vehicular recreational use has and continues to spread invasive species along roads and trails. The Travel Management Project, currently being planned on the Forest, would designate roads, trails and areas open to motorized vehicles and close the rest of the Forest, once a motor vehicle use map is published in December 2015. Cross-country travel off of designated routes and outside of designated areas would be prohibited, except by permit, which would greatly reduce potential for vehicles to spread invasive species into new areas. However, this may make it more difficult to detect and treat any new invasive species populations along closed roads and trails. Some roads or trails that would be closed under the travel management decision may be made available for administrative and permittee use, which would only partially reduce the potential for spread of invasive species.

Under all alternatives, ongoing and reasonably foreseeable future actions including prescribed burning, grazing, timber harvest, limited road construction, and wildfire suppression activities would continue to run the risk of spreading the known populations of invasive plants.

Under Alternative 1, some sites would continue to be treated under the existing Forest-wide and project level invasive species treatment decisions. These decisions are nearing the end of their implementation life span and remaining infestations would continue to spread. New infestations would go untreated.

All alternatives include re-treatment of areas that have been sprayed in the past. The treatments approved through this EIS are not expected to be additive in herbicide accumulations because accumulated residues from repeated applications of herbicides is not likely to be incrementally detectable due to the time between applications and the length of time that the herbicides reside in the soil. Where herbicides have longer residence time in soils, PDF H-5 (Chapter 2.2.2) requires two years between applications. In some cases the type of herbicide may change from the one used under previous decisions, most likely to a less mobile and less toxic herbicide, as in the case of substituting aminopyralid or clopyralid for picloram on knapweed sites.

PDF B-1 (ibid.) would ensure that Forest staff would coordinate with owners and managers of neighboring lands to minimize potential for herbicide use off National Forest to mix with herbicide use approved under this or past projects on National Forest.

Agricultural or other use of herbicides on private land ownership is not likely to influence soils on Okanogan-Wenatchee National Forest System lands due primarily to their lower watershed landscape positions. Although it is possible that herbicide residues could be introduced to treated sites from upstream sources, it is more likely that they could move from Okanogan-Wenatchee National Forest System lands to other ownerships due to a generally higher location within the watershed. However, any mode of transmission from National Forest System lands to ownerships/managers downstream would be by water, and not affect soils. Other natural influences such as wildland fire could result in adverse effects on the soils and productivity of the treatment sites. The potential adverse effects to soils from herbicides are unlikely to incrementally change soil characteristics substantially enough to alter the productivity of any treated sites, thus not likely to be additive to other projects such as timber sales, recreation use or other activities.

3.4.5 Consistency Findings

Based on the analysis above, the proposed invasive treatment would not affect soil productivity or quality because of PDFs consistent with NFMA, and would improve long-term soil productivity as native vegetation is re-established consistent with the Okanogan and Wenatchee National Forest Plans. Any soil loss from treatment activities would be minimal because most treatments are hand-directed spraying with little potential to impact native vegetation; where broadcast spraying would occur, few if any native plants are available to hold soils and treatment would decrease any existing soil loss over time as native vegetation is re-established.

3.5 Water Resources

3.5.1 Introduction and Regulatory Framework

The primary focus of this section is to disclose the effect of herbicide treatments on water resources, although other treatment methods are also analyzed. Project Design Features (PDFs) were developed to minimize the effects of invasive plant treatments on this resource. Predictions on risk to subsurface and surface waters resources used the Syracuse Environmental Research Associates, Inc. (SERA) risk assessments in context of modeling with local soil, topography, and rainfall conditions (Appendix B). Risk was evaluated using the Groundwater Loading Effects of Agricultural Management Systems (GLEAMS) modeling for each of the 9 herbicides proposed for use.

The following laws, regulations are executive orders are relevant to the environmental consequences of this project:

The Clean Water Act (1972) Sections 319 and 303(d)

This project is designed to meet the Clean Water Act. The focus of the analysis for Clean Water Act is potential effects on beneficial uses that are dependent on water from the Forest. A National Pollution Discharge Elimination System (NPDES) permit may be required for some riparian treatments and would be obtained prior to treatment. In general, a permit is required for treatments within 2 to 3 feet of streams in the project area.

Where portions of streams do not meet the Federally-approved state water quality standards, they are listed as water quality limited under Section 303(d) of the CWA. The latest list was approved by EPA in December of 2012 and is on file at the Forest headquarters.

No streams in the project area are listed for chemical pollutants or the herbicides proposed for use. Non-point pollution is the primary cause of impaired waters on National Forest System lands in the planning area. Non-point pollutants are best controlled by good land management practices.

The Land and Resource Management Plans and Their Amendments

Management direction for this project, as it relates to hydrologic and riparian function, is provided by the Okanogan Land and Resource Management Plan (Forest Plan, 1989) and the Wenatchee Land and Resource Management Plan (Forest Plan, 1990), which were both amended by the Northwest Forest Plan (NWFP) in 1994, the Interim Strategies for Managing Anadromous Fish Producing Watersheds (PACFISH) in 1995, the Inland Native Fish Strategy (INFISH) in 1995, and the R6 PNW ROD in 2005.

The 1989 Okanogan National Forest Plan includes the following broad management direction for water resources (pages 4-30/31 and 4-45/46):

- Manage water temperatures to support benefiting resources. Evaluate the effect of proposed projects on water temperature and make adjustments where impacts to benefiting resources are predicted.
- Meet or exceed water quality standards for the State of Washington in accordance with the Clean Water Act, through application of Best Management Practices (BMPs).
- Evaluate cumulative effects of proposed projects on water quality, runoff, and stream channel conditions and adopt measures to avoid adverse effects to these resources.
- Manage woody debris and riparian vegetation to maintain or enhance stream channel and bank structure.

The 1990 Wenatchee Forest Plan states that water resource goals are to maintain or improve water quality, quantity, and timing of run-off, comply with the objectives of the Clean Water Act and Washington State water quality standards, and to provide water of consistently high quality to users and dependent resources (page IV-94-96). A long-term Forest objective is to maintain or improve all riparian areas to “excellent condition,” in order to maintain or improve water resources.

The Northwest Forest Plan (NWFP) amended the Okanogan Forest Plan generally west of the Chewuch River and west of the Methow River and all of the Wenatchee Forest Plan in 1994. The NWFP adds requirements regarding how Federal Lands within the range of the Northern Spotted Owl will be managed. The NWFP contains Aquatic Conservation Strategy (ACS) objectives which more specifically outline how to manage for healthy watersheds. There are nine ACS objectives which are discussed in detail in Appendix D of this EIS (incorporated by reference). The project follows the Aquatic Conservation Strategy and will help maintain or restore watershed health. NWFP Riparian Reserve standard and guideline RA-3 requires herbicides, insecticides, and other toxicants, and other chemicals be applied only in a manner that avoids impacts that retard or prevent attainment of Aquatic Conservation Strategy objectives. This project complies with management direction associated with herbicide use in riparian areas.

PACFISH (1995) amended the Okanogan Forest Plan for anadromous fish habitat outside of the NWFP area (east of the Methow River and generally east of the Chewuch Rivers), and west of the Kettle Crest (the watershed boundary between the Okanogan and Kettle watersheds). Guidance within this document is very similar to the INFISH strategy (below), yet applies to Sub Basins with anadromous fish (outside of the NWFP area). PACFISH sets for Riparian Management Objectives (identical to RMOs for INFISH below except for temperature) and Riparian Habitat Conservation Area (RHCA) Standard and Guidelines which are very similar to both Riparian Reserve Standards under the NWFP and RHCA standards and guidelines for INFISH (below). The interim objective for the PACFISH temperature RMO is:

> No measurable increase in maximum water temperature (7-day moving average of daily maximum temperature measured as the average of the maximum daily temperature of the warmest consecutive 7-day period). Maximum water temperatures below 64° F within migration and rearing habitats and below 60° F within spawning habitats.

INFISH (1995) amended the Okanogan Forest Plan east of the Kettle Crest. Riparian Management Goals, as established by INFISH (pages A-1 and A-2 of the Decision Notice and Finding of No Significant Impact 1995), are to maintain or restore (among other variables) water quality, stream channel integrity, instream flows, and riparian habitat to support populations of well-distributed native and desired non-native plant, vertebrate, and invertebrate populations that contribute to the viability of riparian-dependent communities. RMOs (INFISH, page A-4) have been established to provide the criteria against which attainment or progress toward attainment of the riparian goals is measured. The NWFP, PACFISH and INFISH all include similar standards and guidelines regarding herbicide use. PACFISH and INFISH requires the application of herbicides, pesticides, and other toxicants, and other chemicals in a manner that does not retard or prevent attainment of Riparian Management Objectives and avoids adverse effects to listed anadromous fish (PACFISH)/inland native fish (INFISH). In addition, under RA-4, PACFISH and INFISH prohibit storage of toxicants with RHCAs and prohibit refueling within RHCAs unless there are no other alternatives. Refueling sites within RHCA are required to be approved by the Forest Service and have an approved spill containment plan.

PacFish and InFish compliance is discussed in detail in Appendix D, which is incorporated into the water resources and fisheries analysis herein. The project follows the management direction contained in PacFish and InFish.

The R6 PNW ROD has three standards that are relevant to this analysis of water resources. Standard 15 requires that all treatment projects that involve the use of herbicides develop and implement herbicide transportation and handling safety plans. Standard 19 requires that proximity to surface water and local water table depth be used to determine herbicide formulation, size of buffers needed (if any) and application method and timing to minimize or eliminate direct or indirect negative effects to water quality. Consideration of herbicides registered for aquatic use should be given where herbicides are likely to be delivered to surface waters. Standard 22 prohibits aerial application of herbicides within legally designated municipal watersheds (no aerial spraying would be approved in this project nor does the Forest have any municipal watersheds, so this standard will not be discussed further).

Additional scientific guidance and background information is available within various Watershed Assessments and the National Water Quality Best Management Practices (2012).

3.5.2 Analysis Methods

This analysis is tiered to the R6 PNW FEIS. A primary focus of the site-specific analysis was developing Project Design Features to insure compliance with standards required under the R6 PNW ROD, as well as the amended Okanogan and Wenatchee National Forest Plans standards and guidelines. Information used to develop criteria to minimize effects from treatment included properties of herbicides from herbicide risk assessments, 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 (HUC 10) watershed, the number of acres of chemical treatment (spot spraying, wicking, and limited broadcast application) within stream buffers established in this document were 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 here, and in the EIS, relies on these risk assessments. Herbicide effects to stream aquatic resources were analyzed in risk assessments for each of the 9 herbicides included in the action alternatives. The risk assessments considered worst-case scenarios including accidental exposures and application at maximum reported rates.

The GLEAMS model simulates water quality conditions 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 currently, and efforts have been made to align the model inputs with site-specific conditions in the project area. 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 generally tends to overestimate herbicide in streams for this project because no broadcast spraying is proposed within 100 feet of a perennial or flowing intermittent stream, or lakes and wetlands, or within 50 feet of a dry, intermittent stream. However, many treatment areas are larger than 10 acres. In steeper areas, the model may underestimate the herbicide delivery as the model assumes a 10 percent slope, although much of the Forest has steeper slopes. The model also assumes even rainfall every ten days, not a usual occurrence on this Forest. Less frequent precipitation would in actuality move herbicides a shorter distance.

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. GLEAMS runs were used to model several specific locations where site and treatment conditions were believed to present the highest risk of water contamination.

3.5.3 Affected Environment

For the purpose of analyzing and summarizing aquatic and hydrologic data, a hierarchy of watersheds and watershed boundaries called Hydrologic Unit Codes (HUC) was developed using U.S. Geological Survey (USGS) protocols. The planning area for the Okanogan-Wenatchee Invasive Plant EIS fits within four large river basins: the Okanogan, Methow, Wenatchee, and Yakima. Approximately 70 percent of the land within these watersheds is on National Forest System lands and administrated by the Forest.

The 16,281 acres of invasive plants identified for treatment are scattered across the Forest's 59 5th field watersheds. Most of the 5th field watersheds contain infestations within riparian areas, About 2,711 acres are within Riparian Reserves or RHCA's and of these, 1,278 acres are within 100 feet of streams. No more than 6.2 percent of any riparian area within a 5th field watershed currently contains invasive plants. Most of the invasive plants found in riparian areas are also found in upland areas.

Table 3.10: Known Acres within Riparian Reserves and Habitat Conservation Areas, including Perennial, Intermittent Streams, Wetlands and areas surrounding water bodies by Fifth Field Watershed

Fifth Field Watersheds	Total Acres in NF Lands	Total Acres Riparian Areas	Acres of Infestation Inside Riparian Reserves and RHCAs Areas	Percent of Riparian Acreage Infested
Ahtanum Creek	655	62	0.0	0.0
Antoine Creek-Okanogan River	29,207	1,275	68.4	5.4
Ashnola River	43,035	2,175	0.0	0.0
Baker Creek-Kettle River	372	32	0.0	0.0
Bonaparte Creek-Okanogan River	43,645	1,856	31.3	1.7
Chiwawa River	116,567	12,408	1.3	0.0
Cle Elum River	125,116	12,498	26.7	0.2
Entiat River	177,743	14,531	72.3	0.5
Icicle Creek	131,279	7,459	15.5	0.2
Kachess River-Yakima River	109,551	15,856	254.2	1.6
Lake Entiat-Columbia River	38,884	3,094	15.2	0.5
Little Naches River	209,956	21,948	319.6	1.5
Lost River	106,903	11,471	0.0	0.0
Loup Creek-Okanogan River	3,431	108	1.2	1.1
Lower Chewuch River	170,995	20,480	45.9	0.2
Lower Lake Chelan	84,926	7,405	99.4	1.3
Lower Methow River	129,107	13,307	21.9	0.2
Lynch Coulee-Columbia River	6	1	0.0	0.0
Mad River	54,267	6,710	23.8	0.4
Middle ForkTenaway River-Tenaway River	67,513	8,339	62.4	0.7
Middle Methow River	164,119	14,711	20.7	0.1
Mission Creek	36,616	3,992	21.2	0.5
Myers Creek	23,518	1,721	38.0	2.2
Nason Creek	55,003	7,213	0.3	0.0
Omak Creek-Okanogan River	3,181	186	1.5	0.8
Pasayten River-Similkameen River	133,967	10,720	0.0	0.0
Peshastin Creek	63,220	5,251	1.3	0.0
Rattlesnake Creek-Naches River	142,323	12,797	326.2	2.5
Ross Lake-Skagit River	25,269	2,540	0.0	0.0
Ruby Creek	108,511	10,829	13.8	0.1
Salmon Creek	59,073	4,945	109.4	2.2
Sinlahekin Creek	33,985	3,105	2.4	0.1
Snehumption Creek-Similkameen River	1,305	21	0.0	0.0
Stehekin River	100,498	2,005	0.0	0.0
Swamp Creek-Columbia River	17,366	765	15.3	2.0
Taneum Creek-Yakima River	93,326	13,701	193.3	1.4

Fifth Field Watersheds	Total Acres in NF Lands	Total Acres Riparian Areas	Acres of Infestation Inside Riparian Reserves and RHCAs Areas	Percent of Riparian Acreage Infested
Three Fools Creek-Lightning Creek	64,174	6,180	0.0	0.0
Tieton River-Naches River	162,240	20,095	291.1	1.4
Toroda Creek	44,284	2,849	165.1	5.8
Twisp River	145,563	17,290	14.3	0.1
Upper Chewuch River	145,002	15,290	7.0	0.0
Upper Lake Chelan	213,760	9,403	24.4	0.3
Upper Methow River	119,070	14,547	12.5	0.1
Upper Sanpoil River	18,509	794	15.8	2.0
Wenas River	8,316	978	13.4	1.4
Wenatchee River	120,169	13,026	154.6	1.2
West Fork Sanpoil River	68,195	3,278	204.1	6.2
White River-Little Wenatchee River	171,022	11,982	2.9	0.0
Wilson Creek-Cherry Creek	19,618	2,656	3.2	0.1
Totals	**4,004,357**	**373,885**	**2,711.1**	**0.7**

There are approximately 12,800 miles of stream on the Okanogan-Wenatchee National Forest. Of these, 4,710 miles (37%) are perennial and 7,990 miles (63%) are intermittent. There are several reservoirs and many lakes on the Forest. Wetlands occupy about 1 percent of the Okanogan-Wenatchee National Forest area and are generally associated with rivers and streams. There are approximately 53,400 acres of wetlands. Isolated wetlands occur on hillslopes in association with groundwater sources and atypical soil types (glaciated or landslide landforms).

Temperature is the most widespread water quality impairment on the Okanogan-Wenatchee National Forest. 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 and most of these standard exceedances are likely due to natural conditions. Maintaining and restoring native riparian vegetation would improve shading in the long-term and maintain or improve stream temperatures.

The invasive plants identified in this document are too small to provide effective shade (less than 4 feet tall). A small Japanese knotweed site may provide shade; however these invasive plants outcompete native vegetation such as alder, which would provide for better summer shade and winter stream stability, among other benefits missing when knotweed occupies a riparian area.

Another water quality concern is sediment. Suspended sediment is a measure of suspended sand, silt, clay and organic matter which will settle in time to the stream bottom. It may adversely affect fish by filling in pools, reducing bottom fauna, and silting in spawning gravels. Sediment delivery to streams is dependent on the erosivity of the soil, slope, distance to a stream, amount of exposed soil (effective ground cover), and intensity and continuity of disturbance. Invasive plant sites have been found to be more susceptible to erosion (and sediment delivery to streams) than native vegetation (Lacey, Marlow, & Lane 1998). There is no standard in the current state water quality rules for sediment and Total Maximum Daily Loads (TMDLs) have not yet been established for the any basins on the forest.

Other water quality parameters include turbidity, pH, dissolved oxygen, and bacteria. Invasive plants do not impact these parameters, except in rare circumstances where riparian invasives grow or die en masse and contribute organic material to a small stream.

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, which influences stream function and provides fish habitat. Riparian vegetation stabilizes stream banks, and serves as a filter to prevent or reduce the run-off of eroded soil into streams. Riparian vegetation also provides large and small wood to streams, adding to habitat complexity and providing cover and food for aquatic organisms. Aquatic ecosystems have evolved with certain vegetation types; invasive plants rarely provide riparian benefits and outcompete desirable native vegetation. Streams, lakes, wetlands and floodplain areas are often popular for recreation, and so are at risk from invasive plants brought in by visitors. Invasive plants could slow down or prevent the establishment of native trees, decreasing or delaying the future supply of large wood in stream channels (R6 PNW FEIS).

There are seven legally designated municipal watersheds within the Okanogan-Wenatchee National Forest that provide municipal water for private water users, and cities of Yakima, Cashmere, Chelan Falls, and the National Fish Hatchery in Leavenworth. Portions of the Domerie Creek Watershed which are utilized as a domestic source for the City of Roslyn lie on national forest system lands on the Cle Elum Ranger District. Domestic water diversions are found several miles downstream from the national forest boundary on most major river drainages. Approximately 1,000 wells and other water sources for private and public use (e.g. campgrounds) are mapped on the Forest There are no formally designated municipal watersheds within the Okanogan-Wenatchee National Forest. Portions of the Domerie Creek Watershed which is utilized as a domestic source for the City of Roslyn lie on national forest System lands on the Cle Elum Ranger District and there are domestic water diversions several miles downstream from the national forest boundary on most major river drainages. Approximately 1,000 wells and other water sources for private and public use (e.g. campgrounds) are mapped on the Forest.

There are 3,100 miles of road within treatment areas. System roads on the Okanogan-Wenatchee National Forest comply with regional road standards to divert runoff away from streams via drainage structures. However, some roads with connected ditch lines are within 100 feet of streams. Appendix B lists road segments that contain infestations near streams. These segments are short and scattered in context with the road system as a whole. About 269 miles of the entire Forest road system have mapped invasives within 100 feet of streams. About 495 miles of roads within treatment analysis areas are within 100 feet of streams (see appendix B).

3.5.4 Environmental Consequences

Effects of Invasive Plant Treatment Methods

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.

All alternatives, including No Action, include combinations of the following invasive plant treatment methods. The Action Alternatives allow the full range of treatment options including the use of herbicides, although herbicide use is limited in Alternative 3. In addition, action alternatives include an early detection rapid response (EDRR) process to address new or unknown infestations over the next 10 to 15 years or longer.

For the action alternatives, Project Design Features such as riparian buffers, frequency of application limitations, and herbicide limitations specific to soil type, minimize or eliminate the risk of chemical contamination to Riparian Reserves and RHCAs. These protective measures would work equally well for EDRR sites that would be identified in the future. Project Design Features and herbicide use buffers near streams address various risks of different herbicides and application methods.

All treatment methods would result in removal of invasive plants within riparian areas. However, stream flow and channel morphology would not be adversely affected, due to the small portion of any watershed that would be treated. Treating invasive species in riparian areas would benefit channel morphology over the long term by increasing growth rates of desirable large woody vegetation. Since invasive species do not provide shading, with the exception of Japanese knotweed, no shade would be removed except on 0.1 acre of Japanese knotweed in riparian areas. The removal of knotweed would allow for native species such as alder to grow which would provide better shading that Japanese knotweed

No long term or measurable adverse impacts to water resources are expected at the watershed level in any alternative, based on the analysis described below.

Manual and Mechanical Treatments

Manual and mechanical treatments under all alternatives would pose low risk to water resources (see R6 PNW EIS Appendix J for more discussion about effects of these types of treatments). Manual treatments are generally cutting, digging or pulling weeds. Removal of soil cover would be very small under these circumstances. While 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. Revegetation would occur within a year.

Heavy equipment would not be used, and mechanical treatments would generally be restricted to roads, limiting their impact on riparian condition or water quality.

Manual and mechanical treatments within riparian areas could accelerate sediment delivery to streams through ground disturbance, although the discontinuous nature of the treated areas would result in little effect on the whole treated area. The potential area contributing to stream sedimentation would only be the area immediately adjacent to the stream. However, most of the treatments areas are previously disturbed roadways and trails so additional ground disturbance would not substantially change the existing condition. Modification of surface ground cover can also change the timing of run-off, however the small amount of treatment compared to the watershed area and the low intensity and duration of impact eliminates the potential for measurable impact on stream flows.

Biological Agents and Cultural Treatments

Redistribution of biological agents would occur in all alternatives and is not likely to result in any effects on water resources. Cultural treatments such as solarization or competitive seeding would occur in small areas and would not likely have any discernable effects on water resources. These methods could have beneficial impacts to the extent they effectively contain or control invasive plants within riparian areas and help stabilize slopes.

Herbicide Use

Herbicide use is proposed with Riparian Reserves and RHCAs in all alternatives. Herbicide used further than 100 feet of streams and other water bodies is not likely to contact water or affect water quality. Thus, the analysis for risk of herbicide reaching streams and other water bodies is focused on the aquatic influence zone within 100 feet of streams and other water bodies.

The distance of 100 feet is based on monitoring and research results. Berg (2004) compiled monitoring studies on herbicide treatments with various buffer widths and showed 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. 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).

Berg (2004) also reported that risk of herbicide delivery to intermittent and ephemeral channels is also abated by buffers (ibid.). However, herbicides may be used near dry streams and pose a risk of delivery to water if a large rainstorm occurs after herbicide application and sediment contaminated by herbicide is carried into wet 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. PDF ARBO II 11 (g) (see Chapter 2.2.2) requires that treatments be discontinued if precipitation is predicted.

Roadside ditches are considered intermittent streams for the purposes of analysis and interpretation of herbicide use buffers. Roads and their associated ditch lines may become connected to streams and can carry herbicide to streams during high intensity storm events. About 269 miles of the entire Forest road system have mapped invasives within 100 feet of streams. About 495 miles of roads within treatment analysis areas are within 100 feet of streams (see appendix B). Thus, even within treatment analysis areas where invasives are most likely to spread (see Chapter 3.1.3), the extent of potential herbicide delivery is low.

A high intensity storm is unlikely to affect the entire Forest, nor would all roadsides be treated simultaneously. The type of herbicide use proposed, the timing of treatment and the project design features would effectively eliminate the potential for measurable or harmful amounts of herbicide to reach streams.

No herbicide application would occur within municipal watersheds or on domestic water supplies. Herbicides would not be applied directly to any other water body and herbicide options are limited near all water bodies in all alternatives. This would minimize risk to beneficial uses of water.

As with manual and mechanical treatment, the removal of invasive plants can result in bare areas that are subject to increased erosion and sediment delivery to streams. The scattered nature of invasive plants and the likelihood of rapid revegetation following treatment reduce the potential risk of measurable sediment. None of the alternatives are expected to result in increased stream turbidity. No herbicides would be directly applied to water, thus there would be no change in pH, dissolved oxygen, or bacteria levels in surface waters.

The potential 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. Effects from drift, runoff and leaching were considered in the herbicide risk assessments, prepared for the R6 PNW FEIS, and assume broadcast treatments occur 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.

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 because of dilution and interactions with physical and biological properties of the stream system (Norris et al.1991). The SERA Risk Assessments display a range of values for accidental spills into a small pond. The risk to water quality is low, even in the case of large spills that would be virtually impossible under this project (e.g., 200 gallons of herbicide mix spilled into a small pond). The Forest's 2004 Herbicide Safety Plan prevents spills from occurring or becoming large. Over many years of herbicide use, one documented spill (incident 109403) occurred on the Forest (Tonasket Ranger District in 1994). In that incident a total of 5 gallons of an aquatic glyphosate (Rodeo) tank mix spilled into Nicholson Creek when a truck rolled over. Spreadsheets (worksheets) displaying hazard quotient values for several exposure scenarios including for spills are available in the project record. A spill of the size that occurred over 20 years ago would be considered small and the risk assessments indicate that such a spill would not likely adversely affect beneficial uses of water.

The persistence of herbicides is affected by the herbicide solubility and absorbance in soil. Herbicides with high water solubility may have a low risk for buildup in soil, but may have a higher risk for leaching into groundwater. Herbicides will persist in finer textured soils such as clay loams compared to very well drained sandy soils. These sandy soils can transmit highly mobile herbicides to shallow groundwater. Herbicide persistence in soil also varies according to specific degradation rates (see Soil 3.4). Herbicides vary in the degradation potential based on their chemical structure and the biologic potential of the soil. Herbicides with high mobility or persistence (most notably picloram) have a greater potential for leaching into ground water.

Direct and Indirect Effects of No Action Alternative 1

The continuance of existing invasive plant treatments on 6,000 acres within the Okanogan Wenatchee National Forest is unlikely to have significant effects on water resources. As discussed above, all treatment methods may affect water resources; however adverse impacts of treatment under No Action are far outweighed by adverse effects of the invasive plants. Invasive plant sites are small and scattered, and treatment methods are limited by existing NEPA. Some effective treatment methods would not be available, including newer herbicides that are better suited to site conditions. Many high priority riparian sites would continue to be occupied by invasive plants, degrading the riparian condition. No EDRR would be authorized, jeopardizing timely and effective treatment on new sites, potentially in riparian areas.

Direct and Indirect Effects of Proposed Action Alternative 2

Alternative 2 includes the most flexibility in terms of herbicide use, including near streams and other water bodies. This alternative has the greatest potential treatment benefit, compared to the other alternatives. Beneficial uses of water are not expected to be adversely affected.

SERA Risk Assessments and associated spreadsheets (worksheets) display the potential for herbicide to reach water under a variety of exposure scenarios, and then compared the quantity of herbicide predicted to reach water to specific thresholds of concern for people (e.g., drinking water, swimming), fish and the aquatic environment. Model results are in Appendix B and the full risk assessments are in the project record. The human health (3.9) and fish (3.6) sections also discuss the risk assessment model results relative to water contamination. The results of all risk assessment modeling confirm beneficial uses of water are not likely to be adversely affected, especially when considering the project design features, buffers and riparian treatment caps associated with this project. The 2013 ARBO II contains measures that would effectively minimize or eliminate adverse effects on water quality and the following project-specific PDFs (Water Quality Best Management Practices) would further minimize or eliminate risk from this project to water resources:

- H-5: Do not use more than one application of imazapyr, metsulfuron methyl, or picloram on a given area in any two calendar years, except to treat areas missed during the initial application. Aminopyralid would not be broadcast in any area more than once per year.
- H-6: 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.
- H-7: Wetlands would be treated when soils are driest. If herbicide treatment is necessary when soils are wet, use aquatic labeled herbicides. Favor wicking or wiping treatment methods where effective and practical. No more than 10 contiguous acres or fifty percent of individual wetland areas would be treated in any 30-day period.
- H-8: Herbicide use would not occur within 100 feet of domestic wells or 200 feet of domestic spring developments. Use wicking, wiping or spot treatments within 100 feet of the water source for stock tanks.

Taken together, these PDFs have a high degree of effectiveness and likely eliminate risk of the project having serious adverse effects on water resources or beneficial uses of water. Treatments under EDRR would be also completed in a manner that follows Water Quality BMPs and protects water resources.

The Forest Plan amendment allowing for use of aminopyralid would help reduce use of glyphosate and picloram and thus minimize risks to fish and other beneficial uses.

Direct and Indirect Effects of Alternative 3 – Limited Use of Herbicides

The effects from treatments under this alternative are the same as for Alternative 2 except that less herbicide would be used annually (approximately 215 infested acres of known sites within 100 feet of streams could be treated with herbicides in combination with other methods; the remaining 2,496 acres could be treated only using non-herbicide methods). More acres would be treated with manual and mechanical methods than in Alternative 2, slightly increasing the potential for bank destabilization in localize areas and lowering the effects from chemical methods as those effects are described in Alternative 2.

Compared to Alternative 2, the loss of effective herbicide options would mean that the adverse effects of invasive plants would continue over most infested riparian areas. Many high priority riparian sites would continue to be occupied by invasive plants, degrading the riparian condition.

Cumulative Effects

The present day is the baseline for cumulative effects analysis. Lingering impacts of land management activities have contributed to the existence of invasive plants on the Forest and elsewhere. Management activities and actions on neighboring lands may contribute to spread or containment of invasive plants on National Forest System lands, and vice versa. Spread or new introductions could out-compete native riparian vegetation and reduce the growth of beneficial large wood components; large wood not only provides shade while trees are standing, but also creates turbulence when they fall in water, increasing dissolved oxygen. Invasive species are not as effective as native vegetation in stabilizing stream banks and could result in sediment increases if invasive plants were to be introduced from neighboring lands.

The fifth field watershed scale is an appropriate level to consider whether impacts of site level treatments could combine and have meaningful impacts to downstream water resources.[13] There is little potential for this project to contribute to cumulative adverse impacts on water resources at the watershed scale because the area treated annually would be scattered and not concentrated in any one watershed. The potential for site-level effects is low and risks are further reduced by the PDFs (MBPs) described above. Small amounts of herbicide have the potential of reaching surface or ground waters, however dilution would occur before it could be mixed with herbicide use offsite.

Currently, all 5th field watersheds have less than four percent proposed for treatment, and most have less than one percent (see Table 3.11: Special Status Fish Species and Invasive Plants in Fifth-field Watersheds on the Okanogan-Wenatchee National Forest). Treatments within riparian areas are capped (both existing populations and those treated under EDRR) in each watershed, which limits the potential for contribution to cumulative effects at the watershed scale.

Herbicides are commonly applied on lands other than National Forest System lands for a variety of agricultural, landscaping and invasive plant management purposes. Cooperation regarding invasive plant treatments would be likely to occur. Household and industrial pesticide use would not likely be coordinated with the Forest Service. 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 Washington. Accurate accounting of the total acreage of invasive plant treatment for all land ownerships is unavailable. This information is not relevant to a reasoned decision between alternatives because all alternatives have low potential to be affected by, or affect, the use of pesticides elsewhere. As discussed previously, no water resource variables of importance would likely be affected by this project or have the potential to combine with ongoing or future projects elsewhere to create cumulative effects. It is unlikely that herbicide concentrations would be additive with similar treatments at the watershed scale because PDFs in this project and other project make it unlikely that herbicides would reach streams, and even if they did, dilution would occur to background levels before reaching any other herbicides potentially introduced to streams from other projects.

Beneficial impacts are possible from continued treatment of invasive plants on and off National Forest within the project area. To the extent that everyone prioritizes treatment of riparian invasive plants, there is potential for long term restoration of watershed values.

3.5.5 Consistency Findings

Clean Water Act

Based on the analysis above, this project would maintain the chemical, physical, and biological integrity of all waters in the project area and may restore native plant communities within riparian areas.

Some streams in the project area are currently 303d listed for high water temperatures. Due to the scale of the proposed projects in the riparian areas, stream temperature is likely not to be effected or detectable. Changes to stream side vegetation that provides shade and maintains water temperature would not be impacted from the proposed project. Measurable/meaningful effects on water temperature from this project are not predicted for any streams in the project area. Clean Water Act National Pollution

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[13] Fifth field watershed designations are also referred to as “HUC 10” because each watershed (hydrologic unit) is designated by a 10 digit code.

Discharge Elimination System (NPDES) permits may be required and would be obtained before treatment within a few feet of streams occurs.

Executive Orders

Based on the analysis above, executive orders relative to pollution, floodplains and wetlands would be followed. No adverse effects to water resources are likely and some restoration of riparian plant communities may occur.

Forest Plans

This project meets the intent and standards and guidelines in the Forest Plans and supporting and amending documents.

This project is consistent with PNW ROD standards requiring that water resources be protected by site-specific project design, as is accomplished through the PDFs and BMPs discussed herein.

This project is consistent with all aquatic conservation strategies and plans including PACFISH, INFISH and the Northwest Forest Plan. Appendix D contains detailed analysis showing how this project is consistent with each Aquatic Conservation Strategy objective in the Northwest Forest Plan, and with each PACFISH/INFISH requirement.

3.6 Aquatic Organisms and Habitat

3.6.1 Introduction and Regulatory Framework

Invasive plants found growing adjacent to or within aquatic influence areas can invade and occupy riparian areas and indirectly impact aquatic ecosystems and fish habitat. Invasive plants are displacing native plants, and 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.

The following laws, regulations, policies and plans form the principal compliance framework that also guides the content of this analysis by helping to focus issues important to maintaining aquatic species and their habitats.

The Endangered Species Act. The Forest Service is consulting with the US Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS) to ensure that the proposed invasive plant treatments would not jeopardize the continued existence of federally listed species (or species proposed or considered candidates for listing).

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 sockeye salmon on the Forest), marine waters, and inter-tidal habitats. The geographic extent of EFH on Okanogan Wenatchee National Forest is specifically defined as all currently viable waters and most of the habitat historically accessible to Chinook, coho and sockeye salmon within the watersheds identified in Table 3.11. 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. Additional background information about the MSA is in the project record.

T**he Okanogan National Forest Land and Resource Management Plan** (Forest Plan, 1989) has Forest-wide riparian and fisheries standards and guidelines that apply to this project (page 4-30 to 4-32):

- 2-2: When management activities occur in riparian ecosystems, they shall be designed to rehabilitate, maintain, or enhance the riparian ecosystem, and the adjoining aquatic ecosystem (Replaced by Riparian Reserves S&Gs in the NWFP area, per 1996 Merge).
- 2-4: Maintain vegetation on streambanks that is needed to provide cover and streambank stability (Replaced by Riparian Reserve S&Gs in the NWFP area, per 1996 Merge).
- 2-9: In streamside management units class I, II, and III streams, management activities shall not degrade water quality for aquatic resources below current Washington State water quality standards, except for temporary changes because of permitted activities (Replaced by Riparian Reserve S&Gs in the NWFP area, per 1996 Merge).
- 2-14: In streamside management units class IV streams, management activities shall not deteriorate water quality below current Washington State water quality standards for downstream class I, II, and III streams. Water quality changes in class IV streams may involve some short-term temperature and turbidity increases.
- 3-1: Maintain or enhance the biological, chemical, and physical qualities of Forest fish habitats.
- 3-3: Sediment in fishery streams shall be maintained at levels low enough to support good reproductive success of fish populations as well as adequate instream food production…
    - Fines – Fines (<1.0 mm) in spawning areas (pool tailouts and glides) should be maintained at less than 20 percent as the area weighted average.

The Wenatchee Forest Plan (1990) has Forest-wide riparian area Standards and Guidelines that apply to this project (pages IV-84 and IV-87):

- Riparian area management will meet or exceed State or federal water quality standards and Washington State Forest Practices Rules and Regulations.
- Within Riparian Management Areas, management decisions will be made in favor of riparian dependent resources where conflicts exist.
- Maintain > 90 percent vegetative ground cover provided by trees, shrubs, grasses, sedges and duff within the floodplain and true riparian zone of fish-bearing and perennial non fish-bearing streams.
- Fines – Maintain < 20 percent fines (<1.0 mm) as the area weighted average in spawning habitat (pool tailouts and glides).

The Wenatchee and Okanogan Forest Plans were amended by the Northwest Forest Plan in 1994. The NWFP contains the Aquatic Conservation Strategy (ACS) that was developed to restore and maintain ecological health of watersheds on federally managed lands within the Northwest Forest Plan area. Following existing Forest Service standards and guidelines, invasive plant treatment projects cannot have a negative impact, in the long-term, on riparian-dependent resources or ecological processes in the riparian reserves 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 the Aquatic Conservation Strategy. Refer to the Soil and Water Resources section on how this project meets the Standards and Guidelines of the Aquatic Conservation Strategy.

The ACS establishes Riparian Reserves where riparian-dependent resources receive primary emphasis and where a set of standards and guidelines apply, the pertinent standards and guidelines for this project are (NWFP, p C-37):

- RA-3- Herbicides, insecticides, and other toxicants, and other chemicals shall be applied only in a manner that avoids impacts that retard or prevent attainment of Aquatic Conservation Strategy objectives.

- WR-1 Design and implement watershed restoration projects in a manner that promotes long-term ecological integrity of ecosystems, conserves the genetic integrity of native species, and attains Aquatic Conservation Strategy objectives.

The Okanogan Forest Plan was further amended outside of the area covered by the NWFP. The Interim Strategies for Managing Anadromous Fish-Producing Watersheds in Washington, Oregon, Idaho and Portions of California (PACFISH, 1995) provides direction to protect habitat and populations of anadromous (fish that migrate up rivers from the sea to spawn) habitat outside of the NWFP area. PACFISH identifies Riparian Management Objectives and areas of primary emphasis, known as Riparian Habitat Conservation Areas, where management activities are subject to specific standards and guidelines. The portion of the Okanagan-Wenatchee National Forest under management direction of PACFISH includes the eastern half of the Methow Ranger District (generally east of the Chewuch River, and north and east of the Methow River, downstream from its confluence with the Chewuch River), and the portions of the Tonasket Ranger District within the Okanogan River drainage).

The area on the Okanogan National Forest east of the Okanogan watershed was further amended by the Inland Native Fish Strategy (INFISH, 1995) which provides direction to protect habitat and populations of resident native fish outside of anadromous fish habitat. INFISH also identifies Riparian Management Objectives and areas of primary emphasis, known as Riparian Habitat Conservation Areas, where management activities are subject to specific standards and guidelines.

Riparian Habitat Conservation Areas, under both PACFISH and INFISH are portions of watersheds where riparian dependent resources receive primary emphasis, and management activities are subject to specific standards and guidelines. Refer to Appendix D for listing of PACFISH/INFISH Riparian Management Objectives adopted into the Forest Plan. The following are the pertinent RHCA standards and guidelines found in the Northwest Forest Plan, Inland Native Fish Strategy, and PACFISH that apply to this project.

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

- RA-4- Prohibit storage of fuels and other toxicants within Riparian Conservation Areas. Prohibit refueling within Riparian Habitat Conservation Areas unless there are no other alternatives. Refueling sites within a Riparian Habitat Conservation Area must be approved by the Forest Service or Bureau of Land Management and have an approved spill containment plan.

WR-1- Design and implement watershed restoration projects in a manner that promotes the long-term ecological integrity of ecosystems, conserves the genetic integrity of native species, and contributes to attainment of Riparian Management Objectives.

Both Forest Plans were amended in 2005 by the Region 6 Invasive Plant Management ROD (2005), which requires that invasive plant treatments be designed to minimize or eliminate adverse effects to species and critical habitats proposed and/or listed under the Endangered Species Act, requiring that site-specific project design (e.g. application rate and method, timing, wind speed and direction, nozzle type and size, buffers, etc.) mitigate the potential for adverse disturbance and/or contaminant exposure.

3.6.2 Analysis Methods

The analysis focuses on effects on ESA listed and Forest Service Sensitive species and their habitats. The analysis incorporates SERA Herbicide Risk Assessments and Site Specific Worksheets and GLEAMS model results as discussed in section 3.5 and Appendix B. Levels of herbicide that potentially enter surface waters were compared to levels that may affect aquatic organisms to determine level of risk to various classes of aquatic species, including macrophytes, fish, invertebrates, and algae.

3.6.3 Affected Environment

Watersheds, Infestations and Fish Presence

The project analysis area includes the Okanogan-Wenatchee National Forest. Table 3.8 displays the relative distribution of the invasive plants proposed for treatment at the 5th field watershed scale. The Antoine Creek-Okanogan River watershed has the greatest proportion of infested National Forest acres being proposed for treatment (about 4.4 percent).

Table 3.11: Special Status Fish Species and Invasive Plants in Fifth-field Watersheds on the Okanogan-Wenatchee National Forest

Fifth Field Watershed Name***	Fifth-field watershed	Total Watershed Acres	National Forest Acres	Total Infested Acres	Percent National Forest Infested Acres	Infested Acres in Riparian Reserves, RHCAs*	Threatened, Endangered, and Sensitive Fish Present in Watershed on National Forest **
Ahtanum Creek	1703000301	109,259	655	0.0	0.00%	0.0	NF
Antoine Creek-Okanogan River	1702000601	182,713	29,207	1284.4	4.40%	68.4	NF
Ashnola River	1702000702	43,040	43,035	0.0	0.00%	0.0	WCT
Baker Creek-Kettle River	1702000202	6,729	372	0.0	0.00%	0.0	NF
Bonaparte Creek-Okanogan River	1702000602	250,026	43,645	867.1	1.99%	31.3	UCS, IRT
Chiwawa River	1702001103	120,678	116,567	11.6	0.01%	1.3	UCS, UCC, BT, IRT, WCT
Cle Elum River	1703000101	141,652	125,116	147.1	0.12%	26.7	BT, PW, IRT, WCT
Entiat River	1702001002	209,168	177,743	552.2	0.31%	72.3	UCS, UCC, BT. IRT, WCT
Icicle Creek	1702001104	137,157	131,279	38.4	0.03%	15.5	BT, IRT, WCT
Kachess River-Yakima River	1703000103	199,763	109,551	1620.5	1.48%	254.2	BT, PW, IRT, WCT
Lake Entiat-Columbia River	1702001003	314,382	38,884	247.8	0.64%	15.2	NF
Little Naches River	1703000201	219,887	209,956	876.6	0.42%	319.6	MCS, BT, IRT, WCT
Lost River	1702000801	106,996	106,903	0.0	0.00%	0.0	UCS, UCC, BT, IRT, WCT
Loup Loup Creek-Okanogan River	1702000605	196,028	3,431	14.2	0.41%	1.2	NF
Lower Chewuch River	1702000804	191,388	170,995	251.9	0.15%	45.9	UCS, UCC, BT, IRT, WCT
Lower Lake Chelan	1702000903	144,468	84,926	757.5	0.89%	99.4	PW, WCT
Lower Methow River	1702000807	193,912	129,107	143.9	0.11%	21.9	UCS, UCC, BT, IRT, WCT
Lynch Coulee-Columbia River	1702001004	212,145	6	0.0	0.00%	0.0	NF
Mad River	1702001001	58,455	54,267	167.7	0.31%	23.8	UCS, UCC, BT, IRT, WCT

Fifth Field Watershed Name***	Fifth-field watershed	Total Watershed Acres	National Forest Acres	Total Infested Acres	Percent National Forest Infested Acres	Infested Acres in Riparian Reserves, RHCAs*	Threatened, Endangered, and Sensitive Fish Present in Watershed on National Forest **
Middle ForkTenaway River-Tenaway River	1703000102	132,120	67,513	142.7	0.21%	62.4	MCS, BT, IRT, WCT
Middle Methow River	1702000806	248,595	164,119	132.0	0.08%	20.7	UCS, UCC, BT, IRT, WCT
Mission Creek	1702001106	59,336	36,616	26.5	0.07%	21.2	UCS, IRT, WCT
Myers Creek	1702000201	67,346	23,518	810.2	3.45%	38.0	NF
Nason Creek	1702001102	69,650	55,003	11.6	0.02%	0.3	UCS, UCC, BT, IRT, WCT
Omak Creek-Okanogan River	1702000604	304,633	3,181	17.3	0.54%	1.5	NF
Pasayten River-Similkameen River	1702000701	133,967	133,967	0.0	0.00%	0.0	NF
Peshastin Creek	1702001105	86,745	63,220	6.4	0.01%	1.3	UCS, UCC, BT, IRT, WCT
Rattlesnake Creek-Naches River	1703000202	192,157	142,323	1362.2	0.96%	326.2	MCS, BT, IRT, WCT
Ross Lake-Skagit River	1711000503	172,417	25,269	0.0	0.00%	0.0	NF
Ruby Creek	1711000502	138,682	108,511	17.9	0.02%	13.8	BT, WCT
Salmon Creek	1702000603	96,486	59,073	473.0	0.80%	109.4	WCT
Sinlahekin Creek	1702000703	178,835	33,985	4.1	0.01%	2.4	WCT
Snehumption Creek-Similkameen River	1702000704	64,763	1,305	0.0	0.00%	0.0	NF
Stehekin River	1702000901	218,737	100,498	0.2	0.00%	0.0	WCT
Swamp Creek-Columbia River	1702000505	172,834	17,366	431.6	2.49%	15.3	NF
Taneum Creek-Yakima River	1703000105	291,470	93,326	733.9	0.79%	193.3	MCS, BT, IRT, WCT
Three Fools Creek-Lightning Creek	1711000501	72,480	64,174	0.0	0.00%	0.0	NF
Tieton River-Naches River	1703000203	294,912	162,240	673.8	0.42%	291.1	MCS,BT, IRT, WCT
Toroda Creek	1702000203	104,125	44,284	1233.7	2.79%	165.1	WCT

Fifth Field Watershed Name***	Fifth-field watershed	Total Watershed Acres	National Forest Acres	Total Infested Acres	Percent National Forest Infested Acres	Infested Acres in Riparian Reserves, RHCAs*	Threatened, Endangered, and Sensitive Fish Present in Watershed on National Forest **
Twisp River	1702000805	157,208	145,563	80.3	0.06%	14.3	UCS, UCC, BT, IRT, WCT
Upper Chewuch River	1702000803	145,002	145,002	12.4	0.01%	7.0	UCC, BT, IRT, WCT
Upper Lake Chelan	1702000902	233,589	213,760	275.5	0.13%	24.4	PW, WCT
Upper Methow River	1702000802	120,978	119,070	39.5	0.03%	12.5	UCS, UCC, BT, IRT, WCT
Upper Sanpoil River	1702000401	78,565	18,509	137.5	0.74%	15.8	NF
Wenas River	1703000106	122,790	8,316	50.4	0.61%	13.4	WCT
Wenatchee River	1702001107	201,445	120,169	1120.0	0.93%	154.6	UCS, UCC, BT, IRT, WCT
West Fork Sanpoil River	1702000402	198,950	68,195	1452.4	2.13%	204.1	IRT
White River-Little Wenatchee River	1702001101	175,256	171,022	11.5	0.01%	2.9	UCS, UCC, BT, IRT, WCT
Wilson Creek-Cherry Creek	1703000104	252,706	19,618	43.2	0.22%	3.2	WCT
Grand Total		**7,824,622**	**4,004,357**	**16,281.0**	**0.41%**	**2,711.1**	

*Riparian Habitat Conservation Areas (RHCA) are based on designated NWFP and PACFISH/INFISH buffers as delineated in GIS.

**UCC=Upper Columbia Chinook, UCS=Upper Columbia Steelhead, WCT = Westslope Cutthroat Trout, IRT= Inland Columbia Basin Redband Trout, MCS=Middle Columbia Steelhead, BT= Bull Trout, PW=Pygmy Whitefish, NF=No TES Fish Present ***Watersheds are displayed even if only a portion occurs on the Oka-Wen NF

The 16,281 acres of invasive plants identified for treatment are scattered across the Forest's 59 5th field watersheds. Most of the 5th field watersheds contain infestations within riparian areas: about 2,711 acres are within Riparian Reserves or RHCA's. About 1,278 acres are within 100 feet of streams, and 140 acres are within 100 feet of streams containing listed fish species. No more than 6.2 percent of any riparian area within a 5th field watershed currently contains invasive plants. This indicates that critical habitats for listed species are not currently threatened by invasive plants. However, this could change should invasive plants dominate riparian areas. Some small riparian infestations may have serious impacts, but listed fish species habitat is largely free of mapped invasive plants.

Many of the infested sites are on or near roads that cross either perennial or intermittent streams on Okanogan-Wenatchee National Forest. For the purpose of analyzing proximity of infested sites to listed fish, streams containing listed fish near infested sites were identified, and a width of 100 feet from the stream was used to identify infested sites that may be located immediately adjacent to a stream (i.e., up to water's edge) with listed fish. The total infested acres within each sixth field watershed may be a sum product from multiple infested weed sites .Appendix B lists road segments that have infestations within 100 feet of streams.

Many main stem rivers, such as Naches, Yakima, Wenatchee, Entiat and Methow Rivers provide spawning habitat and serve as migration corridors to Pacific salmon and bull trout. Tributaries to these main stem rivers provide primary spawning and rearing habitats. Most of the spawning and rearing for bull trout occurs in the headwaters, and typically in the lower reaches only adults can be found. Herbicide application is proposed to occur on the streambanks in close proximity to rearing and migration habitat within streams in the sixth field watersheds listed in Table 3.12.

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 3.12 displays ESA federally listed fish species that are known to occur within fifth and sixth field watersheds in the project area.

Table 3.12: ESA Federally Listed Fish Species and Infested Acres within Fifth and Sixth Field Watersheds

Fifth Field Watershed	Sixth Field Watershed	Infested Acres	Listed Fish Species* present within Sixth Field Watershed
Chiwawa River	Lower Chiwawa River	0.08	BT, UCC, UCS
	Middle Chiwawa River	0.01	BT, UCC, UCS
	Rock Creek	0.01	BT, UCC, UCS
	Upper Chiwawa River	0.02	BT, UCC
Cle Elum River	Cooper River	0.04	BT
	Headwaters Cle Elum River	0.29	BT
	Upper Cle Elum River	0.13	BT
Entiat River	Lake Creek-Entiat River	0.33	BT, UCC, UCS

Fifth Field Watershed	Sixth Field Watershed	Infested Acres	Listed Fish Species* present within Sixth Field Watershed
Icicle Creek	Lower Icicle Creek	0.37	BT
	Middle Icicle Creek	1.17	BT
Kachess River-Yakima River	Headwaters Yakima River	0.50	BT
	Kachess River	0.13	BT
	Stampede Creek-Yakima River	4.74	MCS, BT
Little Naches River	Crow Creek	0.04	MCS, BT
	Lower American River	30.66	MCS, BT
	Lower Bumping River	14.05	MCS, BT
	Lower Little Naches River	28.36	MCS, BT
	Upper American River	1.62	MCS, BT
	Upper Bumping River	0.01	BT
	Upper Little Naches River	1.25	MCS, BT
Lower Chewuch River	Doe Creek-Chewuch River	0.71	BT, UCC, UCS
	Eightmile Creek	0.04	BT
	Pearrygin Creek-Chewuch River	0.35	BT, UCC, UCS
	Twentymile Creek	0.01	BT
Lower Methow River	Gold Creek	0.39	BT, UCC, UCS
	Libby Creek	0.04	UCS
	South Fork Gold Creek	0.06	UCC, UCS
Mad River	Lower Mad River	1.54	BT, UCC, UCS
	Tillicum Creek	1.30	BT, UCC
	Upper Mad River	0.15	BT
Middle Fork Tenaway River-Tenaway River	Lower North Fork Teanaway River	0.46	BT
	Upper North Fork Teanaway River	5.30	BT, MCS
Middle Methow River	Goat Creek	0.24	BT, UCC
Mission Creek	Brender Creek-Mission Creek	0.20	UCS
	East Fork Mission Creek	0.16	UCS
	Sand Creek	2.53	UCS
Peshastin Creek	Upper Peshastin Creek	0.13	UCS
Rattlesnake Creek-Naches River	Little Rattlesnake Creek	0.10	MCS, BT
	Lost Creek-Naches River	13.72	MCS, BT
	Lower Rattlesnake Creek	3.32	MCS, BT

Fifth Field Watershed	Sixth Field Watershed	Infested Acres	Listed Fish Species* present within Sixth Field Watershed
	Nile Creek	0.89	MCS, BT
Ruby Creek	Lower Granite Creek	3.66	BT
	Panther Creek-Ruby Creek	1.36	BT
Taneum Creek-Yakima River	Upper Swauk Creek	1.63	MCS
Tieton River-Naches River	Lower South Fork Tieton River	1.89	BT
	Middle Tieton River	0.49	MCS, BT
	North Fork Tieton River	0.06	BT
	Tieton River	13.83	MCS, BT
	Upper Tieton River	0.76	BT
Twisp River	Buttermilk Creek	0.02	BT
	Headwaters Twisp River	0.03	BT
	Little Bridge Creek	0.12	UCS
	Middle Twisp River	0.08	BT, UCC, UCS
	Upper Twisp River	0.03	BT, UCC, UCS
Upper Chewuch River	Andrews Creek	0.05	BT
	Kay Creek-Chewuch River	0.01	UCC, BT
	Lake Creek	0.41	UCC, BT
	Thirtymile Creek-Chewuch River	0.30	UCC, BT
Upper Methow River	Cedar Creek	0.09	BT
	Early Winters Creek	0.26	UCC, BT
	Rattlesnake Creek-Methow River	1.24	BT, UCC, UCS
Wenatchee River	Tumwater Canyon-Wenatchee River	0.09	BT, UCC, UCS
Okanogan-Wenatchee National Forest	Total Acres of Invasive Plant Infestations Within 100 Feet of Listed Fish	142	

Federally Listed and Sensitive Species

Federally Listed fish species found on the Okanogan-Wenatchee National Forest are shown in Table 3.13. Fish species listed on the Region 6 Forest Service Sensitive Species list, and MIS species designated on the Okanogan-Wenatchee National Forest are shown in Table 3.14 and Table 3.13. Steelhead, and

Chinook are under the regulatory jurisdiction of NOAA Fisheries, and bull trout are under U.S. Fish and Wildlife Service.

