

**Biological Opinion, Concurrence, and Conference Report on the Effects to 23  
Species and 4 Critical Habitats from the U.S. Forest Service Pacific Northwest  
Region Invasive Plant Program**  
(USFWS Reference Number 1-7-05-7-0653)

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**TABLE OF CONTENTS**

CONSULTATION HISTORY ..... 4

BIOLOGICAL OPINION/CONCURRENCE/CONFERENCE REPORT ..... 4

DESCRIPTION OF THE PROPOSED ACTION ..... 4

    Management Direction ..... 6

        Desired Future Condition Statement ..... 6

        Goals and objectives ..... 7

        Forest Plan Standards ..... 7

        Inventory and monitoring plan framework ..... 9

        Description of the treatment methods ..... 9

        Manual treatments ..... 9

        Mechanical treatments ..... 9

        Cultural treatments ..... 10

        Prescribed fire treatments ..... 11

        Biological Control Treatments ..... 12

        Herbicide treatments ..... 12

    Effects Determination Methods ..... 15

    Site Restoration and Revegetation ..... 15

    Summary of the Proposed Action ..... 16

ACTION AREA ..... 16

LETTER OF CONCURRENCE ..... 18

    Grizzly bear (*Ursus arctos horribilis*) ..... 18

    Gray wolf (*Canis lupus*) ..... 21

    Canada lynx (*Lynx canadensis*) ..... 24

    Woodland caribou (*Rangifer tarandus caribou*) ..... 26

    Wenatchee Mountains checkermallow (*Sidalcea oregana var. calva*) ..... 29

    Wenatchee Mountains checkermallow critical habitat ..... 31

    MacDonald’s rockcress (*Arabis macdonaldiana*) ..... 33

    Gentner’s fritillary (*Fritillaria gentneri*) ..... 35

    Cook’s lomatium (*Lomatium cookii*) ..... 39

    Ute ladies’-tresses (*Spiranthes diluvialis*) ..... 41

    Kincaid’s lupine (*Lupinus sulphureus kincaidii*) ..... 44

    Warner sucker (*Catostomus warnerensis*) ..... 48

BIOLOGICAL OPINION AND CONFERENCE REPORT ..... 51

    Bald eagle ..... 52

    Northern spotted owl ..... 58

    Marbled Murrelet ..... 65

    Western snowy plover (coastal population) ..... 72

    Western snowy plover critical habitat ..... 82

    Oregon silverspot butterfly ..... 86

    Oregon silverspot butterfly critical habitat ..... 94

    Showy stickseed ..... 97

    MacFarlane’s four o’clock ..... 103

    Spalding’s catchfly ..... 111

Effects of the Action Common to Aquatic Species .....	119
Pathways for effects .....	120
Effects of Non-herbicide Treatment Methods .....	127
Effects of Herbicide Treatment .....	130
Lost River and shortnose suckers .....	140
Oregon chub .....	156
Bull trout (Coastal/Puget Sound, Columbia River, and Klamath DPS) .....	170
Conclusion for the Coastal/Puget Sound DPS .....	183
Conclusion for the Columbia River DPS .....	184
Conclusion for the Klamath River DPS .....	185
Bull Trout Critical Habitat .....	187
Summary of the Biological Opinion Conclusions .....	191
Bald Eagle .....	191
Northern Spotted Owl .....	192
Marbled Murrelet .....	192
Western Snowy Plover .....	193
Western Snowy Plover Proposed Critical Habitat .....	193
Oregon Silverspot Butterfly .....	194
Oregon Silverspot Butterfly Critical Habitat .....	195
Showy Stickseed .....	195
MacFarlane’s Four O’clock .....	196
Spalding’s Catchfly .....	196
Lost River and Shortnose Suckers .....	197
Oregon Chub .....	198
Bull Trout .....	198
Bull Trout Critical Habitat .....	201
SUMMARY OF THE CONSERVATION RECOMMENDATIONS .....	202
Terrestrial Animals .....	202
Bald Eagle .....	202
Spotted Owl .....	202
Marbled Murrelet .....	202
Western Snowy Plover .....	202
Oregon Silverspot Butterfly .....	203
Plants (general) .....	203
Showy Stickseed .....	204
Aquatic Animals (General) .....	204
Oregon chub .....	204
REINITIATION NOTICE .....	204
INCIDENTAL TAKE STATEMENT .....	205
LITERATURE CITED .....	206
PERSONAL COMMUNICATIONS .....	246
APPENDIX A .....	247

## **CONSULTATION HISTORY**

The U.S. Forest Service initiated informal discussions with the U.S. Fish and Wildlife Service (USFWS) regarding the Pacific Northwest Region Invasive Plant Program Forest Plan Amendments (Invasive Plant Program) in March 2002 at a meeting with personnel at the Oregon Fish and Wildlife Office of the USFWS. This was followed by a letter dated July 12, 2002, requesting a species list for the action area and identification of appropriate contacts in the various field offices included in the action area. The USFWS responded in a letter dated October 2, 2002, providing the appropriate contacts and identifying the listed, proposed, and candidate species and designated or proposed critical habitat within the U.S. Forest Service's Pacific Northwest Region. Updates to species lists were requested and received in 2003 and 2004.

Personal contacts via phone call and email between various USFWS and U.S. Forest Service personnel were conducted beginning in August 2002. In November 2002, potential consultation team members had been identified. On November 19, 2002, the USFWS, National Marine Fisheries Service (NMFS), and U.S. Forest Service met to discuss the consultation process. Large-scale, plan-level consultations are difficult and the process continued to evolve as more information regarding the content of the Environmental Impact Statement (EIS) became available. By February 2004, the USFWS had identified a lead office for the consultation team, a team leader, and final team members. U.S. Forest Service, USFWS, and NMFS personnel jointly prepared the "Status of the Species" descriptions. The teams worked closely during the process, reviewing and providing information for the biological assessment. On June, 17, 2005, the U.S. Forest Service formally transmitted the final Biological Assessment to the USFWS.

## **BIOLOGICAL OPINION/CONCURRENCE/CONFERENCE REPORT**

### **DESCRIPTION OF THE PROPOSED ACTION**

The proposed action, described and analyzed in the U.S. Forest Service's Final EIS for Preventing and Managing Invasive Plants, amends the Land and Resource Management Plans (LRMPs) of all National Forests in the Pacific Northwest Region specific to the prevention and treatment of invasive plants. The following is a summary of the description of the action in the Biological Assessment for the Invasive Plant Program. The complete BA is included in this document by reference (U.S. Forest Service 2005). Invasive plants are defined as alien plant species whose introduction does, or is likely to, cause economic or environmental harm or harm to human health. It does not include native species. The action, hereafter referred to as the Invasive Plant Program, increases the emphasis on consistency of invasive plant prevention across the Pacific Northwest Region of the U.S. Forest Service and allows for the use of a new and expanded set of invasive plant treatment tools. The U.S. Forest Service estimates that 420,000 acres of National Forest System lands in the Region are currently infested with 107 different

species of invasive plants. Despite current management efforts, invasive plants continue to increase and invade previously uninfested areas. The new Forest Plan direction contained in this action should help reduce the extent and rate of spread of invasive plants and help prevent new infestations. It releases the U.S. Forest Service from the outdated Forest Plan direction established by the 1988 Record of Decision (ROD) for Competing and Unwanted Vegetation and associated 1989 Mediated Agreement, allowing the agency to apply new practices, technologies, and chemical formulations of herbicides, thereby providing an expanded tool box for addressing this management challenge.

While this action will amend all National Forest LRMPs in the Region, it will not be retained as a Regional-scale decision. Rather, it will become part of the individual Forest Plans. Over time, decision makers for individual National Forests may modify the decisions that result from the EIS on this action, in accordance with planning laws, policies and regulations. Several National Forests will be completing LRMP revisions in the next few years and may include revisions of this action relative to their invasive plant program. The U.S. Forest Service would consult under the Endangered Species Act (ESA) on any significant changes on an individual National Forest scale as needed.

The Invasive Plant Program provides management direction to the National Forests specific to prevention, treatment, inventory, and monitoring of invasive plants, and the subsequent restoration of affected habitat. It revises only that portion of existing management direction that addresses prevention and treatment of invasive plants, and associated restoration activities.

The Invasive Plant Program amendments does not change any of the existing directions and requirements contained in the Interim Strategy for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California (PACFISH)(USDA and USDI 1995a), the Interim Strategy for Managing Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, Western Montana and Portions of Nevada (INFISH)(USDA and USDI 1995b), and the Northwest Forest Plan (USDA and USDI 1994) amendments to the LRMPs. The action does not apply to plants floating on or submerged in water, though it does include potential treatments of riparian species and treatment of plants over water. It does not cover experimental trials of herbicides conducted by the U.S. Environmental Protection Agency (USEPA) to test new products or actions conducted on non-federal lands with National U.S. Forest Service funds (under Section 323 of the Fiscal Year 1999 Department of the Interior and Related Agencies Appropriations Act, and the Secure Rural Schools and Community Self-determination Act of 2000). The Invasive Plant Program is specific to invasive non-native plants, and does not cover similar treatments for native competing and unwanted vegetation, or other restoration not associated with invasive plant treatments. Those portions of the 1988 ROD and the 1989 Mediated Agreement that involve management of unwanted native vegetation will remain in place.

The plan amendments in this action will likely be in effect on the National Forests for the planning period of 5 to 15 years, or until the individual National Forests complete revisions of the LRMPs.

### **Management Direction**

The previous management direction for the prevention and management of invasive plants on National Forests in Pacific Northwest Region comes to a large degree from the 1988 EIS and ROD for Competing and Unwanted Vegetation, and the associated 1989 Mediated Agreement. While it required consideration of invasive plant prevention, specific direction on how to actually prevent the spread of invasive plants was not provided. It specified and limited the tools available for the treatment of competing and unwanted vegetation, but did not provide administrative mechanisms for adapting the requirements and adopting new technologies. Use of five herbicides – glyphosate, triclopyr, dicamba, picloram and 2,4-D (a tool of last resort)– was allowed under previous Regional direction.

The management direction in the Invasive Plant Program is intended to provide more consistent and effective prevention measures, treatments, and restoration efforts. It emphasizes invasive plant prevention, early detection, early treatment, and restoration of affected habitat, monitoring and long-term site management. A key feature of the direction is the requirement to develop long-term site goals for all invasive plant sites prior to treatment, providing a mechanism to link treatment to prevention, revegetation/restoration, and monitoring in an integrated and adaptive process.

The Proposed Action includes all effective treatment methods and authorizes the consideration of ten herbicides. The addition of seven potential herbicides, the elimination of 2 herbicides previously permitted, and direction for their use represents the most substantial change in treatment options from the previous management direction. The Invasive Plant Program also establishes an objective to reduce the use of herbicides over time. Further, the plan limits the U.S. Forest Service these ten herbicides, as evaluated in the Syracuse Environmental Research Associates, Inc. (SERA) risk assessments, individually or in combination and only adjuvants evaluated by risk assessments.