The primary objectives of the Threatened, Endangered, and Sensitive Species Program are to recover federally listed and proposed species and, for Sensitive species, to ensure that actions do not contribute to a loss of viability, or cause a significant trend toward listing under the ESA. The basic concept of Management Indicator Species is the selection of certain species found in specific habitat types to represent the habitat needs of a larger group of species requiring similar habitats. Only MIS species that do not have a higher level of protection status (i.e. ESA listed or Forest Service Sensitive) are shown in Table 3.11.

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 Evolutionarily Significant Unit (ESU) or Distinct Population Segment (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).

Table 3.13: Federally Listed fish species found on the Okanogan-Wenatchee National Forest

Species		Status	Listing Status	Critical Habitat
Steelhead (*Oncorhynchus mykiss)*	Upper Columbia DPS	Threatened	Listed Endangered 8/18/97; (62 FR 43937) Status Upgraded 6/18/09 by court decision (74 FR 42605)	09/02/05; (70 FR 52630)
	Middle Columbia River DPS	Threatened	Listed on 3/25/99; (64 FR 14517) Status Reaffirmed 1/05/06 (71 FR 834)	09/02/05; (70 FR 52630)
Chinook Salmon (O*ncorynchus tshawytscha*)	Upper Columbia River Spring- Run ESU	Endangered	Listed on 3/24/99; (64 FR 14308) Status Reaffirmed 6/28/05; (70 FR 37160)	9/2/05; (70 FR 52630)
Bull Trout (*Salvelinus confluentus)*	Columbia River DPS	Threatened	Listed on 6/10/98; (63 FR 31647)	10/06/04; (69 FR 59996) Revised 10/18/2010 (75 FR 63898)

	Coastal-Puget Sound DPS	Threatened	Listed on 11/01/1999 (64 FR 58909)	09/26/2005 (70 FR 56211) Revised 10/18/2010 (75 FR 63898)

Table 3.14: Sensitive and Management Indicator Species (MIS)

Species	Designation
Pygmy Whitefish (*Prosopium coulteri*)	Sensitive
Umatilla Dace (*Rhinichthys umatilla*)	Sensitive
River Lamprey (*Lampetra ayresiii*)	Sensitive
Redband Trout (*Oncorhynchus mykiss gairdneri*)	MIS
Sockeye Salmon (*Oncorhyncus nerka*)	MIS
Chinook Salmon Spring/Summer-Run (Middle Columbia River DPS)	MIS
Westslope Cutthroat Trout (*Oncorhynchus clarkii lewisi)*	MIS

MIS = Management Indicator Species - The Wenatchee and Okanogan National Forest Plans identify Management Indicator Species (MIS) to evaluate the effects of proposed management activities upon fish and wildlife habitat (USDA 1990, 1989).

Upper Columbia River Steelhead (Threatened)

Information on life history, listing history, and other background information on Upper Columbia Steelhead is in Appendix C and the project record. The discussion here focuses on the presence of fish/habitat within the project area.

Approximately 76 percent of the Wenatchee sub-basin is within Okanogan-Wenatchee National Forest. Several streams and rivers inside the National Forest contain steelhead major spawning areas, including the Wenatchee River, Chiwawa River, Nason Creek, and Peshastin Creek. Within National Forest System land, approximately 16 miles of the Wenatchee River, 23 miles of the Chiwawa River, 10 miles of Nason Creek, and 6 miles of Peshastin Creek contains steelhead spawning and rearing habitat.

Approximately 83 percent of the Entiat sub-basin is within Okanogan-Wenatchee National Forest. Two rivers (the Entiat and Mad Rivers) inside the National Forest contain steelhead major spawning areas. Within National Forest System land, approximately 12 miles of the Entiat River, and approximately 7 miles of the Mad River contains steelhead spawning and rearing habitat.

Approximately 70 percent of the Lake Chelan sub-basin is within Okanogan-Wenatchee National Forest. No anadromous fish enter Lake Chelan because natural barriers prevent their upstream migration in the Chelan River, consequently steelhead do not occupy habitat inside the National Forest within the Lake Chelan sub-basin.

Approximately 84 percent of the Methow sub-basin is within Okanogan-Wenatchee National Forest. Four rivers inside the National Forest contain steelhead major spawning areas, including the Twisp (14 miles), Chewuch (10 miles), Lost (3.53.6 miles), and Methow (1.5 miles) Rivers.

Approximately 21 percent of the Okanogan sub-basin (U.S. portion) is within Okanogan-Wenatchee National Forest. No steelhead major or minor spawning areas are within National Forest System lands.

Upper Columbia River spring-run Chinook salmon (Endangered)

Information on life history, listing history, and other background information on Upper Columbia River Chinook Salmon is in Appendix C and the project record. The discussion here focuses on the presence of fish/habitat within the project area.

Approximately 76 percent of the Wenatchee sub-basin is within Okanogan-Wenatchee National Forest. Several streams and rivers inside the National Forest contain steelhead major spawning areas, including the Wenatchee River, Chiwawa River, Nason Creek, and Peshastin Creek. Within National Forest System land, approximately 16 miles of the Wenatchee River, 23 miles of the Chiwawa River, 10 miles of Nason Creek, and 6 miles of Peshastin Creek contains steelhead spawning and rearing habitat.

Approximately 83 percent of the Entiat sub-basin is within Okanogan-Wenatchee National Forest. Two rivers (the Entiat and Mad Rivers) inside the National Forest contain steelhead major spawning areas. Within National Forest System land, approximately 12 miles of the Entiat River, and approximately 7 miles of the Mad River contains steelhead spawning and rearing habitat.

Approximately 70 percent of the Lake Chelan sub-basin is within Okanogan-Wenatchee National Forest. No anadromous fish enter Lake Chelan because natural barriers prevent their upstream migration in the Chelan River, consequently steelhead do not occupy habitat inside the National Forest within the Lake Chelan sub-basin.

Approximately 84 percent of the Methow sub-basin is within Okanogan-Wenatchee National Forest. Four rivers inside the National Forest contain steelhead major spawning areas, including the Twisp (14 miles), Chewuch (10 miles), Lost (=3.6 miles), and Methow (1.5 miles) Rivers.

Approximately 21 percent of the Okanogan sub-basin (U.S. portion) is within Okanogan-Wenatchee National Forest. No steelhead major or minor spawning areas are within National Forest System lands.

Upper Columbia River Spring-run Chinook salmon (Endangered)

Wenatchee sub-basin: Several streams and rivers inside the National Forest contain spring Chinook salmon major spawning areas, including the Wenatchee River, Chiwawa River, White River, Little Wenatchee River, and Nason Creek. Within National Forest System land, approximately 9 miles of the Wenatchee River, 23 miles of the Chiwawa River, 6 miles of the White River, 9 miles of the Little Wenatchee River, and 4 miles of Nason Creek, contain spring Chinook salmon spawning and rearing habitat.

Entiat sub-basin: Two rivers inside the National Forest contain spring Chinook salmon major spawning areas, the Entiat and Mad Rivers. Within National Forest land, approximately 4 miles of the Entiat River, and approximately 3 miles of the Mad River contain spring Chinook salmon spawning and rearing habitat.

Lake Chelan sub-basin: No anadromous fish enter Lake Chelan because natural barriers prevent their upstream migration in the Chelan River, consequently spring Chinook salmon do not occupy habitat inside the National Forest within the Lake Chelan sub-basin.

Methow sub-basin: Numerous rivers and streams inside the National Forest contain spring Chinook salmon major spawning areas, including the Twisp River (14 miles), Chewuch River (23 miles), Lost River (3.53.6 miles), Methow River (6.5 miles), Early Winters Creek (4.5 miles), and Lake Creek (6 miles).

Okanogan sub-basin (U.S. portion): Spring chinook salmon are considered to be extirpated in the Okanogan sub-basin. An experimental population of spring Chinook has be reintroduced into the sub-basin (UCRSRP, 2007).

Middle Columbia River (MCR) steelhead (Threatened)

Approximately 22 percent of the Yakima sub-basin is within the Okanogan-Wenatchee National Forest. Several streams and rivers inside the National Forest contain steelhead major spawning areas. In the Naches River drainage this includes the Middle Naches River (11 miles), Bumping River (16.5 miles), Little Naches River (24 miles), and Rattlesnake Creek (8.5 miles). In the Upper Yakima River drainage this includes forks of the Teanaway River, Cle Elum River, Taneum Creek, Manastash Creek and Swauk Creek. Actual distribution of steelhead spawning and rearing in the Upper Yakima River drainage is not well documented.

Bull Trout (Threatened)

Bull trout are found on the Okanogan-Wenatchee National Forest within the following fifth field and sixth field watersheds by river basins:

Yakima River Basin

- Tieton River-Naches River (Lower South Fork Tieton River, North Fork Tieton River, Upper Tieton River, Middle Tieton River, Tieton River)
- Rattlesnake Creek-Naches River (Upper Rattlesnake Creek, Lower Rattlesnake Creek, Nile Creek, Lost Creek-Naches River)
- Little Naches River (Upper, Lower and Headwaters Little Naches River, Crow Creek, Upper and Lower American River, Upper and Lower Bumping River, and Deep Creek)
- Kachess River-Yakima River (Stampede Creek-Yakima River, Headwaters Yakima River, Kachess River, and Little Creek-Yakima River)
- Cle Elum River (Lower Cle Elum River, Middle Cle Elum River, Upper Cle Elum, Headwaters Cle Elum River, and Cooper River)
- Middle Fork Teanaway River-Teanaway River (Lower North Fork Teanaway River, Upper North Fork Teanaway River)

Wenatchee River Basin

- Wenatchee River (Tumwater Canyon-Wenatchee River, Beaver Creek-Wenatchee River, Chiwaukum Creek)
- Peshastin Creek (Lower Peshastin Creek, Ingalls Creek)
- Icicle Creek (Lower Icicle, Middle Icicle, Upper Icicle Creek, Eightmile Creek, Jack Creek, French Creek)
- Nason Creek (Lower Nason, Upper Nason Creek)
- White River-Little Wenatchee River (Lake Wenatchee, Lower Little Wenatchee River, Rainy Creek, Lower White River, Napeequa River, Panther Creek)

- Chiwawa River (Lower Chiwawa River, Middle Chiwawa River, Upper Chiwawa River, Headwaters Chiwawa River, Big Meadow Creek, Chikamin Creek, Rock Creek, Phelps Creek)

Entiat River Basin

- Entiat River – (Potato Creek-Entiat River, Preston Creek-Entiat River, Lake Creek-Entiat River)
- Mad River – (Lower Mad River, Upper Mad River, Tillicum Creek)

Methow River Basin

- Lower Methow River – (Gold Creek)
- Middle Methow River – (Lower Beaver Creek, Upper Beaver Creek, Wolf Creek, Goat Creek
- Upper Methow River – (Early Winters Creek, Cedar Creek, Rattlesnake Creek-Methow River, West Fork Methow River, Robinson Creek)
- Lost River – (Lower Lost River, Upper Lost River, Eureka Creek)
- Twisp River – (Buttermilk Creek, South Creek, Upper Twisp River, Headwaters Twisp River)
- Lower Chewuch River – (Eight Mile Creek, Twenty Mile Creek, Doe Creek-Chewuch River)
- Upper Chewuch River – (Thirymile Creek-Chewuch River, Kay Creek-Chewuch River, Lake Creek, Andrews Creek)

Skagit River Basin

- Ruby Creek – (Lower Granite Creek, Lower Canyon Creek, Upper Canyon Creek)

Pygmy Whitefish (Sensitive)

Pygmy whitefish are known to inhabit Chelan, Cle Elum, Kachess, and Kecheelus Lakes within the Okanogan-Wenatchee Forest.

Umatilla Dace (Sensitive)

The distribution of Umatilla dace within the Okanogan-Wenatchee National Forest is not well documented. According to natureserve.org, Umatilla dace occur within the Okanogan and Methow River sub-basins, which lie partially within the Okanogan-Wenatchee National Forest.

River Lamprey (Sensitive)

The distribution of river lamprey within the Okanogan-Wenatchee National Forest is not well documented. According to natureserve.org, river lamprey occur within the upper Yakima River sub-basin, which lies partially within the Okanogan-Wenatchee National Forest.

Interior Redband/Rainbow Trout (MIS)

Redband/rainbow/steelhead trout occupy approximately 1,165 miles of stream habitat within the Okanogan-Wenatchee National Forest (Forest fish distribution database).

According to Proebstel (1997 and 1998) and Small and Dean (Draft, 2006), essentially pure redband trout have been found on National Forest System lands in the Yakima basin (Stafford, Rattlesnake, Little

Rattlesnake, Crow, Wildcat Creeks), Wenatchee basin (Peshastin River, Sand, Icicle Creeks), Entiat basin (Roaring Creek), Methow basin (Little Bridge, West Fork Buttermilk, and Goat Creeks), and Sanpoil basin (Lost Creek).

Westslope Cutthroat Trout (MIS)

Cutthroat trout occupy approximately 1,353 miles of stream habitat within the Okanogan-Wenatchee National Forest (Forest fish distribution database). According to Proebstel (1997 and 1998) and Trotter et al (1999), essentially pure westslope cutthroat trout on National Forest System lands have been found in the: Yakima basin (Stafford, Naneum, Silver, Big, Cabin, Meadow, Cold, Oak, Rattlesnake, Little Rattlesnake, Wildcat, Crow Creeks); Wenatchee basin (Sand, Icicle, Phelps, Buck, Smith, Nason, Lost, Rainy, Snowy Creeks and Fish Lake Creek tributary, Peshastin and Little Wenatchee Rivers); Entiat basin (Cougar and Tommy Creeks); and Methow basin (Foggy Dew, Upper Eagle, North, Cutthroat, Robinson, Early Winters Creeks, Chewuch River, West Oval and Tungsten Lakes). The Lake Chelan basin was not sampled by Proebstel (1997), and may contain populations of bull trout, and westslope cutthroat trout (redband trout were not native above Chelan Falls).

Sockeye Salmon (MIS)

Sockeye salmon are found on the Okanogan-Wenatchee National Forest within the following fifth field and sixth field watersheds by river basins:

Wenatchee River Basin

- Wenatchee River (Tumwater Canyon-Wenatchee River, Beaver Creek-Wenatchee River)
- Icicle Creek (Lower Icicle)
- White River-Little Wenatchee River (Lake Wenatchee, Lower Little Wenatchee River, Lower White River, Upper White River, Napeequa River)

Entiat River Basin

- Entiat River – (Potato Creek-Entiat River, Preston Creek-Entiat River, Lake Creek-Entiat River)

3.6.4 Environmental Consequences

The focus of this section is on the effects of treatment within riparian areas, including within 100 feet of streams containing federally listed fish. Treatments are proposed throughout the project area and would not be concentrated in any one watershed; no more than 16,281 acres total, and no more than 10 percent of the riparian area in any 6^{th} field watershed would be treated annually. This limits the potential for serious impacts to fish or the aquatic ecosystem from treatment in any one place.

Effects Common to All Alternatives

All alternatives, including No Action, pose similar low risks to aquatic species and habitats. Risks to aquatic habitats from invasive plants are limited by the low extent of riparian infestations. Some of the riparian infestations have the potential to degrade fish habitat, but extent is currently limited in any one watershed. If effective treatments are not implemented, riparian plant communities would become increasingly infested with invasive plants, reducing streambank stability and shade. Eventually this would degrade fish habitat.

Currently approved treatments do not pose risk of serious adverse effects to aquatic organisms or habitats. The alternatives are also unlikely to pose risk of serious adverse effects.

All invasive plant treatment methods can result in some soil erosion, stream sedimentation, and disturbance to aquatic organisms if carried out over a large enough area. Direct and indirect effects to aquatic organisms and habitat from non-chemical treatments were analyzed in the R6 PNW FEIS - Appendix J.

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 small spaces between substrate interstices, and helps to create overhanging banks. Where native plants have been replaced with invasive plants, riparian and emergent aquatic vegetation, which would normally provide hiding cover or refuge for fish and other aquatic organisms, may be missing or degraded.

Removal of plant roots along a streambank would cause some ground disturbance and may introduce small amounts of 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 add negligible amounts of sediment. 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 on scattered sites across the Okanogan-Wenatchee National Forest. 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 and the treatment areas are so small. Ground disturbance from hand pulling or planting native vegetation would cover a relatively small area and any sediment created at these sites would be quickly dispersed in the large volume of water. 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.

The presence of people or crews with hand-held tools along streambanks could lead to localized, sediment/turbidity to fish habitat because of trampling, soil sloughing due to stepping on banks and removal of invasive plant roots. However, amounts of potential localized sediment/turbidity would be negligible because the invasive plant populations on the Okanogan-Wenatchee National Forest are not extensive enough in riparian areas to result in significant substantial sediment/turbidity, and emergent vegetation will not be treated. PDFs also require limiting the number of workers in riparian areas. Effective invasive plant treatment and restoration of treated sites would improve the function of riparian areas and lead to improved fish habitat conditions.

These treatments 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.

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, which can. This may result in a warming effect; but many other factors in addition to shade affect water temperature. A significant substantial 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. Along Nason Creek, about one tenth-acre of knotweed is located within 25 feet of the stream and may be providing some shade; no other shade-producing target plants have been observed.

The amount of vegetation that would be removed at any site is not enough to measurably impact stream temperature and therefore listed fish would not be exposed to the effects of increased stream temperature from treatments at this site. The removal of knotweed would not increase solar radiation sufficiently to increase water temperature, and the recovery of alder on this site would eventually provide more effective shade.

Introduction of chemicals into these watersheds in all alternatives pose low risk to aquatic organisms and habitats. This is because the area affected is small compared to the area of habitat, and because the projects (no action and action alternatives) are designed to minimize the risk of adverse effects.

Herbicides can disappear from inadvertently affected treated water by dilution, adsorption to bottom sediments, volatilization, and 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 an 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 potential for herbicides to reach levels of concern for invertebrates and aquatic plants is low in all alternatives and herbicides coming in contact with water as a result of the action alternatives would likely be negligible. Therefore, impacts to the aquatic food web are not likely and therefore, indirect effects to fish are discountable in all alternatives. Most toxicological effects of the proposed action on salmon and steelhead are likely to be from sub-lethal exposure to herbicides, rather than outright mortality from herbicide exposure. Effects such as fish killed as a result of sub lethal changes impairing normal behavioral patterns, otherwise known as ecological death could occur.

Some exposed fish would not respond in any observable or measurable way. It is important to note that many sub-lethal toxicological endpoints or biomarkers may harm fish in ways that are not readily apparent. When small changes in the health or performance of individual fish are observed (e.g. a small percentage change in the activity of a certain enzyme, an increase in oxygen consumption, the formation of pre-neoplastic hepatic lesions, etc.), it may not be possible to infer an impaired normal behavioral pattern, even in circumstances where a significant loss could occur. Where sub-lethal tests have been conducted, they are typically reported for individual test animals under laboratory conditions that lack predators, competitors, certain pathogens, and other hazards found in the natural environment that affect the survival and reproductive potential of individual fish.

Effects of No Action

No action will continue to have minor potential to adversely affect aquatic organisms or habitat from treatments as described above. Lack of response to current and expanding invasive plant populations would lead to increasing risk from invasive plants to important aquatic habitats.

Effects of Action Alternatives

The action alternatives increase the herbicide options and incorporate new design features, including those related to ARBO II. While the potential for treatment in important habitats is increased in the action alternatives, especially Alternative 2, the incorporation of design features and the scattered nature of the invasive plant sites limit the potential for adverse effects. To the extent that invasive plant spread is slowed in riparian areas, a beneficial impact to riparian and aquatic habitats would be expected.

The R6 PNW FEIS and associated 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. An additional SERA Risk Assessment was completed in 2007 for aminopyralid, and the results of that SERA are also used for this analysis. Also in 2011, the clopyralid, glyphosate, triclopyr, and picloram risk assessments were updated (2011a, 2011b, 2011c, 2011d). The ARBO II analysis related to chemical use is also is based on these risk assessments.

Detailed quantitative analysis was conducted to consider whether introduction of herbicide in riparian areas might have the potential to affect aquatic organisms, given the site-specific environmental characteristics in the project area. Site specific conditions were modeled using risk assessment worksheets and the GLEAMS model (see water resources effects section for details). These worksheets indicate proposed treatments have very low potential to adversely affect fish and aquatic organisms in the project area (HQ values well below zero for fish).

The Forest Plan amendment proposal to add Aminopyralid to the list of herbicides approved on the Okanogan-Wenatchee National Forest would be a part of both Alternatives 2 and 3. Aminopyralid is a broadleaf selective herbicide that can be applied with spot spray to the water's edge, and is especially effective on species in the Aster family, the dominant invasive plant group in the project area. It has a high selectivity for broad leaf plants at very low concentrations, with fewer potential environmental effects (SERA 2007). Aminopyralid could be used where the broadleaf selectivity would not affect riparian grasses and sedges, increasing treatment options available in this habitat type. Aminopyralid is substantially less toxic to aquatic organisms and aquatic plants than other herbicides proposed for use. Where effective, treating certain invasive plants with aminopyralid would minimize potential effects to aquatic organisms and aquatic plants, because it would minimize the use of chemicals in riparian habitats that have higher toxicities (picloram and glyphosate, for example). GLEAMS modeling results (see below) illustrate that even broadcast spraying aminopyralid up to waters' edge of streams (which PDF's do not allow), at the highest label application rates, would not cause toxicity levels of concern to occur to aquatic organisms and aquatic plants/algae.

The Project Design Features (PDFs) listed in Chapter 2 for the action alternatives were developed to avoid scenarios of concern to fish species of local interest considering the R6 PNW 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 a reasonable possibility of direct delivery to water exists are aquatic formulations of glyphosate and imazapyr, and aminopyralid because other herbicide spot spraying must be at least 15 feet from water (perennial streams, lakes and wetlands), and no broadcast spraying is allowed within 100 feet of water. The herbicide use buffers along streams, including road crossings and roadside ditches, reduce the potential for drift or run off of herbicide to surface waters.

The action alternatives would approve herbicide and non-herbicide methods anywhere that these methods would be effective, and in both alternatives, timely response to new detections would be emphasized. However, Alternative 3 would rely more heavily on non-herbicide treatments and this would increase the cost and decrease the effectiveness of the response to new infestations (see Chapter 3.2). No serious adverse impacts would be expected from these treatments.

Taken together, these PDFs have a high degree of effectiveness and would minimize risk of the project adversely affecting fish or aquatic organisms. These PDFs would ensure that treatments under EDRR would be completed in a manner that protects aquatic and riparian habitats.

Toxicity Indices for Fish and Habitat

Table 3.15: Toxicity Indices for Fish shows the toxicity indices for fish based on the best available science as compiled in the SERA risk assessments. Concentrations of herbicides below this amount would be below a level of concern for fish. The indices represent the most sensitive endpoint from the most sensitive species for which adequate data are available. Where acute “No effect concentration” (NOEC) levels are not available, SERA calculated a threshold of concern that is 1/20th of published LC50 (concentration at which 50 percent of the population dies).

Table 3.15: Toxicity Indices for Fish

Herbicide	Duration	End-point	Concentration	Species	Effect Noted at LOAEL
Aminopyralid	Acute	NOEC	50 mg/L	Rainbow trout	Partial loss of equilibrium at 100 mg/L[1]
	Chronic	NOEC	1.36 mg/L	Fathead minnow	Reductions in fry weight, length, larval survival, and % normal larvae at 2.44 mg/L
Chlorsulfuron	Acute	NOEC	2 mg/L (1/20th of LC50)	Brown trout	LC50 at 40 mg/L
	Chronic	NOEC[2]	3.2 mg/L	Brown trout	rainbow trout length affected at 66mg/L
Clopyralid	Acute	NOEC	5 mg/L (1/20th of LC50)	Rainbow trout	LC50 at 103 mg/L
	Chronic	NOEC	10 mg/L	Daphnia	Estimated from Daphnia NOEC
Glyphosate (no surfactant)	Acute	NOEC	0.1 mg/L[3]	Coho salmon	Olfactory impairment
	Chronic	NOEC	2.57 mg/L[4]	Rainbow trout	Life-cycle study in minnows; LOAEL not given
Imazapic	Acute	NOEC	100 mg/L	All fish	at 100 mg/L, no statistically sig. mortality
	Chronic	NOEC	100 mg/L	Fathead minnow	No treatment related effects to hatch or growth
Imazapyr	Acute	NOEC	5 mg/L (1/20th LC50)	Trout, catfish, bluegill	LC50 at 110-180 mg/L for North American species
	Chronic	NOEC	43.1 mg/L	Rainbow	“nearly significant” effects on early life stages at 92.4 mg/L
Metsulfuron methyl	Acute	NOEC	10 mg/L	Rainbow	lethargy, erratic swimming at 100 mg/L
	Chronic	NOEC	4.5 mg/L	Rainbow	standard length effects at 8 mg/L
Picloram	Acute	NOEC	0.04 mg/L (1/20th LC50)	Cutthroat trout	LC50 at 0.80 mg/L
	Chronic	NOEC	0.55 mg/L	Rainbow trout	body weight and length of fry reduced at 0.88 mg/L
Triclopyr (TEA)	Acute	NOEC	0.26 mg/L (1/20th LC50)	Chum salmon	LC50 at 5.3 mg/L[5]
	Chronic	NOEC	104 mg/L	Fathead minnow	Reduced survival of embryo/larval stages at 140 mg/L

[1] Partial loss of equilibrium was not statistically significant, did not occur in exposures less than 96 hours, and did not occur in another study. EPA set the NOEC at 100 mg/L for rainbow trout.

[2] 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.

[3] Using values that impaired olfactory function in coho salmon from Tierney et al. 2006.

[4] Estimated from minnow chronic NOEC using the relative potency factor method (SERA Glyphosate 2011).

[5] Using Wan et al. (1989) value for lethal dose.

In addition to effects of direct exposure on listed fish, indirect effects of reduced food sources through the effects herbicides on aquatic non-target species, primarily in the form of reduced algae production and reduced aquatic macrophyte production can occur. The likelihood of adverse indirect effects is dependent on environmental concentrations, bioavailability of the chemical, and persistence of the herbicide in aquatic habitat. For most pesticides, including the chemicals in the proposed action, there is limited information available on environmental effects such as negative impacts on primary production, nutrient dynamics, or the trophic structure of macroinvertebrate communities.

Most available information on potential environmental effects must be inferred from laboratory assays conducted on a specific target endpoint; although a few observations of environmental effects are reported in the literature. Due to the paucity of information, there are uncertainties associated with the following factors: 1) The fate of herbicides in natural streams; 2) the specific effects on, and resiliency and recovery of aquatic communities; 3) the site-specific foraging habits of salmonids and the vulnerability of key prey taxa and 4) the mitigating or exacerbating effects of local environmental conditions.

Benthic algae (Table 3.16) are important primary producers in aquatic habitats and are thought to be the principal source of energy in many mid-sized streams (Vannote et al. 1980; Murphy 1998). Herbicides cause shifts in the composition of benthic algal communities at concentrations as low as in the low parts per billion. Herbicides can elicit significant effects on aquatic microorganisms at concentrations that may occur with normal usage under the label instructions (De Lorenzo et al. 2001). In most cases the sensitivities of algal species to herbicide formulations and their response to herbicide formulations are not known. However, human activities that modify the physical or chemical characteristics of streams can change the trophic system that ultimately reduces salmonid productivity (Bisson and Bilby 1998). Consequently, herbicides have the potential to affect salmonid productivity through their effects on the biotic community.

Table 3.16: Toxicity Indices for Algae

Herbicide	Duration	Concentration	Species	Effects noted at LOAEL
Aminopyralid	Acute	6 mg/L	Diatoms	Cell density
	Chronic			
Chlorsulfuron	Acute	0.01 mg/L	*Selanastrum capriconutum*	Mortality
	Chronic			
Clopyralid	Acute	6.9 mg/L	*Selanastrum capriconutum*	Growth inhibition
	Chronic	Chronic study of duckweed showed EC50 >> sensitive algae (acute)		
Glyphosate (most toxic formulation)	Glyphosate appears to be about equally toxic to algae and aquatic plants; see aquatic plants table			
Imazapic	Acute	0.05 mg/L ***	Various species	Growth inhibition
	Chronic			
Imazapyr	Acute	0.2 mg/L *	Chlorella	Growth inhibition
	Chronic			
Metsulfuron methyl	Acute	0.09 mg/L	*Selanastrum capriconutum*	Growth inhibition
	Chronic			Only short-term data available
Picloram	Acute	0.23 mg/L	Diatoms	Growth inhibition
	Chronic	0.23 mg/L		
	Chronic			
Triclopyr TEA	All exposures	5.9 mg/L *	Unspecified algae	Mortality

Indirect effects of chemicals used to treat invasive plants on ecosystem structure and function are a key factor in determining a toxicant's complete risk to aquatic organisms (Preston 2002). Aquatic plants are generally more sensitive than fish to acute toxic effects of herbicides. Therefore, chemicals can potentially affect the structure of aquatic communities, at the primary production level, at concentrations below thresholds for direct impairment in fish.

Indirect effects resulting from the proposed action are expected to be of varying duration (days to weeks). Degraded water quality, reflected by primary and secondary productivity loss, may occur for a very short time (hours). Recovery of algae and aquatic macrophytes, if impacts occur, could take up to several weeks.

Table 3.17: Toxicity Indices for Aquatic Plants (Macrophytes)

Herbicide	Concentration	Species	Effects noted at LOAEL
Aminopyralid	44mg/L	Duckweed	Frond Density
Chlorsulfuron	0.00047 mg/L *	Lemna minor	Mortality
Clopyralid	See algae		
Glyphosate (most toxic formulation)	3 mg/L	Duckweed	Growth inhibition
Imazapic	0.0013 mg/L	*Lemna gibba*	Growth inhibition
Imazapyr	0.013 mg/L **	*Lemna gibba*	Growth inhibition
Metsulfuron methyl	0.00016 mg/L	Duckweed	Based on chronic data
			Mortality
Picloram	0.1 mg/L ***	Water milfoil	Transient inhibition of flowering
Triclopyr TEA	5.9 mg/L *	Unspecified algae	Mortality

* NOEC is estimated from EC50
** NOEC is estimated from EC25
*** NOEC is estimated from LOEC

Juvenile salmonids feed on a diverse array of aquatic invertebrates, with aquatic insects, and crustaceans comprising the large majority of the diets of fry and parr in all salmon species (Levings et al. 1995). Prominent taxonomic groups in the diet include Chironomidae (midges), Ephemeroptera (mayflies), Plecoptera (stoneflies), Tricoptera (caddisflies), and Simuliidae (blackfly larvae) as well as amphipods, harpacticoid copepods, and daphnids. Chironomids in particular are an important component of the diet of nearly all freshwater salmon fry (Levings et al. 1995). With a few exceptions (e.g. daphnids), the impacts of pesticides on salmonid prey taxa have not been widely investigated. Available studies suggest that aquatic invertebrates are relatively resistant to lethal effects of herbicides however sub-lethal effects may affect invertebrate populations at the site scale.

Availability of food is essential to rearing and migrating fish and is an essential element of those PCEs of critical habitat. The decrease in primary productivity of streams and rivers resulting from herbicide applications would vary in space and in time. Detrimental effects on primary production could be linked to decreases in aquatic invertebrates.

Factors affecting prey species are likely to affect the growth of salmonids, which is largely determined by the availability of prey in freshwater systems. Food supplementation studies (Mason 1976) have shown a clear relationship between food abundance and the growth rate and biomass yield of juveniles in streams. Therefore, herbicide applications that reduce the abundance of aquatic plants (macrophytes) and macroinvertebrates in streams can also reduce the energetic efficiency for growth in salmonids. These considerations are important because juvenile growth is a critical determinant of survival (Baldwin et al. 2009). A study on size-selective mortality in Chinook salmon from the Snake River (Zabel and Williams 2002) found that naturally reared wild fish did not return to spawn if they were below a certain size threshold when they migrated to the ocean. There are two primary reasons mortality is higher among smaller salmonids. First, fish that have a slower rate of growth suffer size-selective predation during their first year in the marine environment (Healey 1982; Beamish and Mahnken 2001). Growth-related mortality occurs late in the first marine year and may determine, in part, the strength of the year class (Beamish and Mahnken 2001). Second, salmon that grow more slowly may be more vulnerable to starvation or exhaustion (Sogard 1997).

Table 3.18: Toxicity Indices for Aquatic Invertebrates

Herbicide	Duration	Concentration	Species	Effects noted at LOAEL
Aminopyralid	Acute Chronic	98mg/L 102 mg/L	Daphnia magna	No effects observed
Chlorsulfuron	Acute Chronic	10 mg/L 20 mg/L	Daphnid	Mortality
Clopyralid	Acute Chronic	214 mg/L 11.8 mg/L	Daphnid	Mortality
Glyphosate (most toxic formulation)	Acute Chronic	11 mg/L 0.7 mg/L	Daphnia magna	Mortality Estimated from less toxic formulation
Imazapic	Acute/ Chronic	100 mg/L	Daphnia magna	No effect at any concentration
Imazapyr	Acute Chronic	100 mg/L 97.1 mg/L	Daphnia magna	No effects observed
Metsulfuron methyl	Acute Chronic	420 mg/L 17 mg/L	Daphnia magna	Immobility Growth
Picloram	Acute	26.8 mg/L	Shrimp	Mortality
	Chronic	3.8 mg/L	Oyster larvae	
Triclopyr TEA	Acute	133 mg/L	Not given	Mortality
	Chronic	81 mg/L	Daphnid	Reproduction

NOEC is estimated from LC50.

** NOEC is estimated from LOEC (lowest observable effect concentration.

*** estimated from subchronic study.

Inert Ingredients-Adjuvants, Impurities and Surfactants

Inert ingredients, including adjuvants, impurities and surfactants, were studied as a part of SERA risk assessment for most herbicides. POEA surfactant may be toxic to aquatic species. The 2011 SERA Risk Assessment for glyphosate considered the differences in toxicity to the aquatic ecosystem of glyphosate with and without this surfactant. Other surfactants did not influence the risk assessment findings.

Herbicide Application to Ditches and Intermittent Channels

Herbicides applied within ditches and intermittent stream channels may be delivered to places where fish or their food might be exposed by leaching into soil, dissolving directly into ditch or stream channel flow (when present), and erosion of exposed soil. Important determinants of exposure risk from ditch or intermittent channel treatments are herbicide properties, application rate, extent of application, application timing, precipitation amount and timing, and proximity to aquatic habitat.

The PDFs and herbicide use buffers limit the amount of any herbicide that may enter the ditch; however an unexpected rainstorm immediately after application may result in a minor amount being delivered downstream. Fish may be exposed at the delivery point for a short amount of time before herbicides are diluted to undetectable levels.

Relative Risk to Fish and Habitat from Herbicides Based on Maximum Herbicide Use Rates

Each risk assessment models the amount of chemical that can reach water under several different scenarios, then compares model results to existing monitoring data to check the accuracy of the model. Effects from drift, runoff and leaching were considered in the SERA (2001, 2003, 2004, 2011) herbicide risk assessments, prepared for the R6 PNW FEIS (USDA 2005a), assuming broadcast treatments occurring directly adjacent to streams. The GLEAMS model 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 sparsely vegetated 50-foot strip along about 1.6 miles of a 1.8 cubic feet per second (cfs) perennial stream.

SERA Risk Assessment worksheets compare the expected herbicide delivery based on the herbicide property, use rate and application method to the toxicity indices for fish, aquatic invertebrates, aquatic plants and algae. A range of hazard quotient (HQ) values is provided including lower, central and upper estimates.

Upper bound estimates are implausible for this project, given the extent of treatment and project design. However, the effect of PDFs and herbicide use buffers in reducing predicted HQ values under SERA risk assessment scenarios have not been quantified. SERA worksheets are available to refine some site-specific parameters (such as application rate); however the effect of the mitigation measures in restricting the timing, extent, location, herbicide selection, and application rate cannot be precisely modeled. Table 3.19 displays which herbicides may exceed HQ of 1 under the SERA modeled acute exposure scenario assuming herbicide treatment of 10 acres adjacent to a small stream.

For this project, it is possible that herbicide concentrations may exceed the level of concern for fish, algae and macrophytes (aquatic plants). Nearly all herbicides may affect aquatic plants should they be exposed. The use of chlorsulfuron near streams is restricted by the PDFs because of the susceptibility of aquatic plants to this herbicide. Adverse effects to aquatic macrophytes could reduce food supply to aquatic invertebrates, which could negatively affect fish species indirectly by reduction of their primary food prey base. Most of the herbicides have the potential to harm aquatic plants, thus Alternatives 2 and 3 therefore could negatively affect the aquatic food chain.

Table 3.19 shows that most of the fish exceedances only occur at maximum, upper bound estimates, which are not likely to actually occur for this project, given the PDFs and herbicide use buffers. Picloram is the chemical associated with greatest risk given its persistence, mobility and toxicity. Thus, picloram would not be used near streams. In contrast, aminopyralid, which is effective on some of the same target plants as picloram, poses relatively low risk to aquatic resources and may be used closer to surface waters.

Glyphosate, picloram and triclopyr are among the first choice for infestations on about 10 percent of the existing infestations.

Table 3.19: Relative Risk to Fish, Aquatic Invertebrates, Algae and Aquatic Plants from Riparian Use of Herbicides at Maximum Project Rates

	Aminopyralid	Chlorsulfuron	Clopyralid	Glyphosate no surfactant	Imazapic	Imazapyr	Metsulfuron methyl	Picloram	Triclopyr TEA
Fish	--	--	--	✱[1]	--	--	--	✱[2]	✱[1]
Aquatic invertebrates	--	--	--	--	--	--	--	--	--
Algae	--	✱[1]	--	✱[1]	--	--	--	✱[1]	✱[1]
Aquatic plants	--	✱[3]	--	✱[1]	✱[1]	✱[2]	✱[2]	✱[1]	✱[1]

-- Predicted concentrations are less than the estimated or measured 'no observable effect concentration'.

✱ Predicted concentrations greater than the estimated or measured 'no observable effect concentration' at maximum proposed application rates.

[1] At the maximum project application rate, the toxicity index is exceeded only in the upper exposure assumptions.
[2] At the maximum project application rate, the toxicity index is exceeded in the central and upper exposure assumptions.
[3] Lower, central and upper exposure estimates exceed the toxicity index at the maximum application rates.

Actual proposed treatments contain untreated buffers; or distances within which only spot spray or hand application is allowed. The herbicide use buffers in the alternatives would substantially limit the amount of herbicide potentially coming in contact with water. The potential amount of herbicide coming in contact with water after application of herbicide use buffers would be minimized to almost non-detectable levels.

Photo-degradation, hydrolysis, adsorption to particles in the water column and along the channel side and bottom, dilution resulting from influx of additional water (either subsurface or surface), and accretion of volume would together minimize potential effects on fish and aquatic habitats. Herbicides coming in contact with water, if any, would either be well below levels of concern or non-detectable under the proposed alternatives.

Site-Specific Model Analysis

The GLEAMS-Driver was used to model site-specific potential for herbicide to reach in streams at six locations; American River and Little Naches River sites on the Naches District, Swauk Creek and Teanaway River sites on the Cle Elum District, Tillicum Creek site on the Entiat District, and Chewuch River site on the Methow Valley District. All of these sites have listed fish adjacent to weed infestation treatment areas. Sites were chosen where infestations along road corridors occurred adjacent to streams with listed fish. In reality, these sites have invasive plants scattered among other vegetation along the streams. Site specific local rainfall, soils, slopes, and streamflow conditions were modeled.

Three herbicides (glyphosate, picloram, and triclopyr TEA) were modeled using typical and highest proposed application rates. These herbicides pose higher risk to aquatic organisms compared to the other proposed herbicides. Herbicide use was modeled assuming broadcast application of each herbicide would occur over a 50 foot wide by 1.6 mile long swath adjacent to each stream with no buffer (approximately 10 contiguous acres), as used in SERA spreadsheets. All site specific modeling resulted in Hazard Quotients less than 1 for all high risk herbicides applied at highest rates, and are well below thresholds of concern for fish. No broadcast would occur of any of these three herbicides within 100 feet of any stream.

The predicted Hazard Quotients (to fish) modeled at all these sites were well below 1, with the highest HQ resulting from aquatic labeled glyphosate (HQ = 0.26919), at highest proposed maximum application rate, at the Little Naches American River site, and from picloram (HQ = 0.19), at maximum application rate, at the American River Site. However, upper exposure assumptions in the national risk assessments indicate a low but comparatively higher level of risk. The model results are in Appendix B.

For the site-specific model runs and within the risk assessment worksheet model, the level of water contamination that would actually occur under typical conditions is overestimated, because stream buffers would be implemented, and only spot spraying, rather than broadcast herbicide application would occur from the waters' edge to 100 feet uphill from the bankfull level. Infested areas are not continuous, but are scattered along miles of roads and streams and there is little risk to fish from acute or chronic herbicide exposures under this project.

The Kachess River-Yakima River watershed is the one fifth field watershed with more than one percent of the area mapped as having invasive plants that also contains listed fish species on National Forest System lands (there are five others, see Table 3.12). No more than 10 percent of the riparian area within any 6th field watershed would be treated in a given year, based on the ARBO II design features (described in Chapter 2.2 of this EIS). Annual treatments are highly unlikely to amount to anywhere near this threshold given the current extent of infestation.

Accidental Spills

Accidental spills have the potential to introduce larger amounts of herbicide into streams and other water bodies. Risks are minimized by only carrying the amount of herbicide that would be applied in 1 day and performing all mixing operations well away from any water bodies. The risk assessment worksheets consider effects in light of a small to large spill. Hazard quotient values exceed 1 for some part of the aquatic environment given accidental spill scenarios for most of the herbicides proposed for use. Some of the herbicides (glyphosate, picloram, triclopyr) have the potential to directly affect fish if there is a large spill, however, the Forest Service has not had a significant or reportable spill in R6 since the implementation of the R6 PNW ROD (Desser 2013). The Forest's 2004 Herbicide Safety Plan prevents spills from occurring or becoming large.

Differences between Action Alternatives

Less herbicide would be used annually in riparian areas with Alternative 3 compared to alternative 2 (approximately 215 infested acres of known sites within 100 feet of streams could be treated with herbicides in combination with other methods in Alternative 3; the remaining 2,496 acres could be treated only using non-herbicide methods). More acres would be treated with manual and mechanical methods than in Alternative 2, slightly increasing the potential for bank destabilization in localized areas and lowering the effects from chemical methods as those effects are described in Alternative 2.

Compared to Alternative 2, the loss of effective herbicide options would mean that the adverse effects of invasive plants would continue over most infested riparian areas. Many high priority riparian sites would continue to be occupied by invasive plants, degrading the riparian condition. This could eventually affect fish habitat.

Effects on Designated Critical Habitat for Federally Listed Fish

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 has been used by the Okanogan-Wenatchee National Forest for years to analyze project effects on listed fish species. When using the MPI, project effects to the Pathways (significant important 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 the project would damage habitat or retard the progress of habitat recovering towards properly functioning condition. These effects have been analyzed at the fifth field watershed level (please note that an older HUC designation than current hierarchal unit was used in this analysis, this influences how the effects are displayed but does not influence the character or intensity of the effects). The term “HUC 10” refers to fifth field watersheds.

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 Okanogan-Wenatchee National Forest would increase native vegetation growth and result in in more cover and food for aquatic species. Thus, it would improve habitat features for federally listed fish species.

The October 18, 2010 designated critical habitat Primary Constituent Elements (PCEs) pertinent for analysis on the Okanogan-Wenatchee National Forest’s freshwater habitats include spawning sites, rearing sites, and migration corridors. The Habitat Approach’s MPI has numerous habitat-associated Indicators that closely “cross-walk” with the PCEs of the October 18, 2010 designated critical habitat. Table 3.20 displays a “cross-walk” between the MPI Indicators and PCEs used to assess effects on designated critical habitat.

Table 3.20: 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

Source: NMFS 2010

Please refer to the soil and water analysis for effects on riparian areas, water quality, lakes, wetlands and floodplains. A discussion about each pathway, indicator and PCE crosswalk is below:

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, and vegetation shading.

Where invasive plants provide the only source of shade on small streams, removing 100 percent of the shade producing cover could possibly change forest floor microclimates and thus affect water temperature at the localized level; this would have to mean that no overstory canopy was present. This would not affect overall stream temperature or habitat because of the low relative size of the infestations within context of the watersheds. No invasive species populations currently on the forest are of a magnitude where treatment would affect water temperature.

One reason treatment of invasive plants is being proposed is to recover native 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 feet of wet perennial and intermittent waterbodies, and along roads that have a high likelihood of transporting herbicides to streams to prevent any potential adverse effects to stream channels or water quality conditions. This PDF will would protect overhanging native 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-foot buffer should have no effect on stream temperature because it is unlikely that vegetation growing 100 feet from the stream is providing enough shade to influence water temperature.

Pathway: **Water Quality**
Indicator: **Sediment/Turbidity**
PCE Crosswalk: **Spawning habitat PCEs**

Herbicide treatment methods that would be used within the Aquatic Influence Zone include spot-spray and hand applications. These treatment types 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 because of the small scale and dispersed nature of such treatments. 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. Hand pulling 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 hand pulling would be negligible.

Pathway: **Water Quality**
Indicator: **Chemical Contaminants/Nutrients**
PCE Crosswalk: **Spawning habitat PCEs**

The most likely route for herbicide delivery to water is potential runoff from a large rain storm soon after application, especially from treated roadside ditches. Project Design Features were designed to minimize herbicide drift to water bodies, including no broadcast spraying with 100 feet of surface water, no fueling within RHCAs and Riparian Reserves, spot spray or hand application within 100 feet of surface water, and applying herbicide only when winds are between 2 and 8 miles per hour, and requiring coarse droplet size, which results in droplets falling to the ground more quickly.

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. These PDFs would both minimize the amount of herbicide reaching the ground surface as well as minimize the potential for herbicide drift.

Herbicides considered high risk to aquatic organisms would not be applied using any method within 50 feet of streams, and none of the herbicides considered in this document would be broadcast sprayed within 100 feet of streams. 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.

Aquatic glyphosate, imazapyr, and aminopyralid would be used for spot spraying at the water's edge along perennial channels (herbicide use buffers prevent other herbicides from being used in these areas). 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 falls in the summer and more vegetation growth to holds soil particles in place. Imazapyr is only moderately water soluble and forest field studies have not found it very mobile in soils. While aminopyralid has high mobility in most soil types, it breaks down rapidly in water through photolysis, and has been shown to be practically non-toxic to fish and aquatic invertebrates.

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 and Dynamics**
Indicator: **Floodplain Connectivity**
PCE Crosswalk: **Rearing habitat PCEs**

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 disturbed the soil and contributed to the establishment of invasive plant populations. Removal of such infestations in floodplains would 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 in floodplains.

Pathway: **Habitat Access**
Indicator: **Physical barriers**
PCE Crosswalk: **Migration habitat PCEs**

Invasive plant treatments will would not create physical barriers or otherwise degrade access to aquatic habitat, nor would such treatments remove such barriers.

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 occur. However, treatment of invasives would not create a chronic or significant sediment source.

Diffuse and spotted knapweed 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. Treatment of invasive plants and the subsequent reestablishment of native vegetation could reduce sediment levels in aquatic habitat; however this would likely be from treatment of larger populations of invasives than currently exist.

Pathway: **Habitat Elements**
Indicator: **Large Woody Debris, and Pool Area, Quality and Frequency**
PCE Crosswalk: **Spawning habitat PCEs**

Treatment of invasive plants would not impact pool area, quality and frequency. Treatment of invasive plants in RHCAs and Riparian Reserves would not impact current wood debris in streams. Conifer seedling recruitment within riparian areas which will would 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 over time, increasing the size and quantity of tree debris reaching streams.

Some loss of non-target riparian vegetation could occur due to drift or overspray; however, this would be localized and would not measurably affect riparian values. In Region Six, there have been no projects over the past ten years that have adversely affected riparian vegetation to a degree that would harm fish or their habitat (Desser, personal communication, 2015).

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 either action alternative to affect 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 4.4 percent of National Forest proposed for treatment and most have less than 0.25 percent. The low intensity of treatment along with the low extent at the watershed scale equates to no impact on stream flows.

Cumulative Effects of All Alternatives

Past road construction, timber harvesting, livestock grazing, mining, water storage, and forest recreation activities have degraded fish habitat conditions on the forest by increasing sedimentation, constricting floodplain areas, reducing instream wood, blocking migration routes, and increasing water temperatures.

Current trends within the Forest are reductions in roads and livestock grazing. Fuels treatments including prescribed burning and thinning are expected to increase. The Forest will would continue to provide a variety of recreation opportunities for the public. Continued implementation of prevention measures in the 2002 Okanogan and Wenatchee National Forest Noxious Weed Prevention Strategy and the 2005 R6 PNW FEIS ROD would reduce the spread of weeds. As a result, current project activities are likely less disruptive than past ones. However, continued use and management of the Forest does present continued risk for new species to invade, and for existing weed infestations to spread.

Past, present and future invasive species management conducted on adjacent ownerships is likely to help reduce the potential for spread into the project area. Herbicides are commonly applied for a variety of agricultural, landscaping and invasive plant management purposes. Some herbicides are relatively water soluble (i.e., Picloram, chlorsulfuron, and imazapic) and could move off-site in water. These herbicides are moderately absorbed to soil particles and could be moved off-site with wind or mass soil movement. It is possible, but not likely, that they could be introduced to the Forest from other sources, such as application(s) on adjacent ownerships. Movement of these herbicides to the Forest is not expected because most of the Forest lands are upstream or upslope from other ownerships. It is more likely that these herbicides used on NFS lands would move off the Forest to the other ownerships below. However, the likelihood that this project would contribute to herbicide concentrations at a level of concern for fish in downstream waters from any of the alternatives is low. The extent of treatment in relation to the size of the total Forest land base is small: less than 0.4 percent of the total Okanogan-Wenatchee Forest land base would be treated annually with herbicides, likely spread over many watersheds. Herbicide application on private lands within the National Forest boundary will would most likely occur to treat invasive plants around private residences and where county roads are within the Forest boundary.

Chronic impacts are unlikely to exceed a threshold of concern for fish (R6 PNW FEIS, page 4-118). Action alternatives are unlikely to contribute to cumulative adverse effects to aquatic resources given the PDFs and buffers associated with the project that would minimize the potential for direct and indirect effects, and thus cumulative effects.

Changes to fish habitat from loss of target and/or non-target vegetation, erosion and sediment, and loss of shade are predicted to be so minor that no contributions to cumulative effects are expected.

3.6.5 Consistency Findings

Introduction

This section discusses consistency with environmental regulations, policies and plans regarding fisheries management, as discussed previously. A summary of Section 7 consultation and other findings related to special status fish species is included here. Appendix D contains detailed interdisciplinary discussion about how the project addresses each aquatic conservation strategy and PACFISH/INFISH objectives. This appendix is incorporated in total into the analysis in this EIS.

The effects analysis for federally listed species, sensitive species, MIS species, and the MSA incorporates similar information and is thus discussed together below.

The project is expected to last for several years and can occur anywhere on the Forest. The variety of treatments would have no to low effect on federally listed aquatic species. 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, aquatic imazapyr, and aminopyralid to water, and other herbicides do have potential to be delivered to streams from treated road banks and ditches during rainstorms. 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, aquatic imazapyr, and aminopyralid 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, aquatic imazapyr, and aminopyralid in water 24 hours after treatment.

Any treatment method, could introduce minor amounts of sediment and/or herbicide into adjoining waters as a result of spot/hand applications, manual/mechanical plant removal, stream bank trampling, and planting. Effects from sediment to aquatic species are expected to be insignificant and discountable due to the small extent and low intensity of disturbance expected.

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. 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 substantial 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. Biological controls would not influence any of the pathways for effects to federally listed fish or their habitat.

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 substantial 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 and imazapyr, or aminopyralid would be spot sprayed on plants, and could be indirectly delivered to water. However, the application methods allowed near streams (spot) would reduce the potential for accidental application to water and minimize the potential to reach any expected exposure concentration of concern.

ESA Findings

Invasive plant treatments within the range of federally listed fish species fall under a class of actions that may affect and are likely to adversely affect the listed species (LAA). The ARBO II covers expected take and all activities in this project would be conducted consistent with ARBO II terms and conditions.

Effects to critical habitat of listed fish species is expected to be negligible. 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.

Sensitive and Management Indicator Species Findings

Invasive plant treatments within the range of sensitive and management indicator aquatic organisms may impact individuals and local habitat conditions, but are not likely to lead to a listing of these species or adversely affect the viability of their habitats. The scattered acreage that would be treated, the low intensity of adverse impacts, and the adherence to PDFs, work together to minimize risks to aquatic species and habitat.

MSA Findings

No adverse effects are anticipated to essential fish habitat established for commercially important species (Magnuson-Stevens Act – MSA) for the same reasons as discussed throughout this section. The scattered acreage that would be treated, the low intensity of adverse impacts, and the adherence to PDFs, work together to minimize risks to aquatic species and habitat.

Species	Magnuson-Stevens Determination
Upper Columbia River Chinook Salmon	No Adverse Effect
Middle Columbia River Chinook Salmon	No Adverse Effect
Coho Salmon	No Adverse Effect

Forest Plan(s) Findings

This project is consistent with all standards and guidelines and other management direction from the two Forest Plans that cover the project area.

All of the applicable management direction boils down to ensuring that this project is conducted in a manner that does not adversely affect aquatic organisms and habitat at a meaningful scale. As discussed previously, the scale and scope of the project by definition limits the extent and intensity of treatment, and therefore, potential for impact. The type of treatments, including herbicides that may be used near streams, are generally low risk. Annual caps, herbicide use buffers and PDFs further limit the potential for impacts.

The project would be done in manner that does not degrade or retard recovery of aquatic or riparian ecosystems, meeting all Standards and Guidelines for herbicide use in riparian areas. The project is consistent with goals and recovery plans for aquatic ecosystems. See Appendix D for a discussion about how this project meets aquatic conservation guidance.

The Okanogan-Wenatchee National Forest provides diverse habitats for wildlife, ranging from wet meadows to dry sagebrush, and from mountain hemlock with subalpine fir to dry, open stands of ponderosa pine. These varied habitats provide for a diverse array of wildlife species, including amphibians and reptiles.

3.7 Terrestrial Wildlife and Habitat

3.7.1 Introduction and Regulatory Framework

The Okanogan-Wenatchee National Forest provides important habitat for several rare wildlife species, including one federally listed endangered species, four species that are federally listed as threatened, one species that is federally proposed, and several species that are included on the Regional Forester's Sensitive Animal List (USFS 2014). In addition, the Forest has identified several animals as Management Indicator Species within each of the two land management plans that provide management direction for the Forest, and the project area provides habitat for neotropical migratory birds of concern. Information on all these wildlife species is included in the section titled "Affected Environment" below.

Invasive plant species have become established and continue to spread, resulting in a loss of wildlife habitat and posing a risk of injury and death to wildlife (Raloff 1998, Mack1981, Randall 1996, Chew 1981, Mills et al. 1989, and Olson 1999). In an effort to reduce the spread of invasive plants and restore native plant diversity, the Okanogan-Wenatchee National Forest has proposed to implement an invasive plants treatment project within the administrative boundary. Methods used to treat invasive plants also have the potential to affect individual animals as well as wildlife habitat. This report summarizes the effects on wildlife from invasive plants and methods used to control invasive plants.

General Guidelines

FSM 2672.4 requires biologists to review FS programs or activities for impacts to threatened, endangered, proposed, and sensitive species and to disclose those findings in a Biological Evaluation. The purpose of this report is to fulfill requirements of FSM 2672.4 and to provide information and analysis to the public and the Responsible Official relative to requirements under FSH 1909.15 (NEPA). Please see individual sections below in this analysis for guidelines applicable to single species.

This analysis also serves as the Biological Evaluation (BE) for sensitive species. A Biological Evaluation will also be prepared for upland terrestrial species that may be affected by the project. Treatments within riparian areas are covered by ARBO II.

Laws, Rules, Regulations

National Forest Management Act (NFMA)

NFMA requires the Forest Service to manage fish and wildlife habitat to maintain viable populations of all native and desirable non-native wildlife species and conserve all listed threatened or endangered species populations (36CFR219.19). Sensitive species and Management Indicator Species (MIS) are identified to meet requirements of this act.

The Wenatchee Forest Plan requires that sensitive species be identified and managed in cooperation with the Washington Department of Wildlife (now Washington Department of Fish and Wildlife) and that inventories be completed where proposed projects may disturb habitat. The Okanogan Forest Plan directs the forest to protect sensitive species.

Endangered Species Act (ESA)

ESA requires the Forest Service to manage for the recovery of threatened and endangered species and the ecosystems upon which they depend. Forests are required to consult with the US Fish and Wildlife Service if a proposed activity may affect the population or habitat of a listed species. This includes any activities funded, authorized or carried out by the agency.

Migratory Bird Treaty Act (MBTA) and Executive Order 13186

Executive Order 13186 outlines Responsibilities of Federal Agencies to Protect Migratory Birds (2001). The MBTA established an international framework for the protection and conservation of migratory birds. This Act makes it illegal, unless permitted by regulations, to pursue, hunt, take, capture, purchase, deliver for shipment, ship, cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird . Under the provisions of the MBTA, the unauthorized take of migratory birds is a criminal offense, even if it is unintentional.

This order directed agencies whose activities could have a measurable negative effect on migratory bird populations to develop a Memorandum of Understanding (MOU) with the Fish and Wildlife Service (USFWS) to promote the conservation of migratory bird populations. It further directed agencies, to the extent permitted by law and subject to the availability of appropriations and within Administration budgetary limits, and in harmony with agency missions, to (1) support the conservation intent of the migratory bird conventions by integrating bird conservation principles, measures, and practices into agency activities and by avoiding or minimizing, to the extent practicable, adverse impacts on migratory bird resources when conducting agency actions; (2) to restore and enhance the habitat of migratory birds, as practicable; and (3) to prevent or abate the pollution or detrimental alteration of the environment for the benefit of migratory birds, as practicable.

Forest Plans

This section outlines management direction in the Okanogan and Wenatchee National Forest Land and Resource Management Plans, as amended by the Northwest Forest Plan (NWFP) Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl, and by the R6 PNW ROD. The majority of the Okanogan-Wenatchee National Forest lies within the range of the northern spotted owl and is managed under the Northwest Forest Plan. Management direction from the standards and guidelines relevant to invasive plant species treatments that apply to wildlife are summarized below.

Riparian Habitat

The Okanogan Forest Land and Resource Management Plan establishes Forest-wide direction for riparian areas (applying to areas within 100' on either side of a class I,II, and III stream channel, lake or ponds and within 50' either side of a class IV stream channel). The Wenatchee Forest Plan Standards and Guidelines states the primary objective for riparian areas will be to maintain and enhance long-term productivity for riparian dependent resources including water quality, fish, wildlife and plant habitat. Restoration of riparian areas degraded by invasive plants is intended by the management direction in the plans.

The current Wenatchee and Okanogan Land and Resource Management Plans were amended to include additional direction to maintain the quality of aquatic and riparian habitats. The Aquatic Conservation Strategy (ACS), as part of the Northwest Forest Plan (NWFP; USDA 1994) was applied to the Wenatchee and a portion of the Okanogan National Forests. The ACS has nine objectives, one of which is applicable to this project: #9 Maintain and restore habitat to support well-distributed populations of native…invertebrate, and vertebrate riparian-dependent species. Riparian Reserve and RHCA standard and guideline RA-3 requires that herbicides be used only in a manner that avoids impacts that retard or prevent attainment of the aquatic/riparian objectives. Appendix D contains more detailed discussion about compliance with Aquatic Conservation Strategy and PACFISH/INFISH management direction.

Raptor Nests

The Okanogan National Forest and the Wenatchee National Forest Land and Resource Management Plans protect raptor nests from site-disturbing activities.

Special and Unique Habitats

The Wenatchee Forest Plan recognizes the need to protect special habitats including, cliffs and rims, ponds, marshes, caves, and springs.

Threatened and Endangered Species

For the Okanogan National Forest Land and Resource Management Plan, threatened and endangered species shall be managed according to recovery plans and coordinated with U.S. Fish and Wildlife Service and Washington State Department of Fish and Wildlife (6-17). Consultation with U.S. Fish and Wildlife Service will occur when threatened and endangered species may be affected by resource proposals (6-18).

The Wenatchee National Forest Land and Resource Management Plan direction is to manage critical wildlife habitat to improve status of threatened and endangered species. Where a species or suitable habitat is present, the Biological Assessment Process and Consultation Procedures must be followed. Species shall be managed to achieve recovery plan objectives.

Northwest Forest Plan Late Successional Reserves

The NWFP standards and guidelines for Late Successional Reserves, in general recommends non-native species that are inconsistent with LSR objectives should be eliminated or controlled (ROD C-19). Invasive plants are not known to affect late-successional habitat (USDA Forest Service 2005a). The dense canopy forests used by species associated with late-successional habitat are not generally infested by invasive plants, except along road shoulders.

Northwest Forest Plan Survey and Manage

The "Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines" (USDA Forest Service and USDI Bureau of Land Management 2001) contains direction for mitigating effects to certain species of vertebrates and invertebrates in this area (Survey and Manage).

On December 17, 2009, the U.S. District Court for the Western District of Washington issued an order in Conservation Northwest, et al. v. Sherman, et al., No. 08-1067-JCC (W.D. Wash.), granting Plaintiffs' motion for partial summary judgment and finding NEPA violations in the Final Supplemental to the 2004 Supplemental Environmental Impact Statement to Remove or Modify the Survey and Manage Mitigation Measure Standards and Guidelines (USDA and USDI, June 2007). In response, parties entered into settlement negotiations in April 2010, and the Court filed approval of the resulting Settlement Agreement on July 6, 2011. Projects that are within the range of the northern spotted owl were subject to the survey and manage standards and guidelines in the 2001 ROD, as modified by the 2011 Settlement Agreement.

The Defendant-Intervener subsequently appealed the 2011 Consent Decree to the Ninth Circuit Court of Appeals. The April 25, 2013 ruling in favor of the Defendant-Intervener remanded the case back to the District Court (Conservation Northwest, et al v. Harris Sherman, et al and D.R. Johnson Company, 715 F.3d. 1181, C.A. 9 (Wash), On February 18, 2014, the District Court vacated the 2007 RODs. This has resulted in the Forest Service returning to the status quo in existence prior to the 2007 RODs.

This Invasive Plant EIS applies the January 2001 ROD standards and guidelines and the December 2003 species list and thus meets the provisions of the 2001 Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines, as modified by the 2014 Settlement Agreement.

The 2014 Settlement Agreement states: "For projects initiated after April 30, 2015, your project must follow direction in (b):

> b. The January 2001 ROD standards and guidelines and the December 2003 species list, except for the red tree vole which remains as Category C across its range, and/or the four categories of projects exempt from the Survey and Manage standards and guidelines as stipulated by Judge Pechman (October 11, 2006, "Pechman exemptions".) Enclosure 3 to the Settlement Agreement (December 2003 species list).
>
> Treating invasive plant species is not one of the four categories listed as exemptions from the Survey and Manage standards and guidelines as stipulated in the "Pechman Exemptions". Therefore pre-disturbance surveys are required as stipulated in the 2001 ROD.

R6 PNW ROD

Standard #20 requires that invasive plant treatments be designed to minimize or eliminate adverse effects to species and critical habitats proposed and/or listed under the Endangered Species Act.

3.7.2 Analysis Methods

Information used in this analysis includes site specific information collected during invasive plant inventories, forest-wide wildlife monitoring information, and GIS coverage's and data sets related to wildlife habitat and site and landscape conditions.

The site-specific analysis for wildlife focuses on potential effects within the currently mapped infestations. Infested areas are polygons mapped in the Natural Resources Information Systems (NRIS). NRIS is a national Forest Service data base for wildlife and plants. The mapped polygons are primarily designed around road systems and transportation routes where the majority of invasive plant infestations occur. The mapped polygon is often much larger than the sum of the actual invasive plant sites they contain in order to include expected spread patterns associated with roads, plantations, areas burned by wildfire, and other habitat conditions at risk of infestations. The actual area of plant infestation, within the mapped polygon, is referred to as the "infested acres". Within the mapped polygon the actual number, density, and distribution of plants (infested acres) will vary. Some are patchy, some are dense, and some are single plants scattered widely in the site. Treatment intensity within the mapped polygons and within the infested acreage vary widely (ranging from 0-100%).

The mapped polygons total approximately 93,205 acres, substantially larger than the current estimate infestation acres (16,281). Invasive plants are most likely to spread within the mapped polygons, so the effects address the range of wildlife species and habitat conditions within the mapped polygons. The wildlife effects analysis not only considers the resource conditions in the entire mapped polygon, but the infested acres as well. The "mapped polygons" will be used to describe the general location of invasive plants; while the "infested acres" will be used to describe the weed extent or intensity of treatment. Only acres actually infested with invasive species would be treated in any given year.

The analysis for potential disturbance to a species is determined using the mapped polygon acres, while the potential for herbicide exposure is measured using infested acres.

Each mapped polygon may contain several species of invasive plants and therefore, may involve more than one treatment per year. Treatments are usually a combination of methods. The analysis of the entire mapped polygon allows identification of resource concerns up front, so that Project Design Features can be developed and evaluated, and later applied if existing invasive plant sites are found to have spread or appear in a different part of a mapped polygon. Even if a new site is found outside a treatment analysis area, it is likely to have similar conditions to sites within treatment analysis areas, because the treatment analysis areas cover so much of the Forest and provide a range of conditions for analysis.

Analysis of the impact of herbicides and surfactants on wildlife was done using a set of herbicide exposure scenarios for maximum project application rates, for acute and chronic exposure of different groups of species. The following exposure scenarios were evaluated for this effects analysis, based on the life history and behavior of the animals found in the project area.

- A large or small mammal eats contaminated fruit, foliage, tall and short grasses, insects, fish or smaller animals, or drinks contaminated water, and receives an acute dose of herbicide residue, soon after spraying. Canids are individually evaluated for some exposure scenarios. Chronic (longer term) exposures based on mammals consuming contaminated fruit, foliage, tall and short grasses, fish, and water are also addressed.

- A large or small bird eats contaminated fruit, foliage, tall and short grasses, insects, fish or small mammals, or drinks contaminated water, and receives an acute dose of herbicide residue, soon after spraying. Chronic exposures based on birds consuming contaminated fruit, foliage, tall and short grasses, fish, and water are also addressed.

In addition, a quantitative analysis is presented for animals consuming contaminated fish. These are also in the herbicide risk assessment worksheets (Tab G02a and G02b) available in the project record.

Most of the herbicides proposed for use pose low or no risk to wildlife. The quantitative analysis for several of the herbicides revealed that exposures over the no adverse effect level (toxicity threshold) are mathematically possible, given extreme assumptions such as a bird or mammal feeds on nothing but contaminated vegetation that has been heavily laden with herbicide. More realistic central and lower estimates, assuming less contamination in the vegetation and less feeding, indicate exposures over the no adverse effect level are not likely. The analysis below focuses on possible exposures over a level of concern using central values. In some cases, upper values are discussed to provide context, however, herbicides that only have one or two scenarios over a level of concern for wildlife at the upper estimates are not discussed in detail because the level of exposure that would have to occur is implausible given the type of infestations that would be treated and the project design features that would apply to new detections as well as current infestations.

3.7.3 Affected Environment

Federally Listed Species

One species listed as "endangered" and four species listed as "threatened" under the Endangered Species Act of 1973 (as amended) (ESA), are found on the Forest. One U.S. Fish and Wildlife Service (USFWS) "proposed species" occurs or are suspected to occur on the Forest as well (see Table 3.21). Proposed species are those proposed in the Federal Register to be listed under Section 4 of the Endangered Species Act.

Information about the life histories, threats, and conservation measures related to federally listed species can be found in Appendix C. The Biological Assessment prepared for the Regional Invasive Plant Program (USDA Forest Service 2005c) is incorporated by reference. Effects to R6 sensitive species have been evaluated and the results are documented in this analysis.

Table 3.21 displays federally listed species known or suspected in the project area. One terrestrial species is proposed for listing.

Table 3.21: Federally Listed and Proposed Species and their occurrence on the Okanogan-Wenatchee National Forest

Common Name	Scientific Name	Status[2]	Occurrence		Designated Critical Habitat
			Okanogan	**Wenatchee**	
Gray wolf	*Canis lupus (outside the Northern Rocky Mtn. DPS)*[1]	E	Yes	Yes	No
Canada lynx	*Lynx canadensis*	T	Yes	Yes	Yes
Grizzly bear	*Ursus arctos*	T	Yes	Yes	No

Common Name	Scientific Name	Status²	Occurrence		Designated Critical Habitat
			Okanogan	Wenatchee	
Northern spotted owl	*Stix occidentalis caurina*	T	Yes	Yes	Yes
Marbled murrelet	*Brachyramphus marmoratus*	T	No	Suspect	No
Wolverine	*Gulo gulo*	PT	Yes	Yes	No

¹ In Washington State, west of U.S Highway 97 and State Highway 17; DPS= Distinct Population Segment

² **E =** Endangered **T** = Threatened **PT**= Proposed Threatened

The bald eagle, peregrine falcon and gray wolf (east of U.S Highway 97 and State Highway 17 in Washington State) have been removed from the endangered species list (delisted). As per Forest Service policy, they have been included on the Regional Forester's Sensitive Species List. The greater sage-grouse (*Centrocercus urophasianus*) is not included in this list because it is not believed to be found on the Forest.

The affected environment for each federally listed species (and species proposed for listing) is discussed below.

Gray Wolf

During the 1980s, Laufer and Jenkins (1989) documented several reports of gray wolves in Washington State, and in the 1990s gray wolves were documented at several sites, including two sites with pups (Fritts 1992, Gaines et al. 1995). Wolves historically inhabited and currently inhabit the Okanogan-Wenatchee National Forest (Gaines et al. 1995, Gaines et al. 2000). There are currently three known, established wolf packs on the Forest. In 2008 a confirmed wolf pack, Lookout Pack, was discovered on the Methow Valley Ranger District. In spring 2011 a second confirmed wolf pack, Teanaway Pack, was discovered on the Cle Elum Ranger District (Wiles et al. 2014). The Wenatchee Pack, on the Wenatchee River Ranger District, was discovered in 2013 (USDA Forest Service 2013). Through DNA, it was determined, that the Lookout pair originated from coastal British Columbia. DNA also revealed the Teanaway alpha female to be a direct descendant of the Lookout Pack. The female from the Wenatchee Pack was determined to be a two (2) year old female from the Teanaway Pack.

Two adult wolves from the Lookout Pack were trapped and fitted with VHF radio collars in July 2008 and an adult from the pack was fitted with a VHF radio collar in 2014 (Wiles et al. 2014). These radio collared adults were tracked from July 2008 through July 2009 and again in 2014. Through this effort, a pack range, (summer and winter activity use area) was determined for the Lookout Pack. The pack's range occurs within the Methow Valley area, north of Lake Chelan. Three wolf dens and five rendezvous sites have been documented for the Lookout Pack on the Forest. One adult female from the Teanaway Pack was fitted with a GPS radio collar June 2011. A pack range was also determined for the Teanaway

Pack using the information gathered from the telemetry work. Four wolf dens and no known rendezvous sites have been documented for the Teanaway Pack on the Forest. No animals from the Wenatchee Pack have been fitted with collars as of spring 2015. Therefore home range has not been determined for the Wenatchee Pack. There are no den or rendezvous sites for the Wenatchee Pack as this is a not a reproducing pair.

For the Lookout Pack, there are 55 acres of plant mapped polygons and 6 infested acres within 1 mile of any known den sites and approximately 61 acres of mapped polygons and 2 infested acres within 0.5 miles of known rendezvous sites. Approximately 2,412 acres of the packs' home ranges occur within mapped polygons. For the Teanaway Pack, there are 33 acres of plant mapped polygons and 3 infested acres within 1 mile of any known den sites. Approximately 554 acres of the packs' home ranges occur within mapped polygons.

Table 3.22: Infested acres within the wolf pack's home range) on the Forest

Pack Range	Plant "Mapped Polygons" within Pack Range	Mapped Polygons/Infested Acres within 0.5 mi. of Rendezvous sites	Mapped Polygons/Infested Acres within 1.0 mi of Den sites
LOOKOUT PACK			
224,835 acres (private and FS lands)	2,412 acres (<1% of documented use area or range)	61 acres mapped polygon/2 acres infested acres	55 acres mapped polygon/6 acres infested acres
TEANAWAY PACK			
168,568 acres (private and FS lands)	554 acres (<1% of documented use area or range)	0 (no known rendezvous sites)	33 acres mapped polygon/3 acres infested acres
WENATCHEE PACK			
NA	NA	NA	NA

Canada Lynx

Surveys and research since the 1980's, have documented a persistent reproducing population of lynx in northern Okanogan County (Koehler et al. 2008). Winter track surveys for lynx have been conducted sporadically on the forest from 1993-2011. Lynx surveys following the national protocol (McDaniel et al. 2000) were conducted during the summers of 1998-2003. Lynx presence has been documented west of the Okanogan River, north of Lake Chelan, and east of Ross Lake, using the national lynx survey (Aubry et al. 2002) and winter snow tracking (Von Kienast 2003, Maletzke 2004). There are 5,610 acres of invasive plant mapped polygons within potential lynx habitat.

Habitat on the Forest is limited to higher elevations (> 4000 feet). A large block of habitat east of the Chewuch River and west of the Okanogan River provides the largest contiguous patch of habitat on the Forest. This habitat is contiguous with habitat in British Columbia and the populations interact. Patchy habitat is present throughout the Pasayten and Lake Chelan Sawtooth Wildernesses. However, the disjunct areas of suitable environments are typically large enough in size and close enough to each other to permit dispersal among subpopulations and to allow the species to potentially interact as a metapopulation. Exceptions to this may occur along identified "fracture zones", or sizeable gaps in dispersal habitat (usually as a result of low elevations and human development) (USDA Forest Service 2011a). These "fracture zones" include the Upper Columbia-Pend Oreille, Southern Okanogan, Stevens

Pass-Lake Chelan, and Okanogan Valley (Singleton et al. 2002). Approximately 1,720 mapped polygon acres occur within lynx core area, primarily along roadsides.

Critical habitat for lynx on the Okanogan-Wenatchee National Forest has been identified as the subalpine fir plant association above 4,100 feet and encompassing approximately 1,836 mi^2. The area includes lynx habitat on National Forest System lands north of Lake Chelan, east of the Cascade Mountains crest, south of the Canada border, and west of the Okanogan River, totaling 1.4 million acres. There are 193 infested acres within lynx critical habitat and 196 infested acres within lynx core area.

The Primary Constituent Elements (PCEs) for lynx critical habitat are boreal forest landscapes supporting snowshoe hares, winter snow conditions that are "deep and fluffy", sites for denning, and matrix habitat. The PCEs include matrix habitat described as patches of boreal forest landscape (e.g. hardwood forest, dry forest, non-forest or other non-snowshoe hare habitat) that occur between patches of boreal forest in close juxtaposition (within the scale of a lynx home range) such that lynx are likely to travel through (USDI Fish and Wildlife Service 2008d; Ruggiero et al. 2000). Boreal forests in the western United States are dominated largely by firs, spruce and lodgepole pines (Hodges 2000, Interagency Lynx Biology Team 2013).

Invasive plants are thought to have no impacts on lynx or lynx habitat (Interagency Lynx Biological Team 2013).

Table 3.23 Infested Acres and Acres within Mapped Polygons in Lynx Habitat

Lynx Habitat Category	Total Potential Lynx Habitat (acres)	Potential Lynx Habitat	
		Acres Mapped Polygons	Infested Acres
Total CORE Area	774,413	1,720	196
SECONDARY Area	255,227	1,819	197
PERIPHERAL Area	391,838	2,071	654
Total Habitat Area	1,421,478	5,609	1,047
Critical Habitat	702,224	1,455	193

Grizzly Bear

Grizzly bears occur in five recovery areas in four states (Idaho, Montana, Wyoming and Washington). Grizzly bears in Alaska are not federally listed. The grizzly bear is listed as a Threatened species, with a determination of warranted for endangered species listing in the North Cascades (USDI Fish and Wildlife Service 1975, 1998, 2011b). The portion of the Okanogan-Wenatchee National Forest north of the I-90 corridor and west of the Okanogan and Columbia rivers is located within the North Cascades Grizzly Bear Recovery Zone (NCGBRZ). There are 23 Bear Management Units (BMUs) on the Okanogan-Wenatchee National Forests (Table 3.7.4 below). BMUs are generally large enough to provide a variety of seasonal habitats. Currently, management direction includes guidelines for reducing the potential for bears becoming habituated to human foods and an interim “no-net-loss” of core area. Core areas are defined as an area that is greater than 500 meters (~1640 feet) from an open road, motorized trail or high use non-motorized trail (Gaines et al 2003). For this analysis, acres of core were obtained from the Forest Cooperate layer; grizzly bear BMU layer (2015).

Although the grizzly bear is considered present in the 9,565 square mile North Cascades Grizzly Bear Recovery Zone, the population is likely less than 50 (Almack et al. 1993) and may be as low as 6 (Romain-Bondi et al. 2004). The most recent confirmed report (Class I) of a grizzly bear in the Recovery Zone was near Cascade Pass in the North Cascades National Park in 2011 (USDA Forest Service 2013). Grizzly Bear CORE area totals 1.9 million acres on the Forest of which less than 1% occurs within plant mapped polygons and less than 0.5% having infested acres. Hawkweeds have been known to displace the grass and bulbs used by grizzly bears in the spring, and invasive plants are approaching measurable impacts to grizzly bear habitat in some areas in the Region (USDA Forest Service 2005a).

Table 3.7.4 Acres of Grizzly Bear Core Area, Invasive Plan Mapped Polygons and Infested Acres by Bear Management Units (BMUs)

BMU	Grizzly Bear CORE Area	Acres of core habitat within Mapped Polygons	Infested Acres
Ashnola	163,876	0	0
Chiwawa	81,764	0	0
Cle Elum	70,363	5	2
Granite Creek	135,177	0	0
Icicle	98,403	0	0
Libby Creek	65,217	28	<1
Lower Chelan	121,135	1,226	107
Lower Chewuch	79,040	17	<1
Lower Entiat	31,767	156	12
Lower Wenatchee	71,075	73	42
Middle Methow	22,733	35	3
Pasayten	176,228	0	0
Peshastin	48,087	0	0
Salmon	21,719	79	9
Swauk	38,387	0	0
Upper Chelan	202,525	114	17
Upper Chewuch	157,902	4	<1
Upper Entiat	49,693	0	0
Upper Methow	138,596	0	0

BMU	Grizzly Bear CORE Area	Acres of core habitat within Mapped Polygons	Infested Acres
Upper Stehekin River	91,595	0	0
Upper Twisp River	100,184	13	2
Upper Wenatchee	87,862	0	0
Total	**1,965,147**	**1,750 <0.5%)**	**195 (<0.5%)**

Northern Spotted Owl

All of the Okanogan-Wenatchee National Forest is included within the range of the northern spotted owl except for eastern portions of the Methow Valley Ranger District and all of the Tonasket Ranger District. Northern spotted owls use late-successional forest habitat primarily in the western hemlock, grand fir, and Douglas fir forested vegetation zones of the eastern Washington Cascades. The upper elevation limit (roughly 5,000 feet) at which spotted owls occur corresponds to the transition to subalpine forest, characterized by relatively simple structure and severe winter weather (Forsman 1975; Forsman et al. 1984).

Protocol surveys have been conducted within approximately 85% of the suitable habitat on the Forest and approximately 230 pairs had been located prior to 1997(USDA Forest Service 2008b). Of these, about 65% were located within LSRs/MLSAs, and 33% within the Snoqualmie Pass Adaptive Management Area (AMA) (USDA Forest Service 2008b). Monitoring of spotted owls on the Okanogan-Wenatchee National Forest has indicated a declining population (Forsman et al. 1996, Franklin et al. 1999, Anthony et al. 2006, Forsman et al. 2008). In the Wenatchee and Cle Elum long-term study areas, population declines range from 40 to 60 percent during the study period of 1990 to 2003 (Anthony et al. 2006) and as great as 70 percent decline in 2008 (Forsman et al. 2008). Applying this rate of decline, the 230 activity centers believed to occur in 1996 may be as few as 92 to 149 activity centers in 2006 and as few as 69 activity centers in 2008. Decreases in apparent adult survival rates were an important factor contributing to decreasing population trends (USDA Forest Service 2008b).

Approximately 828,372 acres of northern spotted owl nesting, roosting and foraging (NRF) habitat, within the range of the northern spotted owl, exists on the Okanogan-Wenatchee National Forest (figure was obtained from the Forest Plan Revision NSO layer 2010. There are approximately 3,823 acres of NRF within invasive plant mapped polygons (less than1 percent of the total NRF on the Forest); of which 1,520 acres occur within ¼ mile of closed system roads. Approximately 1,181 infested acres within NRF habitat occurs on the Forest of which 412 acres occur within ¼ mile of closed system roads. Invasive plant treatment on open roads would not likely cause additional disturbance beyond the ambient noise level.

A total of 231 acres of mapped polygons or 141 infested acres occur within ¼ mile of spotted owl activity centers. There are 77 spotted owl activity centers located within 0.25 mile of current invasive plant infestations.

The FWS designated approximately 2,918,067 acres in 4 units and 26 subunits of spotted owl critical habitat in Washington (USDI Fish and Wildlife Service 2012). Unit 7: East Cascades North (ECN) contains 1,345,523 acres and 9 subunits and completely encompasses the Okanogan-Wenatchee National Forest (sub-units ENC 1-5). A total of 880,466 acres of the Okanogan-Wenatchee National Forest is designated as Critical Habitat for the Northern Spotted Owl (USDA Forest Service 2013). No critical habitat is located on the eastern portions of the Methow or any of the Tonasket Ranger Districts. Approximately 14,481 acres of mapped plant polygons occur within spotted owl critical habitat of which 5,831 acres are infested plant acres. Invasive plants do not currently threaten spotted owl habitats.

Marbled Murrelet

No marbled murrelet nest sites are confirmed on the Okanogan-Wenatchee National Forest. However, most of the potential murrelet nesting habitat on the Forest has not been surveyed. The marbled murrelet recovery plan (U.S. Fish and Wildlife Service, 1997) identified six recovery zones for the marbled murrelet. The Okanogan-Wenatchee National Forest is included in Zones 1 and 2. Approximately 320,700 acres of the Okanogan-Wenatchee Forest is located within daily flying distances (55 miles) of marine environments in Puget Sound. This area is located within the western portions of the Cle Elum, Wenatchee River, and Naches Ranger Districts. There are approximately 107,573 acres of potential murrelet nesting habitat on the Forest. Potential murrelet nesting habitat was generated using late-successional habitat (Forest Plan Revision late-successional layer 2015) within the 55 mile flight distance zone.

Approximately 218 acres of potential murrelet habitat occurs within mapped polygons and of these approximately 96 acres occur and within 1/4 mile of closed system roads. It is highly unlikely marbled murrelets are present on the Forest due to the distance and flight factors needed to access the Forest (flight over the Cascade Crest). There is no Designated Critical Habitat for the marbled murrelet on the Okanogan-Wenatchee National Forest.

Invasive plants are not known to affect the marbled murrelet or its habitat (USDA Forest Service 2005a). The dense canopy forests used by marbled murrelets are not generally infested by invasive plants, except along road shoulders.

Wolverine

The Washington's North Cascades wolverine population appears to be a part of a larger population that includes portions of British Columbia and possibly Alberta (Aubry et al. 2011). A recent 10-year wolverine study was completed on the Okanogan-Wenatchee National Forest on the Methow Valley Ranger District. Wolverine live traps were put in place the winters of 2005/06 thru 2010/11. Fourteen wolverines were captured on 43 occasions (Aubry et al. 2011). A second study was initiated through the Cascades Carnivore Project on the south end of the Forest (Atkins 2010). Although no wolverines were documented on the Forest through this study efforts, lone wolverines were documented north of Mount Adams and in the Goat Rocks Wilderness area on the Gifford Pinchot National Forest (Gunnell 2015). Recent efforts to detect wolverines on the Forest have resulted in confirmed sighting on the Entiat Ranger District 2011 through 2015; Lake Wenatchee and Cle Elum Ranger Districts in 2013 through 2015. A breeding population, in Washington State has been documented north of I-90 (Gunnell 2015).

There is one known den site on the Okanagan-Wenatchee National Forest. On the Okanogan-Wenatchee National Forest, wolverines are frequently found in high elevation wilderness and roadless areas (Aubry et al. 2011). There are approximately 109,425 acres of denning (high elevation) habitat on the forest; of which 16 of these acres are within mapped polygons and approximately 0.5 are infested acres. Acres of wolverine denning habitat were obtained from the wolverine habitat layer created for the Forest Plan Revision 2010. Due to their preference for high elevation remote habitat, (Carroll et al. 2001), wolverine and their habitat are not typically impacted by invasive plants.

Regional Forester Sensitive Species

Wildlife species found on the Okanogan-Wenatchee National Forest included on the Regional Forster's Sensitive Species List are listed below (revised 12/18/2014). Sensitive species are those identified as species at potential risk of loss of viability. 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 USFWS as "candidates" for listing under the ESA, and meeting the Forest Service's criteria for protection, are included on the Sensitive Species Lists. Some of the sensitive species below are also Northwest Forest Plan Survey and Manage Species.

Table 3.23 Sensitive Wildlife Species Documented or Suspected to Occur on the Okanogan-Wenatchee National Forest

Common Name and Taxa	Scientific Name	Occurrence on Okanagan	Occurrence on Wenatchee
Mammals			
Gray wolf	*Canis lupis (Northern Rocky Mtn. DPS)*	D	Not sensitive on Wenatchee
Pacific Fisher	*Pekania pennanti pacifica (west coast DPS)*	D	D
Cascade Red Fox	*Vulpes vulpes cascadensis*	S	D
Western Gray Squirrel	*Sciurus griseus*	D	D
Townsend's Big-eared Bat	*Corynorhinus townsendii*	D	D
Little Brown Myotis	*Myotis lucifugus*	D	D
Bighorn Sheep	*Ovis canadensis*	D	D
Mountain Goat	*Oreamnos americanus*	D	D
Birds			
Northern Goshawk	*Accipiter gentilis*	D	D
Bald Eagle	*Haliaeetus leucocephalus*	D	D
American Peregrine Falcon	*Falco peregrinus anatum*	D	D
Great Gray Owl	*Strix nebulosa*	D	D
Gray Flycatcher	*Empidonax wrightii*	D	D
White-headed Woodpecker	*Picoides albolarvatus*	D	D
Lewis' Woodpecker	*Melanerpes lewis*	D	D
Sandhill Crane	*Grus canadensis*	D	D
Harlequin Duck	*Histrionicus histrionicus*	D	D
Common Loon	*Gavia immer*	D	D
Sharp-tailed Grouse	*Tymphanuchus phasianellus*	S	no
Amphibians			
Larch Mountain Salamander	*Plethodon larselli*	no	D

Common Name and Taxa	Scientific Name	Occurrence on Okanagan	Occurrence on Wenatchee
Reptiles			
Western Pond Turtle	*Actinemys marmorata*	no	S
Striped Whipsnake	*Coluber taeniatus*	no	S
Mollusk			
Puget Oregonian	*Cryptomastix devia*	no	D
Grand Coulee Mountainsnail	*Oreohelix juni*	D	no
Shiny Tightcoil	*Pristiloma wascoense*	S	D
Blue-gray Taildropper	*Prophysaon coeruleum*	no	S
Western bumblebee	*Bombus occidentalis*	D	D
Meadow Fritillary	*Boloria bellona*	D	no
Astarte Fritillary	*Boloria astarte*	D	no
Freija Fritillary	*Boloria freija*	D	no
Great Basin Fritillary	*Speyeria egleis*	S	no
Labrador Sulphur	*Colias nastes*	D	no
Lustrous Copper	*Lycaena cupreus*	D	no
Melissa Arctic	*Oeneis melissa*	D	no
Mardon Skipper	*Polites mardon*	no	D
Peck's Skipper	*Polites peckius*	D	no
Tawny-edged Skipper	*Polites themistocles*	D	no
Subarctic Darner	*Aeshna subarctica*	no	S
Zigzag Darner	*Aeshna sitchensis*	D	D

D = Documented – an organism that has been verified to occur in or reside on an administrative unit.

S = Suspected – an organism that is thought to occur, or that may have suitable habitat, on National Forest System land or a particular administrative unit, but presence or occupation has not been verified.

No = means not suspected or documented

Gray wolf (Northern Rocky Mountain DPS) life history and effects analysis discussed under the "Federally Listed Species" section

Pacific Fisher

Carnivore surveys by the Forest Service have been conducted sporadically across the Okanogan-Wenatchee National Forest from 1993-2010 using baited camera sets, snow tracking and track plates. There were no verified detections of fishers from these surveys. From 1995-1997, Washington Department of Fish and Wildlife conducted carnivore surveys using camera stations in potential fisher habitat throughout the state. No fishers were detected (Hayes and Lewis 2006). Pacific fisher populations in Washington are thought to be extirpated, or contain only remnant scattered individuals (Aubry and Lewis 2003, Lewis and Stinson 1998). In 2008 fishers were translocated to Olympic National Park in western Washington and that population persists to date (Lofroth et al. 2010). Fisher are believed to be currently absent (USDA Forest Service 2015).

In 2015 a proposal to reintroduce fisher at North Cascades National Park Service Complex and Mount Rainier National Park was approved (https://parkplanning.nps.gov/projectHome.cfm?projectId=46313).

Fisher reintroduction could occur as early as fall 2017 at the North Cascades National Park Service Complex. Fisher are believed to be currently absent on the Okanogan Wenatchee National Forest (USDA Forest Service 2015). Therefore fisher will not be discussed further in this document. If they are however found to be present in the future years, effects and mitigations would be similar to those for late-successional species and marten.

Cascade Red Fox

Cascade red fox surveys have been conducted sporadically across the Cascade Range of Washington and Oregon by the Cascade Carnivore Project (CCP) 2008-2014. Numerous detections of Cascade red fox have been documented in the Cascade Range by photographs at baited stations and by DNA analysis of collected scats resulting in the identification of less than 50 individuals (Akins 2014). On the Naches Ranger District, thirteen scat samples were verified to be native Cascade red fox (Akins 2013). Preliminary genetic results suggest serious declines in abundance and distributions.

There are no known den sites on the Okanagan-Wenatchee National Forest. There are approximately 660,751 acres of high elevation habitat (forest, subalpine parklands, and alpine meadows) on the forest; of which 78 of these acres are within mapped polygons and approximately 4 are infested acres. Cascade red fox habitat was created using the Forest vegetation layer 2015. Due to their preference for high elevation remote habitat, (Aubry 1984), Cascade red fox and their habitat are not typically impacted by invasive plants.

Western Gray Squirrel

A portion of one western gray squirrel population in Washington State, known as the North Cascades, occurs on the Okanogan-Wenatchee National Forest. The majority of the occupied western gray squirrel habitat in the Okanogan population occurs on private lands (51%) and National Forest System (35%) lands, with the remainder managed by WADNR and BLM (Linders and Stinson 2007). Reproducing western gray squirrel populations occur on the Forest along the north and south shores of Lake Chelan and in southwestern Okanogan County, on the Chelan, Entiat and Methow Valley Ranger Districts.

Approximately 731,254 acres of potential western gray squirrel habitat exists on the Okanogan-Wenatchee National Forest. Potential western gray squirrel habitat for the Forest was determined using the Washington Department of Fish and Wildlife broad scale habitat layer delineated in 2010. Approximately 11,795 acres of western gray squirrel habitat occurs within mapped plant polygons, of which 1,248 are of infested acres. Although invasive plants have no known impacts to western gray squirrel nest/den habitat, some species of invasive plants, such as knapweeds, are known to have degraded the quantity and quality of truffles and other fungi foraging habitat on the Forest (Mallory Lenz, personal communication).

Townsend's Big-eared Bat

Hibernacula and nursery roost sites for the Townsend's big-eared bat have been documented on the Okanogan-Wenatchee National Forest. Surveys have been limited and additional surveys are required to determine its distribution and status. Three nursery roost sites and 2 hibernacula occur within 1 mile of mapped plant polygons. About 120 acres of mapped polygons within 1 mile of known hibernacula and 5 acres of mapped polygons within 1 mile of known nursery roost sites. Of these mapped polygon acres 3 infested acres are within 1 mile of known hibernacula and 0.09 are infested acres within 1 mile of known nursery roost sites. Although invasive plants are not known to impact big-eared bat roost habitat; there have been cases of documenting invasive plants, such as common burdock, entrapping and causing mortality to other bat species (Raloff 1998; St. Hilaire 2010).

Little Brown Myotis

One known little brown myotis hibernacula site has been documented for the Forest. Nursery roost sites are not known on the Forest. Surveys have been limited and additional surveys are required to determine its distribution and status. The one hibernaculum occurs within 1 mile of mapped plant polygons. Although invasive plants are not known to impact their roosting habitat; cases of documenting invasive plants, such as common burdock, entrapping and causing mortality to other bat species have been documented (Raloff 1998; St. Hilaire 2010).

Mountain Goat

Mountain goats occur throughout the Okanogan-Wenatchee National Forest in their preferred habitat. Surveys are conducted regularly by the WDFW ((WDFW 2010). Approximately 246,776 acres of mountain goat habitat exists on the Okanogan-Wenatchee National Forest, of which 178 acres are in mapped plant polygons and 30 are infested acres. Acres of mountain goat habitat were obtained from the mountain goat habitat layer created for the Forest Plan Revision 2010. Invasive plants do not generally occur in mountain goat habitat, however if infestations expand, the quality and quantity of available forage could be reduced.

California Bighorn Sheep

California bighorn sheep are found on the Okanogan-Wenatchee National Forest two herds are located on the Naches RD, one each on the Entiat, Tonasket and Chelan Ranger Districts. Using the habitat layer created for the revised Forest Plan, a total of approximately 243,017 acres of potential bighorn sheep habitat occurs on the Forest. Approximately 7,412 acres of potential bighorn sheep habitat occurs within the mapped polygons, of which approximately 1,269 are infested acres. As of 2011, approximately 755 of these acres were occupied by bighorn sheep herds on the Forest.

Bighorn sheep may graze on invasive grasses such as cheatgrass. Over time, cheatgrass invasion can degrade bighorn sheep habitat by altering fire cycles in shrub-steppe ecosystems; converting bunchgrass habitat to rangeland dominated by an annual exotic grass (deVos et al. 2003). Although cheatgrass is an invasive plant that can negatively affect bighorn sheep forage, it is not considered a priority species in this analysis because it is so widespread (see Chapter 2).

Dalmatian toadflax and knapweed are currently degrading bighorn sheep habitat on the forest. These species are highly competitive and quickly crowd out native and desirable plants, dramatically reducing available forage for wildlife (Washington State Noxious Weed Control Board 2007). Because of their prolific nature, they have the potential to threaten long-term habitat integrity of bighorn sheep habitat on the Forest (Cassier et al. 1997).

Northern Goshawk

Nesting habitat for the northern goshawk occurs throughout the Forest. Approximately 616,201 acres of goshawk nesting habitat exists on the Okanogan-Wenatchee National Forest (figure was obtained from the Forest Plan Revision late-successional habitat layer 2010). There are approximately 13,358 acres mapped polygons that occur within nest habitat; of which 1,399 acres are infested. Approximately 6,579 acres of habitat occur within ¼ mile of closed system roads and within mapped invasive plant polygons; of which 706 are infested acres. Invasive plants generally do not occur in late-successional habitat due to the high canopy and ground cover (USDA Forest Service 2005a). Currently infested acres are primarily on roadsides and thus do not likely affect northern goshawk nesting habitat.

Bald Eagle

A bald eagle species management guide was written for the Wenatchee National Forest in 1989 (Rees 1989). Thirty-three "potential territories" were identified on the Wenatchee National Forest. Eight of these were designated as "recovery territories." Two of these territories were "active recovery territories": Reservoir West on the Naches Ranger District and Lake Wenatchee on the Wenatchee River Ranger District. Active recovery territories are territories that have occupied bald eagle nest sites. Currently the Okanogan-Wenatchee National Forest has eight active territories. Two of the bald eagle active territories are located on the Naches Ranger District both in close proximity to Rimrock Reservoir, one located on Cle Elum Ranger District, four located on Wenatchee River Ranger District and one on Tonasket Ranger District. Nest sites are monitored periodically. Nest success varies by site and year.

One communal winter roost is located in territory #15 (Columbia River) on the Entiat Ranger District. Bald eagles do roost in various other places on the Forest during winter months. These roost sites vary from year to year. Yearly winter bird count surveys occur along the Tieton, Naches and Yakima Rivers. Bald eagle winter numbers have increased steadily through the years to fairly moderate levels. Bald eagle migration and winter sightings on the Forest occur along the Tieton, Naches, Cle Elum, Wenatchee, Icicle, Methow and Yakima Rivers and the shores of Lake Chelan.

Approximately 38 mapped polygon acres occur within 450 meters of known bald eagle nest sites of which 9.5 are infested acres (NRIS 2011). There are 3 known bald eagle nest sites within 450 meters of treatment areas. The majority of infested acres are along road sides. Approximately 4,527 acres of plant mapped polygons occur within 450 meters of bald eagle nest habitat; of which 1,822 acres are infested. Most of this habitat has not been surveyed to determine occupancy. About 3 acres of the 1,822 infested acres are known to be occupied by nesting bald eagles. Bald eagle nest habitat was obtained from Forest vegetation layer created for the Forest Plan Revision 2010. Thus, invasive plants are not currently affecting bald eagles on the Forest.

Peregrine Falcon

Aerial surveys of cliff habitat and historic eyries were conducted on the Wenatchee National Forest in the late 1980's and early 1990's by the Washington Department of Wildlife (USDA Forest Service 1996). These aerial surveys were used to determine suitable locations of "hack boxes" for peregrine falcon re-introduction efforts. A "hack box" is a man-made structure that prepares captive raised young falcons to become independent hunters, and allows them to successfully fledge into the wild. Peregrine falcons were re-introduced on the Forest (Naches Ranger District) from 1988 through 1993 (Burnham et al 1988-1993). Nest site surveys were conducted on the Okanogan-Wenatchee National Forest from the 1990's to present (NRIS 2011). Suitable habitat continues to be intermittently and informally surveyed. There are currently 8 known peregrine falcon eyries on the Okanogan-Wenatchee National Forest.

There are 4 documented peregrine nest sites located within 0.5 mile of mapped polygons. There are 34 infested acres within 0.5 mile of known peregrine falcon nest sites. Approximately 361 mapped polygon acres are within 1.5 miles of known peregrine eyries. Invasive plant species are not known to impact conditions important to falcon habitat.

Approximately 35,298 acres of plant mapped polygons are located within 1.5 miles of potential peregrine nesting habitat and of these acres approximately 6,877 acres are infested. Peregrine falcon nesting habitat was obtained from a layer created for the Forest Plan Revision 2009.

Great Gray Owl

Great gray owl surveys have been conducted throughout the Okanogan-Wenatchee National Forest starting in 1995 using the survey protocol developed by the Regional Interagency Executive Committee. In 2005 the Okanogan-Wenatchee National Forest leadership team, upon the recommendations of the forest wildlife biologists, determined that surveys were only required and management would occur within the range of breeding great gray owl populations (USDA Forest Service 2005d). Breeding range on the Forest was described as the area between the Canadian Border south to State Highway 20 and the eastern half of the Methow Valley Ranger District and the entire Tonasket Ranger District. There are three known great gray owl nests on the Forest and they all occur on the Tonasket Ranger District. All three nest sites are located within ¼ mile of plant mapped polygons. There are 22 mapped polygon acres within ¼ mile of known nest sites; of which 3 of these acres are infested acres.

Invasive plant species are not known to impact great gray owl nesting habitat. However invasive plants can degrade foraging habitat. In meadows, shallow rooted invasive plants increase soil instability and erosion and reduce wildlife habitat value by decreasing diversity and resiliency of the meadow system (National Fish and Wildlife Foundation 2010).

Gray Flycatcher

Gray flycatchers have been documented on the Okanogan-Wenatchee National Forest; nesting pairs are located in the Okanogan Valley, Wenatchee River and Tonasket Ranger Districts (Kent Woodruff, personal communication). On the Tonasket Ranger District, gray flycatchers are using lodgepole pine stands with bitterbrush understory (Kent Woodruff, personal communication). Approximately 31,981 acres of gray flycatcher habitat exists on the Forest. Approximately 3,979 acres of mapped plant polygon acres occur in gray flycatcher habitat; of which 217 acres are infested with invasive plants. The gray flycatcher habitat used in this analysis was created from the Forest Vegetation layer (2015).

Invasive plants, such as cheatgrass, can alter fire regimes, increasing the frequency and intensity of wildfires in shrubland communities (de Vos et al. 2003). Rapidly-recurring fires have the potential to change habitat structure and prevent the re-establishment of shrub communities (Labbe 2008) which can negatively impact the gray flycatcher. The extent invasive plants are impacting gray flycatcher habitat on the forest is unknown.

White-Headed Woodpecker

Approximately 3,307 mapped polygon acres occur in white-headed woodpecker habitat; of which 469 acres are infested. The white-headed woodpecker habitat used in this analysis was obtained from the Forest Plan Revision data layer 2011.

Invasive plants are not known to impact white-headed woodpeckers or their habitat (USDA Forest Service 2011b).

Lewis Woodpecker

The Forest has approximately 1,030 acres of Lewis' woodpecker habitat. Approximately 158 acres of mapped plant polygons occur within Lewis' woodpecker habitat; of which 11 acres are infested by invasive plants. Lewis' woodpecker habitat used in this analysis was created from the Forest Vegetation layer (2015). Invasive plants are not known to impact Lewis' woodpeckers or their habitat (USDA Forest Service 2011b).

Sandhill Crane

Sandhill cranes have been documented but are uncommon on the Okanogan-Wenatchee National Forest (NRIS 2011). Nesting Sandhill cranes have not been documented on the Forest. The few sightings reported were of spring migrating birds that consisted of a few individuals. Sandhill crane will not be discussed further in this document because of their absence in the project area.

Harlequin Duck

Approximately 662 mapped polygon acres occur within harlequin duck habitat; of which 535 acres are infested. The majority of infested acres are along roadsides that border fast moving streams. Harlequin duck habitat was obtained from the Forest Plan Revision data layer, 2010.

Common Loon

Approximately 454 mapped polygon acres occur within 100 feet of lakes that are occupied by loons; of which 65 of these are infested acres.

Sharp-tailed Grouse

The most suitable habitat available for sharp-tailed grouse on the Forest occurs in the Methow and upper Okanogan Valleys. They are a potential visitor to the Forest. There are no documented sightings on Okanogan-Wenatchee National Forest however they are known to occur adjacent to the Forest on state and private lands in Okanogan County. They have been found on the open shrub steppe habitat interfaced with brushy forested draws. There are approximately 588,298 acres of sharp-tailed grouse habitat on the Forest. Approximately 5,192 acres of mapped weed polygons occur within sharp-tailed grouse habitat; of which 302 acres are infested by invasive plants. The sharp-tailed grouse habitat used in this analysis was created from the Forest Vegetation layer (2015). There is very low likelihood that sharp-tailed grouse would be affected by the project because they have never been seen in the project area, and the amount of suitable habitat is more than 100 times larger than the infested area within it, so overlap between treatment and use by a grouse is not plausible. This species is not discussed further in this document.

Larch Mountain Salamander

Potential habitat occurs on the Naches, Cle Elum and Wenatchee River Ranger Districts. Surveys conducted for the Larch Mountain salamander began on portions of these three districts in the fall 1999 to the present. Inventories for these species on the Forest are incomplete; not all potential habitats have been surveyed. Potential Larch Mountain salamander habitat has not been delineated for the Forest as the vegetation data layer lacks the specifics needed to determine potential habitat. Larch Mountain salamander habitat likely exists within or near infested acres; since forested blocks, and talus areas occur along proposed roadside treatments on the Naches, Cle Elum and Wenatchee River Ranger Districts. There are eight documented Larch Mountain salamander sites on the Forest located on the Cle Elum Ranger District. All eight sites are between 3,000 feet and 4,200 feet in elevation; occurred in the annual precipitation zone above 60 inches; and in talus adjacent to old forest. There are no documented Larch Mountain salamander sites within 100 feet of mapped polygons.

Western Pond Turtle

There are approximately 110,577 acres of potential habitat (rivers, ponds and lakes at or below 2,000 feet elevation) on the Forest. Approximately 46 acres of mapped plant polygon acres occur in western pond turtle habitat; of which 12 acres are infested by invasive plants. The western pond turtle habitat was created from the Forest Vegetation layer (2015). The western pond turtle is an unlikely visitor to the Forest. No documented occurrences exist on the Okanogan-Wenatchee National Forest. Habitat is limited to the eastern fringe of the Forest and no impacts from this project are likely. Pond turtle will not be discussed further.

Striped Whipsnake

In the last decade, only 3 observations have been reported (Hallock and McAllister 2010). Habitat on the Forest is limited to the southeastern edge of the Naches Ranger District. Approximately 324 acres of habitat occurs on the Forest. Fourteen acres of mapped invasive plant polygons occur in striped whipsnake habitat; of which 2 acres are infested. The striped whipsnake habitat used in this analysis was created from the Forest Vegetation layer (2015). There are no documented occurrences on the Forest. Habitat is limited to the southeastern fringe of the Forest. Whipsnake will not be discussed further.

Puget Oregonian

Inventory for this mollusk species on the Forest are incomplete; not all suitable habitat has been surveyed. There is one documented Puget Oregonian site on the Okanogan-Wenatchee National Forest (Cle Elum Ranger District). This site is not within 100 feet of mapped plant polygons. There is potential for the Puget Oregonian to occur on the Naches, Cle Elum and Wenatchee River Ranger Districts where the conditions are most like the west-side Cascades (greater than 60 inches precipitation). On the Forest, it has been found in habitat similar to the Larch Mountain salamander. Potential Puget Oregonian habitat has not been delineated for the Forest, as the vegetation data layer lacks the specifics needed to determine potential habitat. Un-surveyed, potential habitat occurs within the mapped polygons since forested roadside invasive plant populations occur on the Naches, Cle Elum and Wenatchee River Ranger Districts.

Grand Coulee Mountainsnail

Using the habitat layer created from the revised forest plan, an estimated 10,020 acres of potential Grand Coulee mountainsnail habitat (rated high and moderate) occurs within plant mapped polygons, and of these acres 1,146 acres are infested. Known infestations are primarily along roadsides. There are numerous documented sites on the Forest in Okanogan and Chelan Counties (Frest and Johannes 1995). However, no known sites occur within mapped plant polygons. Invasive plant species, such as knapweed, tend to dry out sites more than native vegetation and degrade habitat.

Shiny Tightcoil

There are nine confirmed shiny Tightcoil sites on the Forest. This species is found at moderate to high elevations primarily under deciduous trees such as quaking aspen (Burke 2013). There are no mapped polygons within 100 feet of known shiny tightcoil sites. Potential shiny tightcoil habitat has not been delineated for the Forest, as the vegetation data layer lacks the specifics needed to determine potential habitat. Un-surveyed, potential habitat occurs on the Naches, Cle Elum, Wenatchee River Ranger and Chelan Districts. Invasive plant species that tend to dry out sites more than native vegetation may degrade habitat. Invasive plants in riparian zones that do not alter soil moisture or the substrate preferred by these snails may not affect their habitat.

Blue-Gray Taildropper

The blue-gray taildropper is suspected to occur in the vicinity of the Forest, however the Forest is located outside its known range. No further discussion will occur within this document for the blue-gray taildropper.

Western Bumblebee

There are fifteen documented sightings on the Okanogan-Wenatchee National Forest. Bumblebee habitat on the Forest is primarily within flower-rich meadows of forests and subalpine zones (Jepsen 2012). The colony's life cycle is from early February to late November with hibernation during the winter months (Jepsen 2013). The western bumblebee primarily nests underground in abandoned rodent burrows (Hobbs 1968, MacFarlane et al. 1994). They are general foragers; visiting a wide variety of flowering plants to feed on nectar and collect pollen (Jepsen 2013). Western bumblebee habitat cannot be delineated for the Forest as the vegetation data layer lacks the specifics needed to determine potential habitat. High elevation habitat on the Forest is not generally impacted by invasive plant species. Approximately 2 acres of mapped plant polygons occurs within 100 feet of known sites on the Forest; of which 0.15 acre is infested by invasive plants.