Four types of new management direction were added to Forest Plans through the Invasive Plant Program; 1) desired future condition statements, 2) goals and objectives, 3) prevention and treatment/restoration standards, and 4) an inventory and monitoring plan framework.

### ***Desired Future Condition Statement***

In the Invasive Plant Program EIS, the U.S. Forest Service identified the desired future condition as: “In National Forest lands across Region 6, 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 preventative actions, and the success of restoration efforts.” (U.S. Forest Service 2005)

### ***Goals and objectives***

The Invasive Plant Program EIS presents five goals and associated objectives. Goals 1, 2, 3, and 5 have potential for some general effects to listed species while goal 4 has specific direction on threatened and endangered species. The first goal focuses on integrated approaches to invasive plant management, emphasizing prevention, early detection, and early treatment. The second goal focuses on minimizing the introduction, establishment, and spread of invasive plants during land management actions and land use activities. The third goal focuses on protecting human health, but includes elements such as minimizing herbicide use that relate to effects on listed species. The final goal focuses on sharing information on the prevention and control of invasive plants. The fourth goal focuses on protecting ecosystems and biological diversity, including specific objectives for water quality, non-target species, and threatened, endangered, and sensitive species habitat, as stated below.

Goal 4. Implement invasive plant treatment strategies that protect sensitive ecosystem components, and maintain biological diversity and function within ecosystems. Reduce loss or degradation of native habitat from invasive plants while minimizing adverse effects from treatment projects.

Objective 4.1 – Maintain water quality while implementing invasive plant treatments.

Objective 4.2 - Protect non-target plants and animals from negative effects of both invasive plants and applied herbicides. Where herbicide treatment of invasive plants is necessary within the riparian zone, select treatment methods and chemicals so that herbicide application is consistent with riparian management direction, contained in PACFISH, INFISH, and the Aquatic Conservation Strategies of the Northwest Forest Plan.

Objective 4.3 - Protect threatened, endangered, and sensitive species habitat threatened by invasive plants. Design treatment projects to protect threatened, endangered, and sensitive species and maintain species viability.

### ***Forest Plan Standards***

The Invasive Plant Program includes a suite of new Forest Plan standards for prevention and treatment of invasive plants. Standards 1 through 9 focus on prevention. While these have little short-term impact on listed species, they do have the potential to reduce future invasion of invasive weed species, thereby protecting listed species habitat. These standards include direction to include invasive plant prevention in planning and assessments; clean heavy equipment; use weed-free straw and mulch, and only pelletized or certified weed free feed in wilderness and wilderness trailheads; incorporate invasive plant prevention practices on grazing allotments; use only weed free gravel, fill, sand, and rock; incorporate invasive plant prevention practices during road maintenance in areas with high concentrations of invasive plants; and prohibit the use of motor vehicles off the designated systems.

Standards 11 through 23 focus on invasive plant treatments, including four specific to listed species or their habitat, or that have a potential to effect these species. Standards 11 and 12 stress prioritizing treatments at the landscape level and developing long range strategies for restoring treatment sites. Standard 13 focuses on prioritizing revegetation with native species or, where this is not possible, non-invasive species. Standard 14 limits the U.S. Forest Service to approved biological control agents.

Standards 15 through 19 address herbicide use, with varying level of potential effects to listed species. Standard 15 requires that a licensed applicator be involved in all herbicide applications and that treatment projects include a herbicide transportation and handling safety plan.

Standard 16 provides most direction for the selection of herbicide formulations. It limits the U.S. Forest Service to formulations containing one or more of the following 10 active ingredients: chlorsulfuron, clopyralid, glyphosate, imazapic, imazapyr, metsulfuron methyl, picloram, sethoxydim, sulfometuron methyl, and triclopyr. It allows for the use of mixtures of herbicide formulations containing no more than 3 of the active ingredients listed above to be applied where the sum of all individual Hazard Quotients for the relevant application scenarios is less than 1.0 (as defined in the Guidance Manual for the Assessment of Joint Toxic Action of Chemical Mixtures. U.S. Department Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry.) The standard also prohibits aerial application of chlorsulfuron, metsulfuron methyl, and sulfometuron methyl and limits the use of triclopyr to selective application techniques only (e.g., spot spraying, wiping, basal bark, cut stump, injection). It does allow for including additional herbicides and herbicide mixtures in the future at either the Forest Plan or project level through appropriate risk analysis and NEPA/ESA procedures.

Adjuvants (e.g. surfactants, dyes) and inert ingredients included in herbicide formulations may also cause effects to non-target species. Standard 18 limits the use of adjuvants and inert ingredients to those reviewed in U.S. Forest Service hazard and risk assessment documents such as SERA 1997a, 1997b, Bakke, 2002.

Standard 19 directs National Forest personnel to use site-specific soil characteristics, proximity to surface water and local water table depth to determine herbicide formulation, size of buffers, and application method and timing to minimize or eliminate negative effects to non-target plants, terrestrial animals, water quality and aquatic biota (including amphibians) from herbicide use.

Standard 20 requires the U.S. Forest Service to design invasive plant treatments to minimize or eliminate adverse effects to species and critical habitats proposed and/or listed under the ESA. This may involve surveying for listed or proposed plants prior to implementing actions within unsurveyed habitat if the action has a reasonable potential to adversely affect the plant species. It requires the use of 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 effects and/or contaminant exposure.

Standards 21 through 23 focus on human health and herbicides, requiring buffers for herbicide use near developed campgrounds, recreation residences and private land; prohibits aerial application within legally-designated municipal watersheds; and public notification prior to herbicide treatments.

***Inventory and monitoring plan framework***

The Invasive Plant Program includes an inventory and monitoring plan framework designed to improve the Forest's ability to detect and, respond rapidly to new infestations. Additionally, the monitoring framework outlines the agreed-upon criteria for prioritizing monitoring of projects that may pose more risk to federally-listed species. The contents of the Inventory and Monitoring Plan Framework can be found in Appendix A of the Biological Assessment.

***Description of the treatment methods***

Treatment methods described in the Invasive Plant Program fall into six categories, manual, mechanical, cultural, prescribed fire, biological, and herbicide treatments. The level of potential effect to listed species and critical habitat under the Invasive Plant Program are dependent on the methods employed. The following provides a summary of the potential methods under each category. A more complete description is found in the Biological Assessment (U.S. Forest Service 2005) and EIS.

***Manual treatments***

Manual treatments involve the physical removal and destruction, disruption of growth, or interference with the reproduction of invasive plants. These include actions such as hand pulling, use of hand tools (e.g. shovel, hoe, loppers, shears, trowel, or weed wrench), and mulching with plastic or organic materials. These types of treatments are effective on small infestations if the entire root is removed, but are usually not as effective for deep-rooted or rhizomatous perennials where manual methods often leave root fragments that can generate new plants. Hand-pulling or hoeing also disturbs the soil surface, which may increase susceptibility of a site to reinvasion by weeds. Mulching with plastic or organic materials can be used on relatively small areas (less than 0.25 acre), but will also stunt or stop growth of desirable native species.

The U.S. Forest Service Pacific Northwest Region implemented manual treatments on 11,167 acres in 2000 and 4,351 acres in 2001. Based on information provided by the U.S. Forest Service, under the Invasive Plant Program we anticipate average annual mechanical treatments region-wide of approximately 6,387 acres, but due to timing and project planning, this may reach as high as 13,433 acres in a single year (Appendix A).

***Mechanical treatments***

Mechanical treatments physically remove and destroy, disrupt the growth of, or interfere with the reproduction of invasive plants using machines, such as chain saws, mowers, tractors, or bull dozers. Thermal techniques such as steaming, super heated water, and hot foam are also considered mechanical treatments.

Because invasive plants flower throughout the summer, it is difficult to time mechanical treatments to prevent flowering and seed production and mechanical treatments on some rhizomatous weeds can encourage sprouting and result in an increase in stem density. Tillage methods are most effective for controlling tap-rooted invasive plant species on small acreages and level terrain, where infestations can be revisited on a regular basis to remove new germinants and resprouts. Tillage removes all vegetation and should be combined with seeding or planting of desirable species. Invasive plant seeds may remain viable in soil for several years and therefore often re-infest a tilled site, thus requiring continued follow-up treatments.

Thermal techniques are being tested or used with some success throughout the Pacific Northwest Region by such agencies as the Oregon Department of Transportation, The Nature Conservancy and the Bureau of Land Management (BLM). It has been most successful when used for maintenance treatments instead of initial treatments. Hot foam has been used by the BLM effectively on puncture vine and slender false brome. This technique is limited to the reach of the foam generator, but is effective on seedlings and annuals and can be applied under weather conditions including wind and light rain. It has shown some success with perennials.

The U.S. Forest Service Pacific Northwest Region implemented mechanical treatments on 555 acres in 2000 and 641 acres in 2001. Based on information provided by the U.S. Forest Service, under the Invasive Plant Program we anticipate average annual mechanical treatments region-wide of approximately 1,453 acres, but due to timing and project planning, this may reach as high as 3,242 acres in a single year (Appendix A).

### ***Cultural treatments***

Cultural methods of invasive plant management 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, applying fertilizer to desirable vegetation, and controlled grazing.

Native plant species usually do not out-compete invasive plants in disturbed habitat. Herbicide application after invasive plants have emerged, followed by tillage and drill seeding, can be effective in establishing desirable species on some sites (Sheley and Petroff, 1999). This process, however, can lead to increased soil compaction, and cannot be conducted on steep, remote, or rocky sites.

Fertilization has had limited use in invasive plant management, including experimental use on hawkweed. Soluble nitrogen fertilizer applied after herbicide treatment may increase the competitiveness of perennial grasses and beneficial forbs. This method is most effective in pastures or rangelands where nitrogen levels are not high enough for optimum grass performance.

Grazing can be used to manage several invasive plant species successfully. Grazing animals prefer certain forage, and selective use of preferred forage can shift the competitive balance of plant communities. Goats and sheep have been used in various

areas for controlling knapweed and leafy spurge. Sheep have been used to control cheatgrass. Goats have been used to successfully control Himalayan blackberry using high stocking levels in small fenced areas. Use of grazing animals as an invasive plant management tool must be based on selecting the appropriate grazer for the target invasive plant species. Grazing to manage weeds on roadsides, trailheads, and larger infestations on the forest is limited because of the difficulty of maintaining and managing the animals. A long-term commitment to small ruminant grazing, or a combination of techniques is necessary for effective site-specific invasive plant management as the grazers significantly decrease the infestation but will not totally remove the species. Invasive species may resprout or grow from soil seed banks following grazing..

The U.S. Forest Service Pacific Northwest Region implemented cultural treatments on 317 acres in 2000, though none was reported in 2001. Based on information provided by the U.S. Forest Service, under the Invasive Plant Program we anticipate average annual cultural treatments region-wide of approximately 291 acres, but due to timing and project planning, this may reach as high as 596 acres in a single year (Appendix A).

### ***Prescribed fire treatments***

The use of prescribed burning for treatment of invasive plants has had limited application in the Pacific Northwest Region. While fire is sometimes necessary to prompt the germination of some plant seeds, fire can also cause sprouting of invasive plants, and create site conditions that are optimum for the spread of invasive plants. On the other hand, fire can sharply reduce the abundance of some species by preventing flower or seed set, destroying seeds, stimulating germination (for future seedling treatments), depleting carbohydrate reserves or killing rhizomes, bulbs, or buds. Fire can also be used to facilitate revegetation, increase herbicide efficacy, and remove litter to assist in emergence of desirable species. The most effective fires for controlling invasive plant species are typically those administered just before flower or seed set, or at the young seedling/sapling stage, though this timing may interfere with important growth periods for native species. Repeated burns are sometimes helpful in controlling invasive plants. Herbicide treatments may be required as a follow-up treatment to kill the flush of seedlings that germinate following a burn.

Flaming is a tool of use for controlling invasive plants. Flaming is done with the use of propane torches. Flaming destroys cell structure in the plant, therefore reducing its energy towards growth. It will kill most small weeds and will at least stunt or kill larger weeds, depending on their root system. Flaming is limited to conditions that would be too moist to carry a fire. They are useful for spot burning single plants or a small population of plants with little disturbance to the surrounding vegetation.

The U.S. Forest Service Pacific Northwest Region implemented prescribed fire treatments for invasive plants on 1,149 acres in 2000 and 172 acres in 2001. Based on information provided by the U.S. Forest Service, under the Invasive Plant Program we anticipate average annual prescribed fire treatments region-wide of approximately 581 acres, but due to timing and project planning, this may reach as high as 1,210 acres in a single year (Appendix A).

### ***Biological Control Treatments***

Biological control is the deliberate use of natural enemies (parasites, predators, or pathogens) to reduce weed densities. Biological control is used when invasive plant populations have become so large that eradication or control is no longer deemed possible. The use of biological control agents reduces invasive plant vigor, and is an attempt to make an invasive plant a minor component of its newly adopted community. Natural enemies that are restricted to one or a few closely related plants in their country of origin are targeted for biological control.

APHIS must approve the entry of all biological control agents into the United States. A Technical Advisory Group, consisting of representatives from all federal agencies with interests in invasive plant biological control, assists researchers and APHIS officials responsible for issuing permits for proposed biological control agents, throughout the biological testing and agency approval process. Once APHIS has approved entry into the United States, interstate movement of plant pests requires a USDA Plant Protection and Quarantine permit. Permits are only approved for states that have been covered by an Environmental Assessment and ESA consultation. In addition, individual state departments of agriculture may also require permits for entry (all four states in the Pacific Northwest Region require permits).

Management with biological agents is a slow process that reduces the vigor of the target and does not eradicate the invasive plant population. Researchers estimate 15 to 29 percent of biological control programs have been successful (DeLoach 1991, Meyers et al. 1989). Therefore, biological agents may be ineffective without being integrated with other strategies.

The U.S. Forest Service Pacific Northwest Region implemented biological control cultural treatments on 1,813 acres in 2000 and 889 acres in 2001. Based on information provided by the U.S. Forest Service, under the Invasive Plant Program we anticipate average annual biological control treatments region-wide of approximately 1,741 acres, but due to timing and project planning, this may reach as high as 4,250 acres in a single year (Appendix A).

### ***Herbicide treatments***

Herbicide treatments represent the major change in the tools available to the U.S. Forest Service on combating invasive plants as a result of this decision. While the Invasive Plant Program allows for use of a larger number of herbicides, these were selected to minimize non-target effects while meeting the needs to treat invasive weeds. This required a variety of herbicides with various selectivity and properties. The U.S. Forest Service further limited application methods for herbicides with higher potential for non-target effects.

Herbicides may be selective (control either some broadleaf plants or grasses while not affecting others) or non-selective (control all types of vegetation), control only actively growing vegetation, or provide invasive plant control through root uptake from the soil

(short-term to over a few years). Differences in selectivity are the basis for developing effective invasive plant control prescriptions while minimizing adverse effects and facilitating native plant community maintenance or restoration, thus the need for a suite of herbicides with different properties and selectivity. Different herbicides also vary in effectiveness and length of control on different invasive plants, as well as effects to the environment and suitability to different environmental conditions.

Herbicides vary in their environmental activity, physical form, and the equipment used to apply them. In combination with other site and biological factors, these characteristics influence both the probability of meeting site-specific goals for invasive plant control, and the potential of impacting non-target components of the environment. In terms of physical form, herbicides may be oil- or water-soluble molecules dissolved in liquids, or attached to granules for dry application to soil surface. Physical form can affect the level of impact to non-target species and movements of herbicides in the ecosystem. Herbicides may move from their location of application through leaching (dissolved in water as it moves through soil), volatilization (moving through air as a dissolved gas), or adsorption (attached by molecular electrical charges to soil particles that are moved by wind or water).

Herbicides may be applied with a variety of equipment and techniques that vary in effectiveness, environmental effects, and cost. Aerial application (sprays or granules) using helicopters or fixed-wing aircraft allow for rapid broadcast coverage of large or inaccessible areas. Ground delivery, including spraying from ground vehicles with hose sprayers or booms using an array of spray nozzles is commonly used for broadcast spraying of roads, but can be used with all-terrain vehicles for broadcast or spot spray in remote areas. Granular herbicides may be applied using hand-held seeders or other specialized dispensing devices. Selective application is used to minimize non-target effects. Selective application methods include backpack sprayers for spraying foliage, stem, or surrounding soil of target invasive plants; herbicide-soaked wicks or paintbrushes for wiping target vegetation; and lances, hatchets, or syringes for injection of herbicide into stems of target plants.

Herbicides are sold as one or more commercial products, called formulations. The product label for herbicide formulation provides legally binding direction on its use, including safe handling practices, application rates, and practices to protect human health and the environment. Under the terms of the Invasive Plant Program, the U.S. Forest Service is limited to the product label directions, but they are usually more conservative. See Table 4 in the Biological Assessment (U.S. Forest Service 2005) for a list of the herbicides, selected brand names, properties and general uses.

The decision to use herbicides over other control methods would be based on integrated weed management principles. Decisions would be made based on whether other methods or combination of methods are known to be effective on the species in similar habitat. The choice of herbicide would be based on the invasive species; how it reproduces, its seed viability, the size of its population, site conditions, known effectiveness under

similar site conditions and the ability to mitigate effects on non-target species. In most cases, if an herbicide is selected, it would be used in combination with other methods.

The choice of application method for herbicide treatments used will be based, in part, on site accessibility. Aerial spraying, for example, would only be used in areas where access is remote and difficult and populations are of the size that non-herbicide methods or selective herbicide application are not feasible. Aerial application of herbicides is expected to occur rarely, if at all, within the Pacific Northwest Region. In a query of the forests in the Region, only four National Forests responded that there was a potential for future use of aerial application of herbicides, based on infestations (some very large) in inaccessible areas like Hell's Canyon and the Biscuit Fire. Aerial application is most likely to occur in Eastern and Southern Oregon, specifically the Wallowa-Whitman (Hell's Canyon), and perhaps the Umatilla, the Malheur, and the Siskiyou (Biscuit Fire) National Forests.

The Invasive Plant Program limits the U.S. Forest Service to formulations containing chlorsulfuron, clopyralid, glyphosate, imazapic, imazapyr, metsulfuron methyl, picloram, sethoxydim, sulfometuron methyl, and triclopyr. It allows for the use of mixtures of herbicide formulations containing no more than 3 of the active ingredients. To reduce potential effects to non-target species, the Invasive Plant Program prohibits aerial application of chlorsulfuron, metsulfuron methyl, and sulfometuron and limits the use of triclopyr to selective application techniques only (e.g., spot spraying, wiping, basal bark, cut stump, injection). It does allow for including additional herbicides and herbicide mixtures in the future at either the Forest Plan or project level through appropriate risk analysis and NEPA/ESA procedures. Because adjuvants and inert ingredients included in herbicide formulations may also cause effects to non-target species, the program limits their use to those reviewed in U.S. Forest Service hazard and risk assessment documents such as SERA 1997a, 1997b, Bakke, 2002. The Forests are directed to site-specific information to develop projects that reduce or eliminate negative effects of herbicides to non-target plants, terrestrial animals, water quality and aquatic biota.

Currently, the following infestations have been identified as suitable for aerial application (based on terrain and infestation size alone): 200 acres on the Malheur National Forest, 1,000 acres on the Umatilla National Forest, and 15,000 acres each on the Biscuit Fire and in Hells Canyon National Recreation Area. However, there are no current proposals to actually use aerial application of herbicides in these locations, or anywhere else in the Pacific Northwest Region, so the amount and locations of aerial applied herbicide may change over time.

Because of the substantial change in herbicide treatments under the Invasive Plant Program, past use is not a good estimator of future activity. Based on information provided by the U.S. Forest Service, under the Invasive Plant Program we anticipate average annual ground-based herbicide treatments region-wide of approximately 15,392 acres, but due to timing and project planning, this may reach as high as 31,350 acres in a single year (Appendix A). Four National Forests identified the need for aerial treatments in the near future. Based on information provided by the U.S. Forest Service, under the

Invasive Plant Program we anticipate average annual aerial herbicide treatments region-wide of approximately 3,196 acres, but due to timing and project planning, this may reach as high as 10,862 acres in a single year (Appendix A).

### **Effects Determination Methods**

The thought process behind making effects determinations involved answering series of layered questions, starting with evaluating whether the species was likely to be found within the action area based on survey data or habitat. They also evaluated the potential for invasive plant species to occur in the vicinity of species, the likely treatments for the invasive species, and the potential for the treatments to affect listed species. In the case of herbicide treatments, the U.S. Forest Service utilized information from risk assessments produced under contract by SERA.

In determining potential delivery of herbicides and concentrations in streams, the SERA assessment use a conservative application scenarios of a broadcast spray application on a 10 acre area immediately adjacent to a 1.8 cfs stream (no riparian buffer). For chronic exposures, degradation and dissipation of the herbicide over time are implicitly considered in the model used in the SERA risk assessments. To further evaluate the potential for chronic risk, the U.S. Forest Service conducted additional analysis for chronic exposure to determine whether chronic exposures above toxicity thresholds were mathematically possible even if they assumed no degradation or dissipation of the herbicide. More specifically, the question addressed was whether chronic toxicity indices (either measured or estimated NOEC) could be exceeded if 100% of the amount of herbicide applied to 10 acres at the highest application rate was steadily delivered directly into a stream flowing at 1.8 cfs (0.08 meters/second) over 90 days (for fish) or 21 days (for invertebrates, algae, and aquatic plants).