Colony collapse disorder is a concern for bee species and is discussed as a stressor that may contribute to cumulative effects later in this chapter. Neither the herbicides proposed for use, nor treatment of invasive plants are implicated in colony collapse disorder.

Meadow Fritillary

On the Forest, there are two sites on the Tonasket Ranger District, (Beaver Creek and Lost Lake) one of which is historic, and one site on the Methow Valley Ranger District (Bear Mountain). In Oregon and Washington, it is strictly associated with intact, natural meadows and clearings at high elevations. Adults fly in two generations from May to June, and in late July and August. Larvae feed on violets (Acorn and Sheldon 2006, Flekenstein 2006b). The meadow fritillary is considered imperiled in Washington (NatureServe 2010). There are no mapped invasive plant polygons that are within 100 feet of known sites on the Forest. The meadow fritillary will not be discussed further in this document because impacts to this species are highly unlikely to result from this project.

Astarte Fritillary

Numerous sighting of the Astarte fritillary occur on the Forest; Tonasket, Methow Valley, Chelan and Wenatchee River Ranger Districts (Xerces 2010a, NRIS 2015). Habitat of this species is arctic-alpine rock slides, windswept ridges and scree slopes, usually south-facing and above the tree-line, at elevation of at least 7,000 feet (Opler and Wright 1999, Pyle 2002 as cited by Xerces 2010a). This high elevation habitat is not impacted by invasive plants. There are no infested acres within Astarte fritillary. The Astarte fritillary will not be discussed further in this document because impacts to this species are highly unlikely to result from this project.

Freija Fritillary

Freija fritillary has been documented on the Okanogan-Wenatchee National Forest at high elevations (Pyle 2002) on the Tonasket and Methow Valley Ranger Districts. Typical habitat for this species is high elevation willow bogs, moist arctic-alpine tundra slopes, and occasionally forest meadows (Pyle 2002). This high elevation habitat is not impacted by invasive plants. The freija fritillary will not be discussed further in this document because impacts to this species are highly unlikely to result from this project.

Great Basin Fritillary

Great Basin fritillary has been documented on the Okanogan-Wenatchee National Forest at high elevations (Pyle 2002). The NRIS 2015 data base shows two historic records (1967), one site, in Bear Canyon on the Naches Ranger District. This is a low elevation site and not in habitat that is typically described for this species. This could be a mapping error. Habitat for this species consist of mountain meadows, forest openings and exposed rocky ridges http://www.butterfliesandmoths.org/species/Speyeria-egleis). This high elevation habitat is not impacted by invasive plants. The Great Basin fritillary will not be discussed further in this document because impacts to this species are highly unlikely to result from this project.

Labrador Sulphur

Labrador Sulphur is documented to occur on the Okanogan-Wenatchee National Forest, on the Tonasket and Methow Valley Ranger Districts (Pyle 2002). This high elevation habitat is not impacted by invasive plants and Labrador Sulphur will not be discussed further because impacts to this species are highly unlikely to result from this project.

Lustrous Copper

The lustrous copper has been recorded only at the far northern edge of the state, on Slate Peak (Pyle 2002); documented on the Okanogan-Wenatchee National Forest on the Methow Valley Ranger District. Extensive potential habitat exists within the Pasayten Wilderness (Fleckenstein 2006a). This high elevation habitat is not impacted by invasive plants and lustrous copper will not be discussed further because impacts to this species are highly unlikely to result from this project.

Melissa Arctic

The Melissa Arctic is considered secure in Washington (NatureServe 2010). There are eight known sites in Washington, and “all are in the high Cascades, east of the divide, north of Lake Chelan and west of the Okanogan River” (Fleckenstein 2006c). It is documented on the Okanogan-Wenatchee National Forest, on the Tonasket, Methow Valley and Chelan Ranger Districts. This high elevation habitat is not impacted by invasive plants and Melissa Arctic will not be discussed further because impacts to this species are highly unlikely to result from this project.

Mardon Skipper

Mardon skipper is a rare butterfly found in four disjunct populations. It is considered imperiled in Washington (NatureServe 2010). Its range on the Forest extends north to Rimrock Lake on the Naches Ranger District. Surveys have been extensive on the Naches District; successfully covering the majority of available Mardon skipper habitat.   There are currently 36 documented sites (St. Hilaire et al. 2010). Mardon skippers occupy grassland habitats, the characteristics of which appear to vary by region. In the southern Washington Cascades they seem to be restricted to short sedges and grass species such as fescue and oatgrass dominated meadows with adequate nectar sources for adults. Adults use a variety of flowers for nectar sources. The Okanogan-Wenatchee National Forest sites range in elevation from 3,260 feet to 5,340 feet. They are found in dry and mesic grand-fir forest types, within grassland intrusions and in small (<1/2 acre) to larger meadow complexes (St. Hilaire et al. 2010). Approximately 6 acres of mapped polygon acres occur in occupied mardon skipper habitat; of which 1 acre is infested by invasive plant species. Invasive plant species do not provide egg-laying or larval food plants.

Peck’s Skipper

Peck’s skippers are found across much of northern United States and Canada. In Washington, this species is documented on the Colville National Forest and the Okanogan-Wenatchee National Forest at elevations of approximately 2000 to 5000 feet (Foltz 2010a). On the Forest they have been documented on the Tonasket Ranger District at 3 sites; Mount Hull, Cockle Springs and Lost Creek. In the Pacific Northwest, they inhabit mountain meadows, marshy edges of potholes, and roadsides (Pyles 2002). Riparian habitats (e.g., wet grassy meadows) are preferred (Warren 2005). Peck’s skipper habitat cannot be delineated for the Forest as the vegetation data layer lacks the specifics needed to determine potential habitat. Approximately 2 acres of mapped plant polygons occurs within 100 feet of known sites on the

Forest; of which 0.1 acre is infested by invasive plants. Invasive plant species do not provide egg-laying or larval food plants.

Tawny Edge Skipper

In Washington, this species is documented on the Colville and Okanogan-Wenatchee National Forests (Pyle 2002). On the Forest they are documented on the Tonasket Ranger District at 4 sites near Mount Hull; Mud Lake, Tonasket Creek, Cockle Springs and Haley Canyon (NRIS 2015). In the Cascades, the habitat is limited to moister areas in higher elevations, such as pond and marsh meadows, moist meadows, and stream margins (Foltz 2010b). Known records are from elevations of 2500 to 4000 ft. (Evergreen Aurelians 2010). In Washington, the species flight period occurs from late May to early August (Foltz 2010b). Tawny-edge skipper habitat cannot be delineated for the Forest as the vegetation data layer lacks the specifics needed to determine potential habitat. It is likely that un-surveyed, potential habitat occurs within the Treatment Areas on the Forest. Approximately 2 acres of mapped invasive plant polygons occur within 100 feet of known sites; of which 0.07 acres are infested. Some species of invasive plants may degrade the skipper’s meadow habitat.

Subarctic Darner

There are two known sites in Washington and one of the sites is located on the Okanogan-Wenatchee National Forest. The site at Fish Lake, on the Wenatchee River Ranger District, was discovered in 2000 (Fleckenstein 2006f, NRIS 2015). In 2013 and 2014 the Forest conducted odonate (dragonfly) surveys at 16 sites (bogs, fens, and shallow ponds) for the purpose of documenting the presence of sensitive dragonfly species. The subartic darner was not found (Rohrer 2014). Approximately 19 infested plant acres are within 100 feet of Fish Lake. Subarctic darner habitat cannot be delineated for the Forest as the vegetation data layer lacks the specifics needed to determine potential habitat. Invasive plants such as reed canarygrass and yellow loosestrife are present and threaten the long-term habitat integrity at Fish Lake (Lamquest, pers. com.).

Zigzag Darner

The zigzag darner was found at 5 of the 16 sites surveyed during the 2013 and 2014 Forest odonate surveys (Rohrer 2014). On the Forest this species is documented on the Wenatchee River, Tonasket and Methow Valley Ranger Districts (NRIS 2015). This species is found in wet sedge meadows, fens, bogs, and very shallow peated ponds (Xerces 2010d). Zigzag darner habitat cannot be delineated for the Forest as the vegetation data layer lacks the specifics needed to determine potential habitat. Although the NRIS data base shows no invasive plants within 100 feet of known zigzag darner sites, Lamquest (pers. com) did note that invasive plants such as reed canarygrass and yellow loosestrife are present and threaten the long-term habitat integrity at Fish Lake (one of the known zigzag darner sites).

Subarctic Bluet

Subarctic bluet is suspected to occur on the Forest. This species is lives in a variety of wetlands, but most common around floating aquatic moss. The Forest conducted odonate (dragonfly) surveys at 16 sites during 2013 and 2014 field season for the purpose of documenting the presence of sensitive dragonfly species. The subarctic darner was not found (Rohrer 2014). There are no documented occurrences on the Okanogan-Wenatchee National Forest (Fleckenstein 2006e). Subarctic habitat cannot be delineated for the Forest as the vegetation data layer lacks the specifics needed to determine potential habitat. Since surveys have been conducted and no sites were found on the Forest, no foreseeable impacts are expected from the proposed project. Therefore, the subarctic bluet will not be discussed further in this document.

Survey and Manage Species

Using the 2003 Settlement Agreement Survey and Manage list (Pechman exemption), vertebrate and invertebrate species of interest within Northwest Forest Plan lands whose range includes the Okanogan-Wenatchee National Forest are: great gray owl, Larch mountain salamander, Puget Oregonian, masked duskysnail, Chelan mountainsnail, and blue-gray taildropper. Except for the Chelan mountainsnail and masked duskysnail, these species are discussed under sensitive species above.

Chelan Mountainsnail

Using the habitat layer created from the revised forest plan, an estimated 10,020 acres of potential Chelan mountainsnail habitat (rated high and moderate) occurs within mapped plant polygons, and of these 1,146 are infestation acres. Known plant infestations are primarily along roadsides. Eight known Chelan mountainsnail sites are within mapped plant polygons. Invasive plant species, such as knapweed, tend to dry out sites more than native vegetation and degrade habitat.

Masked Duskysnail

The masked duskysnail is also sometimes referred to as Washington duskysnail; is a small freshwater snail that inhabits kettle lakes and riparian associate. It lives on the mud substrate, and feeds on the algal and microbial film on aquatic macrophytes and likely on detritus (Monthey, 1998).

This species has been identified at 4 sites on 2 lakes in Washington State: Curlew Lake in Ferry County, and Fish Lake in Chelan County.   Curlew Lake does not occur on the Forest but Fish Lake site is partially within the Okanogan-Wenatchee National Forest, on the Wenatchee River RD. There are approximately 19 mapped polygon acres within 100 feet of Fish Lake. Masked duskysnail habitat cannot be delineated for the Forest as the vegetation data layer lacks the specifics needed to determine potential habitat. Invasive plants, such as reed canarygrass, yellow loosestrife and knapweed are present and threaten the long-term habitat integrity at Fish Lake (Lamquest, pers. com.).

Management Indicator Species

Management Indicator Species (MIS) are selected species whose welfare is believed to be an indicator of the welfare of other species using the same habitat, or a species whose condition can be used to assess the impacts of management actions on a particular area (Thomas et al. 1979). The MIS approach is used in concert with other indicators to gauge the effects of management on wildlife. Table 3.24 below lists the MIS species identified in the Wenatchee and Okanogan Forest Plans.

A detailed report of each MIS on the Forest describing baseline, preferred habitat, viability outcomes and risk factors, can be found in the Status of Management Indicator Species on the Okanogan and Wenatchee National Forests (USDA Forest Service 2011a), which is incorporated in this section by reference. Effects to habitat and potential herbicide exposure will generally be used as the key metrics to assess impacts of proposed invasive plant treatments. Northern spotted owl and Canada lynx are in the Federally Listed Species section above and for the mountain goat is in the R6 Sensitive Species section above.

Table 3.24: Management Indicator Species and their associated habitat for the Okanogan-Wenatchee National Forest

Species	Indicators for: (source habitat)	Okanogan (habitat acres on the Forest)	Wenatchee (habitat acres on the Forest)	Mapped Polygon acres within Habitat
Rocky Mountain elk	Big game species; with winter range identified as its limiting habitat	not a MIS on Okanogan	152,581	6,428
Mule Deer	Big game species; with winter range identified as its limiting habitat	321,775	152,581	18,222 OKA 6,428 WEN
Mountain Goat	Rockland, alpine, high elevation old- growth conifer habitat	not a MIS on Okanogan	218,446	96
Canada Lynx	Lodgepole pine habitat	63,847	not a MIS on Wenatchee	1,720
Barred Owl	Mature and mixed conifer old-growth	170,799	not a MIS on Wenatchee	339
Northern Spotted Owl	Mature and mixed conifer old-growth	82,116	621,105	3,823
Pileated Woodpecker	Mature and old growth conifer (medium-large trees/cool/moist forest groups	66,237	58,861	11,395
Three-toed Woodpecker/	Mature and old growth habitat in lodgepole pine types (including subalpine fir) on the OKA and mature or old-growth habitat on the WEN	783,357	973,135	1,597
American Marten	Mixed conifer old-growth and mature habitat (cold moist and cold dry forests)	30,262	166,310	1,599
Primary cavity excavators (10 species)	Dead & live defective standing trees/ dead & down tree habitat structure	Not available, not affected by invasive plants	Not available, not affected by invasive plants	Species commonly found on both Forests.
Beaver	Riparian/deciduous forest habitat	not a MIS on Okanogan	177,118	3,859
Ruffed Grouse	Riparian/deciduous forest habitat	193,891	276,457	12,559

Mule Deer and Rocky Mountain Elk

Deer populations and habitat are widely distributed throughout the Forest and elk populations and habitat are widely distributed throughout the Naches and Cle Elum Ranger Districts and Wenatchee River Ranger District south of the Wenatchee River. The Okanogan and Wenatchee Forest Plans contain standards and guidelines relative to mule deer habitat and elk habitat on the Okanogan-Wenatchee National Forest, and require that habitat capability to support deer and elk is maintained or improved. Although the Treatment Analysis Areas lie within mule deer and elk winter, transition, and summer ranges; winter range was identified as the limiting and key factor and used to evaluate the viability of mule deer and elk as MIS on the Okanogan-Wenatchee National Forest (USDA Forest Service 1989 and 1990). Therefore, this analysis will discuss effects primarily to winter range.

Approximately 1,710 infested plant acres occur in deer and elk winter range on the Wenatchee National Forest and 2,235 infested plant acres occur in deer and elk winter range on the Okanogan National Forest.

Of the invasive plant species known to occur on the Forest, knapweed, oxeye daisy, leafy spurge, and Dalmatian toadflax are the species that grow on dry rangeland and shrubland (Washington State Noxious Weed Control Board 2007), which is typical deer and elk winter range on the Forest. These plant species are aggressive invaders; highly competitive. They quickly displace native vegetation and desirable forage plants, dramatically reducing available forage for wildlife (Washington State Noxious Weed Control Board 2007, Wright and Kelsey 1997). Because of their prolific nature, they have the potential to threaten long-term habitat integrity of deer and elk winter range on the Forest (deVos et al. 2003). Deer may consume some invasive plant species, such as spotted knapweed, but usually under conditions that limit availability of preferred forage, such as heavy snow and high animal densities (Wright and Kelsey 1997). Spotted knapweed contains compounds that can affect rumen flora thereby deterring extensive feeding (Olson and Kelsey 1997; Wright and Kelsey 1997).

Mountain Goat

Mountain goats were selected as a management indicator species on the Wenatchee National Forest because the population was divided into a number of sub-populations where management activities, or the lack of them, could potentially eliminate a sub-population and thus reduce distribution and potentially affect long-term viability. Mountain goats occur throughout the Wenatchee National Forest in their preferred habitat. Mountain goat populations and habitat are generally widely distributed, with some areas exhibiting lower abundance, but dispersal is still possible among subpopulations to allow for interactions within the metapopulation. Of the 96 acres of mapped polygons occurring in mountain goat habitat, approximately 25 are infested acres.

Invasive plants are not likely affecting n mountain goat habitat at this time, however if infestations expand, the quality and quantity of available forage could be reduced.

Barred Owl

Barred owl use late successional habitat of mixed conifer, which is widely distributed on the Forest (USDA Forest Service 2011a). In North America, barred owls have a stable to increasing trend (Sauer et al. 2008). In western North America, numbers and range are expanding (Gutierrez et al. 2007). Of the 339 mapped plant polygons acres within barred owl habitat on the Okanogan National Forest, approximately 60 of those acres are currently infested by invasive plants. These infested acres are primarily roadside locations. Invasive plants generally do not occur in late-successional habitat due to the high canopy and ground cover. Therefore invasive plants are suspected to have little effect on barred owl nesting habitat.

Pileated, Three-toed Woodpecker and other Cavity Excavators

Approximately 11,395 acres of mapped plant polygons occur within pileated woodpecker habitat; of which approximately 1,618 acres of habitat are infested. Approximately 1,597 acres of mapped plant polygons occur within three-toed woodpecker habitat: of which 175 acres of habitat are infested by invasive plants. These are primarily roadside locations. Invasive plants are not affecting the snag habitat important for woodpeckers and other cavity excavators (black-backed woodpecker, downy woodpecker, hairy woodpecker, Lewis's woodpecker, northern or common flicker, red-naped sapsucker[14], white-headed woodpecker, and Williamson's sapsucker).

American Marten

The analysis completed in the Status of Management Indicator Species on the Okanogan and Wenatchee National Forests (USDA Forest Service 2011a), indicated that 89 percent of the watersheds on the Forest provide habitat for marten. However 75 percent of the watersheds with habitat were well below historic levels of source habitat. Under historical conditions there was a high probability that viable populations of American martens and other species associated with the cool/moist forests group in the medium/large trees family were well distributed throughout the planning area. The effects of development and habitat change across the Okanogan-Wenatchee National Forest has led to a lower probability that populations of American martens and all other species associated with marten source habitat are viable and are likely well-distributed in only a portion of the forest (USDA Forest Service 2011a, Wisdome et al 2000). At broad scale, the American marten is considered secure through most of its North American range and is listed as secure in Washington State (NatureServe 2010). Approximately 1,599 mapped plant polygon acres occur within marten habitat; of which 328 acres are infested plant acres. These invasive plant locations are primarily along roadsides. Invasive plants generally do not occur in old-growth or mature habitat due to the high canopy and ground cover. Therefore invasive plants are suspected to have little effect on American marten habitat.

Beaver

The beaver is a management indicator species on the Wenatchee portion of the Forest, but occurs throughout the Forest in its preferred habitat. Their preferred habitat is low gradient streams, ponds, and small mud-bottomed lakes with dimmable outlets and deciduous tree and shrub present (USDA Forest Service 2011b). Beaver were selected as an indicator of deciduous and riparian ecosystems (USDA Forest Service 1990: III-48). They are a keystone species that alter the aquatic and riparian ecosystems they inhabit (USDA Forest Service 2011b). Populations and habitat are widely distributed, but highly dispersed with some areas exhibiting lower abundance, and isolation. There is opportunity for subpopulations on most of the Wenatchee National Forest to interact, but some subpopulations are so disjunct or of such low density that they are essentially isolated from other populations (USDA Forest Service 2011a). Approximately 3,859 mapped polygon acres occur within beaver habitat; of which 1,844 acres are infested. Approximately 1% of the available beaver habitat on the Wenatchee National Forest is currently infested by invasive plants. This is not currently threatening habitat, but spread of invasive plants into beaver habitat could begin to degrade native plant communities upon which beaver depend.

Ruffed Grouse

Ruffed grouse occur throughout the forest in their preferred habitat; riparian and early successional deciduous habitat (USDA Forest Service 2011b). Habitat is widely distributed and abundant. Since the ruffed grouse is considered a game bird by the State, viability is not a concern. Approximately 12,559 mapped polygon acres occur within ruffed grouse habitat; of which 3,085 acres are infested. Ruffed grouse's diet varies and includes herbs, buds, catkins, and twigs of trees and shrubs; fruits, acorns and seed.

[14] The yellow-bellied sapsucker listed in the Okanogan Forest Plan (USFS 1989:III-78), was taxonomically split into three species in 1983: red-naped, red-breasted, and yellow-bellied sapsuckers (AOU 1983, Walters et al. 2002); only the red-naped sapsucker occurs in Eastern Washington.

Invasive plants such as purple and yellow loosestrife and Japanese knotweed can adversely affect nesting and foraging habitat for some riparian species, including ruffed grouse (Washington State Noxious Weed Control Board). Invasive plants have primarily impacted riparian habitat around ponds and lakes where the overstory tends to be more open.

Birds of Conservation Concern

Table 3.25: Bird Species of Conservation Concern that May Occur on the Forest (Marshall et al 2003, Seattle Audubon Society 2011).

Species	Habitat	Diet
Calliope hummingbird	Open woodlands, scrubby vegetation, riparian	Plant nectar.
Flammulated owl	Open pine forest. Nests in tree/snag cavities	Crickets but will also take moths and beetles
Golden eagle	Open shrub habitat. Nests are primarily on cliffs and ledges, but tree nests are also used. Invasive plants are not known to be specifically affecting golden eagle habitat.	Rabbits and hares, squirrels, woodrats, salmon and medium to large birds.
Prairie falcon	Cliffs and outcrops provide opportunity for nesting; Grasslands are preferred habitat.	Small mammals, usually ground squirrels, but will also prey on birds, especially in winter
Willow Flycatcher	Riparian, shrubby area with water.	Flying insects
Black swift	Nests on cliff faces near or behind waterfalls, usually in deep canyons in wooded areas.	Flying insects
Loggerhead shrike	Open habitats of eastern Oregon and Washington. Uses elevated perches for hunting and singing, open grassy areas for hunting, and scattered shrubs or small trees for nesting (Holmes 2003).	Primarily insects during the breeding season and small vertebrates in the winter.

Landbirds (Partners-in-Flight Conservation Strategy Species)

The Forest Service has prepared a Landbird Strategic Plan (January 2000) to maintain, restore, and protect habitats necessary to sustain healthy migratory and resident bird populations. Individuals from multiple agencies and organizations within the Oregon-Washington Chapter of Partners in Flight participated in developing publications that served as references for conserving landbirds in this region (Panjabi et al. 2005).

Two conservation strategies cover the Okanogan-Wenatchee National Forest. The majority of the Forest is covered in the “Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington” (Altman 2000). This plan covers mid to high elevation forest types along the eastern slope of the Cascades and identifies primary management needs for birds in this forest zone and covers the majority of the Okanogan-Wenatchee National Forest. The principal issues affecting bird populations listed in this plan include habitat alteration from timber harvesting, changes in historic fire regimes, and grazing by livestock (Altman 2000).

The remainder of the forest is covered in the “Conservation Strategy for Landbirds in the Columbia Plateau of Eastern Oregon and Washington” (Altman and Holmes 2000), which discusses riparian, shrub-steppe, and juniper habitats. The principal issues affecting bird populations in the Columbia Plateau include habitat loss and fragmentation resulting from conversion to agriculture, and habitat degradation and alteration from livestock grazing, invasion of exotic vegetation, and alteration of fire regimes.

Both of these plans identify invasion by exotic plants as an important issue adversely affecting landbird populations. The Columbia Plateau plan states, "One of the most severe impacts in shrub-steppe has been the increased spread of exotic plants" such as cheatgrass (Altman and Holmes 2000). Although cheatgrass is not a priority invader species in this document, some sites may be treated if they are associated with other priority infestations treated within the scope of this document, or are part of priority project, such as improving important wildlife habitat.

These strategies identify groups of focal species and their associated habitat attributes that can be used to identify desired landscapes. The following tables list the priority habitat features and associated focal species for conservation from the respective plans. Conservation issues and strategies relevant to invasive plant invasions or their treatments from the respective plans are included after the habitat tables for each zone.

Table 3.7.14 Priority Habitat Features and Associated Focal Species for Conservation in Priority and Unique Habitats in the North Cascades Subprovince of the East Slope of the Cascades (Altman 2000)

Habitat	Habitat Feature	Focal Species for North Cascades
Ponderosa Pine	Large patches of old forest with large snags	White-headed woodpecker
	Large trees	Pygmy nuthatch
	Open understory with regenerating pines	Chipping sparrow
	Patches of burned old forest	Lewis' woodpecker
Mixed Conifer (Late-Successional)	Large trees	Brown creeper
	Large snags	Williamson's sapsucker
	Grassy openings and dense thickets	Flammulated owl
	Multi-layered/dense canopy	Hermit thrush
	Edges and openings created by wildfire	Olive-sided flycatcher
Oak-Pine Woodland	Early-successional/dense understory regen	Nashville warbler
	Large oaks with cavities	Ash-throated flycatcher
	Large conifer trees and snags	Lewis' woodpecker
Lodgepole Pine	Old growth	Black-backed woodpecker
Whitebark pine	Old growth	Clark's nutcracker
Meadows	Wet/dry	Sandhill Crane
Aspen	Large trees with regeneration	Red-naped sapsucker
Subalpine fir	Patchy presence	Blue Grouse

Table 3.26: Priority Habitat Features and Associated Focal Species for Conservation in Priority and Unique Habitats in the Columbia Basin Subprovince of Eastern Oregon and Washington (Altman and Holmes, 2000)

Habitat	Habitat Feature	Focal Species for Columbia Basin
Shrub-Steppe		
Steppe	Native bunchgrass cover	Grasshopper Sparrow
Steppe-Shrubland	Interspersion of tall shrubs and openings	Loggerhead Shrike
	Burrows	Burrowing Owl

	Deciduous trees and shrubs	Sharp-tailed Grouse
Riparian		
Woodland	Large snags (cottonwood)	Lewis' Woodpecker
	Large canopy trees	Bullock's Oriole
	Sub canopy foliage	Yellow Warbler
	Dense shrub layer	Yellow-breasted Chat
Shrub	Shrub density	Willow Flycatcher
Unique Habitats		
Aspen	Large trees and snags with regeneration	Red-naped Sapsucker
Cliffs and Rimrock	Undeveloped foraging areas	Prairie Falcon

Shrub-steppe habitat degradation has occurred from intensive grazing and invasion of exotics, particularly annual grasses such as cheatgrass and woody vegetation. The loss of big sagebrush communities to brush control and loss of habitat to fire management, either suppression or over-use has also occurred (Altman and Holmes 2000). Invasion and seeding of crested wheatgrass has reduces habitat availability in the Columbia Basin Subprovince (Altman and Holmes 2000). Riparian habitat degradation has occurred from conversion of native riparian shrub and herbaceous vegetation to invasive exotics such as reed canary grass, purple loosestrife (ibid.).

3.7.4 Environmental Consequences

Introduction

This section discusses impacts to various groups of terrestrial wildlife species and the potential risks associated with invasive plant treatments proposed in all alternatives. Findings and determinations for special status species are provided, including cumulative effects analysis considering other risks to these species from ongoing and proposed activities in their range.

In general, there is low risk from this project to free-ranging wildlife, such as the species discussed above in Chapter 3.7.3. This is because 1) the invasive plant sites are currently small and scattered across many watersheds and habitat areas; 2) invasive plants are concentrated on roads and other disturbed areas that do not provide optimum wildlife habitat value; and 3) the intensity of change to habitat features of value to these species is very low. The herbicides proposed for use are not likely to adverse effect or impact any wildlife species.

In contrast, no treatment, or ineffective treatment of invasive plants could result in adverse effects to habitats if current infestations continue to spread into riparian areas, late-successional forests, meadows and other valuable habitat areas.

Effects of invasive plant treatments to wildlife were evaluated in detail in the R6 PNW FEIS, the corresponding Biological Assessment (USDA Forest Service 2005c), project files, and SERA risk assessments. All treatment methods and proposed herbicides have the potential to disturb, temporarily displace, or directly harm various wildlife species or their prey. Conversely, successful control of invasive plant infestations provides long-term benefits to wildlife, by restoring native habitats.

The effects of the invasive plant treatments on wildlife are relative to the size and locations of existing and future invasive plant infestations, the type of treatment used, and the timing and duration of the treatments. Treatment of infestations along disturbed roadsides are not likely to substantially affect terrestrial wildlife populations, since this vegetation type does not provide essential habitat for native wildlife species, and it consists of long, narrow areas spread over large distances. Treatment of large infested areas may create more disturbances for longer periods than treatment of small infestations. Treatment of dense infestations can create bare ground, which may reduce cover and expose certain species to increased predation. However, invasive plants do not typically provide suitable habitat for most wildlife species.

Generally, invasive plant treatments would not alter native habitat structure or composition for terrestrial wildlife species, including TES, MIS, or bird species included in Birds of Conservation Concern (USDI Fish and Wildlife 2008c) or the Partners in Flight strategy for landbirds (Altman 2000). Incidental damage or removal of native vegetation immediately adjacent to invasive plants or within the infested weed site may occur during treatments, but would be very limited in distribution and magnitude. In some cases, removal of invasive plants could cause a localized decrease in the amount of vegetative cover provided. However, due to the patchy nature of most invasive plant infestations and the selective nature of some of the herbicides, the amount of cover lost would be very small compared to the amount of habitat available.

All treatments in all alternatives involve the potential for people to disturb nesting, roosting or breeding wildlife. The PDFs are intended to ensure that disturbance is limited where necessary.

Effects of Non-chemical Methods

Most of the treatment methods pose little to no risk to wildlife species or habitat. Risks from non-herbicide invasive plant treatment to wildlife were evaluated by consulting peer-reviewed literature, previous biological opinions, and species experts, as well as using professional judgment. For additional general effects to wildlife resulting from non-herbicide methods refer to the R6 PNW FEIS, Appendix J (USDA Forest Service 2005a).

Disturbance from manual and mechanical treatments is likely to pose greater risks to terrestrial wildlife species than herbicide or cultural methods (see Appendix J of the R6 PNW FEIS, USDA Forest Service 2005a). Small species that lack rapid mobility (e.g. amphibians, mollusks) are vulnerable to crushing or injury from people or equipment. Manual treatments can take longer to implement than other methods, increasing the length of time of disturbance. Manual treatments are often used at small sites, where the potential to impact wildlife would be minimal, but may also be used in large areas with scattered invasive plants. In these situations, crews (typically of 3 to 5 people) may be in an area for more than a day. Mechanical methods can generate more noise disturbance than other methods. Use of vehicle mounted equipment, like mowers, is less selective and more likely to directly impact small animals than use of hand operated equipment, such as string trimmers. Mechanical treatment methods would typically occur along roadsides, in rock sources, or in dispersed use sites, and areas that are unlikely to provide wildlife habitat.

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. Vehicles used to spray roadside vegetation with herbicides do not make noise above 92 dB, based on recent field measurements, so no “injury” or “harassment” from noise will occur. 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 spotted owls if used close to nests during the early nesting season. Bald eagles and peregrine falcons could be disturbed by these same tools, as well as human presence, but eagles and falcons are quite variable in their responses to activity and noise in the vicinity of their nests or roosts.

Small species that lack rapid mobility (e.g., mollusks and salamanders) are vulnerable to crushing or injury from people or equipment.

Cultural seeding treatments require native seed mixes. The planting or seeding desirable species along with invasive plant treatments can be effective at shading or out-competing invasive plants. This treatment could also cause short-term disturbance, but has the potential to restore wildlife habitat faster than passive re-vegetation.

Biological control will not directly affect native wildlife species; however, recent studies have found that native rodents may take advantage of the food source provided by biological control agents (Pearson et al. 2000). Biological control that reduces invasive plant populations, increases native plant populations, and provides a supplemental food source would be indirectly beneficial to wildlife.

Early Detection Rapid Response (EDRR)

The action alternatives would approve non-herbicide methods anywhere that these methods would be effective, and in both alternatives, timely response to new detections would be emphasized. However, Alternative 3 would rely more heavily on non-herbicide treatments and this would increase the cost and decrease the effectiveness of the response to new infestations (see Chapter 3.2). No serious adverse impacts would be expected from these treatments. Alternative 1 does not include EDRR.

Effects of Herbicides

Risk from herbicide exposure was determined using data and methods outlined in the SERA risk assessments. Tables 8 and 9 in the Biological Assessment for the R6 PNW FEIS (USDA Forest Service 2005d, pp. 138-140) 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. There is insufficient data on species-specific responses to herbicides for free-ranging wildlife, so wildlife species were placed into groups based on taxa type (e.g. bird, mammal), body size, and diet (e.g. insect eaters, fish eaters, herbivores). Quantitative estimates of dose for each animal grouping for each herbicide are contained in the project file worksheets.

Under “worst case” scenarios, mammals and birds that eat insects or grass may be harmed by some herbicides and surfactants. Amphibians also appear to be at higher risk of adverse effects due to their permeable skin and aquatic or semi-aquatic life history. The 2011 glyphosate risk assessment indicates that use of POEA surfactants may be associated with greater impacts that use of glyphosate alone. This project does not include the use of POEA surfactants.

The “worst case” 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, and/or implementation of PDFs. Therefore, risk is overestimated when compared to actual applications proposed in this project.

Nonetheless, caution in the design and implementation of the project is warranted. In many cases, insufficient data is available to allow for a quantitative risk assessment. For instance, there is no quantitative scenario for a predatory bird that eats primarily other birds, such as the peregrine falcon, so the “fish-eating bird” scenario was used as a surrogate. This scenario likely overestimates the dose to the peregrine falcon because the hypothetical fish consumed are from a pond contaminated by a large spill of herbicide. These hypothetical fish likely have higher concentrations of herbicide in their bodies (and thus a higher dose to the predatory bird) than would a small bird that incidentally ingested herbicide before it was preyed upon. Also, data was insufficient to assess risk of chronic exposures for insect-eating birds and mammals for several herbicides.

The limited spatial extent of infestations, which are limited primarily to disturbed roadsides and the limits placed on herbicide applications, would reduce exposure of wildlife to herbicides. Standards 19 and 20 adopted in the R6 PNW ROD require that adverse effects to wildlife species be minimized or eliminated through project design and implementation. In addition, Standard 16 restricts broadcast use of triclopyr, which eliminates plausible exposure scenarios. All action alternatives must be designed to comply with these standards. The limited spatial extent of infestations (80 percent of sites are 0.25 acres or less) and the limits placed on herbicide applications would reduce exposure of wildlife to herbicides. To account for uncertainty, the project design feature (PDF) place restrictions on how and where herbicides are applied.

Professional judgment was used to evaluate the life history traits (e.g. diet, habitat, activity patterns, seasonal occurrence, etc.) of each wildlife species to determine the likelihood of exposure to herbicides used to treat invasive plants. The combinations of likelihood of exposure, dose estimated from exposure scenarios, and GIS wildlife location data for the Forest were used to conclude a risk of effect from herbicide treatments. The exposure scenarios result in a dose below the toxicity index for aminopyralid, chlorsulfuron, clopyralid, imazapic, imazapyr, picloram and metsulfuron methyl, and therefore the effects of these chemicals on wildlife will not be discussed in great detail. Glyphosate, picloram, and triclopyr TEA pose low, but comparatively greater risk.

Data are limited regarding the potential for adverse effects of herbicides on mollusks and amphibians. There are 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 fish (as determined by the quantitative estimates from exposure scenarios) will also be considered to pose a risk to amphibians.

Relyea (2005) found no effect to three species of aquatic snails from the glyphosate formulation Roundup. Only glyphosate and picloram have been tested on a terrestrial mollusk; the brown garden snail (*Helix aspersa*). Neither glyphosate, nor picloram appeared to pose a risk to the snail (USDA Forest Service 2005d, Appendix B).

Forest Plan Amendment

The two action alternatives would amend the Okanagan and Wenatchee Forest Plans adding the herbicide aminopyralid to the list of approved active ingredients. This would benefit wildlife by 1) increasing treatment effectiveness (see Chapter 3.2) and 2) reducing risks associated with other herbicides, specifically glyphosate, picloram, and triclopyr. In addition, the low risk of hexaclorabenzene posed by exposure to picloram and clopyralid would be eliminated if aminopyralid is used instead.

Summary of Direct and Indirect Effects by Alternative

Alternative 1

The No Action alternative could result in a substantial loss of habitat over time for several wildlife species. As habitats become more and more dominated by invasive plants, they would not be used, or used less, by native and rare wildlife species. Some decrease in available foraging habitat for elk and other big game is possible within the project area as a result of invasive plant spread. Rice et al. 1997; Trammell and Butler (1995) found that deer and elk avoided sites infested with leafy spurge. The spread of invasive wetland plants could reduce waterfowl nesting habitat (Van Driesche et al. 2002, Blossey

1999). Spread of common burdock could result in additional instances of direct mortality to bats and hummingbirds. Invasions of purple loosestrife makes habitat unsuitable for numerous birds, reptiles and mammals (Rawinski and Malecki 1984; Thompson et al. 1987, Weiher et al. 1996). Under Alternative 1, infestations that have spread and new infestations that are found would go untreated, and would likely continue to expand. Habitat for a variety of wildlife, including some of the Forest Service sensitive species, would likely degrade to the point that habitat becomes unsuitable.

Risks to wildlife from about 6,000 acres of existing treatments would be low. However, some of the herbicides that pose relatively greater risk to birds and mammals (e.g., glyphosate, picloram, triclopyr), would be used instead of newer herbicides that pose relatively less risk (e.g., metsulfuron methyl, imazapyr, aminopyralid).

Alternative 2

Alternative 2 has the best chance of containing, controlling or eradicating invasive plants because a fuller range of tools would be allowed for use. This would benefit wildlife by protecting habitats from invasive plants.

This alternative allows for the most herbicide use, including use of herbicides that pose relatively higher risk to birds and mammals (glyphosate, picloram, triclopyr). However, these herbicides are preferred in only about 10 percent of the current infestations, and relatively lower risk herbicides such as aminopyralid would be preferred for the majority of sites. Given low priority of these herbicides, the type of infestations that would be treated, the PDFs and buffers, there is the low likelihood that wildlife would be exposed to harmful levels of herbicide. These herbicides do not bioaccumulate in the bodies of animals.

The use of clopyralid and picloram near peregrine falcon nesting areas could result in low exposure to hexachlorobenzene (HBC) that is implicated in egg shell thinning (Pagel 2004-2006). PDFs eliminate this low risk. Alternative 2 allows for use of aminopyralid, which is preferred for many broadleaf target species that are currently being treated using higher risk herbicides.

A discussion about each species/groups of species discussed in the affected environment section is discussed below.

Alternative 3

Alternative 3 is similar to Alternative 2 because all of the same treatment methods would be approved. However, Alternative 3 is less likely to suppress, contain, control or eradicate invasives and increase the cost and decrease effectiveness of treatments (see Chapter 3.2). In some cases, wildlife habitats would be at greater risk from invasive plant infestations. There would be less risk associated with herbicide use and more risk of general disturbance from manual and mechanical methods. However, these impacts are relatively minor (see Appendix J R6 PNW FEIS) and would be limited in extent.

Alternative Comparison

Effects on Federally Listed Species

Gray Wolf

Direct and Indirect Effects

Analysis conducted for the Wildlife Biological Assessment for R6 PNW FEIS indicated that herbicide exposures of concern are highly unlikely for wolves or their prey. No reduction in security, no increase in development or human activity levels would result from the action alternatives. Direct effects from invasive plant treatments include disturbance caused by noise, people and vehicles.

Disturbance by humans and vehicles during project implementation is the primary mechanism that could cause adverse effects for gray wolf. Project design features for activities conducted adjacent to den and rendezvous sites would minimize adverse effects from disturbance.

The action alternatives comply with PDF J-1, which seasonally limits disturbance. Thus, disturbance effects would be minimal. No Action treatments also include seasonally limitations.

The use of glyphosate, picloram, and/or triclopyr poses greatest relative risk; these herbicides would be used the least in Alternative 3. However, even in Alternative 2, wolves would not be exposed to harmful levels of any herbicide.

Cumulative Effects

Section 3.1.6 lists past, present (ongoing) and reasonably foreseeable future projects on the Forest. The potential overlap of impacts of invasive plant treatment and these activities on the gray wolf and their habitat was considered in this analysis. Wolves are exposed to disturbance from vehicle traffic, recreationists, timber harvest activities, development, and other sources of disturbance and habitat loss on both federal and non-federal lands. It is unlikely that there would be negative cumulative effects to gray wolves from Alternatives 2 and 3 when added to other federal and non-federal activities, because Alternatives 2 and 3 create only discountable or no effects from disturbance or herbicide exposure, do not change wolf security habitat, and would be unlikely to occur at the same time as other projects in the same area. Invasive plant treatments typically occur in small patches, primarily along roads, would be relatively short in duration, and would likely occur only once or twice during the treatment season. The probability of an effect from Alternatives 2 and 3 is so low that it could not be added to other actions occurring on National Forest System lands or other ownerships in a meaningful way. Therefore, the alternatives would not result in any cumulative effects to the gray wolf.

Canada Lynx

Direct and Indirect Effects

The proposed invasive plant treatment project has low potential to cause disturbance to the Canada lynx. Prey habitat is unlikely to be affected. The use of glyphosate, picloram, and/or triclopyr poses greatest relative risk and these herbicides would be used the least in Alternative 3. However, even in Alternative 2, lynx would not be exposed to harmful levels of any herbicide. Treatments would not reduce forest cover, large woody debris, or habitat connectivity, nor would they increase in development or human activity levels.

Disturbance to lynx can be caused by noise, people and vehicles. PDF J-1 would limit disturbance between May 1 and August 31, should treatments occur within 1 mile of active dens. This protection zone distance was recommended from Ruggerio et al. (2000) as a precaution to prevent kitten survival. However, it is unlikely that an invasive plant treatment project would occur close enough to suitable denning areas that disturbance would be a concern.

Invasive plant treatments would not remove or degrade suitable habitat since invasive plants do not provide adequate forage for snowshoe hare or other prey. Successful control of invasive plant infestations provides long-term benefits to lynx by restoring native habitat and forage for their prey and preventing future degradation of habitat.

Cumulative Effects

Section 3.1.6 lists past, present (ongoing) and reasonably foreseeable future projects on the Forest. The potential overlap of impacts of invasive plant treatment and these activities on Canada lynx and their habitat was considered in this analysis. Canada lynx are exposed to disturbance from vehicle traffic, recreationists, timber harvest activities, development, and other sources of disturbance and habitat loss on both federal and non-federal lands. It is unlikely that there would be negative cumulative effects to Canada lynx from Alternatives 2 and 3 when added to other federal and non-federal activities, because Alternatives 2 and 3 create only discountable or no effects from disturbance or herbicide exposure and do not remove or degrade lynx habitat. Invasive plant treatments typically occur in small patches and primarily along roads within lynx habitat, would be relatively short in duration, and would likely occur only once or twice during the treatment season. The probability of an effect from Alternatives 2 and 3 is so low that it could not be added to other actions occurring on National Forest System lands or other ownerships in a meaningful way. Therefore, the alternatives would not create any cumulative effects to Canada lynx.

Grizzly Bear

Direct and Indirect Effects

Analysis conducted for the R6 PNW FEIS on invasive plants (USDA Forest Service 2005a) indicated that herbicide exposures of concern are highly unlikely for grizzly bear or their prey. This is because a grizzly bear would not plausibly be exposed to herbicide directly, nor could they encounter enough contaminated prey to be affected. See Risk Assessment Worksheets in the project record for Hazard Quotient calculations.

Disturbance caused by noise, people and vehicles could occur during implementation of manual, mechanical, cultural and chemical treatments. However, disturbance is expected to be negligible for the following reasons:

- Since grizzly bears den during the winter and invasive plant treatment will occur April through September, no disturbance to denning individuals is expected.
- Disturbance to traveling individuals is highly unlikely as invasive plant treatments are short-term with few people and might only be repeated once in the same growing season (1 day or less). Therefore disturbance resulting from invasive plant treatments would be of low level, short duration and infrequent.
- Areas infested with invasive plants are usually roadsides and openings created by logging. Grizzly bears tend to avoid open roads (Gaines et al. 2003). Less than one percent of the grizzly bear core area is located with the analysis area.
- Grizzly bears are uncommon within the forest and are unlikely to encounter any individual area when humans are present.
- PDF J-1 includes a seasonal disturbance restriction.

Cumulative Effects

Section 3.1.6 lists past, present (ongoing) and reasonably foreseeable future projects on the Forest. The potential overlap of impacts of invasive plant treatment and these activities on the grizzly bears and their habitat was considered in this analysis. Grizzly bears may be subjected to disturbance from vehicle traffic, recreationists, timber harvest activities, development, and other sources of disturbance and habitat loss on both federal and non-federal lands. It is unlikely that there would be negative cumulative effects to grizzly bears from the alternatives, even when added to other federal and non-federal activities, because the direct and indirect effects are discountable and would not combine with effects from disturbance or herbicide exposure to impact individual bears or their habitat.   Invasive plant treatments typically occur in small patches and primarily along roads, would be relatively short in duration, and would likely occur only once or twice during the treatment season. The probability of an effect from Alternatives 2 and 3 is so low that it could not be added to those from other ownerships in a meaningful way. Therefore, the alternatives would not create any cumulative effects to the grizzly bear.

Northern Spotted Owl and Goshawk

Direct and Indirect Effects

Analysis conducted for the R6 PNW FEIS (USDA Forest Service 2005a) indicated that herbicide exposures of concern are highly unlikely for spotted owls or their prey with the herbicides approved for use in the R6 PNW ROD (USDA 2005b). No change in habitat structure or composition would occur. The only likely effect from invasive plant treatments is noise disturbance to nesting owls caused by machinery used for some treatments along maintenance level 1 (closed) roads. Invasive plant treatments along open system roads are considered to be within normal ambient noise levels and noise disturbance to nesting owls is expected to be negligible for the following reasons:

- PDF J-2 requires that invasive plant management that create noise above ambient levels would not take place within 0.25 mile of a nest site or activity center whose status is unknown, or un-surveyed nesting habitat within 0.25 mile of maintenance level 1 (closed) roads during breeding season (between March 1 and July 31). There are no seasonal restrictions on invasive plant treatments along the roadside of open roads as these activities fall within normal ambient levels.

- The 0.25 mile protection zone distance has been included in several biological opinions throughout spotted owl range and has been found to be effective at minimizing effects to spotted owls, because it reduces or eliminates the source of disturbance near nests or suitable habitat.

- The 0.25 mile protection zone distance was originally designed to protect owls from noise and disturbance generated by timber harvest activities. Proposed invasive plant treatments would generate less noise than timber sale activities and would occur on a smaller spatial scale.

- Individual invasive plant treatments in or near spotted owl habitat are likely to be of short duration because they are generally small.

An analysis of spotted owl pellets on the Okanogan-Wenatchee National Forest showed the primary prey species is the northern flying squirrel (G*laucomys sabrinus*), bushy-tailed woodrat (*Neotoma cinerea*) and voles (*Microtus* spp.) (Richards 1989; Forsman et al. 2001). These prey items are nocturnal and hide under cover during the day. Flying squirrels are chiefly arboreal and feed primarily on fungi and lichen. Voles, mice, and wood rats eat primarily vegetation and seeds. While it is unlikely that arboreal owls or their primary prey would be exposed to herbicides used within the owls' activity centers, some of their other prey, like mice and woodrats, could be exposed to treated vegetation.

Prey is unlikely to be directly sprayed because they are largely nocturnal, hide under cover during the day, and would likely flee areas with human activity. However, a worst-case exposure scenario for spotted owls was conducted using prey that had been directly sprayed, with the assumption that 100 percent of the herbicide is absorbed by the prey, and the prey is ingested immediately by the owl. Direct spray of the prey is used because that scenario results in a higher dose to the prey and owl than would ingesting a prey item that had consumed treated vegetation.

Invasive plants are not common within old growth forests that provide habitat for the spotted owl. Invasive plants occur primarily along roads or in other disturbed areas. Current and future invasive plant treatments would not remove or modify any of the primary constituent elements that define critical habitat. No native trees would be removed or treated during invasive plant management activities. Invasive plant treatment would not change canopy closure or affect other components of forest structure (e.g. tree size, snags, down logs). Treatments at known infestations, and at newly discovered infestations, would not change the amount of nesting, roosting, foraging or dispersal habitat, nor affect habitats required by their prey.

The effects are similar for goshawk. No change in habitat structure or composition would occur. Noise disturbance to nesting goshawk could be caused by machinery used for some treatments along maintenance level 1 (closed) roads. Invasive plant treatments along open system roads are considered to be within normal ambient noise levels. PDF J-11 avoids disturbing active goshawk nests.

Invasive plants are not common within old growth forests that provide habitat for the goshawk. Invasive plants occur primarily along roads or in other disturbed areas. Invasive plant treatment would not change canopy closure or affect other components of forest structure (e.g. tree size, snags, down logs). Treatments at known infestations, and at newly discovered infestations, would not change the amount of nesting, roosting, foraging or dispersal habitat, nor affect habitats required by goshawk prey.

Cumulative Effects

Section 3.1.6 lists past, present (ongoing) and reasonably foreseeable future projects on the forest. The potential overlap of impacts of invasive plant treatment and these activities on northern spotted owls and their habitat was considered in this analysis. Northern spotted owls and goshawks are exposed to disturbance from vehicle traffic, recreationists, timber harvest activities, development, and other sources of disturbance and habitat loss on both federal and non-federal lands. It is unlikely that Alternatives 2 and 3 would add to the negative effects to northern spotted owls when added to other federal and non-federal activities, because effects from the alternatives are discountable or have no effects as a result of disturbance or herbicide exposure, and do not remove or degrade spotted owl habitat. Invasive plant treatments typically occur in small patches and primarily along roads within spotted owl habitat, create noise that is within ambient noise levels, are of short duration, and would likely occur only once or twice during the treatment season. The probability of an effect from the alternatives is so low that it could not be added to other actions on the Forest or to those from other ownerships in a meaningful way. Therefore, the alternatives would not create any cumulative effects to northern spotted owls or goshawks.

Marbled Murrelet

Direct and Indirect Effects

No marbled murrelet nest sites are confirmed on the Okanogan-Wenatchee National Forest. Approximately 218 acres of potential murrelet habitat occurs within mapped polygons and of these approximately 96 acres occur and within 1/4 mile of closed system roads. It is highly unlikely marbled murrelets are present on the Forest due to the distance and flight factors needed to access the Forest (flight over the Cascade Crest). There is no Designated Critical Habitat for the marbled murrelet on the Okanogan-Wenatchee National Forest.

Murrelets feed on marine fish, which would not be exposed to herbicides from control of invasive plants on the Okanogan-Wenatchee National Forest, or its administered lands, because no marine habitat exists on the Forest. However, some murrelets in some locations have been reported to feed upon freshwater fish (Carter and Sealy 1986). However, even at maximum use rates, there is no risk that a murrelet would eat a contaminated fish and be harmed by any alternative in this project.

The primary risk the proposed invasive plant treatments could have on the marbled murrelet is the potential to cause disturbance during breeding season (USDA Forest Service 2005a). Disturbance to nesting murrelets is expected to be negligible in this project for the following reasons:

- PDF J-3 require that invasive plant management that create noise above ambient levels not take place within 0.25 mile of a nest site, activity center with unknown status, or un-surveyed nesting habitat within 0.25 mile of level 1 (closed) roads during breeding season (between April 1 and September 15 – may be adjusted based on local knowledge or waived if no evidence of nesting). No seasonal restrictions on invasive plant treatments along the side of open roads are required because these treatments would fall within normal ambient levels.

- Invasive plants are not widespread within marbled murrelet (old growth) habitat; they occur primarily along road shoulders, powerline corridors and adjacent harvest units. Minimal treatment would occur within or adjacent to habitat.

- Invasive plant treatments in or near marbled murrelet habitat are likely to be of short duration (1 day or less).

- Marbled murrelets are unlikely to occur on the Forest and are not known to nest on the Forest.

Based on the above, the disturbance effects to marbled murrelets created by the implementation of mechanical, cultural, biological, manual and chemical methods to treat invasive plants—including equipment used to spray roadside vegetation—are insignificant.

Cumulative Effects

Section 3.1.6 lists past, present (ongoing) and reasonably foreseeable future projects on the forest. The potential overlap of impacts of invasive plant treatment and these activities on marbled murrelets and their habitat was considered in this analysis. Marbled murrelets are exposed to disturbance from vehicle traffic, recreationists, timber harvest activities, development, and other sources of disturbance and habitat loss on both federal and non-federal lands.

It is unlikely that any of the alternatives would contribute to negative effects on marbled murrelets when added to other federal and non-federal activities, because minimal impact from disturbance or herbicide exposure is expected and treatments would not remove or degrade murrelet habitat. Invasive plant treatments are typically occur in small patches along roads within murrelet habitat, create noise that is within ambient noise levels, would have relatively short duration, and would likely occur only once or twice during the treatment season. The probability of an effect is so low that it could not be added to other actions on the Forest or to those from other ownerships in a meaningful way. Therefore, the alternatives would not create any cumulative effects to marbled murrelets.

Wolverine

Direct and Indirect Effects

Wolverines occur in remote areas of the Okanogan-Wenatchee National Forest. There are approximately 109,425 acres of wolverine denning (high elevation) habitat on the forest. About 16 acres of wolverine denning habitat are infested. Less than 1 percent of the denning habitat is proposed for treatment; therefore, unaffected habitat which could be used for any displaced animal is widely available.

Disturbance associated with all treatments in all alternatives would be short-term in nature (a few days) and limited extent (i.e. localized). Disturbance resulting from all treatments methods is expected to be negligible for the following reasons:

- Disturbance to natal dens would not occur based on treatment period; invasive plant treatments would not occur during wolverine denning period (February through early May).
- Disturbance to traveling individuals is highly unlikely as invasive plant treatments are typically of short-duration, infrequent, and accomplished with few people.
- Areas infested with invasive plants are usually roadsides and openings created by timber harvest, which are generally avoided by wolverine (Gaines et al. 2003).
- No invasive plant treatments including manual, mechanical, chemical, biological and cultural methods would remove or alter wolverine or Cascade red fox habitat.

Wolverine's prey includes small and medium-size mammals, birds and carrion. It is extremely unlikely that a wolverine would enter into an invasive plant treatment area, because they are rare within the forest and generally avoid areas where there has been recent human activity (Gaines et al. 2003). Thus, they are unlikely to be directly sprayed or encounter vegetation or prey that has been recently sprayed. No exposure scenarios exceed a level of concern for any herbicide in any alternative in this project.