For terrestrial species, data from the SERA assessment was utilized via surrogates to estimate the maximum potential exposure. Because these species live in very different habitats, and utilize the environment in various ways, this was estimated separately for each species using the best available surrogate and conservative assumptions. For example, they assume 100 percent absorption of herbicides sprayed directly on small mammals and that 100 percent of one day's food for larger herbivores.

For both terrestrial and aquatic animals, these assumptions are very conservative. Therefore, the level of effect described in the Biological Assessment is likely to be higher than the actual effect of treatments on the ground.

### **Site Restoration and Revegetation**

Site restoration or revegetation is part of any long term strategy to reduce invasive plants. Restoration may be passive (allowing plants on site to fill in a treated area) or active. Passive restoration may be appropriate where treated sites leave only small gaps of bare ground and native vegetation on site can provide adequate seed source to fill in such gaps. However, where invasive plant treatments leave larger bare areas or post-treatment native vegetation cannot provide adequate seed sources, active revegetation may be necessary to avoid reinvasion by invasive plants.

The selection of appropriate species for revegetation is dependent on a number of factors, including management objectives and site characteristics such as soil texture, precipitation/temperature regimes, and shade conditions. Due to limitations on native seed availability and cost, ease of establishment, seed production, and competitive ability resource managers have historically relied on non-native species. Although some introduced species will continue to be used in site restoration, this Invasive Plant Program places priority on using native species for revegetation where possible. Because of limitations on the availability of native seed, it does allow for the use of non-invasive non-native species where necessary. For example, numerous annual or sterile cereal grasses may be used and are not persistent.

### **Summary of the Proposed Action**

The Invasive Plant Program releases the U.S. Forest Service from the 1988 ROD and associated mediated agreement, allowing for the use of a new and expanded set of invasive plant treatment tools to tackle the invasive plants on National Forest Lands in the Pacific Northwest Region. It revises only that portion of existing management direction that addresses prevention and treatment of invasive plants, and associated restoration activities. It does not change the existing directions and requirements contained in PACFISH, INFISH and the Northwest Forest Plan.

This program focuses on prevention, treatments, and restoration efforts, including long-term site planning. It emphasizes invasive plant prevention, early detection, early treatment, and restoration of affected habitat as well as monitoring and long-term site management.

While the Invasive Plant Program includes all potential treatment methods, the primary change from previous management direction is a change from the four herbicides allowed under the Mediated Agreement to 10 herbicides under the Invasive Plant Program. While this represents an increase in the types of herbicides available to the U.S. Forest Service, they were carefully chosen to provide the necessary tools to tackle the invasive species and provide more targeted options while minimizing effects on non-target species. They reduced potential risks to listed species by removing dicamba and 2,4-D from the list of approved herbicides, prohibiting aerial application of chlorsulfuron, metsulfuron methyl, and sulfometuron, and limiting the use of triclopyr to selective application techniques only.

The EIS and consultation on the Invasive Plant Program covers the plan-level requirements, but does not address site-specific information. The U.S. Forest Service will complete NEPA and ESA compliance at a more site-specific level prior to the implementation of any projects that may affect listed species.

### **ACTION AREA**

The action area is defined as “all areas to be affected directly or indirectly by the proposed Federal action and not merely the immediate area involved in the action.” (50

CFR 402.02). As these plan amendments apply to all LRMPs within the Pacific Northwest Region of the U.S. Forest Service and may be implemented on any lands within this system, the action area includes all U.S. Forest Service administered lands within Oregon and Washington, portions of the Payette and Nez Perce National Forests (Hell's Canyon National Recreation Area) in Idaho, managed by the Wallowa-Whitman National Forest, and portions of the Rogue River and Siskiyou National Forests that extend into California.

In addition, some areas beyond U.S. Forest Service lands may be affected by actions on those lands, where the impacts of the action travel beyond the administrative boundaries, such as with the transport of herbicides or soil, or disturbance from noise on adjacent forest lands. The mechanisms for the transport dictate the limits of the action area.

Moving water is the primary transport mechanism for sediment, and in some cases, herbicides. Water will move these substances downstream through the main channel systems until dispersed by dilution or they encounter a barrier that allows them to settle out of the system. We lack the detailed information to determine the rate of dilution or presence of barriers at the plan level. Therefore, for the purposes of this consultation, we have considered effects in each 4<sup>th</sup> field HUC (Hydrological Unit Code) containing U.S. Forest Service lands. This is a very conservative assumption, and includes many areas likely well beyond potential effects.

Wind may move herbicides, and in rare cases soil, beyond the boundaries of the National Forest system. Drift of herbicides has the greatest potential to affect adjacent lands, and is dependent on wind patterns and direction at the time of application, application method, and the toxicity of the chemical to non-target plants. Drift is more likely with aerial application of herbicides, but may occur with any broadcast application method. To minimize off-site effects, the Invasive Plant Program prohibits aerial application of four of the most potent herbicides (chlorsulfuron, metsulfuron methyl, sulfometuron methyl, and triclopyr). We anticipate that effects from drift of herbicides off of U.S. Forest Service lands would be a very rare event. Applications would have to occur very near the U.S. Forest Service boundary. In addition, drift is most likely with aerial application, which are undertaken only when conditions are correct, including limited wind, and are only likely to occur on four National Forests (Appendix A). We anticipate that herbicide drift off of U.S. Forest Service lands will be rare, but may occur. We do not have the information available at the plan level to define areas off of U.S. Forest Service lands where drift may occur or the extent of that drift. Therefore, for the purposes of this consultation, we have considered effects from drift for areas immediately adjacent to U.S. Forest Service lands using a small but undefined buffer.

Activities on U.S. Forest Service lands that generate significant noise above ambient levels, such as heavy machinery, or the simple presence of people in an area may affect sensitive animal species to the point of affecting their survival or reproduction. The effects of disturbance generally extend only a short distance beyond the activity due to attenuation of sound and decreased sensitivity of species to distant activities. The effects of disturbance are also dependent on the species occurring in the area at the time of the

disturbance, and may vary by life history stage. For example, some species are only sensitive during breeding or on wintering grounds. Finally, the duration of the activity can affect species' degree of reaction to disturbance. While we anticipate disturbance effects of activities under the Invasive Plant Program may, in rare cases, occur off of U.S. Forest Service lands, we do not have the information available at the plan level to define the likely area of effect. Therefore, for the purposes of this consultation, we have considered effects from disturbance immediately adjacent to U.S. Forest Service lands

Based on the potential for water transport, drift, and disturbance, we have defined the action area for this consultation as all U.S. Forest Service lands in, or administered by, the Pacific Northwest Region, areas downstream of U.S. Forest Service lands within the 4<sup>th</sup> field HUC, and a small, but undefined, buffer immediately adjacent to U.S. Forest Service lands. We anticipate that subsequent site-specific consultations will refine this definition into a more detailed description of the action area for specific projects or groups of projects.

## **LETTER OF CONCURRENCE**

This section contains the rationale for the USFWS concurrence with the U.S. Forest Service's determination that the Invasive Plant Program may affect, but is not likely to adversely affect the grizzly bear (*Ursus arctos horribilis*), gray wolf (*Canis lupus*), Canada lynx (*Lynx canadensis*), woodland caribou (*Rangifer tarandus caribou*), Wenatchee mountains checkermallow (*Sidalcea oregana var. calva*) and its critical habitat, MacDonald's rockcress (*Arabis macdonaldiana*), Gentner's fritillary (*Fritillaria gentneri*), Cook's lomatium (*Lomatium cookii*), Ute ladies'-tresses (*Spiranthes diluvialis*), Kincaid's lupine (*Lupinus sulphureus kincaidii*), and Warner sucker (*Catostomus warnerensis*).

### **Grizzly bear (*Ursus arctos horribilis*)**

#### ***Life History, Population, and Distribution***

A detailed account of the life history, taxonomy, and behavior can be found in the final rule listing of the grizzly bear (U.S. Fish and Wildlife Service 1975) and in the grizzly bear Revised Recovery Plan (U.S. Fish and Wildlife Service 1993a).

Grizzlies are omnivorous and opportunistic feeders. They may eat carrion, grasses, riparian forbs, berries, bulbs, insects, pine nuts, fish, ungulates, ground squirrels, roots, bulbs, fungi, tree cambium, and even garbage (Cole, 1972, Hamer 1974, Hamer et al. 1977 as cited in U.S. Fish and Wildlife Service 1993a, Martinka 1972, Murie 1944, Pearson 1975, and Singer 1978). In some areas grizzlies may be almost entirely herbivorous, and they rely on plants that have recently emerged, when crude protein levels are highest (U.S. Fish and Wildlife Service 1993a). Foods high in protein and carbohydrates that allow for significant fat deposition prior to hibernation are essential for the grizzly's survival.

The search for food has a prime influence on grizzly bear movements. Upon emergence from the den they seek the lower elevations, drainage bottoms, avalanche chutes, and ungulate winter ranges where their food requirements can be met. From late spring to early summer they follow plant green-up back to the higher elevations. In late summer and fall, the bears will transition to fruits and nuts as a food source.

The grizzly bear is a wide ranging species with very large home ranges. Currently occupied areas are characterized by contiguous, relatively undisturbed mountainous habitat with a high diversity of topographic and vegetative diversity (U.S. Fish and Wildlife Service 1993a). Grizzlies prefer dense cover with interspersed openings for feeding sites.

The current total population of grizzly bears in the lower 48 states is estimated to be between 800 and 1000 bears. Within the action area there are possibly less than 20 grizzlies and the entire North Cascades Recovery Area and the Selkirk Cabinet-Yaak Recovery Area may contain up to 60 bears (U.S. Fish and Wildlife Service 1999a).

Of the six identified recovery zones in the lower 48 states, only portions of the North Cascades and Selkirk recovery zones are within the action area. Both of these recovery zones are located in northern Washington and cross the international boundary with Canada. The Mount Baker-Snoqualmie, Okanogan, and Wenatchee National Forest's contain portions of the North Cascades recovery zone, the remainder of which occurs in Canada. The Selkirk recovery zone is located primarily in Canada, with the southern portion extending 23 miles (60 km) south of the border into Washington and Idaho. The Selkirk recovery area intersects the Colville National Forest in extreme northeastern Washington, east of the Pend Oreille River and Sullivan Lake, encompassing the Salmo-Priest Wilderness Area. The USFWS combined the Selkirk and Cabinet-Yaak zones to create one recovery zone in 1999. None of the Cabinet-Yaak ecosystem occurs within the action area.

### ***Effects of the Action***

#### *Disturbance*

Methods used to treat invasive plants or restore habitat may affect the grizzly bear by introducing an increased level of sound or visual disturbance into the environment. The presence of smoke, aircraft, humans, and vehicles during manual, mechanical, cultural, and prescribed fire treatments have the potential to disturb grizzly bear by causing them to temporarily avoid foraging habitat. However, invasive plant projects generally involve very short-term disturbance requiring one to two treatments with few people and might only be repeated once in the same growing season. Therefore the level of disturbance and effect is anticipated to be very small and ephemeral.

#### *Herbicides*

Grizzly bears forage on vegetation, particularly grass, in the spring, so they could be exposed to herbicide residues on vegetation from broadcast spray applications. At typical application rates, the estimated doses from the exposure scenarios are all less than the reported NOAELs (no-observable adverse effect level) for all herbicides except triclopyr.

At highest application rates, estimated doses from the exposure scenarios exceed the reported NOAELs for glyphosate, triclopyr, and picloram. The estimated doses for all other herbicides in the Invasive Plant Program are equal to or less than reported NOAELs.

Grizzly bears that consume vegetation with glyphosate residue applied at the highest application rate may experience some adverse effects. However, glyphosate is a non-selective herbicide and would kill any grass to which it was applied, making it unpalatable in a short time. Given the potential temporary displacement of bears from the area due to disturbance, it is unlikely that bears would feed on newly sprayed plants before the plant dies. So, while the potential for adverse effects to grizzly bears from ingesting glyphosate exists, in practice, the scenario is extremely unlikely to occur.

The use of triclopyr for invasive plant treatment is restricted in the Invasive Plant Program by Standard 16, which states, “The use of triclopyr is limited to selective application techniques only (e.g. spot spraying, wiping, basal bark, cut stump injection).” Exposure scenarios calculate doses based on a broadcast spray-type application over an entire foraging area. The estimated doses could not occur with triclopyr applied to non-desirable vegetation in a selective manner. Therefore, with Standard 16 in place, adverse effects to grizzly bear from the use of triclopyr will not occur.

For picloram at the highest application rate (1 lb/acre), the estimated dose (35.3 mg/kg) slightly exceeds the acute NOAEL (34 mg/kg) for a grizzly bear-sized mammal. The acute dose is substantially less than the acute LOAEL (172 mg/kg) for decreased weight gain (U.S. Environmental Protection Agency 1998). Dose estimates are not precise, but encompass some variability, so the estimated dose is functionally a NOAEL. The chronic dose is less than the chronic NOAEL. Because the U.S. Forest Service used very conservative assumptions in estimating the level of herbicide that grizzly bears could ingest, we do not anticipate any adverse effects to grizzly bear from consuming grass that has been sprayed with picloram under the Invasive Plant Program

#### *Indirect Effects*

Indirect effects to grizzly bears would consist of changes to their habitat. Invasive plant treatments will not remove or degrade suitable habitat since invasive plants do not provide forage for grizzly bears. Successful control of invasive plant infestations provides long-term benefits grizzly bears by restoring native habitat and preventing future degradation of habitat.

#### ***U.S. Forest Service Determination***

The U.S. Forest Service determined that the Invasive Plant Program may affect, but is not likely to adversely affect the grizzly bear based on the following:

- Prevention standards will help to protect foraging habitat from invasive plants.
- Distribution of grizzly bears within the action area is very limited so the opportunity for bears to be in or near treatment areas is also very limited.

- Disturbance from projects could occur, but is managed along with other disturbance according to Interagency Grizzly Bear Committee guidelines and rules.
- Disturbance from invasive plant treatment projects is low level, short duration, and infrequent.
- It is implausible that any grizzly year could receive a dose of any herbicides under the invasive plant program that would cause potential adverse effects to the bear.

***U.S. Fish and Wildlife Service Concurrence***

The USFWS concurs with the U.S. Forest Service's determination that the action may affect, but is not likely to adversely affect the grizzly bear based on the following reasons:

- Distribution of grizzly bear within the action area is limited and population numbers are low, therefore, it is very unlikely that the grizzly bear would be in or near an active treatment area.
- Disturbance from invasive plant treatment projects is low level, short duration, and infrequent, requiring one to two treatments over 1 or 2 days. Bears are anticipated to move only temporarily, if at all, in response to these low level disturbances.
- Potential effects from exposure to herbicides in the Invasive Plant Program are insignificant. It is highly unlikely that grizzly bears could receive a dose of herbicide that would cause any adverse affects.
- Prevention standards will help to protect foraging habitat from future infestations of invasive plants.

**Gray wolf (*Canis lupus*)**

***Life History, Population, and Distribution***

A detailed account of the life history, taxonomy, and behavior can be found in the final rule to reclassify and remove the gray wolf from the list of endangered and threatened wildlife (U.S. Fish and Wildlife Service 2003a).

The gray wolf historically occupied almost any area that supported sufficient populations of hoofed mammals (ungulates like deer, elk, and moose). They were generally absent from arid deserts and high mountaintops. Virtually any area that has sufficient prey and adequate protection from human-caused mortality could be considered potential gray wolf habitat (U.S. Fish and Wildlife Service 2003a).

Wolves prey on a variety of large mammals, including elk, deer, bison, and livestock, and will eat carrion. Occasionally, small mammals, snowshoe hare, birds, large invertebrates, and even domestic pets may be taken as prey items.

Wolves are social animals and live in established packs. Packs are primarily family groups consisting of a breeding pair (i.e. “alpha male and alpha female”), their pups from current and previous years, and occasionally an unrelated wolf. Gray wolves give birth to pups in April or May. Normally, only the alpha female in a pack will breed. Pups become very mobile by fall.

Gray wolves use very large home ranges and may defend territories as large as 400 square miles (U.S. Fish and Wildlife Service 2003a). Young wolves may disperse large distances from their natal pack’s territory and dispersal movements of 500 miles have been documented.

The gray wolf population in the Northern Rocky Mountain states (Idaho, Montana, and Wyoming) continues to increase in distribution and numbers. Estimates of wolf numbers at the end of 2004 were 452 wolves in the Central Idaho Recovery Area, 324 in the Greater Yellowstone Recovery Area, and 59 in the Northwest Montana Recovery Area for a total of 835 wolves. A total of 66 breeding pairs raised two or more pups. This was the fifth consecutive year that the recovery goal of at least 30 breeding pairs was met or exceeded.

In 2004, the first wolf pack within the action area was confirmed on the Wallowa-Whitman National Forest, on the Idaho side of Hells Canyon National Recreation Area. While this pack is currently within the experimental population, wolves that cross the State line into Oregon or Washington would be outside the identified boundary of the experimental population. Transient wolves have been documented to occur on the Colville, Gifford Pinchot, Malheur, Mount Baker-Snoqualmie, Okanogan, Umatilla, Wallowa-Whitman, and Wenatchee National Forests.

Wolves within the action area have been mostly transient individuals and have not established packs and defended territories. There have been some den and rendezvous sites detected in north-central Washington, but these have not persisted to form an established pack territory. It is expected that, as wolf populations in Idaho expand, wolves will disperse into Washington and Oregon.

### ***Effects of the Action***

#### *Disturbance*

Direct effects from invasive plant treatment include disturbance caused by noise, smoke, aircraft, people and vehicles, which are activities common to manual, mechanical, cultural, and prescribed fire methods. These activities could potentially disturb gray wolves by causing them to temporarily avoid foraging areas. However, invasive plant projects involve very short-term disturbance requiring one to two treatments with few people and often are only repeated once in the same growing season. Currently, wolves are transient within the action area and are unlikely to encounter any individual project.

### *Herbicides*

Because wolves are extremely rare and transient within the action area and because they prey mostly upon large mammals, it is extremely unlikely that a gray wolf would be exposed to herbicides. Any exposure would require wolves to feed upon the exact individual of prey that had been feeding exclusively on treated vegetation, or had been directly sprayed within the treatment area. It is not feasible for large mammals like elk and deer to be directly sprayed. Even if an elk or deer had foraged in the treatment area, a single wolf would have to consume the entire deer or elk within 24 to 48 hours of exposure before the herbicide was eliminated from the herbivore's body. Even with these very conservative assumptions, wolves would not receive a toxic dose of herbicide.

### *Indirect Effects*

Indirect effects to gray wolf would consist of changes to the habitat of their prey. Invasive plant treatments will not remove or degrade suitable habitat since invasive plants do not provide adequate forage for elk and other prey. Successful control of invasive plant infestations provides long-term benefits to gray wolf by restoring native habitat and forage for their prey and preventing future degradation of habitat.

### ***U.S. Forest Service Determination***

The U.S. Forest Service determined that the Invasive Plant Program may affect, but is not likely to adversely affect the gray wolf based on the following:

- Prevention standards will help to protect foraging habitat of their prey from invasive plants.
- Distribution of gray wolf within the action area is very limited, and sporadic, so the opportunity for wolves to be in or near treatment areas is also very limited.
- Disturbance from projects could occur, but unlikely and would be further evaluated at the project scale.
- Disturbance from invasive plant treatment projects is low level, short duration, and infrequent.
- Doses of any herbicides in the Invasive Plant Program that would cause potential adverse effects are not plausible.

### ***U.S. Fish and Wildlife Service Concurrence***

The USFWS concurs with the U.S. Forest Service's determination of may affect, not likely to adversely affect the gray wolf based on the following reasons:

- Distribution of gray wolf is limited and currently wolves are only transient within the action area. Therefore, it is very unlikely that the gray wolf would be in or near an active treatment area, making potential effects discountable.

- Disturbance from invasive plant treatment projects is low level, short duration, and infrequent, requiring one to two treatments over 1 or 2 days.
- Potential effects from exposure to herbicides in the Invasive Plant Program are insignificant.
- Prevention standards will help to protect foraging habitat from future infestations of invasive plants.

### **Canada lynx (*Lynx canadensis*)**

#### ***Life History, Population, and Distribution***

A detailed account of the life history, taxonomy, and behavior can be found in the final rule listing of the Canada lynx (U.S. Fish and Wildlife Service 2000a) and in the Canada Lynx Conservation Assessment and Strategy (Ruediger et al. 2000).

In the western United States, most lynx occurrences (83 percent) are associated with the Rocky Mountain Conifer Forest at elevations of 4,920 to 6,560 ft (McKelvey et al. 2000). The primary vegetation types associated with lynx habitat include lodgepole pine (*Pinus contorta*), subalpine fir (*Abies lasiocarpa*), and Engelmann spruce (*Picea engelmannii*). Cool, moist Douglas-fir (*Pseudotsuga menziesii*), grand fir (*Abies grandis*), western larch (*Larix occidentalis*) and aspen (*Populus tremuloides*) forests may contribute to lynx habitat when interspersed with subalpine forests. Within these vegetation types, lynx inhabit includes areas that support their primary prey, snowshoe hares (*Lepus americanus*).

Large woody debris is needed for natal den sites and provides important escape and thermal cover for the kittens. Denning habitat must be in or adjacent to snowshoe hare habitat. Snowshoe hare habitat is composed of a dense, multi-layered understory that maximizes cover and browse at both ground level and at varying snow depths throughout the winter. In summer, snowshoe hares eat forbs, grasses, leaves of shrubs, and some woody browse, while the winter diet is restricted to small twigs and some bark (Koehler 1990).

Lynx are described as being generally tolerant of humans (Staples 1995). Reports suggest that lynx are not displaced by human presence, including moderate levels of snowmobile traffic (Mowat et al. 2000) and ski area activities (Roe et al. 1999).