Cumulative Effects

Chapter 3.1.6 lists past, present (ongoing) and reasonably foreseeable future projects on the Forest. The potential overlap of impacts of invasive plant treatment and these activities on the North American wolverine and their habitats was considered in this analysis. Wolverines may be subjected to disturbance from vehicle traffic, recreationists, timber harvest activities, development, and other sources of disturbance and habitat loss on both federal and non-federal lands.

It is unlikely that there would be negative cumulative effects to either species from the alternatives when added to other federal and non-federal activities, because the alternatives create only discountable or no effects from disturbance or herbicide exposure, do not change habitat, and would be unlikely to occur at the same time as other projects in the same area. Invasive plant treatments typically occur in small patches and primarily along roads, would be relatively short in duration, and would likely occur only once or twice during the treatment season. The probability of an effect from the action alternatives is so low that it could not be added to those from other ownerships in a meaningful way. Therefore, the alternatives would not add incrementally to effects of other projects on the North American wolverine.

Regional Forester Sensitive Species

Cascade Red Fox

Direct and Indirect Effects

There are no known red fox den sites on the Okanagan-Wenatchee National Forest. Few infested acres are currently mapped within widespread fox habitat.

Disturbance associated with all treatments in all alternatives would be short-term in nature (a few days) and limited extent (i.e. localized). Disturbance resulting from all treatments methods is expected to be negligible for the following reasons:

- Disturbance to natal dens would not occur based on treatment period; invasive plant treatments would not occur during the fox denning period (February through early May).
- Disturbance to traveling individuals is highly unlikely as invasive plant treatments are typically of short-duration, infrequent, and accomplished with few people.
- Areas infested with invasive plants are usually roadsides and openings created by timber harvest, which are generally avoided by wolverine (Gaines et al. 2003).
- No invasive plant treatments including manual, mechanical, chemical, biological and cultural methods would remove or alter Cascade red fox habitat.

It is not likely for fox to be exposed to herbicide from this project given the low extent of infestation in widespread habitat.

Cumulative Effects

Chapter 3.1.6 lists past, present (ongoing) and reasonably foreseeable future projects on the Forest. The potential overlap of impacts of invasive plant treatment and these activities on the Cascade red fox and their habitats was considered in this analysis. Fox may be subjected to disturbance from vehicle traffic, recreationists, timber harvest activities, development, and other sources of disturbance and habitat loss on both federal and non-federal lands.

It is unlikely that there would be negative cumulative effects to Cascade red fox from the alternatives when added to other federal and non-federal activities, because the alternatives create only discountable or no effects from disturbance or herbicide exposure, do not change habitat, and would be unlikely to occur at the same time as other projects in the same area. Invasive plant treatments typically occur in small patches and primarily along roads, would be relatively short in duration, and would likely occur only once or twice during the treatment season. The probability of an effect from the action alternatives is so low that it could not be added to those from other ownerships in a meaningful way. Therefore, the alternatives would not add incrementally to effects of other projects on the Cascade red fox.

Western Gray Squirrel

Direct and Indirect Effects

Disturbance from all treatment methods is not likely to affect the western gray squirrel, because they are arboreal and nests in trees (WDFW 2005a). These trees would not be affected by the treatments.

Invasive plants can affect truffles and other fungi foraging habitat (Mallory Lenz, personal communication). Thus, ineffective or absence of treatment could result in continued habitat degradation. No ground based applications of herbicide would reach the upper canopies of mature trees where squirrels nest. However, they forage on the ground, and could be exposed to herbicides by consuming contaminated fungi. However, the Herbicide Risk Assessments and associated worksheets do not indicate that a squirrel could receive a harmful dose of herbicide through this exposure mechanism. Alternative 2 would treat the most area using herbicides of all the alternatives, however, no harmful exposures are plausible.

Cumulative Effects

Section 3.1.6 lists past, present (ongoing) and reasonably foreseeable future projects on the Forest. The potential overlap of impacts of invasive plant treatment and these activities on gray squirrels and their habitat was considered in this analysis.

Invasive plant treatments are typically in small patches, occur primarily along roads or in other disturbed areas, create noise that is generally within ambient levels, would be of relatively short duration, and would likely be repeated only once or twice during the treatment season. The probability of an effect is so low that it would not add incrementally to those from other federal and non-federal activities in a meaningful way. There is no potential for cumulative effects from herbicide exposure. The herbicides proposed for use do not bioaccumulate or biomagnify, therefore, the alternatives would not add incrementally to the effects of other projects on western gray squirrels.

Townsend's Big-eared Bat and Little Brown Myotis

Direct and Indirect Effects

Proposed invasive plant treatments are not likely to disturb the Townsend's big-eared bat or little brown myotis. Invasive plants do not occur in close proximity to the bats or myotis themselves, so disturbance from treatment of known sites is unlikely. Documented roost sites are in caves, mine shafts, and buildings on the Forest that are also distant from invasive plant polygons. Therefore, disturbing roosting bats or myotis is highly unlikely. They may roost on bridges within or near treatment areas. Roadside treatments typically consist of a boom or nozzle spray attached to a pick-up truck, or a person with a backpack sprayer conducting spot sprays of plants. These treatment methods do not generate noise beyond the background noise of the road and bridge use, and do not occur in close proximity to bats themselves. Therefore, there is little likelihood of disturbing roosting bats during treatment of roadside invasive plants.

These animals would not be directly exposed to spray of herbicides in any alternative since all spraying is conducted during daylight hours when bats are roosting far above the ground. They forage over large areas at night, catching insects (primarily moths) in flight or by gleaning from vegetation. In all alternatives, the small amount of acreage proposed for treatment, scattered in small patches, make it unlikely that bats would forage on insects that have been inadvertently sprayed by herbicides. Even if contaminated insects were ingested by a bat, the amount of herbicide exposure to the bat would be very low and the risk assessment worksheets do not indicate a level of concern for any herbicide.

Data are lacking on risk from chronic herbicide exposure of bats to contaminated insects. However, given the small acreages treated and the relatively large areas in which bats and myotis forage, they are not likely to forage exclusively within treated areas over a 90-day period (the chronic exposure). Thus, no plausible risk from chronic exposure exists.

Cumulative Effects

Section 3.1.6 lists past, present (ongoing) and reasonably foreseeable future projects on the Forest. The potential overlap of impacts of invasive plant treatment and these activities on Townsend's big-eared bats and little brown myotis and their habitats was considered in this analysis. The alternatives would not contribute to negative effects on bats or myotis when added to other federal and non-federal activities because exposure to herbicides and disturbance is extremely unlikely.

Mountain Goat

Direct and Indirect Effects

Disturbance to mountain goat resulting from all treatments is expected to be negligible for the following reasons:

- Existing habitat infested by invasive plants is limited (less than 0.5% of habitat on the Okanogan-Wenatchee Forest is currently infested by invasive plants).
- Mountain goat habitat is unfavorable for most invasive plant establishment.
- Any disturbance would typically be short-term, low intensity, infrequent and limited in extent.

The SERA Risk Assessments and Risk Assessment worksheets indicate that some of the herbicides proposed for use could adversely affect digestion or have other sub lethal impacts to grass eating mammals. At the maximum rates proposed for use on this project, clopyralid, glyphosate, picloram, and triclopyr all have the potential to exceed the threshold of concern for grass eating mammals. However, given the low level of habitat infested or threatened by invasive plants, it is not likely mountain goats would consume large enough quantities of herbicide sprayed vegetation to receive a high enough dose to affect the animal. Alternative 2 poses relatively greater risk due to more extensive use of these herbicides, however, the risks are outweighed by positive benefits on native plants and habitat from effectively treating the invasive plants. Goat habitat requirements would not be adversely affected by the project.

Cumulative Effects

Section 3.1.6 lists past, present (ongoing), and reasonably foreseeable future projects on the Forest. It is unlikely that the alternatives would contribute negative impacts to mountain goats when incrementally added to other federal and non-federal activities because effects from habitat loss, disturbance or herbicide exposure would be minor or discountable (see above). Other activities, such as grazing, prescribed burning, road maintenance or recreation would also create disturbance or may modify habitat, and the incremental addition of disturbance effects from invasive plant treatments are so low in magnitude, short in duration, and low in intensity that could not be measurably added to the effects of other projects. With all direct, indirect, and cumulative effects considered, mountain goat populations are expected to remain stable.

California Bighorn Sheep

Direct and Indirect Effects

Disturbance to bighorn sheep resulting from all treatments is expected to be negligible for the following reasons:

- Less than 1 percent of available habitat is proposed for treatment; therefore, unaffected habitat which could be used for any displaced animal is widely available. Disturbance associated with all treatments would be short-term in nature (a few days) and limited extent (i.e. localized).

- There would be no disturbance to bighorn sheep during critical time periods: no treatment would occur on lambing grounds, as it is unfavorable for most plant establishment; treatments to winter range would occur during spring through fall, outside bighorn sheep use period.

The SERA Risk Assessments and Risk Assessment worksheets indicate that some of the herbicides proposed for use could adversely affect digestion or have other sub lethal impacts to grass eating mammals. At the maximum rates proposed for use on this project, clopyralid, glyphosate, picloram, and triclopyr all have the potential to exceed the threshold of concern for grass eating mammals. However, bighorn sheep are not likely to consume large enough quantities of herbicide sprayed vegetation to receive a high enough dose to affect the animal. Alternative 2 poses relatively greater risk due to more extensive use of these herbicides, however, the risks are outweighed by positive benefits on native plants and habitat from effectively treating the invasive plants. Sheep habitat requirements would not be adversely affected by the project.

Cumulative Effects

Section 3.1.6 lists past, present (ongoing), and reasonably foreseeable future projects on the Forest. It is unlikely that the alternatives would contribute negative impacts to bighorn sheep when incrementally added to other federal and non-federal activities because effects from habitat loss, disturbance or herbicide exposure would be minor or discountable (see above). Other activities, such as grazing, prescribed burning, road maintenance or recreation would also create disturbance or may modify habitat, and the incremental addition of disturbance effects from invasive plant treatments are so low in magnitude, short in duration, and low in intensity that could not be measurably added to the effects of other projects. With all direct, indirect, and cumulative effects considered, bighorn sheep populations are expected to remain stable.

Bald Eagle

Direct, Indirect and Cumulative Effects

Bald eagles are sensitive to human disturbance during the breeding season (USDI Fish and Wildlife Service 1999a), particularly within sight distance of nest sites. Human and vehicle presence can cause the birds to leave nests or stay away from the nest long enough to have detrimental effects to eggs or young (USDI Fish and Wildlife Service 1986). Mechanical methods (e.g. string trimmers, road brusher and mowers) are more likely to cause effects at greater distances than other treatment methods, because machinery creates louder noise than other methods.

Disturbance near winter roost sites is not likely to occur because invasive plant treatments do not occur during the winter use period of October 31 to March 31. Currently, 38 infested acres are mapped within 450 meters of bald eagle nests and less than 3 infested acres are mapped within occupied nesting habitat. PDF J-4 requires that treatment be discouraged or minimized within 450 meters of bald nests from January 1 to August 15 each year. Local knowledge may be used to adjust dates, size and shape of distance buffers, to site-specific conditions. This only applies to treatment activity that creates noise above ambient levels and human presence that would cause eagles to abandon the nest (as determined by a local specialist). Occupancy of nest sites would be determined each year prior to treatment. This would minimize disturbance to nesting bald eagles and protect eggs and nestlings. The low intensity of the disturbance related to invasive plant treatment, the and low duration (usually 1 day or less) of treatment disturbance, and the small scattered nature of the infestations all reduce potential for disturbance for any alternative to bald eagle.

The fish-eating, and prey-eating bird scenario was evaluated for all herbicides proposed in any alternative, and no accidental, acute or chronic exposures of concern were indicated.

There are no direct or indirect effects to bald eagles likely, so there are no effects to add incrementally to other actions on Federal and non-Federal lands. No cumulative effects to bald eagles would result.

Peregrine Falcon

Direct and Indirect Effects

There are 4 documented peregrine nest sites located within 0.5 mile of mapped polygons. There are 34 infested acres within 0.5 mile of known peregrine falcon nest sites. Approximately 361 mapped polygon acres are within 1.5 miles of known peregrine eyries. Approximately 35,298 acres of plant mapped polygons are located within 1.5 miles of potential peregrine nesting habitat and of these acres approximately 6,877 acres are infested.

There is low risk of disturbance or herbicide exposure to falcons even though there may be treatments relatively close to their habitat. Invasive plant treatments are typically in small patches, occur primarily along roads or in other disturbed areas, create noise that is generally within ambient levels, would have relatively short duration, and would likely be repeated only once or twice during the treatment season and. Habitat would not be altered resulting from treatment.

Disturbance would be minimized by adherence to PDF J-5: Treatment of areas generally within 0.5 mile of peregrine nest would be timed to occur outside the nesting/fledgling period, which is generally March 1 through June 30. Local knowledge may be used to adjust dates, size and shape of distance buffers, to site-specific conditions. This only applies to treatment activity that creates noise above ambient levels and human presence that would cause peregrines to abandon the nest (as determined by a local specialist). Occupancy of nest sites would be determined each year prior to treatment. This would minimize disturbance to nesting peregrine falcons and protect eggs and nestlings.

The fish-eating, and prey-eating bird scenario was evaluated for all herbicides proposed in any alternative, and no accidental, acute or chronic exposures of concern were indicated.

Hexachlorobenzene (HCB), the contaminant in picloram, and to a lesser extent clopyralid, do bioaccumulate in animal tissue; however they are present in very small amounts (picloram, 8 parts per million and clopyralid, <2.5 parts per million). The risk of bioaccumulation of HCB from picloram and clopyralid use therefore is very low. The R6 PNW FEIS (USDA Forest Service 2005a), states that HCB is a ubiquitous and persistent chemical in the environment and the amount released from Forest Service use would be inconsequential in comparison to existing background levels and annual releases from manufacturing. However, use of picloram and clopyralid in remote locations would constitute the primary source of HCB in those areas.

Monitoring of peregrine falcons in the PNW has revealed HCB in their blood samples, and peregrine populations in the PNW appear to continue to be affected by contaminants, although not HCB specifically. Eggshell thinning induced by DDE, the metabolite of DDT, affect populations in the Pacific Northwest and elsewhere, and residual levels of DDE continue to be detected in some peregrines (Henny et al. 1996; Mora et al. 2002). Reproductive failure at peregrine nests has been chronic in northern CA and OR due to eggshell thinning (USDI Fish and Wildlife Service 1999b).

As a further precaution to prevent risk of picloram and clopyralid exposure, PDF J-5 limits the use of clopyralid to one application per site per year, within 1.5 miles of peregrine nests; and limits the use of picloram to one application per site per two years, within 1.5 miles of peregrine nests. With the implementation of PDF J-5, exposure of eggs to harmful levels of HCB would not occur.

The use of aminopyralid instead of clopyralid or picloram would eliminate HCB exposure. This is one reason that the Forest Plan amendment and inclusion of this herbicide in the action alternatives would be beneficial to wildlife and reduce potential adverse effects from treatment.

Cumulative Effects

The probability of an effect is so low that it could not be added to those from other federal and non-federal activities in a meaningful way. Thus, no cumulative effects are possible from this project.

Great Gray Owl

Direct, Indirect and Cumulative Effects

No impact to great gray owl is expected, from disturbance or herbicide. Treating invasive plants would improve great gray owl foraging habitat; alternative 2 has the greatest potential to realize this benefit (see Chapter 3.2).

Three known nests are located within 0.25 mile of an infested acre. Approximately 22 infested acres occur within 0.25 mile of known nest sites. Invasive plant treatments are typically in small patches, occur primarily along roads or in other disturbed areas, create noise that is generally within ambient levels, would have relatively short duration, and would likely be repeated only once or twice during the treatment season and PDFs would prevent disturbance to nesting birds. Active owl nest sites would be protected from disturbance above ambient noise levels during nesting periods (PDF J-11). This would prevent invasive plant treatments from disturbing nesting owls.

Herbicide exposure would not harm great gray owl. The dose estimated for "mammal-eating bird" was used to determine potential herbicide effects. Prey are unlikely to be directly sprayed because they are largely nocturnal and hide under cover during the day, and would likely flee areas with human activity. However, a worst-case exposure scenario for the great gray owl was conducted assuming consumption of prey that had been directly sprayed, 100 percent of the herbicide is absorbed by the prey, and the prey is ingested immediately by the owl. Even in this implausibly high exposure scenario, no doses of concern were estimated for any herbicide in any alternative.

The probability of an incremental effect is so low that it could not be added to those from other federal and non-federal activities in a meaningful way.

Gray Flycatcher

Direct, Indirect and Cumulative Effects

Gray flycatcher is common on the Forest and invasive plant treatment would not result in the removal or alteration of habitat. They nest in trees and are not susceptible to disturbance and/or trampling of nestlings/eggs caused by invasive plant treatments (USDA Forest Service 1992). The differences between the alternatives do not result in a difference in potential effects on gray flycatchers. Disturbance is expected to be negligible, and exposure of herbicides is unlikely however if exposure to herbicides occurs, it is not likely to cause an adverse effect.

Gray flycatchers are insectivorous birds and could be exposed to herbicides by consuming contaminated insects. However, this scenario does not result in any acute doses of concern for any herbicide. Chronic doses are implausible for any alternative given the small, scattered nature of the invasive plant infestations.

There are no likely direct or indirect effects to gray flycatchers, so there are no effects to incrementally add to other actions. Therefore, effects from the action alternatives would not accumulate with other existing or foreseeable future effects.

White-Headed and Lewis Woodpecker

Analysis for woodpeckers is included in discussion for Snag and Down Wood Dependent MIS Species below.

Harlequin Duck

Direct, Indirect and Cumulative Effects

Approximately 662 mapped polygon acres occur within harlequin duck habitat; of which 535 acres are infested. The majority of infested acres are along roadsides that border fast moving streams. Invasive plant treatments would not result in the removal or alteration of harlequin duck habitat.

The primary effects of invasive plant treatment are expected to be disturbance to nesting ducks caused by noise, human activity, and to lesser extent vehicles and trampling to eggs. Disturbance and trampling could occur along the shore from people treating invasive plants either manually, with string trimmers (weed whackers), or with herbicides. Disturbance to nesting harlequins is expected to be negligible because implementation of treatment method is expected to be of short duration (three to four hours in a single day), and infrequent (1 visit during nesting season). Trampling of young is not expected as treatment generally occurs after the eggs have hatched and young have left the nest.

None of the herbicides proposed for use pose a risk to harlequin ducks. The fish eating bird scenario was evaluated for all herbicides and no acute or chronic exposures of concern were indicated. Also the rapid dilution and movement of herbicide in water would reduce the potential for fish or birds to be exposed to herbicide.

The risk of effects from the alternatives is so low that no cumulative effects to the harlequin duck are possible. There is no possibility that effects from this project would combine with any other stressor or activity and have a cumulative effect.

Common Loon

Direct, Indirect and Cumulative Effects

Common loons are rare on the Okanogan-Wenatchee National Forest, nesting usually in mid to high elevation lakes. There are 156 infested acres within 100 feet of lakes occupied by loons.

Invasive plant treatments including manual, mechanical, cultural, biological and chemical would not result in the removal or alteration of loon habitat. *The* primary effects of invasive plant treatment are expected to be disturbance to nesting loons caused by noise from human activity *because loons* are easily disturbed by humans. Loon abundance and reproductive success is dependent upon the availability of undisturbed shoreline or island nesting sites. Disturbance to nesting loons could occur along the shore from people treating invasive plants manually, mechanically with string trimmers (weed whackers), or with herbicides. *However, d*isturbance to nesting loons is expected to be negligible because implementation of treatment method is expected to be of short duration (three to four hours in a single day), and infrequent (1 visit during nesting season).

Loons feed primarily on small fish, but also eat crustaceans, amphibians, insects and mollusks (Merrifield 2003). Based on available data (see G02b tab in the Risk Assessment worksheets in the project record for details), adverse effects to fish-eating birds from herbicides in this analysis are not likely.

Due to the low intensity and extent of treatment impacts, no cumulative effects are discernible when impacts from this project are added to other stressors or activities expected to occur on the Forest.

Larch Mountain Salamander

Direct and Indirect Effects

There are no documented salamander sites within 100 feet of mapped polygons. Invasive plant treatments would not remove or alter habitat for this species nor would treatments cause large-scale microclimate changes within their suitable habitat. Components such as down logs and rocks would remain in place on treatment sites. Invasive plant treatments would not threaten the persistence of the species at any known site. Trampling could impact these species during any treatment method under any alternative, but highly unlikely since they spend the majority of the year and day light hours in subterranean environment and only surface when there is high moisture and cool temperatures. PDF J-7 requires that salamander habitats be avoided during times when they may be present.

The Risk Assessment Worksheets were used to estimate effects on amphibians from herbicide exposure. Aminopyralid, chlorsulfuron, clopyralid, imazapic, imazapyr, metsulfuron methyl, picloram and triclopyr pose little to no risk of mortality to amphibians. Toxicity data is limited for some herbicides regarding amphibians, in these cases, fish are used as a surrogate, based on studies comparing data available for both groups of species (Berrill et al. 1994; Berrill et al. 1997; Perkins et al. 2000).

Impacts to amphibians from glyphosate use was evaluated in SERA 2011. Given the rate and type of glyphosate use proposed in this project, adverse impacts are not likely. Formulations of glyphosate that contain POEA surfactant that are more toxic to aquatic organisms and amphibians would not be used in this project. Toxicity data for glyphosate exposure on amphibians is available and no exposures of concern are plausible (Risk Assessment Worksheets tab G03).

To prevent exposure of herbicides to salamanders, broadcasting of herbicides would not occur within ¼ mile of suitable un-surveyed habitat, rocky outcrops and talus. No herbicide use would occur within occupied habitat. These features are included in PDF J-7 to ensure that inadvertent exposure does not occur.

Cumulative Effects

Activities, such as grazing, road maintenance, or recreation can result in disturbance to salamander and snail habitat. Invasive plant treatments could add to the disturbance, but are such low magnitude, short duration, and low intensity and PDF are in place to reduce the risk of trampling that no significant cumulative effect is likely to occur.

Salamanders may be exposed to very low levels of herbicide within the project area but are not likely to be exposed to herbicide use from other sources because they are limited in their movements. PDFs are also in place to reduce the risk of herbicide exposure resulting from this project. A number of studies have documented declines in amphibians, even in relatively undisturbed habitats (Drost and Fellers 1996, Lips 1998, 1999), while other studies have found some populations to be stable (Pechmann et al. 1991). Detecting actual population declines in amphibian populations is difficult due to the extreme annual variation in populations caused by environmental factors, such as drought (Pechmann et al. 1991, Reed and Blaustein 1995).

Potential causes of amphibian declines investigated include habitat loss, non-native predators (Drost and Fellers 1996, Knapp and Matthews 2000), and disease (Muths et al. 2003, Berger et al. 1998, Berger et al. 1999), pesticides (Bridges and Semlitsch 2000, Hayes et al. 2006), climate change (Blaustein et al. 2001, Crump 2005), and ultraviolet radiation (Starnes et al. 2000, Adams et al. 2001). There is no “smoking gun” at the global scale and all the causes are implicated to some degree (Halliday 2005). Because the herbicides proposed for use in this project are rapidly excreted (even by aquatic organisms), do not bioaccumulate or biomagnify, and pose low risk to salamander, significant cumulative effects from herbicide exposure are unlikely. Thus, there are no cumulative effects to the Larch Mountain salamander from herbicide use, even when considering other stressors implicated in amphibian decline.

Puget Oregonian

Direct, Indirect and Cumulative Effects

The snail, Puget Oregonian, has been found in habitat similar to the Larch Mountain salamander. Invasive plant treatments would not remove or alter habitat for this species nor would treatments cause large-scale microclimate changes within their suitable habitat. Components such as down logs and rocks would remain in place on treatment sites. Invasive plant treatments would not threaten the persistence of the species at any known site. Trampling could impact these species during any treatment method under any alternative, but highly unlikely since they spend the majority of the year and day light hours in subterranean environment and only surface when there is high moisture and cool temperatures. Herbicide impacts are unlikely, and PDF J-7 would further reduce risks. No direct, indirect or cumulative impacts to Puget Oregonian are expected.

Chelan Mountainsnail[15], Grand Coulee Mountainsnail and Shiny Tightcoil

Direct, Indirect and Cumulative Effects

Invasive plant treatments would not remove or alter habitat for these species nor would treatments cause large-scale microclimate changes within their suitable habitat. Components such as down logs would remain in place on treatment sites. Although trampling could occur to these species during any treatment method, because treatments are not typically implemented when soil moisture is high. Avoiding treatment during wet periods would reduce the potential for these mollusks to be exposed to herbicides and reduce the risk of mortality by trampling. If tramping did occur it would be limited to a few individuals immediately on or near the vegetation to be treated. Other individuals in the population would likely be under cover of rocks and woody debris, or in adjacent habitat, and therefore would not likely be subject to tramping or disturbance from invasive plant treatments. PDF J-7 would minimize disturbance to these mollusks.

There are limited data on herbicide effects to mollusk species. Data on terrestrial snails are limited to studies with glyphosate and picloram on the brown garden snail (*Helix aspersa*) (SERA 2011a Glyphosate; SERA 2011b Picloram). No studies showed adverse effects to snails. No other data are available. At the rates proposed for this project, invertebrates are unlikely to be affected by any herbicide use. Conclusions of risk are made with the reservation that data are limited but represent the best science available for estimating effects. Precaution measures are in place; PDF J-7 prohibits herbicide use within occupied habitat and limits herbicide application within un-surveyed, quality habitat to selective application techniques only (e.g. spot and hand) and limiting application period in occupied and suitable habitat to when mollusks would be under ground or structure (wood, rock, etc.)

Invasive plant treatments are typically in small patches, occur primarily along roads, would have relatively short duration, and would likely occur only once or twice during the treatment season, and generally when soils are dry and mollusks are protected under rocks and logs. Activities such as grazing, road maintenance, or recreation could create cumulative disturbance. The magnitude and extent of trampling from invasive plant treatments is very low and restricted to a few individuals present on or immediately adjacent to invasive plant species. Trampling from invasive plant treatments is unlikely to add substantially to trampling or disturbance from other activities, thus this project is not likely to contribute to cumulative effects on mollusks.

Western Bumblebee

Direct, Indirect and Cumulative Effects

[15] Chelan mountainsnail is a survey and manage species but is discussed here because effects to mollusks are similar between species.

The primary threats to the western bumblebee identified by Jepsen (2013) included pathogens from other bees, impacts from reduced genetic diversity, habitat alterations (resulting from fire suppression, grazing and logging). Other threats include pesticide use, fire, agricultural, urban development and climate change. Herbicides can pose serious threats to bumblebees by the removal of floral resources.

The western bumble bee was among the two most abundant bumblebees in most of western North America until fairly recently. While there were perhaps millions of populations in 1998, and the range and area of occupancy were huge, there is no basis for assessing how many populations still exist, how many of them are potentially viable, or what the current range is. In less than 15 years this has gone from the second most common bumblebee in the western US to undetectable in substantial areas and rare elsewhere except in the far north and perhaps highest elevations. The decline of this subgenus is on-going and continent-wide.

Rao and Stephen (2010) indicate that this once common species no longer occurs in coastal and valley regions of Oregon. The Oregon Natural Heritage Program has records from several places in 2006-2008, mostly single bees, but 49 were found in a prairie in northeastern Oregon during 2007-2008 (NatureServe 2013). The Xerces Society has 2012 records only for one place each in Oregon, Washington, and Wyoming, and from one place each in Colorado and Montana in 2011, and a different place in Montana in 2010. The Xerces Society considers this species in steep decline and COSEWIC (Committee on the Status of Endangered Wildlife in Canada) considers it of conservation concern in Canada. The decline appears to have spread considerably from 2005-2010. Although there is not enough data yet to confirm a population rebound, western bumble bees were found in 2014 in areas that they had not been seen in for many years (Doughton 2014).

The NatureServe State rank for Oregon is S1S2 – imperiled to critically imperiled. A Global Rank is difficult to define since this species is such rapid and steep decline.

Like other severely declining bumblebees, the main cause of decline of western bumble bees is thought to be pathogen spillover of a particularly virulent, probably imported, strain of the microsporidian (*Nosema bombi*) and an imported protozoan parasite (*Crithidia bombi*) from domesticated bumblebees (this species and *Bombus impatiens*) that were reared in Europe and returned to the U.S. for greenhouse pollination (e.g. Committee on Status of Pollinators, 2007, Colla and Packer, 2008, Evans et al., 2008; Federman, 2009 and references reviewed in all). The major decline of the subgenus Bombus was first documented in this species, specifically as Nosema nearly wiped out commercial hives, leading to the cessation of commercial production of this species. Wild populations crashed simultaneously. The timing, speed, and severity of the population crashes strongly supports the idea that an introduced disease caused the decline of these bees.

Some pesticides can pose a risk to bumble bees. Neonicotinoids are new systemic and persistent insecticides that are very toxic to bees. In 2013, use of this type of insecticide on street and parking lot trees in Wilsonville and Hillsboro, Oregon resulted in the death of an estimated 50,000 bumble bees (OregonLive.com 2013a, b). The bumble bees killed were yellow-faced bumblebees (*Bombus vosnesenskii*) (Hilburn 2013).

Bumble bees are also threatened by invasive plants and insects (Xerces Society 2013). The invasion and dominance of native grasslands by exotic plants may threaten bumble bees by directly competing with the native nectar and pollen plants that they rely upon.

Manual and mechanical treatments are not expected to directly affect western bumblebees as they are very mobile and can leave the area when treatments occur. Also, they rely on a wide range of nectar plants, so the removal of invasive plants would not limit their food availability.

The honey bee is a standard test subject for required toxicity testing of pesticides, so there is data on risk to bees in the risk assessments for all herbicides included in this project. Considering the herbicides proposed for use in this project, only glyphosate and triclopyr pose a potential risk to bees. HQ values for these herbicides exceed 1 for some insect (honey bee) exposure scenarios, including:

-At maximum project use rate, the upper bound estimate is HQ = 1.7 for a honey bee after feeding on tall grass that has been sprayed with triclopyr acid.

-At the maximum project use rate, the upper bound estimates for various dietary routes (grass, other insects) range from HQ = 1.1 to 2. For glyphosate, a relatively large number of acute toxicity studies have been conducted on bees and other species of terrestrial insects using both technical grade glyphosate as well as various glyphosate formulations, for both contact spray and dietary exposures (Appendix 4 in SERA 2011).

None of the other herbicides indicated a risk to bees in the risk assessments.

It should be noted that all estimates of dietary exposure are based on consumption of fruit, grass or other vegetation by terrestrial insects, rather than nectar or pollen. If invasive plants are sprayed when flowers are not present, risk to western bumblebees would be greatly reduced.

Treating infestation of invasive plant populations while they are still small would reduce risk to western bumblebees because it would limit potential exposure to glyphosate or triclopyr. Aminopyralid, clopyralid and picloram and clopyralid are the primary herbicides used on thistles and knapweeds visited by bumble bees, and these herbicides do not pose discernable risks.

This project is unlikely to contribute to cumulative effects on honey bee because of the type of herbicide use proposed and the small scattered nature of the infestations. Prescribed fire and vegetation management, including both commercial and non-commercial thinning, has the potential to impact the habitat of western bumblebee. There is a possibility that host plant species could be impacted by vegetation and fuels treatments and this effect could be cumulative for invasive plant species that would be eradicated by proposed treatments. However, bumblebees will feed on many different species of plants so even if one species was completely eliminated from an area, there would still be sufficient alternate floral resources available so an effect to bumblebees would be highly unlikely.

Colony Collapse Disorder

Pesticides are one of several factors thought to possibly contribute to catastrophic losses of honey bees (“colony collapse disorder” or CCD) reported since 2006 (CCD Steering Committee 2007). Since this project proposes to use herbicides, a class of pesticides, a discussion of the possible connection of herbicide use and CCD is warranted.

The European honey bee (*Apis mellifera*) is not native to the United States (US), but was introduced by European settlers in the 1600s. It is widely distributed and commercially produced in US; with escaped feral colonies formerly present across most of the country. Parasitic mites have destroyed most of the feral colonies. (CCD Steering Committee 2007)].

In 2006-2007, commercial honey bees in North America and other parts of the world experienced alarming declines characterized by the disappearance of adult bees from the hives with no or few dead bees near the hive; healthy, capped brood; food reserves that have not been robbed; minimal evidence of wax moth or hive beetle damage; and a laying queen with immature bees and newly emerged attendants (CCD Steering Committee 2007; Winfree et al. 2007). This phenomenon has been termed “colony collapse disorder” (CCD). By 2007, almost 30 percent of beekeepers in the US reported losses of up to 90 percent of their colonies (Cox-Foster et al. 2007; Winfree et al. 2007). These levels of losses have continued through 2010 (CCD Steering Committee 2010). CCD has not been reported in wild native bees (Winfree et al. 2007).

In 2010, several independent studies showed that bees are exposed to a variety of pesticides and that some pesticides interact with bee pests and parasites (such as mites), bee viruses, and other pesticides to effect bee mortality (CCD Steering Committee 2010). The CCD steering committee concludes that these studies taken together support the hypothesis that CCD is a syndrome of stress caused by many different factors likely working in combination. The studies funded by the National Institute of Food and Agriculture's Coordinated Agricultural Project (CAP) found sub-lethal effects of neonicotinoids (nicotine based insecticides) and fungicides on bees, and hypothesized that these pesticides impair the bee's immune system, leaving bees more susceptible to three important bee viruses. Two common miticides, coumaphos and fluvalinate, which are pesticides registered for use in bee colonies to control varroa mites, are also suspect, either acting individually or in combination (CCD Steering Committee 2010).

No insecticides or fungicides, which are suspected in CCD, are proposed for use in this document. Herbicides have a low likelihood of being implicated in CCD, but cannot be completely ruled out. None of the herbicides included in the action alternatives exceeded toxicity values for honey bees at typical application rates. At highest application rates, only glyphosate caused any mortality, and this necessitated a direct spray of the honeybee at the highest rate. Glyphosate would only be used at the highest application rates using stem injection which is not likely to affect pollinators because Herbicides are not typically used directly on the agricultural crops (unless they are genetically engineered to be herbicide resistant) that honey bees pollinate because they would have a high likelihood of adversely affecting the agricultural crop (unlike on grass crops where selective herbicides are used on the crop directly). Herbicides are used near these crops to control weeds, however. The control of weeds in and around genetically engineered crops, which reduces flowering plants in the field, ditches and field edges, is thought to contribute to honey bee nutritional deficiencies, (Ellis, et. al. 2010). Well-nourished bees are less vulnerable to parasites (Eischen and Graham 2008). Unlike in agricultural settings, and especially around genetically engineered, herbicide resistant crops, the use of herbicide on Forest Service lands is likely to increase the diversity of food plants for bees because native plants would begin to recover. Healthy native plant communities contain much greater diversity than sites dominated by invasive plants.

None of the alternatives are likely to have adverse effects on honey bees or contribute to CCD for the following reasons: 1) treatments on the forest are often in remote locations far from crops and commercial bee hives; 2) any treatments in the vicinity of bee hives would entail treatment of patches of invasive plants and not a widespread application likely to expose honey bees; 3) the proposed herbicides have a relatively low toxicity to honey bees.

Peck's Skipper, Tawny-edge Skipper, and Mardon Skipper (Butterflies)

Direct and Indirect Effects

Impacts on butterflies are expected to be negligible for all alternatives this project. PDF J-10 would require selective herbicide application in Peck's skipper, tawny-edge skipper and Mardon skipper habitat. This would minimize herbicide exposure.

Manual techniques could harm eggs or larvae through trampling by foot traffic. However impacts would be minimized by coordinating the treatment method, timing, locations, and amount of habitat treated annually with local Biologist. The impact of tramping would be limited to a few individuals (at most) immediately on or near the vegetation to be treated. Treatment would be timed to occur outside the flight period; therefore no adults would be trampled.

Invasive plant treatments are necessary to protect and restore the habitat for the Mardon skipper (Kerwin 2011), and it follows that the same could be applied to the other butterflies. Invasive plant treatments maintain and improve the quality of these species habitats while preventing future degradation of habitat. Alternatives 1 and 3 restrict herbicide use to certain sites, and some infestations would remain untreated or be treated less effectively, which may result in fewer acres of habitat restoration and maintenance.

The Conservation Assessment for Mardon skippers recommends if herbicides are used to protect non-target vegetation and avoid heavy equipment (Kerwin 2011). Since no conservation assessments have been done for any of the other sensitive butterfly species that occur within project area, conservation measures developed for Mardon skippers will be applied to all sensitive butterfly species.

Data on the effects of herbicides to butterflies are almost non-existent. Risk to butterflies can only be inferred based on the few test species for which data are available (R6 PNW FEIS). The honey bee is a standard test subject for required toxicity testing of pesticides, so there is data on risk to bees in the risk assessments for all herbicides included in this project. Considering the herbicides proposed for use in this project, only glyphosate and triclopyr pose a potential risk to bees, and by extension, butterflies.

HQ values for these herbicides exceed 1 for some insect exposure scenarios:

- At maximum project use rate, the upper bound estimate is HQ = 1.7 for a honey bee after feeding on tall grass that has been sprayed with triclopyr acid.
- At the maximum project use rate, the upper bound estimates for various dietary routes (grass, other insects) range from HQ = 1.1 to 2. For glyphosate, a relatively large number of acute toxicity studies have been conducted on bees and other species of terrestrial insects using both technical grade glyphosate as well as various glyphosate formulations, for both contact spray and dietary exposures (Appendix 4 in SERA 2011).

None of the other herbicides indicated a risk to bees in the risk assessments.

Cumulative Effects

Chapter 3.1.6 lists past, present (ongoing) and reasonably foreseeable future projects on the Forest. The potential overlap of impacts of invasive plant treatment and these cumulative activities on the Mardon skipper, Peck's skipper, and tawny-edge skipper and their habitat were considered in this analysis. These species are exposed to trampling from vehicles, recreationists, domestic livestock, and other sources of disturbance and habitat is being lost on both federal and non-federal lands. It is unlikely that there would be incremental negative cumulative effects to these species from the action alternatives when added to other federal and non-federal activities, because the action alternatives create only discountable or no effects from trampling or herbicide exposure, do not change Mardon skipper, Peck's skipper, tawny-edge skipper habitat, and would be unlikely to occur at the same time as other projects in the same area.

Invasive plant treatments typically occur in small patches and primarily along roads, herbicide applications would be selective, and treatments would be limited to no more than 50% of a site in any one year PDF J-7). The probability of an effect from the alternatives is so low that it could not be add incrementally to those from other ownerships in a meaningful way. Therefore, the action alternatives would not contribute to any cumulative effects to the Mardon skipper, Peck's skipper, or tawny-edge skipper.

Zigzag and Subarctic Darner, Masked Duskysnail[16]

[16] Masked duskysnail is a survey and manage species and is discussed here because effects are similar.

Direct and Indirect Effects

Manual, mechanical and herbicide treatments are proposed within suitable habitat. The masked duskysnail, zigzag darner and subarctic darner inhabit bogs, fens and kettle lakes. Low levels of tramping may result from invasive plant treatments but PDF J-8 requires the method and timing of treatments to be annually coordinated with the local biologist prior to treatment in occupied habitat, which would further reduce the threat of trampling. If tramping did occur it would be limited to a few individuals immediately on or near the vegetation to be treated. Thus, impacts would be negligible.

Invasive plant treatments would not remove or alter habitat for these species nor would treatments cause large-scale microclimate changes within their suitable habitat.

No testing on the effects of herbicides on duskysnails or darners (dragonflies) has been done. All herbicides are required to be tested on honeybees as part of the registration requirements, but testing of other terrestrial invertebrates in toxicity studies varies for each herbicide. Data on the effects of herbicides to dragon flies are almost non-existent. The honey bee is a standard test subject for required toxicity testing of pesticides, so there is data on risk to bees in the risk assessments for all herbicides included in this project. Considering the herbicides proposed for use in this project, only glyphosate and triclopyr pose a potential risk to bees, and by extension, butterflies.

HQ values for these herbicides exceed 1 for some insect exposure scenarios:

- At maximum project use rate, the upper bound estimate is HQ = 1.7 for a honey bee after feeding on tall grass that has been sprayed with triclopyr acid.
- At the maximum project use rate, the upper bound estimates for various dietary routes (grass, other insects) range from HQ = 1.1 to 2. For glyphosate, a relatively large number of acute toxicity studies have been conducted on bees and other species of terrestrial insects using both technical grade glyphosate as well as various glyphosate formulations, for both contact spray and dietary exposures (Appendix 4 in SERA 2011).

None of the other herbicides indicated a risk to bees in the risk assessments.

PDF J-8 limits the types of herbicides used to aquatic formulations in duskysnail and darner habitat. It also restricts the method of application techniques to selective only (e.g. spot spraying and hand) within 100 feet of Fish Lake. PDF H-7 limits the amount of area treated near lakes to no more than 50 percent of the perimeter or 10 contiguous acres in any 30-day period. Successful control of invasive plant infestations provides long-term benefits to darner by restoring native habitat and preventing future degradation of habitat.

Since the subarctic darner site on the Forest is considered historic (Fleckenstein 2006f), there is a high probability that the subarctic darner would not be present during invasive plant treatments.

Cumulative Effects

Section 3.1.6 lists past, present (ongoing) and reasonably foreseeable future projects on the forest. Negative cumulative effects are unlikely because the alternatives pose low risk, on a small scale with very short duration.

Activities such as recreation could create cumulative disturbance. The magnitude and extent of trampling from invasive plant treatments is very low and restricted to a few individuals present on or immediately adjacent to invasive plant species. Trampling from invasive plant treatments is unlikely to add significantly to trampling or disturbance from other activities. Since these species are not very mobile there are no other herbicide effects to add to other past, present or future effects of treatments that may occur on other lands. Invasive plants such as reed canarygrass and yellow loosestrife are present and threaten the long-term darner and duskysnail habitat integrity at Fish Lake (Lamquest, pers. com.). Alternative 2 would have the greatest likelihood of achieving treatment objectives (Chapter 3.2).

Survey and Manage Species

Using the 2003 Settlement Agreement Survey and Manage list (Pechman exemption), vertebrate and invertebrate species of interest within Northwest Forest Plan lands whose range includes the Okanogan-Wenatchee National Forest are: great gray owl, Larch mountain salamander, Puget Oregonian, masked duskysnail, Chelan mountainsnail, and blue-gray taildropper. Species present or possible within the project area are discussed under sensitive species above.

Management Indicator Species

Mule Deer and Rocky Mountain Elk

Direct and Indirect Effects

Invasive plant treatments on summer range can create disturbance to mule deer and elk, but the level of disturbance would be short-term, low intensity, and limited in extent. The level of disturbance would not create negative effects for these very mobile and wide-ranging species. Invasive plant treatments would have no negative effect on deer or elk. Since there are no likely adverse effects from disturbance or herbicide exposure, there is no appreciable difference in effects between alternatives. Disturbance near winter range is not likely to affect deer and elk, because invasive plant treatments do not occur during the winter; the time period elk and deer would be using the range.

Browsing habits of deer and grassing habits of elk make it possible for them to consume herbicide sprayed vegetation. HQ values greater than 1 were calculated for large, grass eating mammals at use rates proposed for this project (see risk assessment worksheets, tab G02). Acute exposures of grass eating mammals to triclopyr at upper bound estimates exceeded 100 for the highest residue rates on short grass.

Table 3.27 below displays HQ values for grass eating mammals assuming triclopyr is used at a rate of 2 pounds per acre. **Bolded** values exceed 1; an HQ below 1 means that exposure is below the no adverse effect level.

Table 3.27: Acute Hazard Quotient Values for Grass-eating Mammals

Exposure Scenario		HQ central estimate	HQ low estimate	HQ high estimate
Acute Scenario: Mammal Eats Tall Grass Contaminated with Triclopyr				
	Small mammal (20g)	0.7	7E-02	**3**
	Larger Mammal (400g)	0.3	3E-02	**1.4**
	Large Mammal	**2.0**	0.2	**10**
Acute Scenario: Mammal Eats Short Grass Contaminated with Triclopyr [Highest Residue Rate]				
	Small mammal (20g)	0.7	7E-02	**3**

	Larger Mammal (400g)	0.7	7E-02	**3**
	Large Mammal (70g)	**5**	0.5	**22**
Chronic Scenario: Mammal Eats Tall Grass Contaminated with Triclopyr				
	Small mammal (20g)	0.6	2E-02	**7**
	Larger Mammal (400g)	0.6	2E-02	**7**
	Large Mammal	**4**	0.2	**49**
Chronic Scenario: Mammal Eats Short Grass Contaminated with Triclopyr [Highest Residue Rate]				
	Small mammal (20g)	**1.3**	6E-02	**15**
	Larger Mammal (400g)	**1.3**	6E-02	**15**
	Large Mammal (70g)	**9**	0.4	**106**

Table 3.28 Chronic Hazard Quotient Values for Grass-eating Mammals

Exposure Scenario		HQ central estimate	HQ low estimate	HQ high estimate
Acute Scenario: Mammal Eats Tall Grass Contaminated with Glyphosate				
	Small mammal (20g)	3	0.3	16
	Larger Mammal (400g)	0.3	3E-02	1.7
	Large Mammal	0.2	2E-02	0.9
Acute Scenario: Mammal Eats Short Grass Contaminated with Glyphosate [Highest Residue Rate]				
	Small mammal (20g)	3	0.3	16
	Larger Mammal (400g)	0.8	8E-02	4
	Large Mammal (70g)	0.4	5E-02	2
Chronic Scenario: Mammal Eats Tall Grass Contaminated with Glyphosate				
	Small mammal (20g)	0.2	2E-02	1.2
	Larger Mammal (400g)	5E-02	5E-03	0.3
	Large Mammal	3E-02	3E-03	0.2
Chronic Scenario: Mammal Eats Short Grass Contaminated with Glyphosate [Highest Residue Rate]				
	Small mammal (20g)	0.5	6E-02	3
	Larger Mammal (400g)	0.1	1E-02	0.6
	Large Mammal (70g)	7E-02	7E-03	0.3

The use of triclopyr for invasive plant treatment is restricted by the R6 PNW ROD Standard #16, which limits the use of triclopyr to selective application techniques only (e.g. spot and hand), minimizing the potential for non-target forage to be sprayed. In addition, it is unlikely for a mule deer or elk to feed on enough contaminated grass to receive doses associated with central or upper estimates.

Cumulative Effects

It is unlikely that the alternatives would incrementally add to negative effects to mule deer and elk from other federal and non-federal projects because these alternatives create minimal effects from disturbance or herbicide exposure. Mule deer and Rocky Mountain elk may be temporarily disturbed by treatments. Other activities, such as grazing, prescribed burning, road maintenance, or recreation also create disturbance or some modify habitat. Invasive plant treatments could add incrementally to the disturbance, but are such low magnitude, short duration, and low intensity that they would not be measurable. With all direct, indirect, and cumulative effects considered, mule deer and Rocky Mountain elk populations are expected to remain stable.

Reducing the invasive species would have long-term benefits by maintaining and improving preferred forage species by deer and elk. Treating winter range would protect sagebrush habitat from adverse modification due to future spread of invasive plants and possibly reducing the likelihood of habitat loss from fires. Treatment of invasive plants and other restoration projects in meadow habitat could beneficially affect deer and elk by preserving native forage species and maintaining the long-term suitability of the habitat.

Mountain Goat

Direct and Indirect Effects

There are approximately 246,776 acres of mountain goat habitat on the Okanogan-Wenatchee National Forest of which 178 acres are infested with invasive plants. Disturbance resulting from all treatments in all alternatives is expected to be negligible for the following reasons:

- Existing habitat infested by invasive plants is limited (less than 0.5% of habitat on the Okanogan-Wenatchee Forest is currently infested by invasive plants).
- Mountain goat habitat is unfavorable for most invasive plant establishment.
- Any disturbance would typically be short-term, low intensity, infrequent and limited in extent.

With the low level of habitat currently infested by invasive plants, it is not likely mountain goats would consume large quantities of herbicide sprayed vegetation. Table 3.27 and Table 3.28 above display acute and chronic hazard quotient values for grass eating mammals, including mountain goat. However, as explained above, the potential for upper or central estimate exposures to actually occur is very low, due to the way the invasive plants are spread out across the entire Forest, and the amount of contaminated vegetation a goat would have to eat to receive a harmful dose is not plausible.

Considering all direct, indirect and cumulative effects to mountain goats, this project would not impact or contribute to a negative trend in viability on the Okanogan-Wenatchee National Forest.

Cumulative Effects

Section 3.1.6 lists past, present (ongoing), and reasonably foreseeable future projects on the Forest. Other activities, such as grazing, prescribed burning, road maintenance or recreation would also create disturbance or may modify habitat, and the incremental addition of disturbance effects from invasive plant treatments are so low in magnitude, short in duration, and low in intensity that could not be measurably added to the effects of other projects. With all direct, indirect, and cumulative effects considered, mountain goat populations are expected to remain stable. Invasive plants do not currently occur in mountain goat habitat, however if infestations expand, the quality and quantity of available forage could be reduced. Alternative 2 has the best chance of abating the spread of invasive plants.

Barred Owl

Direct, Indirect and Cumulative Effects

Barred owl use late successional habitat of mixed conifer, which is widely distributed on the Forest (USDA Forest Service 2011a). In North America, barred owls have a stable to increasing trend (Sauer et al. 2008). In western North America, numbers and range are expanding (Gutierrez et al. 2007). Of the 339 mapped plant polygons acres within barred owl habitat on the Okanogan National Forest, approximately 60 of those acres are currently infested by invasive plants. These infested acres are primarily roadside locations. Invasive plants generally do not occur in late-successional habitat due to the high canopy and ground cover. Therefore invasive plant treatments would have little effect on barred owl nesting habitat. Effects from herbicide exposures are the same as those previously discussed for the northern spotted owl. No herbicide exceeded a level of concern for predatory birds and herbicide treatments would not pose a risk of adverse effects to predatory birds (worksheet tab G02b).

Effects to nesting birds from noise that would exceed ambient levels of disturbance would be short duration (1 day or less), and infrequent (1 to 2 visits per year). Approximately 60 acres of barred owl habitat have documented invasive plant infestations present. These are primarily located along roadsides.

Considering all direct, indirect and cumulative effects to barred owls, this project would not contribute to a negative trend in viability on the Okanogan-Wenatchee National Forest. In addition, this project would not modify habitat and disturbance would be minimal.

No direct or indirect effects to barred owl are likely, so none would add incrementally to the effects of other past, present or reasonably foreseeable future actions and no cumulative effects would result. Populations are expected to remain stable.

Pileated and Three-toed Woodpecker

Direct and Indirect Effects

Species that forage and nest in trees would not be exposed to herbicides because no trees would be treated and no aerial application is proposed. Even though woodpeckers are insectivorous birds, their feeding methods reduce the risk to herbicide exposure; forage (beetles and ants) is generally buried inside of decaying wood.

Exposure scenarios involving birds eating contaminated insects were evaluated for the herbicides proposed for use in this project (worksheet tab G02b). No exposures of concern are predicted for any alternative. None of these species are susceptible to noises or disturbance caused by treating patches of invasive plants. No risk of trampling would occur because nests are in tree cavities.

Invasive plant treatment would not alter three-toed or pileated woodpecker habitat. Since there are no likely adverse effects from disturbance or herbicide exposure, there is no meaningful difference in effects between alternatives. No direct or indirect effects to MIS woodpecker species are likely, so effects would not add incrementally to the effects of other projects and no cumulative effects would result. Populations are expected to remain stable.

Primary Cavity Excavators and Secondary Cavity Users

Direct, Indirect and Cumulative Effects

This group of ten bird species, including the pileated and 3-toed woodpeckers above, nest in tree cavities and are not susceptible to the short-term disturbance that would occur with invasive plant treatments.

There would be no threat of trampling nestlings or eggs. Herbicide effects to Lewis's woodpecker, Black-backed woodpecker, Williamson's sapsucker, white-headed woodpecker, red-naped sapsucker, northern flicker, hairy and downy woodpeckers, and pygmy nuthatch are the same as has been discussed above for MIS woodpecker species (the pygmy nuthatch also forages on tree limbs and trunks).

Mountain bluebird and flammulated owl catch insects in flight and/or on the ground. Risks to this species are evaluated from herbicide exposure using the insectivorous bird scenario (Worksheet Tab G02). No herbicide exceeded an acute or chronic dose of concern for insectivorous birds. Because there is no effect from disturbance, herbicide exposure or alteration of habitat, there is no meaningful difference in effects between alternatives.

None of the alternatives would have direct or indirect effects on snag and down wood dependent species likely, so would not add incrementally to the effects of past, present or reasonably foreseeable future actions; therefore no cumulative effects to snag and down wood dependent species would result.

American Marten

Direct, Indirect and Cumulative Effects

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. No herbicide exceeded a level of concern for carnivores eating contaminated small mammals (see Worksheet Tab G02a). Invasive plants are not impacting habitat for martens. Invasive plant treatments would not alter habitat suitability because no native trees would be removed or treated. There are no likely adverse effects from disturbance or herbicide exposure with either alternative.

No direct or indirect effects to marten are likely, so no effects would add incrementally to the effects of other past, present or reasonably foreseeable future actions and no cumulative effects would result. Populations are expected to remain stable.

Beaver

Direct, Indirect and Cumulative Effects

Beaver are mature deciduous riparian dependent species. The short-term (one day or less), low magnitude, scattered disturbance that would occur with invasive plant treatments would not cause negative effects to beaver populations.

Exposure scenarios for small, herbivorous mammals apply to beaver. At upper (worst case) exposure estimates, HQ = 8 for chronic triclopyr exposure from consuming contaminated fruit, based on triclopyr use rates proposed under this project (Triclopyr Risk Assessment Worksheet tab G02a). Given the diet and foraging habits of and beaver, they are unlikely to forage exclusively in one patch of treated invasive plants, so actual doses that exceed levels of concern are unlikely. R6 PNW ROD Standard #16 limits the use of triclopyr to selective application techniques only (e.g. spot and hand), where impacts to non-native vegetation that beavers use are minimized. It is not plausible that beavers would receive a chronic dose of triclopyr, even when cumulative effects are considered, given the amount of contaminated feed that would have to be consumed over a 90 day period.