Because reliable data is generally unavailable, there are no population estimates for the entire range of the lynx in the lower 48 states. Within the action area, in Washington the lynx population has been roughly estimated that between 96 and 190 individuals. The current presence of a resident lynx population in Oregon and Idaho has not been substantiated.

Lynx have been documented on the Colville, Wenatchee and Okanogan National Forests in Washington and the Deschutes, Umatilla, and Wallowa-Whitman National Forests in Oregon. Resident, reproducing lynx occur on the Colville and Okanogan Forests, while the lynx on the Deschutes, Umatilla, and Wallowa-Whitman Forests were likely dispersing individuals. Reproductive lynx are suspected Wenatchee National Forest, though this has not been confirmed. Lynx are also suspected to occur on the Gifford-Pinchot National Forest in Washington, but only as dispersing individuals.

### ***Effects of the Action***

#### *Disturbance*

Methods used to treat invasive plants or restore habitat may affect the Canada lynx by introducing an increased level of sound or visual disturbance into the environment. Smoke, aircraft, humans, and vehicles are all activities common to manual, mechanical, cultural, and prescribed fire treatment methods and have the potential to disturb Canada lynx by causing them to temporarily avoid foraging habitat. However, invasive plant projects involve very short-term disturbance requiring one to two treatments with few people and may only be repeated once in the same growing season. Canada lynx are rare within the action area, are unlikely to encounter any individual project, and can generally tolerate the level of disturbance anticipated by the Invasive Plant Program.

#### *Herbicides*

Canada lynx are not likely to be exposed to herbicides because any appreciable exposure would require the lynx to feed upon the exact individual of prey that had been feeding exclusively on sprayed vegetation or had been directly sprayed within the treatment area. Even with these very conservative assumptions, Canada lynx would not receive a toxic dose of herbicide. It is not feasible for snowshoe hare to be directly sprayed because hare would leave the immediate vicinity due to human presence and they occur in areas with high stem densities that are not subject to invasive plant invasion and therefore the need for treatments.

#### *Indirect Effects*

Indirect effects to lynx would consist of changes to the habitat of their prey. Invasive plant treatments will not remove or degrade suitable snowshoe hare 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.

### ***U.S. Forest Service Determination***

The U.S. Forest Service determined that the Invasive Plant Program may affect, but is not likely to adversely affect the Canada lynx based on the following:

- Prevention standards will help to protect foraging habitat and habitat for their prey from invasive plants.
- Distribution of Canada lynx within the action area is very limited, so the opportunity for lynx to be in or near treatment areas is also very limited.

- Disturbance from projects could occur, but are unlikely and would be further evaluated at the project scale.
- Disturbance from invasive plant treatment projects is low level, short duration, and infrequent. Lynx are known to tolerate low to moderate levels of human activity and disturbance.
- Doses of any herbicides in the Invasive Plant Program that would cause potential direct adverse effects to Canada lynx are not plausible.

***U.S. Fish and Wildlife Service Concurrence***

The USFWS concurs with the U.S. Forest Service's determination of may affect, not likely to adversely affect the Canada lynx based on the following reasons:

- Distribution of Canada lynx within the action area is limited and population numbers are low, therefore, it is very unlikely that the Canada lynx would be in or near an active treatment area. The potential for disturbance is discountable.
- Disturbance from invasive plant treatment projects is low level, short duration, and infrequent, requiring one to two treatments over 1 or 2 days.
- Potential effects from exposure to herbicides in the Invasive Plant Program are insignificant.
- Prevention standards will help to protect foraging habitat from future infestations of invasive plants.

**Woodland caribou (*Rangifer tarandus caribou*)**

***Life History, Population, and Distribution***

A detailed account of the life history, taxonomy, and behavior can be found in the final rule listing of the woodland caribou (U.S. Fish and Wildlife Service 1984) and in the Revised Recovery Plan (U.S. Fish and Wildlife Service 1994a).

Woodland caribou do not make the long, mass migrations for which tundra caribou (*Rangifer tarandus groenlandicus*) are famous. Several woodland caribou herds do, however, make seasonal elevational migrations. As winter progresses and snow accumulates, the caribou are found above 6,000 feet in open canopy forests of subalpine fir/Engelmann spruce. The snow pack during this time of year has consolidated enough for the caribou to walk on, and they use the deep snow platform to reach arboreal lichens, which are their primary winter food.

In spring, the caribou will move to low elevation areas that are "greening up" and forage on forbs and shrubs. The caribou will follow the greening vegetation as it progresses up

slope in elevation throughout the spring and summer. Pregnant females will move back to snow-covered areas at higher elevations to calve in early June.

As recently as 1950, the Selkirk population of woodland caribou numbered about 100 individuals (Evans 1960). However, by the early 1980's only 25 to 30 individuals remained. After a number of augmentation attempts from 1987 to 1998, the population remains at approximately 35 individuals.

This last remaining woodland caribou population in the United States is restricted to approximately 443,360 acres in the Selkirk Mountains of northeastern Washington, northern Idaho, and southeastern British Columbia (U.S. Fish and Wildlife Service 1994a). Because woodland caribou are a mobile species with a large home range, they occur only occasionally in a small portion of the action area. Their primary occurrence in the action area is on the Sullivan Lake Ranger District of the Colville National Forest, which contains approximately 77,000 acres of caribou habitat in the Selkirk recovery area (U.S. Fish and Wildlife Service 1994a).

### ***Effects of the Action***

#### *Disturbance*

Methods used to treat invasive plants or restore habitat may affect the woodland caribou by introducing an increased level of sound or visual disturbance into the environment. The presence of smoke, aircraft, humans, and vehicles during manual, mechanical, cultural, and prescribed fire treatments have the potential to disturb caribou by causing them to temporarily avoid foraging habitat. However, invasive plant projects generally involve very short-term disturbance requiring only one to two treatments with few people and might only be repeated once in the same growing season. Therefore the level of disturbance is anticipated to be very small and ephemeral.

#### *Herbicides*

Woodland caribou forage on herbaceous vegetation and shrubs, in the spring and early summer, so they could be exposed to herbicide residues on vegetation from broadcast spray applications.

At typical application rates, the estimated doses from the exposure scenarios are all less than the reported NOAELs (no-observable adverse effect level) for all herbicides except triclopyr. At highest application rates, estimated doses from the exposure scenarios exceed the reported NOAELs for glyphosate, triclopyr, and picloram. The estimated doses for all other herbicides in the Invasive Plant Program are equal to or less than reported NOAELs.

Woodland caribou that consume vegetation with glyphosate residue applied at the highest application rate may experience some adverse effects. However, glyphosate is a non-selective herbicide and would kill the vegetation to which it was applied, making it unpalatable in a short time. Given the potential temporary displacement of caribou from the area due to disturbance, it is unlikely that caribou would feed on newly sprayed plants before the plant dies. Also, invasive plant control in caribou habitat is usually conducted

to protect forage habitat for caribou, so it would be counter-productive to use the non-selective glyphosate in foraging areas. While the potential for adverse effects to caribou from ingesting glyphosate exists, the scenario is extremely unlikely to occur.

The use of triclopyr for invasive plant treatment is restricted in the Invasive Plant Program by Standard 16, which states, “The use of triclopyr is limited to selective application techniques only (e.g. spot spraying, wiping, basal bark, cut stump injection).” Exposure scenarios calculate doses based on a broadcast spray-type application over an entire foraging area. The estimated doses could not occur with triclopyr applied to non-desirable vegetation in a selective manner. Therefore, with Standard 16 in place, adverse effects to woodland caribou from the use of triclopyr will not occur.

For picloram at the highest application rate (1 lb/acre), the estimated dose (35.3 mg/kg) slightly exceeds the acute NOAEL (34 mg/kg) for a woodland caribou-sized mammal. The acute dose is substantially less than the acute LOAEL (172 mg/kg; U.S. Environmental Protection Agency 1998) for decreased weight gain. Dose estimates are not precise, but encompass some variability, so the estimated dose is functionally a NOAEL. Because the U.S. Forest Service used very conservative assumptions in estimating the level of herbicide that caribou could ingest, we do not anticipate any adverse effects to woodland caribous from consuming grass that has been sprayed with picloram under the Invasive Plant Program.

#### *Indirect Effects*

Indirect effects to woodland caribou would consist of changes to their habitat. Invasive plant treatments will not remove or degrade suitable habitat since invasive plants do not provide forage for caribou. Successful control of invasive plant infestations provides long-term benefits to caribou by restoring native habitat and preventing future degradation of habitat.

#### ***U.S. Forest Service Determination***

The U.S. Forest Service determined that the Invasive Plant Program may affect, but is not likely to adversely affect the woodland caribou based on the following:

- Prevention standards will help to protect foraging habitat from invasive plants.
- Distribution of woodland caribou within the action area is very limited, and sporadic, so the opportunity for caribou to be in or near treatment areas is also very limited.
- Disturbance from projects could occur, but is managed along with other disturbance according to Interagency Grizzly Bear Committee guidelines and rules. This would help reduce potential disturbance of caribou because the caribou habitat in the action area is completely within the grizzly bear Selkirk recovery zone.

- Disturbance from invasive plant treatment projects is low level, short duration, and infrequent.
- It is implausible that woodland caribou would receive a dose of any herbicides under the invasive plant program that would cause potential adverse effects to any individuals.

***U.S. Fish and Wildlife Service Concurrence***

The USFWS concurs with the U.S. Forest Service's determination of may affect, not likely to adversely affect for the woodland caribou based on the following:

- Distribution of woodland caribou within the action area is limited and population numbers are very low, therefore, it is very unlikely that the caribou would be in or near an active treatment area.
- Disturbance from invasive plant treatment projects is low level, short duration, and infrequent, requiring one to two treatments over 1 or 2 days. Caribou are anticipated to move only temporarily, if at all, in response to these low level disturbances.
- Potential effects from exposure to herbicides in the Invasive Plant Program are insignificant. It is highly unlikely that woodland caribou in the action area could receive a dose of herbicide that would cause any adverse affects.
- Prevention standards will help to protect foraging habitat from future infestations of invasive plants.

**Wenatchee Mountains checkermallow (*Sidalcea oregana var. calva*)**

***Life History, Population, and Distribution***

Detailed accounts of life history, taxonomy and behavior can be found in the final rule listing the Wenatchee Mountains checkermallow as endangered (U.S. Fish and Wildlife Service 1999b) and in the recovery plan (U.S. Fish and Wildlife Service 2004a).

Wenatchee Mountains checkermallow is restricted to Chelan County, Washington. This plant is currently known from only five populations located within Chelan County. The largest population has an estimated 11,000 plants, and the remaining four range in size from 8 to 300 individuals. One of the small populations is found along the shoulder of a forest road within the Wenatchee National Forest. Although there were 43 individuals present in 2001, only two of those were reproductive adult plants. The 5-year trend in the size of this population appears to be increasing (U.S. Fish and Wildlife Service 2004a).

The Wenatchee Mountains checkermallow is a relatively long-lived herbaceous perennial with a stout taproot branches at the root crown and give rise to several stems that grow as tall as 8 to 60 inches. Pink flowers begin to appear in the middle of June and peak in the

middle to end of July. Well-developed fruits are usually present by early August. It is generally found in the wetter portions of open forest-moist meadow habitats in slight topographic depressions, and on the perimeter of shrub and hardwood thickets. The largest population, at the Camas Meadows Natural Area Preserve, is managed by Washington Department of Natural Resources and is threatened by several invasive plants. These species include diffuse knapweed (*Centaurea diffusa*), meadow knapweed (*Centaurea pratensis*), Canada thistle (*Cirsium arvense*), dalmation toadflax (*Linaria dalmatica*), white top (*Cardaria* spp.), and sulfur cinquefoil (*Potentilla recta*). An active weed management program has reduced this threat and to date has not affected any Wenatchee Mountains checkermallow populations.

### ***Effects of the Action***

Potential effects could result from manual, mechanical or chemical treatments. Biological controls will not be introduced, but could move into occupied areas from outside sources.

Impacts to Wenatchee Mountains checkermallow from manual treatments could occur due to accidental pulling or trampling while treating invasive species. The risk of injury to above ground plant structures causing individual mortality is considered to be low. The mechanical methods most likely used near Wenatchee Mountains checkermallow include mowing or string trimming and the use of heavy equipment. These activities could crush, sever, or otherwise impact plant structure, with the greatest potential impact occurring at the time of fruit and seed development. Using chemical treatments, individual plants could be damaged or killed by the accidental application or drift of herbicide from ground based applications.

### ***U.S. Forest Service Determination***

The U.S. Forest Service determined that the Invasive Plant Program may affect, but is not likely to adversely affect the Wenatchee Mountains checkermallow based on the following:

- Currently, no invasive species occur within the populations found on U.S. Forest Service lands, therefore any treatment is considered unlikely into the foreseeable future.
- A similar treatment regime on nearby Washington Department of Natural Resources land has produced successful results over six years, without observable effects to Wenatchee Mountains checkermallow.
- Invasive plants are currently being treated on non-federal land in the Camas Meadows Natural Area Preserve administered by the Washington Department of Natural Resources. Because active management of invasive species by Washington Department of Natural Resources is effectively taking place, the risk of infestation and therefore, treatment on U.S. Forest Service lands is low.

- Risks of accidental pulling or trampling of all non-target species will likely be minimized by techniques such as flagging occupied areas prior to treatments, and careful hand pulling of invasive species close to individuals or populations, as directed by Standards 19 and 20 in the Biological Assessment.
- Other techniques under Standard 20 to minimize risk to the species from chemical treatments are application during dormancy, selective application such as defined spot spray, shielded spray, or hand wiping. Workers, operators, and applicators could then avoid effects to individual Wenatchee Mountains checkermallow plants.

***U.S. Fish and Wildlife Service Concurrence***

The USFWS concurs with the U.S. Forest Service's determination of may affect, not likely to adversely affect for the Wenatchee Mountains checkermallow based on the following:

- Manual treatments are generally low impact. Because manual treatments are easily monitored and effects are readily minimized or removed by flagging, the potential effects to Wenatchee Mountains checkermallow, the is expected to be insignificant.
- The effects of mechanical treatments are primarily attributable to accidents or mistakes, which would be sufficiently reduced by flagging Wenatchee Mountains checkermallow or careful hand pulling of invasive plants near the species so as to be discountable.
- Although there is a risk of drift from broadcast chemical applications, the probability of this occurrence is minimized by implementation of the Standards. Avoidance measures such as flagging and hand pulling as are expected to reduce the potential for effects on Wenatchee Mountains checkermallow to the extent that such changes are discountable

**Wenatchee Mountains checkermallow critical habitat**

***Life History, Population, and Distribution***

The USFWS designated critical habitat for this species in a Final Rule on September 6, 2001 (U.S. Fish and Wildlife Service 2001a).

The primary constituent elements of critical habitat for Wenatchee Mountains checkermallow include surface water or saturated upper soil profiles; a wetland community dominated by native grasses and forbs and generally free of woody shrubs and conifers that produce shade and competition for the species; seeps and springs on fine-textured soils (clay loams and silt loams), which contribute to the maintenance of hydrologic processes necessary to support meadows that remain moist into early summer; and elevations of 1,600 to 3,300 feet.

The critical habitat designation included 2,051 acres on U.S. Forest Service lands, 1428 acres on state land and 2,656 acres on private land for a total of 6,135 acres. Therefore, the action area includes 33 percent of the designated critical habitat for this species.

***Effects of the Action***

The potential effects arise from mechanical treatments only. Mowing or string trimming and the use of heavy equipment to treat occupied or unoccupied critical habitat could alter drainage patterns, compact wetland soils, sever or crush wetland associates or plant parts of wetland associates. Mechanical treatment is the most likely treatment type near critical habitat for Wenatchee Mountains checkermallow, and could have the most potential for impact if timed to conflict with flowering or fruit and seed development.

Under 36 CFR 261.13, the use of mechanical and heavy equipment in areas off-road “in a manner which damages or unreasonably disturbs the land, wildlife, or vegetative resources” is prohibited. These regulations, and the use of standard avoidance techniques as directed under Standards 10, 19, and 20, such as flagging habitat boundaries, will effectively minimize the potential for direct impacts to Wenatchee Mountains checkermallow.

***U.S. Forest Service Determination***

The U.S. Forest Service has determined that the Invasive Plant Program may affect, but is not likely to adversely affect designated critical habitat for Wenatchee Mountains checkermallow, based on the following:

- Currently, no invasive species occur within the populations located on U.S. Forest Service lands, therefore any treatment of designated critical habitat is considered unlikely into the foreseeable future.
- A similar treatment regime on nearby Washington Department of Natural Resources land has produced successful results over six years, without observable effects to critical habitat for Wenatchee Mountains checkermallow.
- Invasive plants are currently being treated on non-federal land in the Camas Meadows Natural Area Preserve administered by the Washington Department of Natural Resources. Because active management of invasive species by Washington Department of Natural Resources is effectively taking place in similar habitat under a written plan, the risk of infestation and therefore, treatment is unlikely.
- Risks from mechanical treatments will be further reduced by careful hand pulling of invasive species within and near populations, thereby minimizing the chance of contact between critical habitat for Wenatchee Mountains checkermallow and heavy equipment.

***U.S. Fish and Wildlife Service Concurrence***

The USFWS concurs with the U.S. Forest Service's determination of may affect, not likely to adversely affect for the Wenatchee Mountains checkermallow critical habitat based on the following:

- Federal regulations regarding the use of mechanical and heavy equipment in wet areas away from system roads will reduce the risk of effects to critical habitat.
- Potential effects of mechanical treatments are primarily attributable to accidents or mistakes. The risk of these effects would be further minimized by the avoidance of wet areas called for in Standards 10, 19, and 20, and the flagging of occupied habitat so that affects are likely to be discountable.

**MacDonald's rockcress (*Arabis macdonaldiana*)**

***Life History, Population, and Distribution***

Detailed accounts of the life history, taxonomy and ecology of can be found in the Final Rule listing the MacDonald's rockcress as endangered (U.S. Fish and Wildlife Service 1978) and in the recovery plan (U.S. Fish and Wildlife Service 1990a).

MacDonald's rockcress can be 1.4 to 9.7 inches tall in flower, and have highly branched, short, stiff below ground or ground-level stems; which form new basal rosettes at their tip. The inflorescence is a simple raceme or occasionally comprising simple flowers in the axils of upper cauline leaves. It has 4 to 19 four-petaled flowers with up to six open at a time (Vorobik, 2003). Individuals may reach 25 to 50 years old based upon an average rate of growth of 0.2 to 0.4 inches per year. The plant appears to maintain a relatively stable population density and cover value. Flowering is irregular; plants do not flower or fruit every year.

MacDonald's rockcress primarily occurs on barren to shrub-covered shallow, rocky, ultramafic serpentine soils which are peridotite in origin. These soils are often rich in copper, chromium and nickel deposits, which are toxic metals to many plants. The plant is most often found on newly exposed serpentine soils rather than weathered soils. MacDonald's rockcress populations are usually found on level to steep unstable slopes on dry open Jeffrey pine (*Pinus attenuata*) woodland communities in elevations ranging from 2,000 to 4,500 feet. Canopy cover is generally less than three percent.

A current assessment by the USFWS in 2003 estimates the total number of MacDonald's rockcress throughout its range to be 43,250 to 43,300 plants. Although a Botanical Area is designated covering much of the plants range, populations are still threatened by off-road vehicle use and competition from other plants due to fire exclusion practices (U.S. Fish and Wildlife Service 2003).

At the time of listing, Red Mountain of the North Coast Range of California in Mendocino County, California was the only known population of MacDonald's

rockcress. Since 1980, the plant has been observed at 11 additional locations in Curry and Josephine Counties in Oregon. The number of known plants in Oregon is estimated to be between 50 - 95 plants. In 2002 the Biscuit Fire burned through several plant populations in both Counties. The populations were assessed in 2004 with the finding that the majority of the populations have remained intact since the fire.

The critical factor limiting the distribution of the plant is the restricted availability of suitable habitat, namely the presence of an ultramafic substrate. There is no evidence that the range of the plant is any more restricted today than in the recent past. The currently accepted range for MacDonald's rockcress has expanded to include six counties, four in California and two in Oregon. Roughly 87 populations of the plant have since been identified rangewide that total approximately 397 square miles in Mendocino, Del Norte, Siskiyou and Trinity counties in California and Curry and Josephine counties in Oregon (U.S. Fish and Wildlife Service 2003b).

Within the action area, MacDonald's rockcress has been documented on Siskiyou National Forest. The number of populations and individual plants within the action area is relatively small. Known occurrences currently range from approximately ten to several hundred plants. Even at the upper estimate of several hundred MacDonald's rockcress plants, this amounts to less than five percent of the known population over the range of the species.

### ***Effects of the Action***

The occurrence of MacDonald's rockcress in the action area is small (approximately 5 percent of the entire known occurrences). This species does not usually occupy habitat that is susceptible to infestation from invasive plants.

If invasive plants do invade the habitat and need treatment, individual rockcress plants could be damaged or killed from the accidental application or drift of the herbicide from ground based chemical applications. The risk of these effects occurring can be minimized by techniques such as timing of application during dormancy, use of herbicides not selectively toxic to the Fabaceae family (of which MacDonald's rockcress is a member), flagging individuals, careful hand pulling of invasives closer to the populations or through selective application methods such as defined spot spray, shield spray or hand wiping (Standard 20 of the Biological Assessment). Sparse vegetative cover in the immediate vicinity of populations make MacDonald's rockcress individuals easy to locate and avoid. Because the species does not usually occur in habitat that is susceptible to infestation from invasive plants, the risk of affecting the species with chemical treatments is very low. Potential negative effects to MacDonald's rockcress would be outweighed by the benefits of reducing or removing invasive plant species.