Beaver are susceptible to the limited disturbance caused by treating patches of invasive plants. Invasive plant treatments (including mechanical, manual, biological, herbicide, and cultural treatments) would not cause adverse effects to beaver. Since there are no likely adverse effects from disturbance or herbicide exposure, there is no meaningful difference in effects between alternatives.

Invasive plant treatments (including mechanical, manual, biological, herbicide, and cultural treatments) would have no effect on mature deciduous riparian habitat, nor would they likely cause disturbance or herbicide exposure to deciduous riparian dependent species.

The alternatives are not likely to affect mature deciduous riparian dependent species, so would not add incrementally to the effects of past, present or reasonably foreseeable future actions; therefore no cumulative effects to mature deciduous riparian dependent species would result.

Ruffed Grouse

Direct, Indirect and Cumulative Effects

Ruffed grouse are mature deciduous riparian dependent species. The short-term (one day or less), low magnitude, scattered disturbance that would occur with invasive plant treatments would not cause negative effects to grouse populations.

Exposure scenarios for vegetation and fruit eating birds apply to ruffed grouse. Vegetation eating birds are among the most sensitive to herbicide use of the type proposed. In particular, HQ values greater than one were calculated for many acute and chronic exposure scenarios for birds eating vegetation or fruit exposed to triclopyr (Triclopyr Risk Assessment Worksheets tab G02b). For a small bird (10g) eating contaminated broadleaf foliage, HQ = 3 for the central (more realistic) estimate; the upper estimate for this scenario has the HQ = 15. For large birds (4kg), however, risks are lower; HQ = 0.3 for the central (more realistic) estimate; the upper estimate for this scenario has the HQ = 1.7. A ruffed grouse would be considered medium sized, and the upper estimates assume maximum exposures that are implausible for this project.

Given the diet and foraging habits of grouse, they are unlikely to forage exclusively in one patch of treated invasive plants, so actual doses that exceed levels of concern are unlikely. R6 PNW ROD Standard #16 limits the use of triclopyr to selective application techniques only (e.g. spot and hand), where impacts to non-native vegetation that grouse would consume are minimized.

Central estimates for a small, foliage eating bird, glyphosate also minimally exceeds the no adverse effect exposure level, assuming broadcast treatment over an acre. However, for a large bird, no exceedances were calculated. Glyphosate use is not likely to pose risks to ruffed grouse since they are unlikely to feed on a patch of treated invasive plants and even if they did, risks are relatively low.

Grouse are susceptible to the limited disturbance caused by treating patches of invasive plants but the intensity and duration of the impact would be low.

Invasive plant treatments (including mechanical, manual, biological, herbicide, and cultural treatments) would have no effect on mature deciduous riparian habitat, nor would they likely cause disturbance or herbicide exposure to deciduous riparian dependent species.

No alternative would have direct or indirect effects on snag and down wood dependent species likely, so would not add incrementally to the effects of past, present or reasonably foreseeable future actions; therefore no cumulative effects to snag and down wood dependent species such as ruffed grouse would result.

Landbirds and Birds of Conservation Concern

Landbirds include Birds of Conservation Concern (BCC) 2008 (USDI Fish and Wildlife Service 2008c), and landbirds identified in the Partners-in-Flight (PIF) and Conservation Strategy. Species that are on these lists, which have not been addressed above, are displayed below.

Table 3.29 displays the risks to these birds from herbicide use based on the most relevant exposure scenario. Most species eat more than one type of food. Species have been placed into the Animal/Diet Group that was most conservative or that had the highest likelihood of exposure from the proposed treatments.

Table 3.29: Risk to Birds from Invasive Plant Treatments

Animal/Diet Group	Potential Effects (R6 Invasive Plant FEIS 2005 and 2013 Risk Assessment Worksheets)	Species	Species List
Predatory Birds	Manual, mechanical, cultural, biological and herbicide treatments could disturb species during the nesting season or affect their prey base. Worst-case exposure does not exceed toxicity index for any herbicide at either typical or maximum application rates, under either acute or chronic scenarios.	Prairie falcon	BBC
		Golden eagle	BCC
		Sandhill Cane	BCC
Insectivorous Birds	Manual, mechanical, cultural, biological and herbicide treatments could result in trampling or harm to eggs/young of ground- or low-nesting species during the breeding season. Herbicide use as proposed in this project does not appear to be a risk to these small insectivorous birds; triclopyr at the acute upper estimate only minimally exceeds the no adverse effect level. Such exposures are not plausible given the type of infestations to be treated, PDFs and standards limiting triclopyr to selective use. No estimate for chronic exposure is calculated, but chronic exposure is not plausible.	Willow flycatcher, Black swift, Loggerhead shrike, Chipping sparrow, Hermit thrush, Olive-sided flycatcher, Nashville warbler, Ash-throated flycatcher, Grasshopper sparrow, Burrowing owl	BCC

Animal/Diet Group	**Potential Effects** **(R6 Invasive Plant FEIS 2005 and 2013 Risk Assessment Worksheets)**	**Species**	**Species List**
	No threats of harm to eggs/nestlings would result from any proposed treatment method as birds are cavity nesters. No risk of ingesting insect prey that have been exposed to herbicides due to feeding methods; food sources are protected (beetles and ants are buried inside of decaying wood). For the Flammulated owl, potential threats occurring from ingesting insects exposed to herbicides are also limited to triclopyr at the upper estimate. No estimate for larger birds or chronic exposure is available but likely the larger size of this bird reduces that chance of a plausible exposure. Chronic exposure is not possible.	White-headed woodpecker Pygmy nuthatch, Lewis' woodpecker, Brown creeper, Williamson's sapsucker, Black-backed woodpecker, Red-naped sapsucker, Flammulated owl	PIF &/or BCC
Seed foraging **Birds**	No threats of harm to eggs/nestlings would result from any proposed treatment method as birds nest in the upper canopy of conifers. No risk of ingesting forage exposed to herbicides due to feeding methods; food sources are protected (cached seeds are generally covered and not susceptible to herbicide exposure); seeds sources are protected inside cones.	Clark's nutcracker, (also pertains to woodpeckers)	PIF
Nectar foraging **Birds**	Manual, mechanical, cultural, biological and herbicide treatments could result in trampling or harm to eggs/young of ground- or low-nesting species during the breeding season. No risk of ingesting forage that has been exposed to herbicides due to feeding methods; food sources are protected-nectar of flowers is inside the "throat" of the flower, which would not result in ingestion of any herbicide.	Calliope hummingbird	BBC
Herbivorous Birds	Manual, mechanical, cultural, biological and herbicide treatments could result in trampling or harm to eggs/young of ground- or low-nesting	Blue grouse, Sharp-tailed grouse	PIF

Animal/Diet Group	Potential Effects (R6 Invasive Plant FEIS 2005 and 2013 Risk Assessment Worksheets)	Species	Species List
	species during the breeding season. See ruffed grouse above; triclopyr and glyphosate use poses relatively greater risk to grouse, but the level of exposure needed to exceed the no adverse effect level is implausible.		

3.7.5 Consistency Findings

The following sections disclose the degree of risk/effect/impact for each wildlife species of concern and the procedural steps needed to ensure that this project is conducted consistent with regulations, policies and plans related to wildlife. Standard #20 from the R6 PNW ROD would be met because the project design features minimize or eliminate adverse effects on these species.

Under the Northwest Forest Plan, this project would meet ACS objective #9, riparian reserve standard and guideline RA-3 and LSR standard and guideline for non-native species by maintaining and restoring habitat for native wildlife species through the eradication, containment, control or suppression of non-native plants.

The National Forest Management Act would be met. Viable populations of all native and desirable non-native wildlife species would be maintained and listed threatened or endangered species populations would be conserved (36CFR219.19). Sensitive species and Management Indicator Species (MIS) would not be jeopardized.

This project is consistent with Okanogan and Wenatchee National Forest Plan standards and guidelines related to wildlife. Under the Northwest Forest Plan, this project would meet ACS objective #9, riparian reserve standard and guideline RA-3 and LSR standard and guideline for non-native species by maintaining and restoring habitat for native wildlife species through the eradication, containment, control or suppression of non-native plants.

Endangered Species Act

The following findings and determinations are associated with each species listed or proposed for listing under the Endangered Species Act. Species with No Effect do not require further consultation with regulatory agencies. Informal consultation is required for species with the determination that the project may affect, but is not likely to adversely affect, federally listed species. A biological evaluation will be submitted to the US Fish and Wildlife Service for their concurrence that this project would not adversely affect wolf, lynx, bear, owl or murrelet.

Species	Determination	Reason
Gray wolf	NLAA	Exposure to herbicides or surfactants is not likely and disturbance from loud machinery is avoided through PDF J-1.

Species	Determination	Reason
Canada lynx	NLAA	Exposure to herbicides or surfactants is not likely and disturbance from loud machinery is avoided through PDF J-1.
Canada lynx designated critical habitat	No Effect	No effects to primary constituent elements.
Grizzly bear	NLAA	Exposure to herbicides or surfactants is not likely and disturbance from loud machinery is avoided through PDF J-1.
Northern spotted owl	NLAA	Exposure to herbicides or surfactants is not likely and disturbance from loud machinery is avoided through PDF J-2.
Northern spotted owl designated critical habitat	No Effect	No effects to primary constituent elements.
Marbled murrelet	NLAA	Exposure to herbicides or surfactants is not likely and disturbance from loud machinery is avoided through PDF J-3.
Wolverine	No Jeopardy	Exposure to herbicide or surfactants is not likely.
NLAA = May Affect, Not Likely to Adversely Affect		

Sensitive and Survey and Manage Species

Table 3.30 displays findings and determinations are associated with each species listed on the most recent RF sensitive list (date) or are survey and manage species under the Northwest Forest Plan. For sensitive species, impacts range from “no impact (NI)” to “may impact individuals, but would not impact populations” (MII) where minimal risk exists.”

For survey and manage species, two determinations are shown, “No Jeopardy” (NJ) if species are not present, and “Not Likely to Jeopardize the Continued Existence of the Species” (NLJ) where the species exists but risks are minimal. PDFs ensure that these species would be considered in treatment planning.

Table 3.30: Findings and Determinations for Forest Service Sensitive and Survey and Manage Species

Species	Determination	Reason
Mammals		
Pacific Fisher	No impact	Not present in project area
Cascade red fox	No impact	Not likely present during treatment, herbicide effects or disturbance unlikely
Western gray squirrel	No impact	Treatments could improve habitat, but have no adverse effect.
Townsend’s big-eared bat	No impact	Not likely present during treatment, herbicide effects or disturbance unlikely
Little brown myotis	No impact	Not present in project area
Bighorn sheep	No impact	Not likely present during treatment, herbicide effects or disturbance unlikely
Mountain goat	No impact	Not likely present during treatment, herbicide effects or disturbance unlikely, would slightly improve habitat
Birds		

Species	Determination	Reason
Bald eagle	No impact	Adverse effects from herbicide unlikely, PDF J-4 substantially reduces potential for effects
Northern goshawk	No impact	Adverse effects from herbicide unlikely, PDF J-11 substantially reduces potential for effects
American peregrine falcon	No impact	Adverse effects from herbicide unlikely, PDF J-5 substantially reduces potential for effects
Great gray owl	No impact	Adverse effects from herbicide unlikely, PDF J-11 substantially reduces potential for effects
Gray flycatcher	No impact	Not likely present during treatment, herbicide effects or disturbance unlikely
White-headed woodpecker	No impact	Not likely present during treatment, herbicide effects or disturbance unlikely
Lewis' woodpecker	No impact	Not likely present during treatment, herbicide effects or disturbance unlikely
Sandhill crane	No impact	Not present in project area
Harlequin duck	MII	Low likelihood of disturbance, adverse effects from herbicide unlikely
Common loon	MII	Low likelihood of disturbance, adverse effects from herbicide unlikely
Sharp-tailed grouse	No impact	Not present in project area
Amphibians and Reptiles		
Larch Mountain salamander	No impact	Not likely present during treatment, ARBO II PDFs 11 and PDF J-7 substantially reduces potential for effects
Pacific pond turtle	No impact	Not present in project area
Striped whipsnake	No impact	Not present in project area
Invertebrates		
Puget Oregonian	No impact	Not likely present during treatment, ARBO II PDFs 11 and PDF J-7 substantially reduces potential for effects
Masked duskysnail	MII	Some individuals may be trampled, suitable habitat would be maintained or improved, herbicide effects unlikely, PDF J-8 minimize potential for effects
Chelan mountainsnail, Grand Coulee mountainsnail, Shiny tightcoil	MII	Some individuals may be trampled, suitable habitat would be maintained, herbicide effects unlikely, ARBO II PDFs 11 and PDF J-7 minimizes potential for effects
Blue-gray taildropper	No impact	Not present in project area
Western bumblebee	MII	Suitable habitat would be maintained or improved, herbicide effects unlikely
Mardon skipper	MII	Some individuals may be trampled, suitable habitat would be maintained or improved, herbicide effects unlikely, ARBO II PDFs 11 and PDF J-10 minimize potential for effects
Lustrous copper	No impact	Not present in project area
Melissa arctic	No impact	Not present in project area
Meadow fritillary	No impact	Not present in project area

Species	Determination	Reason
Astarte fritillary	No impact	Not present in project area
Freija fritillary	No impact	Not present in project area
Great Basin fritillary	No impact	Not present in project area
Labrador sulphur	No impact	Not present in project area
Peck’s skipper	MII	Some individuals may be trampled, suitable habitat would be maintained or improved, herbicide effects unlikely, ARBO II PDFs 11 and PDF J-10 minimize potential for effects
Tawny-edged skipper	MII	Some individuals may be trampled, suitable habitat would be maintained or improved, herbicide effects unlikely, PDFs J-10, F-1 thru F-7 minimize potential for effects
Zigzag darner	MII	Some individuals may be trampled, suitable habitat would be maintained or improved, herbicide effects unlikely, PDF J-8 minimize potential for effects
Subarctic bluet	No impact	Not present in project area
Subarctic darner	No impact	Not likely present during treatment, PDF J-8 minimize potential for effects
MII = May impact individuals, but would not impact populations. NJ = No Jeopardy NLJ = Not Likely to Jeopardize the continued existence of the species		

3.8 Rangeland Resources

3.8.1 Introduction and Regulatory Framework

The Forest operates under two Land and Resource Management Plans (Forest Plans) which have several amendments. Although the original Okanogan Forest Plan (1989) has no management direction specific to livestock grazing as it relates to invasive species, the Wenatchee Forest Plan requires that invasive species be suppressed, contained, controlled or eradicated, as budget allows giving third priority to areas in or adjacent to commodity producing areas and fourth priority to areas adjacent to disturbed areas.

3.8.2 Analysis Methods

Infested acres are the primary measure used to indicate the impact of invasive species infestations within grazing allotments. Infested acres are the proportion of the total mapped area that is infested with the target invasive species. The mapped area is delineated by a polygon that may represent a general area where the population is found or may represent the spatial extent of the infestation or population. The often larger mapped polygon area delineates the actual perimeter of the infestation and may contain substantial areas that are not currently occupied by weeds. The mapped polygon acres will also be displayed to disclose the general area of infestation within the grazing allotment where cattle impacts would occur (where cattle grazing would potentially spread the weeds or where weeds would likely continue to displace palatable native vegetation).

3.8.3 Affected Environment

Presently, 37 percent of the Okanogan-Wenatchee National Forest is within cattle and sheep grazing range allotments (1,571,992 acres, based on INFRA data located at the Okanogan-Wenatchee National Forest Supervisor's Office). Many of the grazing allotments have invasive plant sites located within. Numerous factors contribute to the establishment and spread of invasive species, one of which can be ungulate grazing and browsing. Of these103 allotments (74 active and 29 vacant), 83 percent have invasive species sites. These invasive species sites within allotments represent approximately 69 percent of the infested acres forest wide (11,284 of the total 16,281 infested acres are within grazing allotments). Four allotments have been closed to grazing where invasive plants may have been introduced. Allotment acres, and invasive plants identified within allotments are presented in Table 3.31.

Table 3.31: Invasive Plants within Grazing Allotments

Allotment Status	*Allotment acres	Invasive Plant Infested Acres	Invasive Plant Mapped Polygon Acres	Percent of Allotment Mapped Polygon Acres occupied by Invasive Plants	Percent of Total Forest Land base infested with Invasive Plants (Mapped Polygon Acres)
Active	1,061,551	9,443	65,537	6.2	1.5
Vacant	490,189	1,841	13,501	2.6	.3
Closed	78,521	0.2	1.3	.002	~0
Total	1,630,261	11,284	79,039	4.8	1.9

*Includes non-Forest lands.

Domestic and wild grazing animals contribute to invasive plant establishment and spread through selective eating, redistribution of invasive plant seeds in manure, skin, hair, and hooves, and soil disturbance, which creates 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 methods (Sheley, et al., 1996). [17]

Invasive species are not present on all allotments, nor are they present on only active allotments. On the Wenatchee National Forest in particular, many allotments have been vacant for several decades or more and yet invasive species are present on many of these. Invasive species are not confined uniquely to grazing allotments, as these plants are commonly present where no allotments exist. It is evident that the distribution of invasive plants across the Forest is strongly connected to the impacts of historic livestock grazing. This is especially evident where invasive plants are common on the Chelan, Entiat, and Wenatchee River Ranger Districts where there is little to no active grazing, but a lot of historic grazing occurred (See vacant allotments, Table 3.31).

Historical grazing either by domestic or wild grazing animals likely occurred over much of the project area, but recent livestock grazing activities are much more defined and concentrated on managed allotments. There is likely a connection between unmanaged, historic livestock grazing to the increase of some invasive plants. However, in more recent times there is still a connection and problems associated with spread of invasive plants into well managed allotments as well as allotments that have been vacant to

[17] For a complete review of the influence of ungulates on non-native plant invasions in forests and rangelands, see the R6 PNW 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.

livestock grazing for decades. For example, on the Methow and Naches Ranger Districts, Dalmatian toadflax has spread into areas within active allotments where very light cattle grazing occurs. On the Chelan Ranger District, Dalmatian toadflax and common crupina appears to be able to spread into native upland blue bunch wheatgrass/bitterbrush plant communities; however these infestations coincide with known historic grazing areas of both sheep and horses. Some of the expansion of the common crupina populations was after livestock had been removed from the Round Mountain allotment but the area of expansion had received heavy historical grazing.

Houndstongue, diffuse knapweed, Dalmatian toadflax, spotted knapweed, Canada thistle and St. John's wort are the Washington State listed invasive species that are most prevalent in the allotments forest-wide. The invasive plants are scattered within mapped infested areas, often with low density.

Dispersal vectors for houndstongue seed (burs) are primarily by cattle. Deer, elk and other small mammals are also thought to readily disperse houndstongue seed, but dispersal is minor compared to cattle (de Clerck-Floate 1997). Most of the houndstongue populations are spread across six grazing allotments on the Tonasket Ranger District. The level of infestation within National Forest System lands is variable with some dense populations. The houndstongue plants are often widely scattered throughout the grazing allotments with most of the spread attributed to livestock dispersal. The populations were mapped based on grazing allotment boundaries because populations were too widespread to map each scattered patch, although infestations contain sizeable areas that are not currently occupied by weeds. Non-National Forest System lands adjacent to these populations are also infested with houndstongue.

The largest Dalmatian toadflax infestations are located in the vacant Union Valley and Antoine Creek allotments on the Chelan District and on the active Eagle-Blag and Naches allotments on the Naches District. A relatively large population is also present on the vacant Swakane allotment on the Entiat District. Dalmatian toadflax is commonly found in the upland shrub steppe habitat type.

Diffuse knapweed (83 allotments), spotted knapweed (59 allotments) and St. John's wort (54 allotments) are common along roads within a majority of allotments (103 allotments total). These species are most often confined to the road shoulder and do not invade healthy native plant communities, however where there has been a history of disturbance (i.e., timber harvest, livestock loafing and bedding, gravel extraction), these species have invaded off road areas. Diffuse knapweed has invaded the drier more open sites and can be very dense in disturbed areas. Canada thistle is most commonly associated with the drier edges of wetlands. It often forms very dense patches within the transition zone between the wetland and uplands, especially where there has been historic livestock grazing.

The most common invasive plants, bull thistle, cheatgrass, common mullein, and bulbous bluegrass are prevalent forest-wide; the Naches, Cle Elum, Wenatchee River, Entiat and Chelan Ranger Districts have mapped some of these low priority species (see Table 3.1 and Table 3.2: Infested Acres by Type of Site). These species are widespread on the Forest or District and are generally very low priority for treatment and are often not mapped. The population densities of these low priority invasive species are similar on the Methow Valley and Tonasket Ranger Districts.

There are several species of new invader weeds that have established within grazing allotments on the Forest. Hoary alyssum is very aggressive new invader on the Tonasket Ranger District and more common in drier forest habitats. Hoary alyssum has recently established within 8 grazing allotments within the project area with the potential to spread rapidly to more allotments. Once established, it decreases forage value because the woody stems of mature plants are low in crude protein and digestible carbohydrates. The ability of hoary alyssum to persist under dry conditions and its continuous flowering and fruiting enables it to compete with native plants on range and wildlands and reduce biodiversity (Jacobs, Mangold, 2008). Similarly, musk thistle and common crupina are aggressive invaders in the shrub steppe and drier forested rangelands but are still confined to relatively localized areas on the Forest.

Orange and meadow hawkweed are new invaders in mountain meadows, and moist forest openings, and are currently established within the Tonasket and the Methow Valley Ranger District allotments. Orange hawkweed can reproduce by seeds, stolons, rhizomes, and buds on the roots. Once established, it quickly develops into a patch that continues to expand until it covers the site with a solid mat of rosettes with as many as 3,200 plants per square yard, displacing other vegetation (Wilson and Callihan 1999). These conditions, with a solid mat of rosettes, have been observed on the Forest.

Whitetop is also an aggressive new invader in rangelands and often invades the more productive forage areas. One of the largest populations of whitetop is in shrub-steppe habitat in the Squaw Gulch allotment on the Methow Valley Ranger District. It is most often found in the bottom of swales within shrub steppe habitat where there is deeper soil and more moisture. This species is in direct competition with livestock forage. Populations of these new invader species are still relatively small and localized on the Forest. Most all whitetop sites are on the Methow Valley Ranger District, with only one site on the Naches Ranger District and one on the Tonasket Ranger District.

Domestic and wild grazing animals can both contribute to plant invasion through: (1) selective eating of native plants while leaving invasive species alone, thus favoring an increase in invasive plants; (2) ingesting or carrying invasive plant seeds in/from one area and spreading them to other areas through manure, digestive products, skin, hair and hooves, and (3) disturbing the soil which creates conditions favorable to invasive plants or the germination of invasive plant seed though scarification. (R6 PNW FEIS, p. 3-19).

Several intentional and unintentional introductions of invasive plants into native plant communities have been associated with livestock management, and some introductions have resulted in widespread invasions. For example, the extremely invasive plant, kudzu was introduced in the southern United States as a forage crop to reduce erosion and to improve the soil. Landscape spread of invasive plants can occur when seeds are moved along transportation corridors from infested sites or infested ungulate forage, attached to or held within animals. Both domestic and wild ungulates spread seeds by these means. Vehicles used for livestock management provide additional vectors for spread. (R6 PNW FEIS, p. 3-19).

Dispersal vectors are primarily vehicles, wind, water, and animals (hair, hooves, and gastrointestinal ingestion and redistribution). In many instances cattle and other browsers avoid areas where invasive weeds are prevalent in large monocultures, and move to areas where desirable forage occurs. Some weed seeds are destroyed within the gastrointestinal tract; however, seeds can pass through grazing animals with some of the seeds still remaining viable (Wallander et al. 1995). Long-lived seeds and hard seeded species of forbs and grasses consumed by grazers have been reported to survive passage through gastrointestinal tracts of cattle (Gardner et al. 1993).

Watering systems, such as troughs and tanks with frequent animal visitation, and other range structural improvements such as corrals where the ground is disturbed, have high potential for invasive plant establishment and spread. However, the ground is often constantly disturbed within active grazing allotments preventing establishment of introduced seed. Vacant and closed allotments are more likely to have established invasive plant populations associated with structural improvements where the plants have had a chance to grow and spread outside the disturbed areas. Additionally, livestock often exhibit trailing behavior that can result in disturbed areas for invasive species to establish and spread. Areas with the highest potential for trailing impacts from livestock are fence lines, road shoulders, and travel routes between foraging areas and water sites. In addition, cattle loafing areas and sheep bed grounds create suitable disturbance for invasive plant establishment. There are 17 corrals, 833 water troughs, 342 miles of fence, and 663 acres of sheep bed grounds on the Okanogan-Wenatchee equaling approximately 1200 acres of disturbed areas on the Okanogan-Wenatchee National Forest where invasive plants have or could establish.

Table 3.32 displays overlap between invasive plants and active allotments on the Forest.

Table 3.32 Invasive Plants within Active Grazing Allotments

Active Allotment	District	Class of Livestock C=Cattle S=Sheep	INFRA allotment acres	Infested Acres
Aeneas	Tonasket	C	14,161	323.7
Alta Coulee	Chelan	C	2,937	25.0
Annie	Tonasket	C	12,948	263.5
B.S.	Tonasket	C	9,102	36.8
Bailey	Tonasket	C	13,607	220.6
Bannon	Tonasket	C	5,458	74.4
Beaver	Methow	C	44,068	31.5
Benson	Methow	C	22,245	10.3
Beth	Tonasket	C	741	2.8
Big Canyon	Tonasket	C	6,044	93.2
Bodie	Tonasket	C	120	6.1
Boulder	Methow	C	7,803	0.7
Buck	Methow	C	1,281	14.1
Cayuse	Tonasket	C	1,310	10.0
Cedar	Tonasket	C	23,439	1157.4
Clark	Tonasket	C	10,529	131.9
Cobey	Tonasket	C	500	10.0
Conrad Meadows	Naches	C	4,060	5.8
Cub	Methow	C	65,750	123.7
Cumberland	Tonasket	C	11,670	206.7
Deadhorse	Tonasket	C	2,117	0
Dugout	Tonasket	C	6,002	450.4
Eagle Blag	Naches	S	21,274	351.0
East Chewack	Methow	C	33,177	32.6
Ethel	Tonasket	C	2,437	65.8
Fawn	Methow	C	14,419	75.6
Finley	Methow	C	13,047	13.8
Fir	Tonasket	C	6,791	79.5
Fish Coulee	Tonasket	C	235	0
Frazer	Methow	C	11,422	3.0
Frosty	Tonasket	C	10,546	30.7
Funk	Tonasket	C	2,505	4.0
Goat	Methow	C	18,094	33.9
Gold	Tonasket	C	4,460	259.1
Goodenough	Tonasket	C	769	0
Haley	Tonasket	C	5,368	412.2
Hull	Tonasket	C	13,958	598.9
Hunter-Mcfarland	Methow	C	50,869	36.9

Active Allotment	District	Class of Livestock C=Cattle S=Sheep	INFRA allotment acres	Infested Acres
Limekiln/Sugarloaf	Naches	S	18,309	20.6
Little Bridge	Methow	C	27,498	40.5
Lookout Mountain	Methow	C	47,952	38.7
Lost	Tonasket	C	1,187	1.2
Manastash	Naches	S	21,056	160.8
Mosquito Ridge	Naches	S	14,377	103.9
Mutton Creek	Tonasket	C	4,145	0
Naches	Naches	S	39,626	377.1
Nile	Naches	S	61,100	823.6
No. 2 Canyon	Wenatchee	C	370	0.0
Ogle	Tonasket	C	5,996	150.2
Phoebe	Tonasket	C	16,101	425.8
Rainy Jove	Naches	S	11,714	5.7
Ramsey	Methow	C	12,308	7.7
Rattlesnake	Naches	S	15,032	282.7
Revis	Tonasket	C	229	9.1
Ryan	Tonasket	C	8,077	20.4
Salmon Basin	Tonasket	C	21,819	175.8
Schalow	Tonasket	C	1,226	0.9
Sheridan	Tonasket	C	3,054	0
Siwash	Tonasket	C	15,073	266.5
Soup Creek	Naches	C	19,973	51.9
Strawberry	Tonasket	C	14,344	371.6
Swauk	Naches	S	20,892	483.5
Switchback	Naches	S	11,204	61.9
Texas	Methow	C	2,577	1.0
Tieton	Naches	C	42,083	226.6
Toats Coulee	Tonasket	C	56,754	6.5
Toroda	Tonasket	C	5,147	4.8
Tunk	Tonasket	C	16,961	66.8
Virden	Cle Elum	C	640	0
Wauconda	Tonasket	C	13,884	37.1
Wheaton	Tonasket	C	462	0
Wolf (Active Portion)	Methow	C	14,866	24.4
		Totals	1,061,551	9,442.9

Acres of invasive plants overlapping vacant allotments, and lists of invasive plant species within various allotments, are available in the project record.

3.6.4 Environmental Consequences

Effects of Treatment Methods

All alternatives authorize integrated treatments using a combination of treatment methods. Manual control methods include non-mechanized treatments, such as hand pulling or using hand tools to remove plants by cutting, digging, or removing seed heads. Mechanical methods typically include handheld power tools such as: mowers, brushers, weed whackers. Manual methods can be effective and are sometimes the easiest and quickest methods on small infestations if the entire root is removed (see Chapter 3.2 in this EIS).

Mowing would have the potential for the greatest reduction of forage production of all the manual/mechanical methods. Manual/mechanical treatments may contribute to slight short-term losses of forage production but any losses would not be enough to cause a direct effect to allotment management because the amount of forage removed would be negligible relative to the total forage production in a pasture.

Cultural methods ore described in the PNW FEIS on pages 3-82 and 3-83. These methods are generally targeted toward enhancing desirable vegetation to minimize invasion. Common cultural treatments include planting or seeding desirable species to shade or out-compete invasive plants, and laying cloth or plastic over small infestations. These methods would be used on a very limited scale relative to the large grazing areas with minimal to no effects anticipated on livestock grazing or allotment permittees. Competitive seeding of desirable plants by tillage and drilling combined with herbicide treatment can be effective and would be a cultural treatment option in some areas with a net increase in desirable livestock forage. There would be a delayed forage benefit as the treatment area would need temporary livestock exclusion fencing until treatment objectives area met. Fertilization would be very limited in use and is most effective in pastures or rangelands where nitrogen levels are not high enough for optimum grass performance. This would be a beneficial effect to forage production but on a very limited scale.

The release of biological control agents would have no effect on grazing allotment permittees or range resources. The effectiveness of biocontrol may be impacted by livestock grazing if the animals select the target invasive plant. Few invasive plants are selected for by grazing animals, however there may be limited situations where the invasive plant targeted for biological agent release is the dominate vegetation and much of the above ground biomass would be removed by livestock. Coordinating the timing of the biocontrol releases with the grazing use periods or routing schedules (sheep) would reduce potential conflict.

Some herbicides have label use restrictions that would 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, grazing restrictions on the label would be followed.

Direct and Indirect Effects of Alternative 1

Alternative 1 would allow about 6,000 acres to be treated as authorized under current NEPA. The majority of infested acres of invasive plants would not be treated and would likely continue to spread (see chapter 3.2.4 for more information). Many of the acres treated under existing decisions are within grazing allotments and as invasive species continue to spread via common dispersal methods, rangeland resources could become more degraded. Without effective treatment, invasive plants would likely continue to displace palatable native vegetation and could reduce forage amounts on grazing allotments. Activities within allotments would continue to serve as seed dispersal vectors as these invasive species sites continue to grow. As described in the treatment effectiveness section, invasive plants would continue to displace native plant species, thereby decreasing vegetative diversity, and serving as additional seed sources for new infestations both on and off National Forest system lands. Once invasive species begin to dominate these communities, a loss of species diversity, composition, and ecosystem function could occur. Invasive species would likely continue to spread into areas that are not currently infested. Established invasives would likely serve as seed sources for spread to other areas of the Forest and nearby or adjacent other Federal, State or private lands.

Direct and Indirect Effects of Action Alternatives

Alternatives 2 and 3 would treat up to 16,281 infested acres Forest-wide per year. Treatments on the 103 affected grazing allotments (approximately 1,571,992 acres) would help maintain and restore forage on treated sites and adjacent lands. This alternative may result in some short-term effects to allotment management such as adjustments to pasture rotations or routing patterns. For instance, grazing would be avoided on a recently sprayed pasture (re-entry period according to the herbicide product label). Permittees may experience a slight loss of grazing opportunity, however many of the grazing strategies within allotments have deferred rotations and, as proper timing permits, focusing invasive weed treatments to the pastures during the resting phase would reduce potential impacts to the livestock operators. An actual reduction in Animal Unit Month (AUM) attributed to invasive plant management cannot be quantified at the project scale due to unavailable data, variability between allotments, and the ongoing process of Allotment Management Plan revision.

Alternative 2 would more effectively reduce potential for spread of invasive species into un-infested disturbed areas such as fence lines and sheep bed grounds or into undisturbed native plant habitat. Populations of new invader species such as hoary alyssum, orange hawkweed, and whitetop which are still relatively small and localized would be much less likely to spread to other disturbed areas of the grazing allotments. Management objectives to eradicate, or control these small sites would reduce the potential threat to species diversity, composition, and ecosystem function and the potential to greatly reduce available forage within grazing allotments.

Similar to the effects discussed in Alternative 2, Alternative 3 may result in some short-term effects to allotment management to avoid a situation where the livestock would graze the weed species before or immediately after treatment. Adjustments may be needed to pasture rotations or routing patterns, timing and duration of use where these activities are implemented on active allotments. Permittees may experience a slight loss of grazing opportunity, however many of the grazing strategies within allotments have deferred rotations and focusing invasive weed treatments, when feasible, on pastures during the resting phase would avoid most all potential impacts to the livestock operators. Because fewer acres would be treated with herbicides, less potential for herbicide exposure to livestock and permittees would result. However, no impacts from herbicide exposure are predicted in any alternative.

Alternative 3 is less cost effective (see Chapter 3.2) than Alternative 2 so the potential for positive impacts on rangeland resources would be less. Both action alternatives would improve rangeland condition compared to Alternative 1.

Early Detection Rapid Response

Early treatment of newly discovered infestations would prevent establishment and spread of invasive species, helping to maintain available forage and current livestock stocking levels. EDRR would reduce effects to cattle and sheep from toxic species. Any EDRR treatments would be subject to the 16,281 acre annual treatment cap (including any existing treatments), but would allow for treatment to be quickly initiated on infestations of a new species when treatments can do the most good.

Forest Plan Amendment

Adding aminopyralid would benefit the range resource because it can be applied in a wide range of habitat types and its broadleaf selectivity would not affect forage grasses and sedges important to livestock, resulting in fewer effects to non-target species in general (See Chapter 3.2 above)). Aminopyralid would be the first choice to treat invasive plants on more acres than any other herbicide due to the higher selectivity at lower concentrations with fewer potential environmental effects. Also, this herbicide has no label restrictions on grazing. This herbicide would be very effective in reducing invasive plant competition with non-target palatable vegetation. Controlling invasive plants with this herbicide within grazing allotments would provide the highest potential for more available forage as compared to the herbicides already approved in the R6 PNW ROD, Standard #16.

Cumulative Effects of All Alternatives

Invasive plant spread was estimated to be at 8 to 12 percent in 2005Prevention measures are required for projects on the Forest, including grazing; emphasis on prevention is intended to reduce the rate of spread (R6 PNW FEIS Chapter 4.2).

The cumulative effects spatial analysis area includes all of the National Forest System lands and the non-National Forest System land in-holdings within the Okanogan-Wenatchee National Forest boundary. Past, present and reasonably foreseeable future actions are summarized in the Introduction to Chapter 3. Past management activities on the Forest that have contributed to the establishment of invasive species, and therefore the decline in range health include timber harvest, fuels treatments, wildfire and fire suppression activities, road and utility construction and maintenance, trail management/recreational use and livestock grazing. In recent years, climatic change has resulted in stressors such as drought. Most of the present and reasonably foreseeable future actions listed at the beginning of this chapter would create ground disturbance or vectors for spread which would continue to provide opportunities for invasive species to establish.

Roads would continue to be a major conduit for invasive plants. Forest Service projections suggest that recreation uses of National Forests would continue to increase, and other land management and use activities such as grazing, vegetation management, fuels management (Healthy Fuels Initiative), and fire suppression would continue to cause ground disturbances and contribute to the introduction, spread and establishment of invasive plants on National Forest system lands with associated reductions in range health (R6 PNW FEIS, p. 4-22). Land uses and development on other lands within the National Forest boundary would likely continue to contribute to the potential for invasive species to be distributed in the Forest. For example, the use of invasive plants such as knotweed and purple loosestrife by landowners for landscaping, while small individually, can collectively result in substantial impacts, especially along riparian corridors (R6 PNW FEIS, p. 4-23).

There are 82,978 acres of non-National Forest System lands within grazing allotment boundaries. There would be a potential for introduction and spread of invasive plants on to National Forest lands from these lands. There would be the natural dispersal of invasive species into National Forest land via wind, water, birds and animals, but the highest potential of spread would be along the road systems. Looking only at the allotments containing over 1000 acres of non-Forest land, there are 14 active grazing allotments (with a total of 54,537 acres) and 6 vacant allotments (with a total of 23,537 acres) of non-Forest land within the grazing boundaries. The risk of spread of invasive plants from the non-Forest lands would be the greatest within these allotments.

Otherwise, no cumulative impacts on rangeland resources from land uses or ongoing projects are expected.

3.9 Human Health

3.9.1 Introduction and Regulatory Framework

This section focuses on the health effects to workers and the public from herbicide use proposed in the alternatives. The R6 PNW FEIS and its Appendix Q: Human Health Risk Assessment detailed the potential for health effects from manual and mechanical treatments as well as the use of 8 of the herbicides proposed for this project and is incorporated by reference in this EIS. Four of the risk assessments that were incorporated into the R6 PNW FEIS were updated in 2011 (imazapyr, glyphosate, picloram, and triclopyr). This section includes findings from the newer risk assessments based on herbicide application rates proposed for this project.

The action alternatives would also add a new herbicide, aminopyralid, which is likely to be more effective at lower rates for many of the target species found on the Forest, with less risk of adverse effects. The risk assessment for aminopyralid (SERA 2007) is the primary source of toxicological information about that herbicide.

Herbicide active ingredients, metabolites, inert ingredients, and adjuvants and people with herbicide sensitivity are addressed in the risk assessments and the R6 PNW FEIS.

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 at issue for this project-level analysis. No unusual circumstances have been found requiring the need for additional human health analysis for non-herbicide treatments. For more information on potential hazards associated with non-herbicide treatments, see the R6 PNW FEIS Chapter 3.5.

During scoping the public expressed concerns about the use of herbicides and what kinds of effects they may have on human health and exposures such as direct contact by forest workers, drinking contaminated water, gathering and using special forest products, or as a result of recreationists coming into contact with contaminated vegetation. There is concern about long-term and cumulative effects to humans from the use of herbicides. The public has expressed concerns about whether glyphosate may cause cancer in people, especially since the World Health Organization recently identified this herbicide as a probable carcinogen. This concern is addressed by examining the precautionary processes that are incorporated in the Invasive Plant Treatment planning and implementation processes on the Okanogan-Wenatchee National Forest, and by comparing the alternatives in terms of the potential for worker/public exposure based on the best available science in the SERA Risk Assessments.

The use of herbicide in the action alternatives would be according to label requirements, with further restrictions in the R6 PNW ROD (Forest Plan) standards. For example, treatment restoration standard 15 requires application be performed or directly supervised by a licensed applicator; standard 16 includes restrictions on tank mixtures; and standard 23 requires timely public notification and signing of treatment areas.

Invasive plant infested sites are scattered throughout the Forest and occupy less than 1 percent of National Forest System lands on the Forest. Invasive plant treatments on the Forest are implemented through Forest Service crews, contracts or in partnership with county crews. Applicators are generally from the communities in and around the Forest and are well-trained in safe herbicide handling and transportation practices. No environmental justice issues have been raised for this project.

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

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

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

3.9.2 Analysis Methodology

This analysis incorporates analysis in the R6 PNW FEIS and scientific risk assessments completed by Syracuse Environmental Research Associates, Inc. (SERA). Appendix Q of the R6 FEIS summarizes information about the human health hazards associated with herbicide use. The risk assessments include peer-reviewed articles from the open scientific literature and current EPA documents, including Confidential Business Information. Along with active ingredients, the assessments also reviewed herbicide additives, inert ingredients, and impurities, where information was available. Hexachlorobenzene (HCB), present as an impurity in picloram at 8 parts per million, and in clopyralid at much lower levels, was also evaluated.

To assess human health risks this analysis compares the dose of herbicide received by a worker or a member of the public under each exposure scenario with the corresponding herbicide “Reference Dose” (RfD) established by EPA or by the Forest Service/SERA risk assessment for acute and/or chronic exposures. If doses from estimated exposures for a specific Forest Service herbicide application are less than the RfD’s, there would be no indication of a risk of health effects.

RfDs are established by taking the no observable adverse effect level (NOAEL) for each herbicide and then adjusting it to compensate for uncertainty. Most frequently, a RfD is 1/100th of the lowest NOAEL, but it may be even lower in some cases. The RfD is also referred to as the toxicity threshold or threshold of concern. The Hazard Quotient (HQ) is the ratio of the estimated level of exposure compared to the RfD. When a predicted dose is less than the RfD, then the HQ (dose/RfD) is less than 1, and toxic effects are unlikely for that specific herbicide application (i.e., the use is presumably safe). No chemical is studied for all possible effects and the use of data from laboratory animals to estimate hazard or the lack of hazard to humans of other species is an uncertain process. Thus, prudence dictates that normal and reasonable care should be taken in the handling of any chemical.

The risk assessments and project specific risk assessment worksheets quantify expected exposures and calculate the HQ’s. These worksheets provide a range of values (lower, central and upper) rather than rely on a single estimate. The upper exposure estimates are based on the maximum estimate for every exposure factor that is considered, which is very unlikely to occur in our operations (e.g., maximum application volume, maximum concentration in field solution, maximum volume of a spill, maximum residue rates on food items, maximum exposure rates, maximum hours worked). The upper exposure estimates are not reflective of the way herbicides would be used in this project and the probability of maximum exposures occurring is very low. Thus, the central and lower estimates provide more realistic risk assessment results and are reported here.

Three of the herbicides proposed in this project (aminopyralid, imazapyr and metsulfuron methyl) did not have any HQ values greater than 1, even for the upper estimates. HQ values for the upper estimates are available in the project files, however, they are not considered plausible for this project and are not discussed further in the human health analysis in this chapter.

Even considering central or lower HQ estimates, many of the exposure scenarios for the general public are implausible or extremely conservative. The general public is unlikely to be directly exposed to treated areas because these areas will be posted and because applicators would avoid directly spraying people.

Estimates of longer-term consumption of contaminated water are based on estimated application rates throughout a watershed; however, only small portions of a watershed would be treated. Exposure scenarios based on longer-term consumption of contaminated vegetation assume that an area of edible plants is inadvertently sprayed and that these plants are consumed by a person over a 90-day period. While such inadvertent contamination might occur, it is extremely unlikely to happen as a result of directed applications (e.g., backpack applications). Even in the case of boom (broadcast) spray operations, the spray is directed at target vegetation and the possibility of inadvertent contamination of cultivated or edible vegetation would be low. In addition, for herbicides and other phytotoxic compounds, it is likely that the contaminated plants would show obvious signs of damage over a relatively short period of time and would therefore not be consumed (SERA 2007).

3.9.3 Affected Environment

Many people live near, spend time in, work in, or depend on forest products from the Okanogan-Wenatchee National Forest. Some dispersed and developed recreation areas (trailheads, campgrounds, picnic areas, recreation sites, boat docks and ramps, etc.), traditional gathering and special forest product collection areas currently occur in or near the vicinity of invasive plant sites. People engaged in these activities could potentially be inadvertently exposed to herbicides from treatment of invasive plants in or near these areas.

A variety of mushrooms, berries, roots, and herbs, some of which have cultural importance to traditional gatherers, occur on the Okanogan-Wenatchee. While no site specific areas have been shared with the Forest Service, the Confederated Tribes of the Colville Reservation and the Yakama Nation, use the Forest for collecting plants that are used to make traditional foods, basket, and medicine. Traditional gathering is essential to the maintenance of tribal traditions and culture. Gathering is also economically important. Gatherers return to the accustomed gathering areas of their ancestors to tend and harvest plants to be used for traditional purposes. Passing these traditions on to future generations preserves conservation ethics and ecosystem stewardship that have evolved over generations.

The Okanogan-Wenatchee National Forest also issues permits for special forest products, such as pine cone and bough collection for the commercial decoration market and firewood gathering. The majority of invasive plant sites occur in disturbed areas, whereas special forest products are more often found in natural settings. Nonetheless, special forest product harvesters have a greater potential for contact with contaminated vegetation than the general public.

Invasive plant infested sites are scattered throughout the Forest and occupy about .04 percent of National Forest System lands on the Okanogan-Wenatchee. Invasive plant treatments on the Forest are implemented through Forest Service crews, contracts, or in partnership with County Weed Boards and their staff. The workers are not associated with any particular race or ethnic background; Forest Service and county workers tend to come from a cross section of the local community (Desser 2011, personal communication with herbicide applicators in Washington Counties).

3.9.4 Environmental Consequences

Introduction

The SERA Herbicide Risk Assessments include analysis for both workers and the general public. One herbicide, triclopyr, poses comparatively greater risk than others to workers and the public, based on the risk assessment quantitative analysis. The only exposure scenarios for workers or the public that pose a discernible risk is from triclopyr, hazard quotient values were less than 1 for all other scenarios, even with worst case assumptions that are not plausible for this project. At more plausible exposures (central estimates, HQ values exceeded 1 for two public exposure scenarios.

Table 3.33: Acute Exposure Scenarios over a Threshold of Concern for the Public (Triclopyr and TCP)

Exposure Scenarios	HQ Central Estimates
Acute – Public Consumption of Contaminated Vegetation	Triclopyr TEA HQ = 6
Acute – Public Consumption of Contaminated Vegetation	TCP HQ=1.8

In both action alternatives, triclopyr is the first choice herbicide for about 90 acres of scotch broom, scattered across 30 sites. Treatment of scotch broom using triclopyr would pose a low level of risk to the public. Public notification of planned treatments, including extra posting of notices at recreation and other developed sites, would allow the public to avoid areas treated with triclopyr (posting would occur for all herbicides as per PDF K-1).

Forest Plan Amendment

The R6 PNW ROD Standard 16 allows herbicides to be added at the project level after completion of appropriate risk analysis and NEPA procedures. Adding aminopyralid to the list of approved herbicides meets the goals and objectives of the R6 PNW ROD, Appendix I-3. Specifically, Goal 3 is to protect the health of people (and to)…..identify, avoid, or mitigate potential human health effects from invasive plants and treatments. Aminopyralid meets this goal because it reduces the amount of herbicide needed to treat target weeds, while reducing risk in comparison to other currently available herbicides.

Direct and Indirect Effects to Workers

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

All herbicides can cause irritation and damage to the skin and eyes if mishandled. Eye or skin irritation would likely be the only overt effect because of mishandling these herbicides. These effects can be minimized or avoided by prudent industrial hygiene practices during handling. Worker exposure can be effectively managed through ordinary prudent practices and use of personal protective equipment (PPE) required for applicators.

Appendix Q: Human Health Risk Assessment of the R6 2005 FEIS, the 2007 Aminopyralid Risk Assessment, and the updated 2011 Risk Assessments summarize risks for backpack and broadcast spraying under normal application and maximum exposures. Exposure levels that were evaluated range from predicted average exposure to worst-case exposure. Risks from accidental/incidental exposures are also displayed. Backpack spray exposures assume that workers on average treat a little more than four acres per day (ranging from 1.5 to 8 acres per day) and broadcast spray exposures assume that workers average 112 acres per day (ranging from 66 to 168 acres per day). For all scenarios, it is assumed that the workers do not receive any protection from exposure provided by clothing.

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

Exposure scenarios involving chemical spills onto the skin are characterized by a spill onto the lower legs as well as a spill onto the hands. In these scenarios, it is assumed that a solution of the chemical is spilled onto a given surface area of skin and that a certain amount of the chemical adheres to the skin. Surfactants or other adjuvants could be used according to label and Standard 18. Many surfactants could cause eye irritation.

The maximum rates proposed for use in the project were evaluated for this EIS (Risk Assessment Worksheets, tabs E02 and E04). Most of the herbicides proposed for use under all alternatives have low potential to harm workers. In most cases, even when maximum rates and upper exposure estimates were considered, HQ values were below the threshold of concern (HQ values below 1). The only herbicide that resulted in HQ values that exceed 1 is triclopyr acid; an HQ = 3 was calculated for workers using worst case estimates for triclopyr TEA; these estimates assume that routine safety practices are not followed. For more realistic central estimates, the HQ = 0.5 indicating no risk from operational worker exposure to backpack use of triclopyr.

In addition to herbicides, the contaminant HCB was quantitatively assessed. The cancer risk from all the worker operational exposures to HCB in picloram or clopyralid are at least two orders of magnitude below the risk standard of one chance in a million, which indicates an inconsequential risk.

Direct and Indirect Effects to the Public

The general public is unlikely to be exposed to high levels of any herbicides used in the implementation of this project. The SERA Risk Assessments considered several exposure scenarios including direct contact, consumption of sprayed vegetation, consumption of drinking water adjacent to a spray operation, and consumption of fish in water adjacent to a spray operation. Accidental exposures including drinking water from a pond contaminated by a large spill were also considered. No reportable spills have occurred on similar projects in Region Six (Desser 2013). The Forest’s 2004 Herbicide Safety Plan prevents spills from occurring or becoming large.

Direct Contact: Exposure is quantified from direct spray and contact with sprayed vegetation scenarios. At the maximum application rates proposed in any alternative, low risk to human health are indicated from direct contact. No scenarios for direct spray or contact with sprayed vegetation resulted in HQs greater than 1. The PDFs include specific notification and posting requirements for administrative and recreation sites to further reduce the possibility of inadvertent direct spray of a member of the public.

Indirect Contact: Quantitative estimates of exposure were conducted for an adult female swimming for 1 hour in water contaminated by runoff from a treated 10-acre slope. All herbicides had HQs orders of magnitude below 1 for this scenario, indicating no plausible risk to the public from this exposure.

Eating Contaminated Vegetation or Fruit: The public could be exposed to herbicide if they eat contaminated vegetation or fruit after spraying, such as berries, mushrooms, or other plants. Directly sprayed plant materials would likely show signs of either dye or herbicide damage, reducing the likelihood they would be consumed. Non-target berries or mushrooms could also be contaminated by drift or uptake from the soil, which would result in lower herbicide residues than direct spraying. The R6 PNW FEIS and the risk assessments considered both one-time acute exposure (eating 1 pound) and chronic 90 day consumption scenarios for eating contaminated vegetation and fruit. These scenarios also approximate the effects of eating other contaminated products, such as mushrooms (Durkin and Durkin 2005).

At the central estimate, only triclopyr resulted in a HQ greater than 1 for either acute or chronic exposures from eating contaminated vegetation, berries or other forest products. Acute consumption of contaminated vegetation had an HQ of 6. Consumption of fruit did not exceed an HQ of 1.

An additional analysis was done for triclopyr for public scenarios involving ingestion of contaminated food or water. Triclopyr has a metabolite, "3,5,6-trichloro-2-30 pyridinol" (TCP), which is more toxic to mammals than triclopyr. TCP and its relevance to human health risk are discussed in detail in the Triclopyr Risk Assessment (SERA 2011). For TCP, acute consumption of contaminated vegetation is the only scenario that exceeded the threshold of concern, with an HQ of 1.8. Assuming dose addition for triclopyr and its metabolite, the total HQ for consumption of sprayed vegetation would be 7.8.

The total HQ of 7.8 is based on reproductive risks to females. Adverse developmental effects in mammals have been observed during laboratory experiments at doses that cause obvious signs of maternal toxicity. No epidemiology studies or case reports have associated human exposures to triclopyr at proposed rates with maternal or developmental effects.

Drinking Contaminated Water: Acute and long-term exposures from consumption of contaminated water were evaluated in the R6 2005 FEIS and the risk assessments. Risks from drinking contaminated water were evaluated for an accidental spill as well as water contaminated by runoff. The risk assessments also evaluated an accidental exposure scenario where a small child drinks 1 liter of water from a quarter-acre pond, into which the contents of a 200-gallon tank that contains herbicide solution is spilled, immediately following a spill. The Forest's 2004 Herbicide Safety Plan prevents spills from occurring or becoming large.

No herbicides resulted in HQs greater than 1 for drinking contaminated water in either acute or chronic scenarios. All calculated HQs were many orders of magnitude below the threshold of concern.

Consuming Contaminated Fish: Both acute and long-term exposure scenarios involving the consumption of contaminated fish were evaluated using the herbicide concentrations in the contaminated water scenarios described above. Acute exposure was based on the assumption that an angler consumes fish taken from contaminated water shortly after an accidental spill into a pond. Chronic exposures were assumed to occur over a lifetime of eating contaminated fish. People who subsist on fish (for example Native American Indians) could have higher exposure rates than recreational anglers. However, based on a lifetime of subsistence fish consumption, no HQ values greater than 1 are associated with the herbicide use proposed in any alternative.

The risk assessments for picloram (SERA 2011) and clopyralid (SERA 2004) also quantitatively assessed chronic risk from HCB for consumption of contaminated fish by subsistence populations. The HQ for carcinogenicity for picloram was 0.4; below the level of concern. Likewise, the HQ for clopyralid is below the level of concern (clopyralid has much less HCB than does picloram).

The HQs for TCB for consumption of contaminated fish are all orders of magnitude below the level of concern, and do not approach 1, even if added to the HQs for triclopyr.

Glyphosate and Cancer: Many recent articles have circulated announcing that in March 2015, the International Agency for Research on Cancer (IARC) has categorized glyphosate as "probably carcinogenic to humans." This is not based on new studies; the studies that were used in IARC's designation have been out a long time. The SERA 2011 Glyphosate Risk Assessment thoroughly discusses the carcinogenic, mutagenic, and genotoxic potential for glyphosate, using many of the same studies reviewed by the IARC.

In 2014, EPA reviewed over 55 epidemiological studies conducted on the possible cancer and non-cancer effects of glyphosate. Their review concluded that this body of research does not provide evidence to show that glyphosate causes cancer, and it did not warrant any change in EPA's cancer classification for glyphosate.

Glyphosate is currently approved for continued use under the No Action alternative and is not a first choice in the action alternatives. Best available science indicates that glyphosate proposed for use in this project would not increase anyone's risk of cancer.

Endocrine Disruption

The potential for the proposed herbicides to cause endocrine disruption effects was addressed in each risk assessment.

The United States Environmental Protection Agency has determined that there is no evidence to suggest that clopyralid or metsulfuron methyl has an effect on the endocrine system (SERA 2004). Based on the chronic bioassays and several additional subchronic bioassays in mice, rats, dogs, and rabbits, there is no basis for asserting that aminopyralid would cause adverse effects on the immune system or endocrine function (SERA 2007). No evidence for chlorsulfuron producing direct effects on the endocrine system was found (SERA 2004).

The glyphosate risk assessment (SERA 2011) stated that "some recent studies raise concern that glyphosate and some glyphosate formulations may be able to impact endocrine function through the inhibition of hormone synthesis (Richard et al. 2005; Benachour et al.2007a, b), binding to hormone receptors (Gasnier et al. 2009), or the alteration of gene expression (Hokanson et al. 2007)" (all references as cited in SERA 2011). Evaluation of the studies indicates that endocrine disruption effects were indicated for surfactants in the formulations rather than glyphosate itself. A commercial surfactant would be added to glyphosate when preparing the solution for application, but the surfactant type of choice is methylated seed oil/crop oil concentrate, which is typically a corn oil derivative and not implied in causing endocrine effects. No POEA or NPE based surfactants would be used.

In the review of the mammalian toxicity data on imazapyr, U.S. EPA Office of Pesticide Programs concluded that "there was no evidence of estrogen, androgen and/or thyroid agonistic or antagonistic activity shown." SERA found that this conclusion was reasonable, based on their review of current information in the 2011 imazapyr risk assessment.

For imazapic, available toxicity studies have not reported any histopathologic changes in endocrine tissues that have been examined as part of the standard battery of tests. Extensive data are available on the reproductive performance and development of experimental animals exposed to imazapic indicates that effects occur at doses higher than that for effects to skeletal muscles. The RfD is based on the effect to muscles and should be protective of endocrine effects; HQ's for Imazapic are orders of magnitude below 1 and do not indicate any risk.

For picloram, a two-generation reproduction study in CD rats reported no endocrine effects at doses as high as 1000 mg/kg/day (SERA 2003). Endocrine effect endpoints examined in this study included reproductive outcomes, histopathological examination of tissues. Other studies reviewed in this risk assessment found no evidence for picloram producing direct effects on the endocrine system.

Sulfometuron methyl appears to have the potential to produce changes in thyroid function at 100 mg/kg/day (SERA 2004). No adverse effects on reproductive parameters were observed in rats exposed to dietary sulfometuron methyl at dietary concentrations up to 5000 ppm (Wood et al. 1980). The acute and chronic RfDs for sulfometuron methyl are 0.87 mg/kg for a decrease in maternal and fetal weight gain and 0.02 mg/kg for effects to blood parameters, respectively. The very low RfDs should encompass risks to thyroid function. Using those RfDs, all HQ's for sulfometuron methyl were well below 1.0, and often orders of magnitude below 1. Considering available data and analysis results, there is no indication of a risk of endocrine effects from proposed use of sulfometuron methyl.

Triclopyr has not undergone evaluation for its potential to interact or interfere with the estrogen, androgen, or thyroid hormone systems (i.e., assessments on hormone availability, hormone receptor binding, or post-receptor processing). However, extensive testing in experimental animals provides reasonably strong evidence that triclopyr is not an endocrine disruptor. No epidemiological studies of health outcomes of triclopyr have been reported, and there is no clinical case literature on human triclopyr intoxication. Several long-term experimental studies in dogs, rats, and mice have examined the effects of exposure to triclopyr on endocrine organ morphology, reproductive organ morphology, and reproductive function; treatment-related effects on these endpoints were not observed.

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

Multiple Chemical Sensitivity

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

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

Forest Service risk assessments incorporate an uncertainty factor of 10 to account for sensitive individuals, which may or may not eliminate risk that an individual may suffer symptoms. However, the uncertainty factor for sensitive individuals addresses variability in tolerances within a normal population.

Individuals reporting MCS assert, either explicitly or implicitly, that they are atypically sensitive. There is no current consensus on the diagnosis and cause of MCS.

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

Cumulative Effects

Workers and the public may be exposed to the herbicides used to treat invasive plants under all alternatives in this project. Cumulative doses are possible within the context of this project, or when combined with herbicide use on adjacent lands or home use by a worker or member of the general public. However, the risk is very small that a person would receive additive exposures during the time period in which the herbicide remained in their body.

The PDFs, herbicide use buffers, and project caps for the action alternatives would apply to any herbicide use on the Forest, whether as a stand-alone project or in conjunction with other land uses (for instance treatment along a road intended to be used for a vegetation management project). The SERA Risk Assessments evaluated chronic exposure scenarios that would involve the public, including repeated drinking of contaminated water, repeated consumption of contaminated berries, and repeated consumption of contaminated fish.

The potential for cumulative human health effects from any herbicide use proposed in this EIS, combined with other potential herbicide applications in the analysis area, would be encompassed in the health risks estimated for chronic exposure scenarios. These herbicides do not bio-accumulate in people and are rapidly eliminated from the body. Chronic (daily over 90-days) worker exposure was considered in SERA Risk Assessments and did not result in HQ values greater than 1 for any "central" estimate.

Chapter 3.1.6 describes the ongoing use of herbicides and other methods to treat invasive plants by other federal, state, and county agencies adjacent to the Forest. Of the known herbicide use on adjacent lands, some may pose greater risk to workers or the public than the herbicide use proposed for this project, especially on State Highways. However, the potential contribution to cumulative pesticide use by any alternative is not significant. The small and scattered nature of the infestations make it unlikely that exposures exceeding a level of concern would occur from simultaneous herbicide treatments on Forest Service and other lands.

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

Workers may be exposed to typical hazards from working in the woods from all treatment methods, especially those using chain saws and other motorized tools. Accidents are correlated with hours worked.

3.9.5 Consistency Findings

All alternatives comply with standards, policies, and laws aimed at protecting worker safety and public health.

The R6 PNW FEIS noted that people of Hispanic/Latino descent and American Indians may be disproportionately exposed to herbicides because they are more likely to be forestry workers (herbicide applicators) than other groups. Invasive plant treatments on the Forest are implemented in partnership with the local counties. Crews generally live in the communities in and around the Forest and are not associated with any discrete minority or low-income population. Herbicide treatment applicators are well trained in safe herbicide handling and transportation practices. The worker health analysis above applies to any herbicide applicator.

Effects to minority groups (such as American Indians) who or gather or use plants, animals or are the same as those evaluated above for public herbicide exposure. An unpublished study of commercial permit holders on Pacific Northwest Forests reported that the largest ethnic groups involved with forest product gathering were Hispanics, and Southeast Asians. However, these groups are unlikely to be more affected by herbicide exposure than the results provided for the general public, given the assumptions in the public health analysis. Chronic exposures to some of the herbicides proposed for use exceeded a threshold of concern, but with the exception of triclopyr, HQ values were less than 1 for all but unlikely upper estimates (which are not realistic even for people who spend the most time gathering forest projects). Posting of treatment sites, especially if triclopyr is used, would be especially important in areas of special forest product or wild food gathering. Thus, this project would not result in disproportionate impacts to low income or minority groups.

3.10 Recreation and Scenic Resources

3.10.1 Introduction and Regulatory Framework

This chapter describes the affected environment and analyzes the effects of the alternatives on recreation, visual quality and special areas. Special areas include Wilderness, recommended Wild, Scenic and Recreational Rivers, Developed Recreation sites, Inventoried Roadless Areas, Potential Wilderness Areas, and other areas allocated to high Visual Quality Objectives under the Forest Plans. The analysis evaluates both the benefits to and the impacts of invasive plant treatments to recreation resources.

Also addressed in this section are social related to herbicide use and difference in treatment methods relative to number of seasonal jobs created.

The regulatory framework for this project depends on the type of land involved, for instance there are requirements associated with Congressional designated areas such as Wilderness, Wild and Scenic Rivers and Roadless Areas. Scenery management in the Forest Plans varies depending on the land allocation.

Wilderness

The Wilderness Act requires wilderness areas to be administered for the use and enjoyment of the American people in such manner to leave them unimpaired for future use as wilderness, and provides for their protection and preservation of wilderness character. The act defines 4 qualities for wilderness:

- untrammeled, where people are visitors who does not remain,
- undeveloped and retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions,

- generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable,
- has outstanding opportunities for solitude or a primitive and unconfined type of recreation.

The Regional Forester is responsible for vegetation manipulation in wilderness. NEPA decisions for wilderness herbicide use that tier to the R6 2005 Invasive Plant FEIS may be signed by Forest Supervisors. Regional Foresters or their designated representatives must approve all subsequent proposed pesticide uses implementing this EIS on National Forest System lands (FSM 2151). The R6 Regional Forester cannot delegate responsibility to sign Pesticide Use Proposals (FSH 2109.14, section 13.4) in wilderness; these documents for actually applying pesticides in wilderness must be signed by the Regional Forester.

Wild and Scenic Rivers

The Wild and Scenic Rivers Act, passed by Congress in 1968 declared that:

Certain selected rivers of the Nation which, with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural or other similar values, shall be preserved in free-flowing condition, and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations.

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 forest pests in a manner compatible with the intent of the Act and management objectives of contiguous National Forest System lands."

Forest Plan Management Direction

The Okanogan and Wenatchee Forest Plans allocate land to management areas, each of which contains visual quality objectives (VQOs), ranging from preservation to urban. Invasive species and their treatment have the potential to adversely affect recreation and scenery in only the most restrictive VQOs: preservation, retention, and partial retention because the modification and maximum modification VQOs allow human activities to dominate the characteristic landscape. The Forest Plans define these as:

- preservation allows ecological changes only,
- retention requires management activities to not be evident to the casual Forest visitor, and
- partial retention requires management activities to remain visually subordinate to the characteristic landscape.

These restrictive VQOs apply to land allocated to scenery, recreation, wilderness, research, wildlife, botany or old-growth under each Forest Plan (more information below under Affected Environment VQOs).

The Okanogan Forest Plan contains two additional Forest-wide standards and guidelines of relevance to this project (p. 4-41, 4-42):

> 10-1: Management activities shall be designed to blend, to the extent practicable, with the natural terrain to achieve aesthetic or other resource objectives consistent with the visual quality objectives for the management area.

> 10-3: Exceptions to management area visual quality objectives shall be limited to the immediate surroundings of the stand, recreation attraction, or features of concern and result in a small number of acres.

The Okanogan Forest Plan also applies a set of Forest-wide standards and guidelines within ¼ mile of recommended wild, scenic and recreational rivers, protecting their wild, scenic or recreational attributes. VQOs for these areas are defined in the underlying management areas.

The Wenatchee Forest Plan requires consideration of mitigation measures to meet visual quality objectives (p. IV-65) and gives high priority for treatment of invasive species in visually sensitive areas (p. IV-92).

3.10.2 Analysis Methods

General dispersed recreation impacts are analyzed using:

- known infestations within 300 feet of maintenance level 2-5 (open) roads and trails (the approximate distance where both invasive plants and the effects of their treatment could be seen),
- known infestations within Forest Plan Riparian land allocations (Riparian Reserves and Riparian Habitat Conservation Areas) which are popular developed and dispersed recreation areas, and
- known infestations outside of the areas above (for people traveling cross country; also although most patches are small, with intermittent plants, some large patches can be seen up to ¼ mile away in terms of changes in color and texture).

Impacts to Special Areas are analyzed by overlaying the boundary of each of the Special Areas with known invasive plant infestations:

- within designated wilderness areas, including lands allocated to WSR rivers within wilderness,
- within wild, scenic and recreational river corridors recommended for designation in the Forest Plans outside of wilderness,
- within Inventoried Roadless Areas and draft Potential Wilderness Areas,
- within areas allocated to Developed Recreation in the Forest Plans, and
- within Management Areas with preservation, retention or partial retention Visual Quality Objectives in the Forest Plans (except those in other Special Areas above). These include areas allocated to recreation or scenery management (including the North Cascades Scenic Highway corridor and Mather Memorial Parkway), research, certain wildlife species, botanical areas and old-growth areas.

3.10.3 Affected Environment

The Okanogan-Wenatchee National Forest developed a recreation niche statement in 2007, with public input to describe the role that the Forest plays regionally; this statement helps to illustrate what makes this Forest unique:

> *Stretching from the inspiring heights of the Cascade Crest to the open lowlands of the Columbia River, the Okanogan-Wenatchee National Forest is defined by contrasts. Vast wild areas offer solitude, challenge and freedom, while travel corridors offer easy access to avenues of adventure.*

Quality of life and connections to the land will continue to draw a growing and diverse population who call this amazing place their own.

As described by the niche statement above, this Forest offers a wide range of recreation opportunities from primitive and remote settings to more developed settings. The Forest serves local residents, but well-traveled routes like Interstate 90 over Snoqualmie Pass, Highway 20 over Washington Pass (North Cascades Scenic Highway), Highway 2 over Steven's Pass, Highway 12 over White Pass and Highway 410 over Chinook Pass also provide residents from the west side of the Cascade Range with easy access to the dry and sunny east-side climate of the Forest. The Forest is important regionally for the abundance of backcountry recreation opportunities for both motorized and non-motorized visitors. Approximately 36 percent (1.5 million acres) of the Forest is located within designated wilderness, and another 26 percent (1.1 million acres) is within inventoried roadless and potential wilderness areas, providing numerous opportunities for those seeking backcountry, dispersed recreation settings.

The Forest has more than 150 developed campgrounds and picnic sites, nearly 180 developed trailheads, six historic Forest Service guard stations available for rent, and numerous boating sites and horse camps available for visitors. The Forest also administers special use permits for 682 recreation residences, mostly concentrated on the southern portion of the Forest.

Numerous water bodies, ranging from small, alpine tarns to large lakes and rivers, attract visitors for camping, boating, fishing, and wildlife viewing. Eighteen rivers and creeks that flow through the Forest, totaling 459 miles are recommended under the Forest Plans as Wild, Scenic or Recreational Rivers. Dispersed camping is popular, especially along routes adjacent to the many streams and rivers located across the Forest, and many sites are used for hunting camps and large group gatherings.

During winter, snowmobiling, cross-country skiing, snowshoeing, downhill skiing, snowboarding, snow camping, and snow play are all popular recreation activities on the Okanogan-Wenatchee National Forest.

A National Visitor Use Monitoring (NVUM) study was conducted on the Forest between October 2009 and September 2010 (USFS 2010).[18] Visitor activity participation is a good indicator of the types of recreation opportunities and settings in current demand by recreation visitors. According to the NVUM the top five recreation activities for the Forest, in terms of total number of participants, were hiking/walking, viewing natural features, relaxing, viewing wildlife, and driving for pleasure (USFS 2010).

Relationship between Recreation and Invasive Species

Recreational activities are influenced by, and have influence on, the rate and degree of invasive plant invasion and spread. Since many recreational activities involve movement across landscapes, recreation participants are likely to experience increased exposure to invasive plant populations as they travel across the recreational landscape. Recreational activities not only can promote the spread of invasive plant seeds and plant parts, but also have the potential to create ground disturbances that favor invasive plants. 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. Invasive plants can change scenery and reduce recreational experience by reducing the diversity of the types, forms, and colors of plants in an area (R6 PNW EIS, p. 3-26).

[18] For a complete description of methodology, background, summary data from other Forests and national statistics, visit the NVUM website at: www.fs.fed.us/recreation/programs/nvum.

Many invasive plants most successfully propagate in recently disturbed areas, and recreational activities can, to varying degrees, create such disturbances. Heavy use areas such as trailheads, parking lots and riparian zones are easily denuded of their native vegetation, creating prime environment for invasive plants. Recreation users can also unknowingly spread invasive plant seeds and propagating parts across and between landscapes, with the most likely vectors of spread being roads, trails and riparian corridors. (R6 PNW EIS, Chapter 3.1). Vehicles can transport invasive seeds and parts, as can recreationist themselves on their clothing or equipment, and riparian areas are prime destinations for recreationists.

Invasive plants degrade visual quality, primarily in the immediate foreground (300 feet), rather than in the middle ground or background. Although most patches are small, with intermittent plants, some large patches can be seen up to ¼ mile away in terms of changes in color and texture. Invasive plants can replace or visually subordinate native plants and reduce the diversity of native plant types, forms, and colors in an area.

Outside of wilderness and developed recreation management allocations, and wild, scenic and recreational river corridors (which are discussed separately below), the Forest Plans allocate lands to management areas that have a variety of Visual Quality Objectives (VQOs). The preservation, retention and partial retention VQOs are the most scenic classifications in which invasive species may be affecting visual quality and recreation. Invasive species can result in visual impacts to the immediate foreground (300 feet) when the native plant diversity, form and color are replaced with non-native species.

Dispersed Recreation

The vectors of spread are borne out by the actual location of invasive species in relationship to roads, trails and riparian corridors. The Forest has 4,762 miles of open system road and 3,595 miles of system trail on the Forest. Of the 16,281 acres of current infestations:

- 9,479 (or 58%) are within 300 feet of an open road (ML2-5; OHV use on closed roads and cross-country captured in the acres in the paragraph below).
- There are 398,650 total acres within 300 feet of a ML2-5 road; and 1,031 (or 6%) are within 300 feet of a trail. There are 269,340 total acres within 300 feet of a trail, 3,492 (or 21%) are within Riparian Reserves or Riparian Habitat Conservation Areas.

The above acres have overlaps. Most of the dispersed recreation on the Forest occurs within the above areas, although some people do travel cross-country in areas without roads and trails, for example with Off-Highway Vehicles (OHVs). Some invasive plant populations are large and may be visible more than 300 feet from a road or trail.

Special Areas

Wilderness

Invasive plants have adverse effects on wilderness character because they can disrupt natural processes. The presence of invasive species is typically a result of human uses such as grazing, pack stock use, hiking, backpacking on trails and cross-country country travel which create disturbed conditions that allow invasive species to establish. As with invasive species in general (above), invasive plants are typically found just outside wilderness at trailheads, and within wilderness along trails, in riparian areas and at popular dispersed campsites. The R6 PNW ROD (2005), Standard #4 requires the use of pelletized or certified weed-free feed in Wildernesses and at Wilderness trailheads which has begun to reduce the potential for pack stock to bring invasive species into wilderness.

The 1964 Wilderness Act presents managers with direction that creates a dilemma regarding what to do about invasive plants. Mangers must choose to either preserve natural conditions by actively manipulating vegetation in wilderness to reduce or eliminate invasive plants, or keep wilderness free from intentional human manipulation and lose natural conditions as a result of changes caused by invasive plants. The R6 PNW EIS sets wilderness as a high priority for treatment, and approved appropriate methods of treatment in wilderness. This analysis will describe effects of invasive plant treatments and the effects of invasive plants on wilderness character.

Of the 1.5 million acres of wilderness on the Forest, only 215 acres of invasive plants have been found in wilderness, of which 209 are crupina populations found in the Lake Chelan-Sawtooth Wilderness. These totals include corridors allocated to Wild, Scenic and Recreational Rivers (WSR) within wilderness, although no invasive plants have been found within WSR corridors. Invasive plants have been found on five wildernesses on the Forest: Goat Rocks, William O. Douglas, Alpine Lakes, Pasayten and Lake-Chelan Sawtooth, with most in the Lake-Chelan Sawtooth. Invasive plants are also found at wilderness trailheads and on roads leading to those trailheads, and more infestations may arise in the future because of these vectors of spread.

Wildernesses on the Forest require a visual quality objective of preservation, unless otherwise authorized by the Wilderness Act.

Roadless and Potential Wilderness Areas

Inventoried roadless areas (IRAs) are areas designated under the Roadless Area Conservation Rule (2001) where roads and timber harvest may only occur under limited conditions. These are generally areas that were evaluated under the second Roadless Area Review and Evaluation (RARE II, 1979). According to the RACR Environmental Impact Statement (p. ES-1):

While NFS inventoried roadless areas represent about 2% of the total land base of the United States, they provide significant opportunities for dispersed recreation, large relatively undisturbed landscapes that provide privacy and seclusion, and are often sources of water that communities treat and distribute for public use. In addition, these areas provide a bulwark against the spread of invasive species, often provide important habitat for rare plant and animal species, conserve biological diversity, and provide opportunities for study, research, and education.

Potential wilderness areas (PWAs) have been inventoried as part of the Forest Plan Revision process, and a draft PWA map was produced, showing areas that could potentially be designated as wilderness in the future because of their current mostly primitive condition. Generally PWAs and IRAs overlap unless conditions have changed since the RARE II inventory completed in 1979. The Forest inventoried 108 PWAs through the Revision process totaling 1,071,934 acres, of which 565,765 acres are within Treatment Analysis Areas; of these, 178 acres are currently infested with invasive species. Like IRAs, where these infestations occur, they are also replacing native plants, decreasing biodiversity and in some cases creating monocultures.

VQOs within IRAs and PWAs range from retention to maximum modification where human activity may dominate the characteristic landscape, but should appear as a natural occurrence when viewed as background.

Recommended Wild, Scenic and Recreational Rivers

Although currently no Wild, Scenic or Recreational Rivers (WSRs) have been designated by Congress on the Forest, 18 rivers and creeks are recommended for designation in the Forest Plans and their Records of

Decision. These WSR recommendations are based on each river's outstanding remarkable values for scenery, recreation, cultural/historic, geologic, fish and wildlife. As part of the Forest-wide Standards and Guidelines, the Okanogan Forest Plan allocates a ¼ mile corridor on each side of recommended rivers as WSRs; these overlay other management allocations, all of which require high visual quality (preservation in wilderness and the equivalent of retention outside of wilderness). Outside wilderness, the Wenatchee Forest Plan has specific management areas that allocate land surrounding recommended rivers to be protected pending legislative action. These corridors on the Forest totals 60,549 acres outside of wilderness and will be used for this analysis. Approximately 150 acres of invasive species currently are mapped within these corridors outside of wilderness on the Forest (no infested WSRs are inside wilderness). Invasive plants are currently only altering the scenic and recreation outstanding remarkable values, although over time, ecological values may be disrupted. WSRs on the Wenatchee National Forest require the preservation VQO inside wilderness and a retention VQO outside of wilderness.

Developed Recreation Sites

Developed recreation sites are some of the most heavily used areas on the Forest. Of the total 11,226 acres allocated to developed recreation, 36 acres are actually infested with invasive species. These plants are currently affecting not only scenery in these areas but also recreational experience as explained in the relationship section above. Developed recreation sites have VQOs ranging from retention to modification on the Okanogan portion of the Forest, and are all allocated to retention on the Wenatchee portion of the Forest. Many of the developed recreation sites are partially within riparian land allocations since recreationists are attracted to these areas.

3.10.4 Environmental Consequences

Direct and Indirect Effects

Alternative 1

This alternative would not approve new invasive plant treatments, and the current effects of invasive plants and their treatment would continue. Most of the current invasive species populations are located in areas where recreation is concentrated and the ground is disturbed. Without treatment, the current 16,281 acres of infestation are likely to continue to spread, particularly in disturbed areas (Chapter 3.2).

If invasive plants spread throughout these heavily used recreational areas, they would replace native plants with invasive species. Where invasive species dominate, they would not appear ecologically natural, would likely be visually evident even to the casual observer, and may not be visually subordinate to the characteristic landscape. Thus, as invasive plants spread, many areas would not meet the Visual Quality Objectives set in the Forest Plans.

Most newly discovered populations would spread from existing populations on the Forest and are likely to be found near existing populations, continuing to degrade scenery and recreational experience. Some may spread away from roads, trails and riparian areas, and these would not impact scenery and recreational experience except for cross-county travelers. Replacing native species with invasive species would degrade the natural experience that recreationists seek on the Forest. Some areas may be abandoned if invasive species become prevalent as a result of degraded scenery or conditions, such as stiff plant stalks, thorns or sharp bristles. Non-motorized travel and in some cases even motorized travel through some areas may become difficult because of thick growth, abrasive vegetation and unpleasant thorns or burs. Because of the current infestations of invasive species along roads and at wilderness trailheads, it is likely that new populations and species would be introduced in to wilderness, similarly degrading wilderness character, scenery and recreational experience.

Alternatives 2 and 3

General Recreation and Scenery Effects

Effects to human health are covered in section 3.9. Both action alternatives include the use of manual, mechanical, cultural, biological, and herbicide control methods. Of the 16,281 acres of known infestations, approximately 9,479 acres would be treated within 300 feet of open roads, 1,031 acres within 300 feet of trails, and 3,492 acres within Riparian Allocations (these acres have overlaps).

Known and any newly discovered infestations could be treated under either alternative, but the method of treatment would be more effective on smaller populations of some species in Alternative 2 than Alternative 3 because of the restrictions on herbicide use (see Section 3.2 of this document). Thus, Alternative 2 would have higher short-term visual effects from more herbicide use (blue dye, dead and dying plants), but greater potential to improve long-term scenery and recreational experience by eliminating invasive species and restoring native plants than Alternative 3 (except where PDFs restrict the use of herbicide, where both alternatives would be the same). Blue dye used with herbicides would fade within 24 hours and be gone within 48 hours. As plants die from herbicides, they wilt within 24 hours and turn brown within 48-72 hours, and the plants generally become smaller than surrounding native plants. In the fall, as native plants turn brown, treated plants may be indistinguishable from native plants, and by the following spring would be unnoticeable.

The most effective herbicides or treatments may be prohibited by PDF or label requirements in riparian areas and therefore effective treatment within these areas may take longer, and the effects of treatment may persist longer.

Manual and mechanical methods would be used more in Alternative 3 than Alternative 2. Some manual treatment methods, such as digging and pulling for plants, cause ground disturbance that could be visible in the immediate foreground throughout the growing season and possibly for many years because of the need for repeated treatment (potentially 2-3 times per year for 10 years since some seeds remain viable for that long). Bumpy, bare soils from ground disturbance would only be visible within about 300 feet. Mechanical and other manual treatments may result in an unnatural "mowed" look if parts of the plants remain on site; these treatments by themselves only contain plant populations and have to be repeated indefinitely unless other treatment methods are used, so visual effects would persist. As a result, neither manual nor mechanical treatment methods are very effective at improving long-term visual quality by re-establishing native plants, and recreational experience would continue to be degraded.

Cultural and biological methods under either alternative are not likely to have any adverse effects on scenery or recreational experience because changes happen so gradually and these methods of treatment cause no ground disturbance. However, biological controls can take 10 years or more to be effective, so restoration of these sites is a long-term effort, and invasive species would remain visually evident and would continue to degrade recreational experience for a long time. Biological controls are generally used in combination with herbicide treatments on the edges of large invasive species populations; it is unlikely that people recreate in these larger populations, except possibly to pass through them on trails. Cultural treatments, usually in the form of grass seeding, would help to restore native vegetation and improve visual quality.

Under all treatments, the degree of visual effects would depend on the size and density of the existing invasive plant infestation. For the most part effects would occur in small patches, interspersed with native plants, often along roadsides, and treatments would not likely be noticeable within 1-4 weeks. Larger patches may be present in open, dry areas, especially in the shrub-steppe and dry forest zones. Broadcast spraying along open system roads could result in more concentrated short-term degradation of scenic quality, but these populations are already altered by the invasive species themselves. Short-term impacts would be offset by improvement in long-term visual quality and recreational experience by restoring native vegetation; restoring native vegetation is more likely in Alternative 2 than Alternative 3 because of both treatment effectiveness and budgetary constraints

Recreational experience may be degraded and recreationists may be inconvenienced by treatments through signs, noise, smells, and possibly areas closed for short periods. These short-term recreational impacts, usually 1-2 days, would be offset by long-term restoration in native plant populations.

Early Detection Rapid Response

The effects of treating invasive species anywhere on the Forest under EDRR are the same as those for known populations above, except that newly discovered populations are likely to be small. These could be treated quickly and effectively with herbicides in Alternative 2, but because of the limitations on herbicide use in areas under one acre in size in Alternative 3, other treatments may not be as effective and not as many acres could be treated because of budgetary constraints. Most spread is likely to be from existing populations already on the Forest, many of which are located in areas of scenic or recreational importance. Because of human use in these areas, new populations of invasive species are likely to be discovered more quickly in these areas allowing them to be treated more quickly; however any spread would add to the visual and recreational impacts of existing populations. Some may spread away from roads, trails and riparian areas, and these would not impact scenery and recreational experience except for cross-country travelers.

Forest Plan Amendment

The Forest Plan amendment to include the use of aminopyralid would allow for the use of this more selective broadleaf herbicide, which would minimize impacts to other native vegetation. Retaining native vegetation would minimize impacts to scenery and recreational experience over other non-selective herbicides.

Special Areas

Except where IRAs and PWAs do not coincide with other Special Areas, infestations in all of the Special Areas would have the highest priority for treatment (see Chapter 2), so it is likely they would be treated before other invasive populations on the rest of the Forest.

Wilderness

The 215 acres of current wilderness infestations would have high priority for treatment, and all would be treated either manually or with herbicides (mechanical treatments are prohibited in wilderness). Manual treatments would result in short-term impacts from ground disturbance, while herbicide treatments would result in short-term impacts from blue dye and dead and dying plants. In both cases neither would likely be visually evident after a season. Generally, the combination of small sites and few acres in Wilderness make it likely that treatment under Alternative 2 would be highly effective, and result in restoration of native plants within five to fifteen years; restricted use of herbicides on small populations of some species may result in more disturbance and less effective treatments in Wilderness under Alternative 3.

Because of the size of some Crupina populations in the Lake Chelan-Sawtooth Wilderness, aminopyralid can be used under both alternatives which would result in fewer effects to non-target species. However other populations of crupina, and most other invasive plant populations in other wildernesses are less than one acre in size, requiring treatment with manual methods under Alternative 3, which would not be as effective and would cause more ground disturbance over longer periods of time than herbicides; manual would be required 2-3 times per year for 10 years or more, and invasive plants would be present in diminishing numbers throughout that time.

All invasive plant populations in the Alpine Lakes, Goat Rocks and Pasayten Wildernesses are less than one acre in size. Off 34 populations in the Lake Chelan-Sawtooth Wilderness, 15 are less than one acre in size, and 10 of 12 populations in the William O. Douglas Wilderness are also less than one acre in size. Because invasive species currently infest roads and trailheads leading to wilderness, treatment of these areas under both alternatives would minimize the potential for spread into wilderness. Restoring native vegetation in these areas would improve both scenery and recreational experience. Treatments at trailheads and roads leading to trailheads would help prevent spread into wilderness. Treatment methods that result in the least adverse effects to wilderness resources would be used.

Recommended Wild, Scenic and Recreational Rivers

All Wild, Scenic and Recreational River corridors would have high priority for treatment, and all methods of treatment, except where restricted by PDF or from herbicide restrictions in Alternative 3, could be used on current populations.

Manual and mechanical treatments within these corridors would result in short-term impacts to scenery from ground disturbance, and herbicide treatments would result in short-term impacts from blue dye, and dead and dying plants. Because manual treatments require 2-3 treatments a year for 10 years or more, visual impacts of ground disturbance would be extended. Dead and dying plants would not be visually evident by the end of the growing season. Restoring native vegetation in would improve both scenery and recreational experience in these corridors.

Developed Recreation

Developed recreation areas would have high priority for treatment (see Chapter 3.2). All methods of treatment could be used on 36 acres of infestations in these sites, although PDFs may restrict the type of treatment and herbicides that could be used in riparian areas, and Alternative 3 would restrict the use of herbicides on some smaller populations.

Many developed recreation sites are within riparian allocations which have more PDF restrictions on herbicide use. Treating invasive species in these areas would mean that people using the sites would see warning signs and the effects of treatments (blue dye, ground disturbance, and dead or dying plants). For herbicides, some people may be able to smell them for up to an hour. Typically, these treatments are scheduled for low use days, like Tuesday, but some recreationists may choose to go elsewhere to avoid herbicides. These scenic impacts would be short-term, with blue dye fading within 24 hours and not visible within 48 hours and the plants themselves would not be visually evident by the end of the growing season. Restoring native vegetation in these areas would improve both scenery and recreational experience at developed recreation sites.

Inventoried Roadless Areas and PWAs

None of the treatments include either road construction or timber harvest and all are consistent with roadless area management direction.

Management Areas with High Visual Quality Objectives

About 4,000 acres of invasive plants outside of the special areas described previously would have high priority for treatment because they are located in management areas with high VQOs. Restoring native vegetation in these areas would improve both scenery and recreational experience in areas with high visual quality objectives.

Cumulative Effects

The cumulative effects analysis area for recreation, scenery and special areas is the Forest boundary since treatments off-Forest would not likely be seen or affect recreational experience on Forest (although any treatments off-Forest would minimize the potential for invasives spread from there to the Forest). The temporal analysis area boundary is from 1980s when invasive species were first recognized on to the Forest until 20 years in the future, when the treatments under this document would be complete and effects from the project are likely to stabilize.

Past actions have resulted in the invasive species that are on the Forest today. Past road construction has not only created ground disturbance conducive to invasive species establishment, but has also facilitated the transport of invasive plant seeds and parts on vehicles and equipment used for recreation, logging, mining, grazing, fire suppression and administration. People and livestock have also brought in invasive plant seeds and parts on their equipment, clothes and fur. The establishment and spread of invasive species has affected both scenic quality (by replacing native plants), and recreation by either degrading recreational experience or resulting in areas so infested that they are no longer useable by recreationists.

In 2005, the R6 PNW ROD adopted a set of prevention measures that minimize the potential for human actions to further introduce or spread invasive species. These prevention standards have been applied not only to new proposals since 2005 but also to ongoing (present) actions such as use of heavy equipment off roads, livestock grazing, and feed used by pack and saddle stock. These measures have been and continue to be somewhat successful in preventing the introduction of new species, and have slowed but cannot prevent spread of existing species. The Washington State Department of Transportation, Counties and Public Utility Districts have treated invasive species along their rights-of-way within the Forest boundary, as have other agencies within lands inside the proclaimed Forest boundary (BLM, USFWS, see Section 3.0); these treatments have not only controlled or eliminated invasive species in those areas, but also prevented spread on to other Forest lands.

Cumulatively, the action alternatives would incrementally slow the spread of invasive species introduced by past and present (ongoing) actions and would restore native plant populations in site-specific areas; the reduction of spread and improvement in native plants would be higher in Alternative 2 than 3, not only because more effective methods are used, but also because more acres could be treated each year given budgetary constraints. This project would also allow for treatment of invasive plants prior to, during and after future ground-disturbing projects (such as road construction or maintenance, and vegetation management projects) that might otherwise spread existing invasive species populations, which would reduce the potential for spread, and maintain scenery, and wilderness and recreational experience.

The Forest Service is currently undertaking a travel management project which would designate motorized routes (roads and trails) and close the rest of the Forest to motorized use except for corridors allowing for dispersed camping and two small cross-country use areas. Because vehicles are a very common method of spread of invasive species, restricting where the motorized use (including recreational use) can occur on the Forest would have the additional effect of preventing spread from current infestations, thereby maintaining scenery quality and recreational experience in relation to invasive plants. The travel management project almost entirely eliminate cross-country motorized recreation experience (except on 33 acres), which would combine with invasive plant treatments in improving non-motorized recreational experience where invasive plants are treated.

The Washington Department of Transportation, Counties and PUDs would likely continue to treat invasive species along their rights-of-ways within the Forest boundary, as would other agencies with land within the proclaimed boundary, which would likely continue to maintain visual quality in those areas and prevent spread on to other Forest lands. Cumulatively, the incremental treatment actions proposed under this document when added to other treatment actions taken by the Forest (Alternative 3 only) and other agencies and would improve visual quality and recreational experience wherever plants are treated.

3.11.5 Consistency Findings

The Wilderness Act requires land managers to both protect and manage to preserve natural conditions. Treatment of "unnatural" invasive species is consistent with the act because all work would be substantially unnoticeable and would restore natural native species.

Wild, Scenic and Recreational River recommendations made in the Forest Plan contain standards and guidelines that require retention of characteristics so that wild, scenic or recreational attributes are retained, the key characteristic of which is VQOs.

High priority is given to areas in visually sensitive areas and all VQOs would be met. Although treatments may be visually evident for short periods of time following treatments, they would be limited to the immediate surroundings and small individual treatment areas as required by the Okanogan Forest Plan. The visual effects of treatment of invasive species would be limited in scope and scale, and would only be visible to the casual visitor for a relatively short time (1-4 weeks). This project does not analyze for or approve large scale treatment or restoration efforts that may be visible for long periods of time.

3.11 Heritage Resources

3.11.1 Introduction and Regulatory Framework

Heritage resources are archaeological and historic sites defined by artifacts and/or the remains of buildings and structures; places and landscapes of religious, sacred and traditional importance to contemporary culture; and single artifacts or objects that represent past human activities/culture. They are irreplaceable and nonrenewable.

Within the National Forests, these sites document the prehistoric and historic life ways of the American Indian; the routes and actions of early explorers, trappers and settlers; the industrial activities of logging, mining, and stock grazing; community resource use; and the history of recreating in the forest and National Forest administration. Heritage resources are important because they provide insight into human adaptation to the environment over time. Individually and cumulatively they reflect the challenges faced by humans over time and through their study, cultural diversity is explained and better understood. Heritage resources with the greatest potential to provide insight into human nature, and/or that are associated with culturally important individuals, events, and objects are listed on or eligible for nomination to the National Register of Historic Places (NRHP) and as such, are given consideration in planning for federally licensed, approved or funded activities. The protection and preservation of these resources is the goal of cultural resource management on the Okanogan-Wenatchee National Forest.

The National Historic Preservation Act (NHPA) of 1966, as amended

Passage of the NHPA in 1966, required the Forest Service to consider effects to heritage resources and protect heritage resources listed on or eligible for the National Register of Historic Places. In cases of adverse effect, the Act requires mitigation measures designed to retrieve as much information about the resource prior to its loss. In 1971 Executive Order 11593 required that heritage resources be inventoried, and nominated or protected until the inventory or nomination process was completed.

This Act and its implementing regulations (36 CFR 800) provide comprehensive direction to federal agencies about their historic preservation responsibilities. The Act established the federal government's policy and programs on historic preservation, including the establishment of the National Register of Historic Places (NRHP). Section 106 of the Act requires federal agencies having direct or indirect jurisdiction over a proposed federal or federally assisted or permitted undertaking to take into account the effect an undertaking may have on historic properties listed on or eligible for the National Register.

On the Okanogan-Wenatchee National Forest, Section 106 is implemented in accordance with a 1997 programmatic agreement entitled, "Cultural Resources Management on National Forests in the State of Washington". Heritage resources that are listed or eligible for the NRHP are collectively known as historic properties. Three types of effects determinations are recognized:

a. No Historic Properties Affected (36 CFR 800.4(d)(1)

When no historic properties are present in the project area or when historic properties are present but are avoided through project design, project design changes or site protection measures.

b. No Adverse Effect (36 CFR 800.5(b)

When historic properties are present but the project is modified or conditions are imposed to avoid adverse effect to those properties through project design, project design changes or site protection measures.

c. Adverse Effect (36 CFR 800.5(1)

When historic properties are present in the project area and will be altered, directly or indirectly, by the undertaking.

In cases of adverse effect, the act requires mitigation measures designed to retrieve as much information about the resource prior to its loss

Executive Order 11593: Protection and Enhancement of the Cultural Environment

Issued May 13, 1971, this E.O. directs federal agencies to inventory heritage resources under their jurisdiction; to nominate heritage resources to the National Register of Historic Places; to use due caution until inventory and nomination processes are completed;, and to assure that federal plans and programs contribute to preservation and enhancement of federally-owned properties.

Executive Order 13175: Consultation and Coordination with Indian Tribal Governments

Issued in November of 2000, this E.O. directs federal agencies to engage in meaningful consultation and collaboration with Indian tribes in the development of Federal policies that have tribal implications. The order is designed to strengthen the government-to-government relationship and to reduce the imposition of unfunded mandates upon tribes.

Okanogan and Wenatchee National Forest Plans

In 1989 and 1980, the Forest Plans added management direction to protect heritage resources and consult with SHPO and the American Indian Tribes.

Both Forest Plans provide management direction for heritage resource management and require compliance with federal laws and regulations governing heritage resource management and emphasizes site protection, evaluation of sites for the National Register of Historic Places, and nomination of those heritage resources meeting appropriate criteria to the National Register of Historic Places. Both plans require field inventories for all ground disturbing activities (USDA Forest Service 1989 pgs. 4-37 to 4-38; 1990 pgs. IV-66 to IV-67).

Forest plan standards and guidelines require field inventories prior to project implementation unless previous surveys are adequate and consultation with the Washington State Historic Preservation Officer (SHPO), interested parties, and American Indian tribes has occurred. The Forest complies with Section 106 of the NHPA via a 1997 programmatic agreement (PA) signed by the Pacific Northwest Region, the State Historic Preservation Office (SHPO), and the Advisory Council on Historic Preservation (ACHP).

The Okanogan Forest Plan requires that native plant species used for food, medicine or religious purposes by American Indian Tribes be perpetuated consistent with goals and objectives of management areas. It also requires coordination with American Indian Tribes regarding identification of key native plant gathering areas and species.

Federal Trust Responsibility and Tribal Rights and Interests

American Indian Tribes are sovereign nations. They are government entities with which the Forest Service has established and continues to maintain a government-to-government relationship. In government-to-government consultation the Forest Service acknowledges the sovereignty of federally recognized American Indian Tribes, and the special government-to-government relationship between the tribes and the United States through Executive Order 13175 (November 6, 2000).

The Confederated Tribes of the Colville Reservation (CCT) and the Yakama Nation (YN) have reserved rights and privileges on Okanogan-Wenatchee National Forest lands ceded to the United States government through treaties or executive orders. The Forest Service is required to manage the lands under their stewardship with full consideration of the federal trust responsibility and tribal rights and interests, particularly reserved rights where they exist. In meeting these responsibilities, the agency consults with these tribes whenever proposed policies or management actions may affect their interests. American Indian access to of religious and cultural significance is permitted as is collection of native plant and animal resources for traditional cultural purposes. Appropriate protection of these areas is coordinated with tribal leaders. The Okanogan-Wenatchee National Forest consults with the CCT and the YN in accordance with 36 CFR 800 and NEPA.

Applicable Treaties and Executive Orders include:

- Executive Oder of 1872; North-Half Agreement of 1891 (Confederated Tribes of the Colville Reservation).
- Yakima Treaty of 1855 (Yakama Nation)

3.11.2 Analysis Methods

The Forest's GIS heritage resource site layer and site probability model were used to determine whether heritage resources exist or are likely to occur within the mapped polygons for invasive species. Most of the treatments have low potential to affect heritage resources, however some future treatments under EDRR would be subject to consultation with a heritage specialist.

3.11.3 Affected Environment

More than 3,200 heritage resources have been documented on the Okanogan-Wenatchee National Forest since passage of the National Historic Preservation Act in 1966. Seasonal hunting, gathering and fishing camps and large permanent villages associated with American Indian use of the Forest are scattered throughout the Forest. Discoveries of stone tools, pictographs and radiocarbon dating of a few heritage resources indicates use of the Forest as far back as 9,000 years ago and that large permanent villages were firmly established 2,000-3,000 years ago along major rivers that flow into the Columbia River. Many of these heritage resources are of cultural, religious and traditional importance to the CCT and to the YN.

Euro-American settlement across the Forest began in the 1800s and is represented in the archaeological record by homesteads, mines, seasonal camps, town sites, agricultural and ranching sites, by vast transportation systems (railroads, roads, trails, ditches, communication lines) and by isolated artifacts. Active and abandoned Forest Service administrative sites (ranger stations, guard stations, fire lookouts) dot the landscape along with more than 600 recreation residences and numerous organizational camps associated with use of the National Forest since its designation in the early 1900s.

A total of 19 heritage resources are listed on the National Register of Historic Places. Standouts because of public interest include the Stevens Pass Historic District, Bonaparte Lookout, the Leavenworth Ranger Station, and the Salmon La Sac Guard Station.

The majority of the heritage resources documented to date were located during field inventories in support of Forest Service activities such as timber sales, prescribed burns, forest ecosystem restoration and even small scale projects like toilet replacements in existing campgrounds. For some ranger districts, coverage is in excess of 80 percent. The Naches and Cle Elum Ranger Districts have the highest number of heritage resources due to terrain and the high number of projects requiring heritage resource inventory.

The Forest is aware of culturally important plants and knows that local tribes and the public gather plants throughout the Forest; however no specific collection areas have been identified by the tribes.

3.11.4 Environmental Consequences

Direct and Indirect Effects of Alternative 1

Under Alternative 1, no new invasive plant treatments are proposed. Ongoing treatments covered under existing NHPA Section 106 consultations. Without additional treatment, invasive plants would continue to spread and compete with native plants. Alternative 1 could reduce the availability of native plants for American Indian and public use, which may jeopardize the Forest's trust responsible to manage treaty and executive order resources in a sustainable manner for the CCT and YN.

Direct and Indirect Effects of Alternatives 2 and 3

In accordance with Section 106 of the NHPA, the treatment of invasives is considered an undertaking because certain methods to control invasives have the potential to affect heritage resources. Of the treatment methods used, manual and mechanical treatments involving ground disturbance are more likely to affect heritage resources than the use of herbicides or biological controls. Manual or mechanized, treatments within the boundary of a heritage resource could change the context of artifacts that archaeologists depend on to determine the purpose/function and/or age of the site. Mowing has negligible effects on heritage resources because it generally does not involve ground disturbance. Ground cover of any sort (e.g., invasives, grass, pine needle duff) tends to protect the surface of a site so extensive removal of ground cover could leave a heritage resource open to the indirect effects of erosion or even vandalism by virtue of exposure and public visibility. PDF M-1 requires that a Cultural Resource Specialist (CRS) assess whether manual or mechanical treatments have the potential to affect heritage resources on a treatment site on a project by project basis. Unless previously surveyed or in an area of previous ground disturbance, field inventories would be conducted in accordance with the Forest's heritage resource site probability model and/or where heritage resources have been documented. Manual or mechanical treatments within the boundary of a heritage resource site would be monitored by a Cultural Resource Specialist or paraprofessional working under the direction of the CRS. Documentation of each project would be in accordance with the Forest's 1997 Section 106 programmatic agreement regarding the management of heritage resources on national forests in Washington State. This PDF would be highly effective in protecting cultural resources from manual and mechanical treatment methods.

Herbicides and biological treatments are non-ground disturbing and as such have little or no potential to affect heritage resources unless native plants are adversely affected (see Chapter 3.3.4). This project is designed to protect non-target vegetation and native plant communities and removal of the threat of invasive plants would help sustain the Forest's trust responsibility to manage treaty and executive order resources in a sustainable manner for the CCT and YN.

The types of herbicide sprays and other treatment methods proposed are unlikely to affect heritage resources typically found on the Forest. The use of glyphosate, for example, has been shown to have little effect because the herbicide is rendered biologically inactive in the presence of organic matter and has a very short persistence in the environment. However, since some herbicides have been shown to affect the chemical composition of masonry and to invalidate carbon-14 samples at an archaeological site if it leaches into organic materials such as wood or charcoal. As such the National Park Service avoids the use of herbicides in cultural resource sites (James Fearn 1978 "The effects of Herbicides on Masonry"; National Park Service 1998, NPS-28, Cultural resource Management). Fortunately, very few heritage resources on this Forest contain masonry features or carbon for radiocarbon dating. If they do (i.e. bricks, chinking in a log cabin, hearth), the sites are generally visible and can be avoided during spraying.

The use of certain herbicides could adversely affect native plants used by the public and American Indians but none of the herbicides proposed for use have been shown to affect native plants. Reduction of invasive plant infestations would have a positive effect on cultural plant populations and might improve the collecting experience. Native plants, including cultural plants would benefit from control of invasive species (Chapter 3.3). Neither the Colville Confederated Tribes nor the Yakama Nation has shared specific information regarding cultural plant collection areas on the Forest. To the extent possible herbicide treatments would avoid native plants and should gathering areas be identified by local tribes, they would potentially be managed as National Register eligible heritage resources.

EDRR

The EDRR strategy would allow rapid treatment of new infestations, which would protect adjacent native cultural plants from spread of invasives. Manual and mechanical treatments may be subject to further Section 106 consultation. Field inventories would be conducted in accordance with the Forest's heritage resource site probability model and/or where heritage resources have been documented and manual or mechanical treatments are prescribed. Manual or mechanical treatments within the boundary of a heritage resource site would be monitored by a Cultural Resource Specialist or paraprofessional working under the direction of the CRS. Documentation of each project would be in accordance with the Forest's 1997 Section 106 programmatic agreement regarding the management of heritage resources on national forests in Washington State.

Forest Plan Amendment

The proposal to add aminopyralid would result in less use of glyphosate and picloram, and may result in reduced impacts to non-target plants, including cultural plants utilized by the public and the CCT and YN (see Chapter 3.3.4).

Cumulative Effects

The geographic cumulative effects boundary for this analysis is the project area and the time frame is from the present day to about 20 years in the future (see Introduction to Cumulative Effects in Chapter 3.1.6). Past human activities have contributed to the existing condition, which forms the baseline for effect analysis.

All projects on the Forest (including this one) are subject to Section 106 consultation and management direction is to protect heritage resources that are listed or eligible for listing on the National Register of Historic Places. Thus, there is no potential for this project to combine with other activities on forest and trigger cumulative effects. Potential direct and indirect impacts from the project are so limited in scale and intensity that cumulative effects are unlikely, even considering activities occurring off Forest within the analysis area.

3.11.5 Consistency Findings

The invasive plant treatment project would comply with all applicable laws, regulations, policies and plans related to heritage resources. No effects on heritage resources are predicted. PDF L-1 would minimize the potential for adverse effects to heritage resources throughout the life of the project under EDRR.

3.12 Social and Economic Analysis

3.12.1 Introduction and Regulatory Framework

Several issues are pertinent to the social and economic analysis. First, the cost of treatment is influenced by the design of the alternatives. Alternative 3 relies on comparatively more expensive and/or less effective non-herbicide methods on about 67 percent of currently infested acreage. Second, manual and mechanical methods of treatment tend to be more labor-intensive and employ more workers than herbicide treatment methods. Alternative 3, which has the greatest relative proportion of manual treatments compared to the other alternatives, could create more jobs, assuming unlimited budgets. Third, the issue of herbicide toxicity and use remain of public concern despite the low risk indicated by the risk assessments. This section discusses the social acceptability of herbicide use. Finally, some members of the public expressed concern that the Forest Service has not been as effective as it should be in using new herbicide chemistry to increase treatment effectiveness on existing and new sites.

The Forest Service in Oregon and Washington is spending about 4.8 million dollars annually to treat approximately 25,000 acres of invasive plants in the Pacific Northwest Region. From 2009 to 2013 the Okanogan-Wenatchee National Forest had an average budget for invasive plant management from $300,000-$700,000 (Okanogan-Wenatchee NF accomplishment reports). An average of 3,500 acres per year was treated annually from 2009 to 2013.

The treatments proposed by the Forest Service are likely to be funded through a variety of mechanisms and partnerships including county, state, federal, and private sources.

Forest Service Manual 1970 contains direction for economic analysis, based on several laws (Multiple Sustained Use Act, National Environmental Policy Act, National Forest Management Act, etc.) and other authorities.

3.12.2 Analysis Methods

Assumptions related to this analysis include:

- Costs vary widely depending on method and invasive plant density and infestation size (less than $50 to more than $1000 per acre); acre costs described here are averaged and estimated from the past several years. In most cases, only a portion of an "acre" is actually "treated" due to spotty and scattered distribution and low invasive plant density. $100/acre per treatment entry is used when all tools are available; $300/acre is used when manual/mechanical methods are required. Cultural and biological methods are not included in this assessment because they account for such a small portion of the treatments proposed

- Our cost analysis assumes that if all treatment methods and herbicide choices are available, about 80 percent of the initial infestation would be effectively killed. Retreatment would be required to treat the remaining infestation, particularly to reach the objective of control or eradication. The cost analysis assumes that infestations were treated annually until very little remained. Costs for each year of treatment are added together and averaged.

- Our cost analysis assumes that if treatment methods are restricted (including restricted choice in herbicide selection associated with completing projects currently authorized that would continue under no action), the effectiveness of each entry would drop to 50 percent. This has the impact of requiring more entries to reach the same treatment objective. See "Rationale for 80 percent annual effectiveness estimate in cost analysis for invasive plant projects" (Desser, 2007) for more information on these assumptions.

- Where the treatment involves herbicides, the herbicides application will occur in the first year and will be 100% herbicide, even though prescriptions may include some manual or mechanical treatment during or before herbicide application.

- Higher average acreage costs of Alternatives 3 are partly related to higher labor cost, because fewer acres can be treated in a day when relying on manual and mechanical methods. In addition, most of the cost of manual and mechanical treatments is in labor, thus labor costs are assumed to be 80 percent of the total cost of Alternative 3. By contrast, the greater reliance on herbicide would decrease the labor cost per acre and about half the total treatment cost of Alternatives 1 and 2 are assumed to be attributed to labor. These assumptions factor into the seasonal jobs created in each alternative assuming an unlimited (unlikely) budget.

- Non-herbicide methods can be more costly than herbicide applications (USFS 2005a, p. 4-94), and treatment costs are a factor in the amount of acreage that can be completed. Most of the cost associated with invasive plant treatment is in labor. Hand pulling, wicking and hand application of herbicides have the highest labor costs. It is the combination of different methods, however, that is often most effective. The availability of volunteer labor could offset the costs associated with manual treatment as long as the commitment and availability of volunteers matched the treatment requirements.

- Labor costs are estimated at $160 per day for 130 seasonal workdays per year. This is based on Washington estimates from the Bureau of Labor Statistics: Occupational Employment statistics, May 2012, http://www.bls.gov/oes/2012/may/oes373012.htm#st2012). This data indicates that in 2012, Landscaping and Groundskeeping Workers earned about $14.52 per hour, Pesticide Handlers Sprayers and Applicators Vegetation earned about $15.25 per hour, and tree trimmers and pruners earned about $19.23 per hour. Washington State employed over 18,000 in these fields.

Although invasive plants are known to have a substantial impact on Washington's economy, this analysis did not attempt to quantify the loss of values in Washington State from invasive plant infestations. Costs used in the analysis are assumptions for the purpose of comparing alternatives; they are estimates and in some cases and may not reflect the most current costs to accomplish control methods (R6 PNW FEIS p. 4-94).

3.12.3 Affected Environment

Economy and Employment

Washington's unemployment rate has increased recently and new job creation is important for the economics for the state. The unemployment rate provides insight into the correspondence between residents' skills and employment opportunities. The natural rate of unemployment has been posited to be around 5 percent. This is called the natural rate because the rate allows for movement between jobs and industries, but does not signal broad economic distress.

The average unemployment rate for the 11-county area is slightly higher than that of the state. However, the average unemployment rate for the planning area obscures the diversity among counties. Five of the counties (Benton, Chelan, Douglas, King, and Kittitas) had lower rates of unemployment than the state. On the other hand, six of the counties (Ferry, Grant, Okanogan, Skagit, Snohomish, and Yakima) had unemployment rates that exceeded that of the state. Ferry had the highest unemployment rate. Counties with high unemployment rates may be susceptible to further economic changes. A breakdown of unemployment rates by county during the past decade is shown in Table 3.34.

Table 3.34: Unemployment Rate by County, 2001 – 2010.

Annual	Benton	Chelan	Douglas	Ferry	Grant	King	Kittitas	Okanogan	Skagit	Snohomish	Yakima	**11-County Average**	**Washington**
2001	5.7	8.1	7.3	11.2	8.9	5.1	6.6	9.9	7.1	5.3	9.4	7.7	6.2
2002	6.3	8.7	7.6	10.6	9.5	6.1	7.2	10.1	8.3	7.0	9.6	8.3	7.3
2003	6.9	8.4	7.7	13.5	9.3	6.2	7.7	9.5	8.2	7.1	9.6	8.6	7.4
2004	6.0	6.9	6.3	10.7	8.2	5.2	6.9	7.9	6.9	5.8	8.5	7.2	6.2
2005	5.7	5.9	5.4	9.1	7.2	4.7	5.9	7.1	5.9	5.1	7.4	6.3	5.5
2006	5.7	5.1	5	9.2	6.5	4.2	5.2	6.6	5.1	4.6	6.8	5.8	4.9
2007	4.8	4.9	4.7	7.9	5.7	3.9	4.8	6.2	4.7	4.3	6.2	5.3	4.6
2008	5.0	5.5	5.3	8.8	6.4	4.7	5.9	6.4	5.7	5.5	6.8	6.0	5.5
2009	7.2	8	8	13.3	9.9	8.5	9.1	9.6	10.1	9.9	8.9	9.3	9.3
2010	7.2	8.6	8.2	14.4	10.5	8.8	9.2	10.3	10.4	10.3	9.7	9.8	9.6

Source: Bureau of Labor Statistics Local Area Unemployment (http://data.bls.gov/cgi-bin/dsrv?la

Currently, invasive plant treatments are completed through the internal invasives/botany programs through seasonal staff or may be contracted to local businesses that provide invasive plant treatment services. In both instances, jobs are created for both skilled and unskilled laborers.

Social Acceptability of Herbicides

People in the local community and beyond sometimes have strong feelings about herbicide use on National Forest lands. For instance, one scoping commenter stated: "Why risk our health to make it cost effective to treat weeds?" Another said: "Most herbicides are deadly poisons to humans and wildlife." Other commenters encouraged effective use of herbicides.

The R6 PNW FEIS considered many alternatives related to herbicide use, including an alternative that would have required that herbicides be used as a method of last resort. These alternatives were not selected by the Regional Forester (R6 PNW ROD).

3.12.4 Environmental Consequences

Direct and Indirect Effects of Alternative 1

Alternative 1 would continue to treat about 6,000 acres that are approved under existing NEPA. Under an unlimited budget, assuming an average annual cost of $100 per treatment acre and an average annual effectiveness of 50 percent per year, total remaining cost of fully meeting all treatment objectives on these acres over a five year period is estimated at $1,199,900. This amounts to a total cost per effectively treated/restored acre over a five year period of about $200 per acre. However, about 12,960 acres of invasives are predicted to remain after this cost is expended.

Alternative 1 could provide up to 14 seasonal jobs for any given 130 day year, assuming an unlimited budget.

Alternative 1 would not likely be acceptable to those who disagree with herbicide use, because it includes continued use of herbicide approved under existing NEPA. Glyphosate is being used currently. The toxicity of this ingredient has been in the news recently and at least one member of the public has expressed concern about its use. Glyphosate would continue to be used in Alternative 1.

However, because no additional herbicide use would be approved, some members of the public might feel most comfortable with no action. However, some members of the public would urge that non-herbicide methods be considered for the more than 10,000 acres that are not currently covered by existing NEPA.[19]

Some members of the public would be concerned about the lack of effective treatment options if no action were selected. The Forest Service would not meet objectives and policies regarding invasive plant management.

Direct and Indirect Effects of Alternative 2

Alternative 2 would treat all existing acres of invasive plants using the widest range of methods and herbicide ingredients. Under an unlimited budget, assuming an average annual cost of $100 per treatment acre and an average annual effectiveness of 80 percent per year, total cost of fully meeting all treatment

[19] No action would not include any new treatments. In the future, if no action is selected for this project and funding is available, non-herbicide treatments could be categorically excluded from documentation in an EA or EIS or further NEPA documentation for herbicide use on a case by case basis could be considered.

objectives over a five year period is estimated at $2,055,500. This amounts to a total cost per effectively treated/restored acre over a five year period of about $126 per acre

Alternative 2 could provide up to 39 seasonal jobs for any given 130 day year, assuming an unlimited budget.

Alternative 2 would not likely be acceptable to those who disagree with herbicide use. Glyphosate would be used in Alternative 2, but would not be the first choice herbicide for any known infestation.

Assuming rapid response to new infestations, Alternative 2 would be expected to cost about $126 per acre from detection to restoration on new detections. Cost incurred with detecting and responding to new invasive plant sites would be expected to go down over time. Implementing effective treatments on existing invasive plant sites will also reduce the sources of spread and therefore the cost associated with treating new sites.

The Forest Plan amendment approving the use of aminopyralid would increase cost effectiveness by reducing the need for and extent of re-treatment over time.

Some members of the public encourage the addition of effective treatment options and would welcome selection of Alternative 2. The Forest Service would be most likely to meet objectives and policies regarding invasive plant management.

Direct and Indirect Effects of Alternative 3

Alternative 3 would approve non-herbicide methods only on about 10,785 acres. These methods would be less effective than the 5,496 acres where all methods would be approved. (50% compared to 80%) Under an unlimited budget, assuming an average annual cost of $300 per treatment acre for the 10,785 acres where no herbicide would be approved, and an average annual cost of $100 per treatment acre for and an average annual effectiveness of 80 percent per year for 5,496 acres where all methods would be approved, total cost of fully meeting all treatment objectives over a five year period is estimated at $7,115,400. This amounts to a total cost per effectively treated/restored acre over a five year period of about $437 per acre.

Alternative 3 could provide up to 86 seasonal jobs for any given 130 day year, assuming an unlimited budget.

Alternative 3 would probably be more acceptable to those who disagree with herbicide use than Alternative 2. Glyphosate could be used in Alternative 3, but there are no known infestations where it would be the first choice herbicide.

Assuming rapid response to new infestations, Alternative 3 would be expected to cost about $437 per acre from detection to restoration on new detections. Cost incurred with detecting and responding to new invasive plant sites would be expected to go down over time. Implementing effective treatments on existing invasive plant sites will also reduce the sources of spread and therefore the cost associated with treating new sites.

The Forest Plan amendment approving the use of aminopyralid would increase cost effectiveness by reducing the need for and extent of re-treatment over time.

Some members of the public would be concerned about the lack of effective treatment options if Alternative 3 were selected. The Forest Service would be less likely to meet objectives and policies regarding invasive plant management compared to Alternative 2.

Cumulative Effects of All Alternatives

Use of funds for invasive plant treatment can impact the amount of money available to other programs. It is possible that the same people would do the jobs associated with this or any other forestry project on the Forest. Therefore, there is no discernible difference in cumulative effects of the alternatives. The number of affected jobs in any alternative is insignificant at any scale.

Government officials estimate that invasive plant control occurs on over 1,250,000 acres in Oregon and Washington, and more than 90 percent of this control is through the use of herbicides (based on informal discussions with state and county agriculture and weed personnel). These data suggest that the broader regional treatment program resembles the Proposed Action. If this is true, then invasive plant control in the region creates roughly 8,038 jobs annually (applying the average of one $20,000 job equivalent for every 138.3 acres treated). Source: R6 PNW FEIS.

If the Forest Service were to select an herbicide restrictive alternative, herbicide use could continue elsewhere in the affected counties. Glyphosate and other herbicides are currently labeled for use in Washington State.

3.12.5 Consistency Findings

This project is consistent with all policies and plans related to socio-economics. Decision makers and the public have been provided with an adequate understanding of the socio-economic costs and benefits of proposed actions that are necessary for informed decisions.

3.13 Required Disclosures

3.13.1 Irreversible and Irretrievable Resources

Invasive plants can alter native plant communities and make restoration more difficult. At some point, invasive plants can irreversibly alter habitat elements important for some species. Invasive plant treatments can prevent this damage from occurring or slow the rate of damage from invasive plants.

No irreversible or irretrievable uses of resources are associated with invasive plant treatments. Removal of invasive plants would have short term, localized risk of adverse impacts, as described throughout Chapter 3.

3.13.2 Short Term Adverse Effects That Cannot Be Avoided

The project design features (Chapter 2.2.2) are intended to minimize or eliminate the risk of adverse effects from the treatments that would be authorized under the alternatives. Low risk of adverse effect cannot be ruled out due to uncertainties about where, when and how the project will be implemented.

Botanical Resources: Some common non-target plants within a few feet of the treated site will likely be killed even with adequate planning and care. 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.

Soil Resources: Minor changes to soil biology would occur from removal of invasive plants or use of herbicides. However, these changes are not likely to have lingering or substantial impacts to soil biology. Project design features manage herbicide persistence in the soil.

Water Resources: Some molecules of herbicide are likely to reach water as a result of riparian treatments approved in all alternatives, however the amount of contamination would not likely be measurable or result in adverse effects to beneficial uses. Some sediment may reach streams from all treatment methods if most vegetation is removed from a given area, however recovery would be rapid and impacts are not likely to have adverse impacts on beneficial uses.

Aquatic Organisms: Some riparian vegetation may be killed in the vicinity of invasive plant treatments but the scale would be small and duration very short, thus meaningful adverse impacts are not expected. Habitat would likely be improved from treatments. Herbicide toxicity exceeding thresholds of concern are unlikely, but possible in the event of a large herbicide spill.

Wildlife: Non-lethal impacts on individual animals are mathematically possible but unlikely given the small and scattered nature of the treatment sites and the project design features. Habitat would likely be improved from effective treatments.

Rangeland Resources: No adverse effects that cannot be avoided from treatments. Invasive plants are degrading rangeland resources and effective treatment would improve these resources.

Human Health: No adverse effects on human health from the project are predicted. People who have chemical sensitivity may choose to avoid certain areas that have been treated. Minor to moderate physical injuries during forestry work are possible.

Recreation and Scenic Resources: Adverse effects on recreation and scenery and limited to minor changes in vegetation, with browned invasive plant patches possible along roads, trails and within developed recreation sites. These impacts are insignificant, localized and short-term.

Heritage Resources: No impacts on heritage resources are predicted from this project.

Social and Economic: Taxpayers will likely be responsible for the costs of some if not all of the treatments. Some people express discomfort about the idea that herbicides are used on National Forest.

3.13.3 Impacts on Long Term Productivity

Treatment does not pose impacts on long term productivity. Left untreated, large invasive plant infestations can persist for decades and cause loss *soil productivity*, native plant communities and *timber*. The project is expected to have positive effects on *forest* productivity as invasive plants are controlled and native vegetation is restored. The alternatives vary in their effectiveness at controlling invasive plants and preventing spread, as discussed in section 3.1. Proposed treatment methods, including herbicide application are unlikely to have long-term impacts on productivity.

3.13.4 Energy Requirements and Conservation Potential

No unusual energy requirements are associated with this project and an insignificant amount of energy resources would be used.

3.13.5 Possible Conflicts with Federal, Regional, State, and Local Land Use Plans, Policies and Controls

Most analysis relevant to Federal lands use plans, policies and controls is found in the individual relevant resource areas throughout Chapter 3. National Pollutant Discharge Elimination System (NPDES) permits may be required for some of the treatments under this decision (see Section 3.5 above). No Tribal Confederated Tribes of the Colville Reservation or Yakama Nation tribal lands would be treated under this decision, although both tribes were consulted and neither raised any concerns. Controlling and eliminating invasive plants would benefit tribes by restoring native plants communities.

3.13.6 Civil Rights, Equal Opportunity and Environmental Justice

Civil Rights would not be affected by any of the alternatives. The project includes both Forest Service contracted work and Forest Service employee accomplished work. Under Executive Order 11246, companies with Federal contracts or subcontracts are prohibited from job discrimination the basis of race, color, religion, sex or national origin. The U. S. Department of Agriculture prohibits discrimination in its employment practices based on race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, and marital and family status. It is the policy of the Forest Service that the Responsible Forest Service Official (FSM 1704) review proposed actions for civil rights impacts and take either of the following actions in compliance with DR 4300-4 and 1010-1 (FSM 1730.1): prepare a civil rights impact analysis and statement of its findings for any proposed policy or organizational action which may have a major civil rights impact, or document the determination that a civil rights impact analysis and a statement of findings are not needed.

In order to make the determination that a civil rights impact analysis and a statement of findings were not needed, we sent postcards to more than 1700 individuals, agencies and tribes about this project, 800 of whom responded that they were interested in the project. A scoping letter about this project was sent to all interested parties and no civil rights or equal opportunity concerns were raised. If cultural plant collection sites were identified by the Tribes in the future, the Forest would consult with Tribal Governments regarding treatments in those areas.

In addition, Alternatives 2 and 3 would provide jobs which may result in more employment for protected classes of people. Alternative 1 would provide no new jobs, although jobs would be provided by treatments approved under existing NEPA decisions until such decisions expired.

The R6 PNW FEIS noted that some minority groups may be disproportionately exposed to herbicides, either because they are disproportionately represented in the pool of likely forest workers, or in the pool of special forest product or subsistence gatherers. The R6 PNW FEIS suggested that Hispanic/Latino forest workers and American Indians are minority groups that could be disproportionately affected by herbicide use.

The potential effects to minority groups who apply herbicides or gather or use forest products are the same as those evaluated above under the worker and public herbicide exposure analysis sections. With the implementation of the action alternatives, there is the potential for some impact to Hispanic, Asian, and American Indian communities. Tribal rights (ceded lands) and Tribal traditional uses were covered earlier in Section 3.11, and none of the alternatives would have any measurable impacts on Tribal interests. The project is not located in a minority community nor would it affect low income individuals. Forestry workers, usually disproportionately Hispanic, would have more exposure to the proposed herbicides than the general public. Also, harvesters of special (non-timber) forest products tend to come from Asian, Hispanic, and American Indian communities. These groups could be exposed to herbicide treatments in areas available for picking or collecting their products.

Even given plausible inadvertent acute or chronic exposures, minority forest workers, special forest product harvesters, and subsistence gatherers are not likely to be exposed to a dose that exceeds a threshold of concern (See Section 3.9 above). Herbicide label restrictions, R6 PNW ROD Standards, and PDFs in this document all lower the risk to workers and the public. This project would not result in disproportionate impacts to low income or minority groups.

3.13.7 Prime Farmlands, Rangelands, Forestlands

No prime farmland or rangeland exist in the project area, and although there may be prime forestlands within the project area treating invasive species would not affect forestland. Under the No Action alternative, continued spread and incidence of invasive plants on National Forest System lands as a result of ineffective or no treatment could impact adjacent private lands which could be considered prime farmland or rangeland. Alternative 2 would provide the most effective treatments because of reduced costs and more herbicide options available and therefore it would better reduce the potential of invasive plants to spread to adjacent private lands from National Forest System lands (also see discussion in Chapter 3.2).

3.13.8 Floodplains and Wetlands (Executive Orders 11988 & 11990)

Proposed invasive plant treatments within the riparian areas and wetlands are discussed in Sections 3.5 and 3.6 above. The proposed treatments would be implemented using the standards from the R6 PNW ROD (USDA 2005b) and Project Design Features (Chapter 2 section 2.2.2). The project does not involve any construction or improvements to occur in wetlands; no destruction or modification of wetlands would take place. No occupancy, development, or modification of floodplains is proposed. No adverse impacts associated with construction, developments, or improvements would occur from any alternative.

3.13.9 Forest Plan Amendments

A Forest Plan amendment would be implemented with this decision. The 2012 Planning Rule (36 CFR Part 219) allows plan amendments to be made using the procedures from the 1982 planning regulations during a transition period (36 CFR § 219.14 (b)(2)). Scoping for this project occurred prior to adoption of the 2012 Planning Rule, thus we will complete the 1982 process initiated with this project. Under the 1982 planning regulations, four factors determine whether or not proposed changes to the Forest Plans are significant amendments. The four factors are:

1. Actions that do not significantly alter the multiple-use goals and objectives for long-term land and resource management.

2. Adjustments of management area boundaries or management prescriptions resulting from further on-site analysis when the adjustments do not cause significant changes in the multiple-use goals and objectives for long-term land and resource management.

3. Minor changes in standards and guidelines.

4. Opportunities for additional projects or activities that will contribute to achievement of the management prescription.

This Forest Plan amendment enhances the agency's ability to address invasive species management objectives but does not alter multiple-use goals and objectives in the Forest Plans to any extent. This Forest Plan amendment does not change any Forest Plan management area boundaries or management prescriptions on the Forests. Amending Standard #16 to add aminopyralid on the Okanogan-Wenatchee National Forest would not change the multiple-use goals and objectives for long-term land and resource management of the Forests.

The Forest Plan amendment authorizes the use of a registered herbicide, aminopyralid. This herbicide is not currently listed among the ten herbicides approved by the Regional Forester in 2005 (R6 PNW ROD).

The Risk Assessment for aminopyralid (SERA 2007) was completed after the ROD and demonstrates that use of this herbicide will not pose new or significant risks compared to the ten already approved.

Aminopyralid is generally a lower risk herbicide and the proposed use would not pose additional risks to human health or the environment. U.S. EPA (2005) has concluded that the use of aminopyralid as a replacement for other herbicides will decrease risk to some non-target species:

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

This Forest Plan amendment allows more effective and efficient treatment of invasive plants by adding aminopyralid to the list of approved herbicides on the Okanogan Wenatchee NF. Aminopyralid is an herbicide that is very effective for most of the invasive plant species found within the Forest. It was developed specifically for wildland use and is effective at low rates. Authorizing the use of aminopyralid will not foreclose on opportunities for additional projects or activities that will contribute to achievement of the management prescription and would make projects more effective in controlling invasive plants.

Based on these factors, adding aminopyralid to the list of herbicides approved for treating invasive plants would not be a significant amendment to the Forest Plans. Use of aminopyralid on the ground would follow project design features associated with the selected alternative for the next 15 years or more.

CHAPTER 4: Consultation and Coordination

4.1 List of Preparers

The following people comprise the core interdisciplinary team who developed the site-specific analysis found in this EIS. Many other Forest Service employees provided review and editorial guidance.

Rochelle Desser – Invasive Plant NEPA and Monitoring Coordinator, USDA Forest Service R6

Contribution: Provided advice on herbicide effects analysis, assembled FEIS, contributed to human health and socio-economic analysis.

Education: A.S. Geo-technology, Flathead Valley College, Kalispell MT; Hutchins School of Interdisciplinary Studies, Sonoma State University, CA.

Jan Flatten – Environmental Consultant, Majeska Environmental Consulting

Contribution: Provided advice on NEPA process, prepared Recreation, Scenery, and Special Areas report.

Education: B.A. Geography, California State University Northridge

Powys Gadd – Heritage Program Manager/Forest Anthropologist, USDA Forest Service, Okanogan-Wenatchee National Forest.

Contribution: Heritage Resource Analysis

Education: B.A. Anthropology, Fort Lewis College, M.A. Anthropology University of Denver

William Garrigues – Hydrologist (retired), USDA Forest Service, Okanogan-Wenatchee National Forest

Contribution: Soil and Water Resource Analysis

Education: B.S. Biology, University of Oregon, B.S. Watershed Sciences, Utah State University.

Molly Hanson – Forest Hydrologist, USDA Forest Service, Okanogan-Wenatchee National Forest

Contribution: Soil and Water Resource Analysis – review/updates

Education: A.A. Wenatchee Valley College, B.A. Geography, Environmental and Resource Management, Western Washington University, M.S. Geography (Earth Surface Processes), University of Utah

L. Dean McFetridge – Rangeland Management Specialist, USDA Forest Service, Okanogan-Wenatchee National Forest

Contribution: Prepared the Treatment Effectiveness and Range Resource Analysis.

Education: B.S. Rangeland Resources, Oregon State University

Brigitte Ranne – Zone Botanist, USDA Forest Service, Okanogan-Wenatchee National Forest Service

Contribution: Team leader and Botanical Resource Analysis

Education: B.A. Physical Geography, Oregon State University, M.S. Geography (vegetation focus), University of Wyoming.

Joan St. Hilaire – Wildlife Biologist, USDA Forest Service, Okanogan-Wenatchee National Forest Service

Contribution: Wildlife Resource Analysis

Education: B.S. Washington State University

Gary Torretta – Fisheries Biologist, USDA Forest Service, Okanogan-Wenatchee National Forest Service

Contribution: Aquatics and Fisheries Resource Analysis

Education: B.S. Wildlife and Wildland Recreation Management, Washington State University.

4.2 Consultation with Tribes

Prior to the initiation of public scoping, government-to-government consultation letters were sent to the Yakama Nation and Confederated Tribes of the Colville Reservation on August 10, 2009. Neither government raised any concerns relating to the project. The tribal governments were provided courtesy advance copies of the DEIS and they did not have any comments. They were also provided courtesy advance copies of this FEIS.

4.3 Consultation with Agencies

Consultation with the U.S. Fish and Wildlife Service and NOAA fisheries was initiated with a Level 1 Team Review that occurred on December 13, 2012 and is continuing. Consultation will be completed before the final ROD is signed. This project falls under guidance provided by the Aquatic Restoration Biological Opinion (II) that was issued in 2013 (ARBO II, USFWS, NMFS).

Consultation with the Washington State Office of Archeology and Historic Preservation is in process.

Consultation with the Washington State Department of Transportation and Department of Natural Resources was initiated with the public scoping letter discussed below. Both agencies replied with letters supporting the proposed action and requesting coordination where activities are adjacent to their rights-of-way and lands.

Consultation was also initiated with the County Weed Boards with the public scoping letter discussed below and replies were received from Okanogan and Yakima County. Yakima County Weed Board expressed support for the project but had concerns about specific weeds and requested coordination. Okanogan County expressed concern about the limited scope of the project, requesting that no limit be placed on acres treated or herbicides used, aerial spraying be allowed, and that all State listed weeds be controlled. County Commissioners were also consulted and no concerns were raised.

Agency comments to the DEIS are published in total in Appendix F.

4.4 FEIS Distribution

Agencies and members of the public expressing interest in the project received notice that the Final EIS is available on request and on the project website: http://www.fs.fed.us/nepa/nepa_project_exp.php?project=24104. The DEIS was distributed to people who requested it or commented during scoping; federal, state and local agencies; and tribal governments. In addition, several people received notification summaries of the DEIS and notification about the comment period. Compact Disc or hard copies of the final documents were provided to people who commented during the comment period, federal and local agencies, and tribal governments. Everyone who has been involved with the project at any stage received notification of the availability of the FEIS.

Public

Ronda Bradeen

Victor & Emma Liles

Chris Frue

George Wooten

Dick Artley

Wayne Bell

Don Johnson

Daniel Russel

Kathleen Yockey

Donna Bresnahan

Christine B. Littleton

Lee Cobert

Joanne Cooper

Agencies

National Park Service
Okanogan County Weed Control Board
Environmental Protection Agency
National Agricultural Library
OECP

Tribal Governments

Confederated Tribes of the Colville Reservation
Yakama Nation

CHAPTER 5: Literature Cited and Glossary

5.1 Literature Cited

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5.2 Glossary

Active ingredient (a.i.) - In any pesticide product, the component (a chemical or biological substance) that kills or otherwise controls the target pests - Pesticides are regulated primarily on the basis of active ingredients. The remaining ingredients are called "inerts."

Activity center (northern spotted owl) - The core of an owl's territory and the focal point of protection measures. Most frequently located in or near the highest concentration of remaining suitable habitat.

Acute effect - An adverse effect on any living organism in which severe symptoms develop rapidly and often subside after the exposure stops.

Acute exposure - A single exposure or multiple brief exposures occurring within a short time (e.g., 24 hours or less in humans). The classification of multiple brief exposures as "acute" is dependent on the life span of the organism. (See also, chronic exposure and cumulative exposure.)

Acute toxicity - Any harmful effect produced in an organism through an acute exposure to one or more chemicals.

Additive effect - A situation in which the combined effects of exposure to two chemicals simultaneously is equal to the sum of the effect of exposure to each chemical given alone. The effect most commonly observed when an organism is exposed to two chemicals together is an additive effect.

Adaptive management - A continuing process of action-based planning, monitoring, researching, evaluating, and adjusting with the objective of improving implementation and achieving the goals of the standards and guidelines

Adjuvant(s) - Chemicals that are added to pesticide products to enhance the toxicity of the active ingredient or to make the active ingredient easier to handle or mix.

Adsorption - The tendency of one chemical to adhere to another material such as soil.

Affected Environment - Existing biological, physical, social, and economic conditions of an area subject to change, both directly and indirectly, as the result of a proposed human action.

Agent - Any substance, force, radiation, organism, or influence that affects the body. The effects may be beneficial or injurious.

Agency for Toxic Substances and Disease Registry (ATSDR) - Federal agency within the Public Health Service charged with carrying out the health-related analyses under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Superfund Amendments and Reauthorization Act (SARA).

Ambient - Usual or surrounding conditions.

Amphibian - Any of a class of cold-blooded vertebrates (including frogs, toads, or salamanders) that are intermediate in many characteristics between fishes and reptiles and having gilled aquatic larvae and air-breathing adults.

Anadromous (Fish) - Fish that spend their adult life in the sea but swim upriver to fresh water spawning grounds to reproduce.

Annual - A plant that endures for not more than a year. A plant which completes its entire life cycle from germinating seedling to seed production and death within a year.

Annual and Life of the Project Caps – The project caps are limitations on the acreage that may be treated annually and over the life of the project.

Bacteria - Microscopic living organisms that metabolize organic matter in soil, water, or other environmental media. Some bacteria can also cause human, animal and plant health problems.

Bankfull (elevation) – The elevation of water in a stream or river where it just fills the channel to the top of its banks and at a point where water begins to flow onto a floodplain.

Bear Management Unit (BMU) - The area assessed for carrying capacity of a sow grizzly bear and cub.

Best Management Practices (BMP) - A practice or combination of practices determined by a state or an agency to be the most effective and practical means (technological, economic, and institutional) of controlling point and non-point source pollutants at levels compatible with environmental quality.

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

Bioconcentration - The accumulation of a chemical in tissues of a fish or other organism to levels greater than in the surrounding water or environment.

Bioconcentration Factor (BCF) - The concentration of a compound in an aquatic organism divided by the concentration in the ambient water of the organism.

Biological control - The use of natural enemies, including invertebrate parasites and predators (usually insects, mites, and nematodes,) and plant pathogens to reduce populations of non-native, invasive plants.

Broadcast application - Herbicide treatment method generally used along roads; boom truck spray is directed at target species. Broadcast methods are used for larger infestations where spot treatments would not be effective.

Herbicide Use Buffer - A strip of land near a waterway or other environmentally sensitive area where a particular chemical and method of application is restricted, depending on the herbicide ingredient.

Candidate species - Those plant and animal species that, in the opinion of the Fish and Wildlife Service (FWS) or National Oceanic and Atmospheric Administration (NOAA) Fisheries, may qualify for listing as “endangered” or “threatened.” The FWS recognizes two categories of candidates. Category 1 candidates are taxa for which the FWS has on file sufficient information to support proposals for listing. Category 2 candidates are taxa for which information available to the FWS indicates that proposing to list is possibly appropriate, but for which sufficient data are not currently available to support proposed rules.

Carcinogen - A chemical capable of inducing cancer.

Chemical Control - The use of naturally derived or synthetic chemicals called herbicides to eliminate or control the growth of invasive plants.

Chronic exposure - Exposures that extend over the average lifetime or for a significant fraction of the lifetime of the species (for a rat, chronic exposure is typically about 2 years). Chronic exposure studies are used to evaluate the carcinogenic potential of chemicals and other long-term health effects. (See also, acute and cumulative exposure.)

Chronic toxicity - The ability of a substance or mixture of substances to cause harmful effects over an extended period, usually upon repeated or continuous exposure sometimes lasting for the entire life of the exposed organism

Code of Federal Regulations (CFR) - Document that codifies all rules of the executive departments and agencies of the federal government. It is divided into fifty volumes, known as titles. Title 40 of the CFR (referenced as 40 CFR) lists all environmental regulations, including regulations for EPA pesticide programs (40 CFR Parts 150-189).

Competitive Seeding – A treatment method that is intended to reduce the potential for invasive plants to become introduced or to reoccupy a site once target populations have been reduced. This method is often combined with other treatment methods.

Congressionally Designated Areas - Areas that require Congressional enactment for their establishment, such as National Parks, Wild and Scenic Rivers, National Recreation Areas, National Monuments, and Wilderness. Also referred to as Congressional Reserves. Includes similar areas established by Executive Order, such as National Monuments.

Connected Actions – An action that would occur at the same time and place, or would be required to occur, in order to implement a proposed action, and therefore would be analyzed in a single NEPA document.

Contaminants - For chemicals, impurities present in a commercial grade chemical. For biological agents, other agents that may be present in a commercial product.

Critical Habitat (for threatened or endangered species under the Endangered Species Act – (i) the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of section 4 of this Act, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 4 of this Act, upon a determination by the Secretary that such areas are essential for the conservation of the species. The USFWS and the NMFS formally designate what is "critical habitat" for their respective species. Critical habitat includes the stream channels with a lateral extent defined by the ordinary high-water line [33 CFR 319.11]). Critical habitat: can include an area not currently occupied by the species, which is itself essential to the conservation of the species. As defined in the ESA "conservation" means any and all methods and procedures, and the use of those, needed to bring a species to recovery—the point at which the protections of the ESA are no longer needed.

Cultural control - The establishment or maintenance of competitive vegetation, use of fertilizing, mulching, prescribed burning, or grazing animals to control or eliminate invasive plants.

Cultural Items - From section 2 of the Native American Graves Protection and Repatriation Act (NAGPRA) (25 U.S.C. 3001 et seq.) which includes Associated Funerary Objects, Unassociated Funerary Objects, Sacred Objects, and Objects of Cultural Patrimony. The term "cultural items" does not include human remains.

Cumulative Effect - The impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions—regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time (40 CFR 1508.7).

Depressed Stock (fish) - A stock of fish whose production is below expected levels based on available habitat and natural variations in survival rates, but above the level where permanent damage to the stock is likely.

Disturbance - An effect of a planned human management activity, or unplanned native or exotic agent or event that changes the state of a landscape element, landscape pattern, or regional composition.

Dosage/Dose - (1) The actual quantity of a chemical administered to an organism or to which it is exposed. (2) The amount of a substance that reaches a specific tissue (e.g. the liver). (3) The amount of a substance available for interaction with metabolic processes after crossing the outer boundary of an organism.

Dose Response - Changes in toxicological responses of an individual (such as alterations in severity of symptoms) or populations (such as alterations in incidence) that are related to changes in the dose of any given substance.

Drift - The portion of a sprayed chemical that is moved by wind off of a target site.

Early Detection and Rapid Response (EDRR) – Treatment of invasive plants over the life of the project according to the implementation planning process.

Endangered Species - Any species listed in the Federal Register as being in danger of extinction throughout all, or a significant portion, of its range.

Endangered Species Act (ESA) - A law passed in 1973 to conserve species of wildlife and plants, determined by the Director of the U.S. Fish and Wildlife Service or the NOAA Fisheries to be endangered or threatened with extinction in all or a significant portion of its range. Among other measures, ESA requires all federal agencies to conserve these species and consult with the Fish and Wildlife Service or NOAA Fisheries on federal actions that may affect these species or their designated critical habitat.

Endemic - A species or other taxonomic group that is restricted to a particular geographic region due to factors such as isolation or response to soil or climatic conditions. (Compare to “Indigenous” and “Native.”)

Environmental justice - Executive Order 12898 of February 11, 1994 requires federal agencies, to the greatest extent practicable and permitted by law, to make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions, the District of Columbia, the Commonwealth of Puerto Rico, and the commonwealth of the Mariana Islands.

Essential Fish Habitat - Waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.

Exotic – Non-native species; introduced from elsewhere, but not completely naturalized. (See also alien and introduced species.)

Extirpated – An organism that is eliminated from a local area.

Fish-Bearing Streams - Any stream containing any species of fish for any period of time.

Federal Insecticide and Rodenticide Act (FIFRA) Pesticide Ingredient - An ingredient of a pesticide that must be registered with EPA under the Federal Insecticide, Fungicide, and Rodenticide Act. Products making pesticide claims must submit required information to EPA to register under FIFRA and may be subject to labeling and use requirements.

Fertilization - Treatment method involving adding of nutrients that could improve the success of desirable species; may be limited, depending on species/soil characteristics.

First-choice Herbicides – First-choice herbicides are those that would be used during the first year of treatment of a given primary target species. It is likely be most effective, given the options associated with a given action alternative. First-choice herbicides are often used in combination with non-herbicide methods.

Flora - Plant life, especially all the plants found in a particular country, region, or time regarded as a group. Also, a systematic set of descriptions of all the plants of a particular place or time.

Forage - Food for animals. In this document, term applies to both availability of plant material for wildlife and domestic livestock.

Forest Service Sensitive Species - For Region 6 of the Forest Service, those plant and animal species identified by the Regional Forester for which population viability is a concern, as evidenced by significant current or predicted downward trends in population numbers or density and habitat capability that would reduce a species’ existing distribution (FSM 2670.5).

Formulation - A commercial preparation of a chemical including any inerts and/or contaminants.

Fragmentation - The degree to which the landscape is broken into distinct patch types.

Fungi - Molds, mildews, yeasts, mushrooms, and puffballs, a group of organisms that lack chlorophyll and therefore are not photosynthetic. They are usually non-mobile, filamentous, and multi-cellular.

Geographical Information System (GIS) – Maps and data showing location and attributes for natural resources found within a project area.

Groundwater - The supply of fresh water found beneath the Earth's surface, usually in aquifers, which often supply wells and springs.

Groundwater Loading Effects of Agricultural Management Systems (GLEAMS) - A model that displays herbicide concentrations in streams under a variety of soil, climate, and vegetative conditions.

Habitat - The place where a population (e.g., human, animal, plant, microorganism) lives and its surroundings, both living and non-living.

Half-life - The time required for the concentration of the chemical to decrease by one-half.

Hand/Selective application - Herbicide treatment of individual plants through wicking, wiping, injecting stems, etc., with low likelihood of drift or delivery of herbicides away from treatment sites. This method ensures no herbicide directly contacts soil.

Hand-pulling/Grubbing - Treatment method which is labor-intensive but effective on single plants or on small, low-density infestations.

Hazard Quotient (HQ) - The ratio of the estimated level of exposure to a substance from a specific pesticide application to the RfD for that substance, or to some other index of acceptable exposure or toxicity. A HQ less than or equal to 1 is presumed to indicate an acceptably low level of risk for that specific application.

Hazard identification - The process of identifying the array of potential effects that an agent may induce in an exposed of humans or other organisms.

Healthy Stock - A stock of fish experiencing production levels consistent with its available habitat and within the natural variations in survival for the stock.

Herbaceous - A plant that does not develop persistent woody tissue above the ground (annual, biennial, or perennial.) Herbaceous vegetation includes grasses and grass-like vegetation, and broadleaved forbs.

Herbicide - A chemical preparation designed to kill plants, especially weeds, or to otherwise inhibit their growth. May or may not include an additive (adjuvant) such as a surfactant.

Herbicide Application Rate – The amount of herbicide active ingredient that would be used on a treated acre. The maximum rate is the amount allowed by an herbicide label. Typical rate is the average rate used by the Forest Service for invasive plant treatment projects. Lowest rate (or lowest effective rate) is the least amount of herbicide that could be used to reach treatment objectives.

Herbicide Treatment – Any use of herbicide to meet treatment objectives. Herbicide treatments are part of the integrated weed management toolbox. Herbicide treatment may be combined with non-herbicide treatments to meet treatment objectives.

Herbicide Use Buffer – An area adjacent to a stream or other water body where herbicide ingredient or application methods are restricted.

Hibernacula - Sites where hibernation occurs.

Human influence zone -Areas of human activity (recreation sites, roads, trails, buildings, mines, hydropower operations, etc.) buffered by one-third mile around trails and one-half mile around roads and other sites.

Ordinary high water line – see bankfull.

Indian Tribe - Any American Indian or Alaska Native tribe, band, nation, pueblo, community, rancheria, colony, or group meeting the provisions of the Code of Federal Regulations Title 25, Section 83.7 (25 FR 83.7), or those recognized in statutes or treaties with the United States.

Indigenous Species - An indigenous species is any which were or are native or inherent to an area. (See also, native.)

Inert Ingredient - Anything other than the active ingredient in a pesticide product; not having pesticide properties.

Infested area or site - A contiguous area of land occupied by, in this case, invasive plant species. An infested area of land is defined by drawing a line around the actual perimeter of the infestation as defined by the canopy cover of the plants, excluding areas not infested. Generally, the smallest area of infestation mapped will be 1/10th (0.10) of an acre or 0.04 hectares.

Integrated Weed Management (IWM) - An interdisciplinary weed management approach for selecting methods for preventing, containing, and controlling noxious weeds in coordination with other resource management activities to achieve optimum management goals and objectives.

Interdisciplinary Team (IDT) - A group of individuals with varying areas of specialty assembled to solve a problem or perform a task. The team is assembled out of recognition that no one scientific discipline is sufficiently broad enough to adequately analyze the problem and propose action.

Introduced species - An alien or exotic species that has been intentionally or unintentionally released into an area as a result of human activity. (See also exotic, invasive, and noxious.)

Introduction - “The intentional or unintentional escape, release, dissemination, or placement of a species into an ecosystem as a result of human activity” (Executive Order 13122, 2/3/99).

Invasive plant - An alien plant species whose introduction does or is likely to cause economic or environmental harm or harm to human health (Executive Order 13122, 2/3/99) (See also exotic and introduced species)

Irreversible effect - Effect characterized by the inability of the body to partially or fully repair injury caused by a toxic agent.

LC50 (Lethal Concentration 50) - A calculated concentration of a chemical in air or water to which exposure for a specific length of time is expected to cause death in 50 percent of a defined experimental animal population.

LD50 (Lethal Dose 50) - The dose of a chemical calculated to cause death in 50 percent of a defined experimental animal population over a specified observation period. The observation period is typically 14 days.

Label - All printed material attached to, or part of, the pesticide container.

Land allocation – A management area designated in a Land and Resource Management Plan associated with certain desired conditions, objectives and standards.

Landscape - An area composed of interacting ecosystems that are repeated because of geology, land form, soils, climate, biota, and human influences throughout the area. Landscapes are generally of a size, shape, and pattern which is determined by interacting ecosystems.

Landscape Character - Particular attributes, qualities, and traits of a landscape that give it an image and make it identifiable or unique.

Landscape Setting - The context and environment in which a landscape is set; a landscape backdrop. It is the combination of land use, landform, and vegetation patterns that distinguish an area in appearance and character from other areas.

Large woody debris - Pieces of wood larger than 10 feet long and 6 inches in diameter.

Late-successional forest - Late-successional forests are those forest seral stages that include mature and old-growth age classes. (ROD USDA-USDI, Standards and Guidelines 1994, B-1)

Leaching - The process by which chemicals on or in soil or other porous media are dissolved and carried away by water, or are moved into a lower layer of soil.

Level of Concern (LOC) - The concentration in media or some other estimate of exposure above which there may be effects.

Lichens - Complex thallophytic plants comprised of an alga and a fungus growing in symbiotic association on a solid surface (such as a rock.)

Lowest-Observed-Adverse-Effect Level (LOAEL) - The lowest dose of a chemical in a study, or group of studies, that produces statistically or biologically significant increases in frequency or severity of adverse effects between the exposed and control populations.

Manual Control - The use of any non-mechanized approach to control or eliminate invasive plants (i.e. hand-pulling, grubbing)

Material Safety Data Sheet (MSDS) - A compilation of information required under the OSHA Communication Standard on the identity of hazardous chemicals, health and physical hazards, exposure limits, and precautions.

Mechanical Control - The use of any mechanized approach to control or eliminate invasive plants (i.e. mowing, weed whipping).

Microorganisms - A generic term for all organisms consisting only of a single cell, such as bacteria, viruses, protozoa and some fungi.

Minimum tool - Use of a weed treatment alternative that would accomplish management objectives and have the least impact on resources

Modification - A visual quality objective meaning human activities may dominate the characteristic landscape but must, at the same time, utilize naturally established form, line, color, and texture. It should appear as a natural occurrence when viewed in foreground or middle ground.

Mollusks - Invertebrate animals (such as slugs, snails, clams, or squids) that have a soft, un-segmented body, usually enclosed in a calcareous shell; representatives found on National Forest System land include snails, slugs, and clams.

Monitoring - A process of collecting information to evaluate if objectives and anticipated or assumed results of a management plan are being realized or if implementation is proceeding as planned.

Most Ambitious Conceivable Treatment Level – The most ambitious treatment scenario would treat all known infestations during the first year of implementation and then retreated until management objectives are met. It includes treatments, re-treatments over a series of years, and passive or active restoration. It is an assumption that allows for a consistent analysis comparing alternatives given that Forest Service ability funding over the life of the project is unknown.

Mowing - Invasive plant treatment method which is limited to level/gently-sloping smooth-surface terrain. Treatment timing is critical, and must be conducted for several consecutive years.

National Environmental Policy Act (NEPA) - An Act passed in 1969 to declare a national policy that encourages productive and enjoyable harmony between humankind and the environment, promotes efforts that prevent or eliminate damage to the environment and biosphere, stimulates the health and welfare of humanity, enriches the understanding of the ecological systems and natural resources important to the nation, and establishes a Council on Environmental Quality.

National Forest Management Act (NFMA) - A law passed in 1976 as an amendment to the Forest and Rangeland Renewable Resources Planning Act, requiring preparation of Forest Plans and the preparation of regulations to guide that development.

National Marine Fisheries Service (NMFS) - The federal agency that is the listing authority for marine mammals and anadromous fish under the ESA.

National Pollutant Discharge Elimination System (NPDES) - As authorized by the Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Point sources are discrete conveyances such as pipes or man-made ditches. Individual homes that are connected to a municipal system, use a septic system, or do not have a surface discharge do not need an NPDES permit; however, industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters.

National Wilderness Preservation System (NWPS) - The Wilderness Act of 1964 established the national Wilderness Preservation System to ensure that certain federally owned areas in the United States would be preserved and protected in their natural condition. The Act defines a wilderness area, in part, as an area which generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable. Areas included in the system are administered for the use and enjoyment of the American people in such manner as to leave them unimpaired for future use and enjoyment as wilderness.

Native species - With respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem (Executive Order 13122, 2/3/99).

Neotropical migrants birds - Birds that migrate from North America to regions south of the Tropic of Cancer (latitude 23 1/2 degrees north) to winter.

Non-target species - Any plant or animal that is not the intended organism to be controlled by a pesticide treatment.

No-Observed-Adverse-Effect level (NOAEL) - Exposure level at which there are no statistically or biological significant differences in the frequency or severity of any adverse effect in the exposed or control populations

No-Observed-Effect-Level (NOEL) - Exposure level at which there are no statistically or biological significant differences in the frequency or severity of any effect in the exposed or control populations.

Noxious weed - “Any living stage (including but not limited to, seeds and reproductive parts) of any parasitic or other plant of a kind, or subdivision of a kind, which is of foreign origin, is new to or not widely prevalent in the United States, and can directly or indirectly injure crops, other useful plants, livestock, or poultry or other interests of agriculture, including irrigation, or navigation or the fish and wildlife resources of the United States or the public health” (Public Law 93-629, January 3, 1975, Federal Noxious Weed Act of 1974).

Omnivore - An animal that feeds on both plants and animals.

Outstandingly Remarkable Value (ORV) - A characteristic of rivers or sections of rivers in the national Wild and Scenic River System. In order for a river to be included in the system, it must possess at least one “outstandingly remarkable” value, such as scenic, recreational, geologic, fish, wildlife, historic, cultural, or other similar features. Outstandingly Remarkable Values are values or opportunities in a river corridor which are directly related to the river and which are rare, unique, or exemplary from a regional or national perspective.

Partial Retention - A visual quality objective which in general means human activities may be evident but must remain subordinate to the characteristic landscape.

Pathogen - A living organism, typically a bacteria or virus that causes adverse effects in another organism.

Percolation - Downward flow or filtering of water through pores or spaces in rock or soil.

Perennial Plant- A plant species having a life span of more than 2 years.

Persistence - Refers to the length of time a compound, once introduced into the environment, stays there.

Personal Protective Equipment (PPE) - Clothing and equipment worn by herbicide mixers, loaders and applicators and re-entry workers worn to reduce their exposure to potentially hazardous chemicals and other pollutants.

Pest - An insect, rodent, nematode, fungus, weed or other form of terrestrial or aquatic plant or animal life that is classified as undesirable because it is injurious to health or the environment.

Pesticide - Any substance used for controlling, preventing, destroying, repelling, or mitigating any pest. Includes fungicides, herbicides, fumigants, insecticides, nematicides, rodenticides, desiccants, defoliants, plant growth regulators, etc.

pH - The negative log of the hydrogen ion concentration. A high pH (greater than 7) is alkaline or basic and a low pH (less than 7) is acidic.

Population - A group of individuals of the same species in an area.

Project “Caps” – Limitations on the acreage that may be treated annually and through the life of the project.

Proposed species - Any plant or animal species that is proposed by the Fish and Wildlife Service or NOAA Fisheries in a Federal Register notice to be listed as threatened or endangered.

Recreational Rivers - A classification within the national Wild and Scenic River System. Recreational rivers are those rivers, or sections of rivers, that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

Redd –A spawning nest made by a fish, especially a salmon or trout.

Reference Dose (RfD) - The RfD is a numerical estimate of a daily exposure to the human population, including sensitive subgroups such as children, that is not likely to cause harmful effects during a lifetime. RfDs are generally used for health effects that are thought to have a threshold or minimum dose for producing effects.

Registered Pesticides - Pesticide products which have been approved for the uses listed on the label.

Restoration - Ecological restoration is the process of assisting the recovery and management of ecological integrity. Ecological integrity includes a critical range of variability in biodiversity, ecological processes and structures, regional and historical context, and sustainable cultural practices. Restoration may be passive (passing of time to allow for site recovery) or active (in this project, active restoration includes seeding, mulching and planting after invasive plants are removed).

Revegetation - The re-establishment of plants on a site - The term does not imply native or non-native; does not imply that the site can ever support any other types of plants or species and is not at all concerned with how the site ‘functions’ as an ecosystem.

Riparian Area (or zone) - Those terrestrial areas where the vegetation complex and microclimate conditions are products of the combined presence and influence of perennial and/or intermittent water, associated high water tables, and soils that exhibit some wetness characteristics. Normally used to refer to the zone within which plants grow rooted in the water table of these rivers, streams, lakes, ponds, reservoirs, springs, marshes, seeps, bogs, and wet meadows.

Riparian Reserve - Areas along live and intermittent streams, wetlands, ponds, lakes, and unstable and potentially unstable areas where riparian-dependent resources receive primary emphasis. Riparian Reserves are important to the terrestrial ecosystem as well, serving as dispersal habitat for certain terrestrial species.

Risk - The chance of an adverse or undesirable effect, often measured as a percentage.

Risk Assessment - The qualitative and quantitative evaluation performed in an effort to estimate the risk posed to human health and/or the environment by the presence or potential presence and/or use of specific chemical or biological agents.

Scenic Rivers - A classification within the national Wild and Scenic River System. Scenic rivers are those rivers, or sections of rivers, that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.

Security habitat - Habitat defined as 0.25 mile from open road or outside of human influence zones for mountain goats, 0.3 mile for grizzly bear core and wolf security habitat.

Sensitive Species – Sensitive species are identified by a Regional Forester for which population viability is a concern, as evidenced by significant current or predicted downward trends in population numbers or density and habitat capability that would reduce a species' existing distribution (FSM 2670.5). Management of sensitive species "must not result in a loss of species viability or create significant trends toward federal listing" (FSM 2670.32).

Seral -Of or pertaining to the series of stages in the process of ecological succession.

Spawn - to deposit fish eggs or sperm directly into the water.

Species of Conservation Concern (aka Concern Species) - Threatened, endangered and proposed species; Regional Forester's Sensitive species, management indicator species, and other identified native species of concern to biologists on the Forest.

Species - "A group of organisms, all of which have a high degree of physical and genetic similarity, generally interbreed only among themselves, and show persistent differences from members of allied groups of organisms." (Executive Order 13122, 2/3/99).

Spot application - Herbicide treatment involving use of a backpack sprayer or other means. Application is aimed at specific target species, with methods of prevention (such as barriers) to control damage to non-target species.

Standards and guidelines - The rules and limits governing actions, as well as the principles specifying the environmental conditions or levels to be achieved and maintained.

Stock —The fish spawning in a particular lake or stream(s) at a particular season, which fish to a substantial degree do not interbreed with any group spawning in a different place, or in the same place at a different season.

Suitable habitat - Habitat in which an animal or plant can meet all or some of its life history requirements.

Surface water - All water naturally open to the atmosphere (rivers, lakes, reservoirs, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other collectors which are directly influenced by surface water.

Surfactant - A surface active agent; usually an organic compound whose molecules contain a hydrophilic group at one end and a lipophilic group at the other. Promotes solubility of a chemical, or lathering, or reduces surface tension of a solution.

Synergistic effect - Situation in which the combined effects of exposure to two chemicals simultaneously is much greater than the sum of the effect of exposure to each chemical given alone.

Take - "The term 'take' means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (Title 16, Chapter 35, Section 1532, Endangered Species Act of 1973).

Threatened species - Plant or animal species likely to become endangered throughout all, or a significant portion of, its range within the foreseeable future. A plant or animal identified and defined in accordance with the 1973 Endangered Species Act and published in the Federal Register.

Threshold of Concern - The maximum dose or concentration level of a chemical or biological agent that will not cause an effect in the organism.

Toxicity - The inherent ability of an agent to affect living organisms adversely. Toxicity is the degree to which a substance or mixture of substances can harm humans or animals.

Toxicology - The study of the nature, effects, and detection of poisons in living organisms. Also, substances that are otherwise harmless but prove toxic under particular conditions. The basic assumption of toxicology is that there is a relationship among the dose (amount), the concentration at the affected site, and the resulting effects.

Treatment Objectives: Treatment objectives reflect the desired outcome depending on the extent, distribution and priority for treating a given invasive plant species.

Tribal and Treaty Rights - Native American treaty and other rights or interests recognized by treaties, statutes, laws, executive orders, or other government action, or federal court decisions.

Unknown Stock – A description applied to stocks where there is insufficient information to identify stock origin or stock status with confidence.

U.S. Fish and Wildlife Service (United States Department of the Interior Fish and Wildlife Service, USDI FWS, USFWS) - The federal agency that is the listing authority for species other than marine mammals and anadromous fish under the Endangered Species Act.

USDA Forest Service (United States Department of Agriculture Forest Service, FS or USFS) - The federal agency responsible for management of the Nation’s National Forest System lands

Viability - Ability of a wildlife or plant population to maintain sufficient size to persist over time in spite of normal fluctuations in numbers, usually expressed as a probability of maintaining a specific population for a specified period.

Viable Population - A wildlife or plant population that contains an adequate number of reproductive individuals appropriately distributed on the planning area to ensure the long-term existence of the species.

Viewshed - Total visible area from a single observer position, or the total visible area from multiple observer position. Viewsheds are accumulated seen-areas from highways, trails, campgrounds, towns, cities, or other viewer locations. Examples are corridor, feature, or basin viewsheds.

Visual Quality Objective - A desired level of excellence based on physical and sociological characteristics of an area. Refers to degree of acceptable alteration of the characteristic landscape.

Waterline – the edge of surface water at the current time.

Well-distributed population- Distribution sufficient to permit normal biological function and species interactions, considering life history characteristics of the species and the habitats for which it is specifically adapted.

Wetland - An area that is regularly saturated by surface or ground water and subsequently is characterized by a prevalence of vegetation that is adapted for life in saturated soil conditions. Examples include swamps, bogs, fens, marshes, and estuaries.

Wild and Scenic River System - The Wild and Scenic Rivers Act of 1968 established a system of selected rivers in the United States, which possess outstandingly remarkable values, to be preserved in free-flowing condition. Within the national system of rivers, three classifications define the general character of designated rivers: Wild, Scenic, and Recreational. Classifications reflect levels of development and natural conditions along a stretch of river. Classifications are used to help develop management goals for the river.

Wilderness - Areas designated by Congressional action under the 1964 Wilderness Act. Wilderness is defined as undeveloped federal land retaining its primeval character and influence without permanent improvements or human habitation. Wilderness areas are protected and managed to preserve their natural conditions, which generally appear to have been affected primarily by the forces of nature with the imprint of human activity substantially unnoticeable; have outstanding opportunities for solitude or for a primitive and confined type of recreation; include at least 5,000 acres, or are of sufficient size to make practical their preservation, enjoyment, and use in an unimpaired condition; and may contain features of scientific, educational, scenic, or historical value as well as ecological and geologic interest.

Wild Rivers - A classification within the national Wild and Scenic River System. Wild rivers are those rivers, or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted.

Wolf rendezvous sites - Temporary resting sites used for several days at a time by a wolf pack during summer months while the pups are developing.

USDA
United States Department of Agriculture

Forest Service
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