### ***U.S. Forest Service Determination***

The U.S. Forest Service has determined that the Invasive Plant Program may affect, but is not likely to adversely affect MacDonald's rockcress, based on the following:

- There are currently no problems with invasive species occurring within the populations located on U.S. Forest Service lands, therefore any treatment of suitable habitat is considered unlikely into the foreseeable future.
- MacDonald's rockcress does not usually occupy habitat that is susceptible to infestation from invasive plants.
- Risks of accidental pulling or trampling of all non-target species will likely be minimized by techniques such as timing of application during dormancy, use of herbicides not selectively toxic to the Fabaceae family, flagging individuals, careful hand pulling of invasives closer to the population..
- Other techniques under Standard 20 to minimize risk to the species from chemical treatments are application during dormancy, selective application such as defined spot spray, shielded spray, or hand wiping. Sparse vegetative cover in the immediate vicinity of populations make MacDonald's rockcress individuals easy to locate and avoid.

***U.S. Fish and Wildlife Service Concurrence***

The USFWS concurs with the U.S. Forest Service's determination of may affect, not likely to adversely affect for the MacDonald's rockcress based on the following:

- MacDonald's rockcress does not usually occur in habitat susceptible to invasive plants, so treatments are unlikely to be needed within the populations.
- The plants are easy to avoid during treatments and the potential for effects to unsurveyed habitat is low, so that affects are likely to be discountable.

**Gentner's fritillary (*Fritillaria gentneri*)**

***Life History, Population, and Distribution***

Detailed accounts of the life history, taxonomy and ecology can be found in the Final Rule listing Gentner's fritillary as endangered (U.S. Fish and Wildlife Service 1999c) and in the recovery plan (U.S. Fish and Wildlife Service 2003b).

The plant is a perennial herb arising from a fleshy bulb producing several large scales surrounded by numerous small rice-grained bulblets. Non-flowering plants vastly outnumber flowering plants in natural populations, and are recognizable only by their single ovate to lanceolate basal leaf that is indistinguishable from several other common related fritillaries. The plant has dull to bright red to maroon-colored, with the flowers mottled or streaked with yellow. The flowers are solitary, or in bracted racemes, one to seven (rarely more) on long slender pedicels. The 1.0 to 1.6 inch bell-shaped flower has segments that bend more or less outward, but are not strongly recurved like the common scarlet fritillary (*Fritillaria recurva*). The length of the nectary on the inside of the flower is one means of distinguishing the species from other common species.

The plant blooms from early April through late May, and as late as June 15th, depending on precipitation, temperature, and herbivory. Reproduction is mostly asexual. Small plants often arise from near the base of larger flowering plants, presumably from under ground “clonal” bulblets coming off the “mother” bulbs. Amsberry and Meinke (2002) documented between 10 and 200 rice-grain bulblets attached to mature mother bulbs on 25 excavated plants.

Using data provided by Brock and Callagan (2000), current estimates indicate that for every flowering fritillary there are on average 14.7 vegetative juvenile plants within 8 inches of the base of flowering plants and 1.5 mature non-flowering plants associated with each flowering plant. Thus a meta-population of 500 flowering plants would have an average of 19,750 plants total, an increase of 39.5 fold. An estimated minimum of 500 flowering plants is needed to maintain each meta-population.

The plant occurs in a variety of habitats including oak woodlands dominated by Oregon white oak (*Quercus garryana*) mixed hardwood forest dominated by California black oak (*Quercus kelloggii*), Oregon white oak, and madrone (*Arbutus menziesii*), and coniferous forests dominated by madrone and Douglas fir. It has been found growing on the edges of grasslands and chaparral, and in open mixed evergreen forest and woodland openings. It is most often found in forest ecotones or transitional areas, especially along ridgelines or aspect changes. The elevations of known occurrences range from 600 feet (near the Rogue River) to over 4,500 feet near Soda Mountain, and it can occur on nearly all aspects if the right habitat conditions are present.

A population census of all known occurrences on BLM lands in 2000 documented 677 flowering plants and 3,334 vegetative (non-flowering) plants. Twenty-two new occurrences were found during the field season of 2001 on Medford District BLM lands, bringing the current total to 775 flowering plants (Brock and Callagan 2001). In addition, nine potential new occurrences on private lands reported in response to information requests printed in area newspapers were investigated in 2001.

Gentner’s fritillary is found only in Jackson and Josephine Counties in southwest Oregon, with most populations occurring around Jacksonville and in the little Applegate watershed. Other populations occur in the Cascade Siskiyou National Monument, in areas just north of Gold Hill, in Big Butte Creek, and in Pickett Creek near Merlin, Oregon.

Although most known occurrences are on Federal lands (mostly BLM), large blocks of suitable habitat on Federal and private land have yet to be surveyed. Non-federal lands within the Rogue River sub-basin contain a high percentage of suitable habitats. Gentner’s fritillary populations on private lands will likely decline as these private lands are converted to human uses over time.

Within the action area, two populations have been documented, one each on Siskiyou and Rogue River National Forests. Both populations are very small. The population on the

Siskiyou contains four plants and the one on the Rogue River contains two plants. Compared to the species abundance for the entire range reported in a 2001 inventory, the number on U.S. Forest Service lands is only 0.5% of the total known. Each population is located in a different recovery unit as established by the Gentner's fritillary Recovery Plan.

Demographic trends of the two populations on U.S. Forest Service lands are stated as unknown in the Recovery Plan (U.S. Fish and Wildlife Service 2003c) for Gentner's fritillary. Also, according to the Recovery Plan, a management area within a recovery unit should minimally contain a demographic population size of 50. Extrapolating this data using Brock and Callagan (2000), this figure translates to approximately five flowering or mature plants. The two populations on U.S. Forest Service lands are isolated from other populations and do not meet the numbers of flowering plants necessary to be considered a management area. A threat identified as specific to the population on the Siskiyou National Forest is the invasive species meadow knapweed, which occupies the meadow where one of the populations is found.

Potential habitat for this species within the action area is very limited. The oak woodland or low elevation conifer woodland/meadow interface where the species is most commonly found is usually at lower elevations than the vast majority of U.S. Forest Service lands. The bulk of populations are found on Medford District BLM lands that contain these lower elevation woodlands.

### ***Effects of the Action***

The occurrence of this species in the action area is small (approximately 0.5 percent of all known occurrences are in the action area), even though surveys are conducted on a regular basis. The two populations are very small, and occur in habitat that is susceptible to infestation from invasive plants. Accidental pulling or trampling would be the most likely effect to this plant because vegetative individuals are difficult to see. However, these impacts would be limited primarily to injury of above ground structures with little risk of individual mortality. Also possible, but less likely is that individual plants could be damaged or killed from the accidental application or drift of the herbicide from ground based applications.

Currently one population on U.S. Forest Service lands is threatened by the invasive species, meadow knapweed. This species has been effectively controlled using manual techniques over the past five years without adverse effect to Gentner's fritillary. Chemical treatments would be the only other method used, if manual treatments proved ineffective in the long term or if other invasive species appeared that could not be effectively treated manually.

The potential of finding additional Gentner's fritillary plants on U.S. Forest Service lands, and therefore affecting them, is low. Regular surveys have only found two small populations and very little habitat. The few plants located within the action area are isolated and are not currently present in large enough numbers to be considered in large-scale population management.

Manual treatments have already been proven successful within the current known population on U.S. Forest Service lands without adverse effect. Therefore, the likelihood of chemical use near this species for projects on U.S. Forest Service lands is low. The benefits derived from treating invasive plants outweigh the low potential for negative effects to Gentner's fritillary.

The risk of herbicide effects would be further minimized by such techniques as flagging the areas containing individuals, careful hand pulling of invasives close to the populations, or through selective application methods such as defined spot spray, shielding spray or hand wiping (Standard 20).

### ***U.S. Forest Service Determination***

The U.S. Forest Service has determined that the Invasive Plant Program may affect, but is not likely to adversely affect Gentner's fritillary, based on the following:

- While accidental pulling or trampling may affect this plant because vegetative individuals are difficult to see, these impacts would be limited primarily to injury of above ground structures with little risk of individual mortality.
- Currently one population on U.S. Forest Service lands is threatened by the invasive species, meadow knapweed which has been effectively controlled using manual techniques over the past five years without adverse effect to Gentner's fritillary.
- The potential of finding additional Gentner's fritillary plants on U.S. Forest Service lands, and therefore affecting them, is low. Regular surveys have only found two small populations and very little habitat.
- As manual treatments have already been proven successful, the likelihood of chemical use near this species for projects on U.S. Forest Service lands is low. The risk of herbicide effects would be further minimized by such techniques as flagging the areas containing individuals, careful hand pulling of invasives close to the populations, or through selective application methods such as defined spot spray, shielding spray or hand wiping (Standard 20).
- The benefits derived from treating invasive plants outweigh the low potential for negative effects to Gentner's fritillary.

### ***U.S. Fish and Wildlife Service Concurrence***

The USFWS concurs with the U.S. Forest Service's determination of may affect, not likely to adversely affect for the Gentner's fritillary based on the following:

- Gentner's fritillary has been documented at only two locations within the action area and not considered in population management. The current locations are known, therefore the species is easily protected.

- Suitable habitat has been surveyed, and the potential of finding additional plants is low. These circumstances in total render the potential for effects to occur so low as to be discountable.
- Currently one population on U.S. Forest Service land is threatened by the invasive species, meadow knapweed which has been effectively controlled using manual techniques over the past five years without adverse effect to Gentner's fritillary

### **Cook's lomatium (*Lomatium cookii*)**

#### ***Life History, Population, and Distribution***

Detailed accounts of life history, taxonomy and ecology can be found in the Final Rule listing Cook's lomatium as endangered (U.S. Fish and Wildlife Service 2002a).

Cook's lomatium is a perennial herb that grows to a height of 6 to 20 inches, from a slender, twisted taproot. The taproot can often branch at ground level to produce multiple stems. Flowers are yellow, fruits are oblong 5/8 to 1/2 inch long and 3/8 to 1/4 inch wide, with lateral thick, corky wings. Cook's lomatium has boat or pumpkin-shaped fruits. Involucels (leaf subtending the flower umbel) are 0.25 to 0.4 inch long, linear and green. Flowering stems emerge from a rosette in late February and flowers appear from mid-March through May. The earliest umbels (clusters of small flowers) are predominantly staminate (male) while later have both staminate and hermaphroditic (male and female) flowers. Pollinators observed include a small bee in the Andreræ family (Brock 1987), a small black moth (Kagan 1986) and several bumblebees (*Bombus* spp.) (Kaye 2000a). Plants that only produce one umbel produce few, if any fruits (Kaye 2000a, 2000b). The species reproduces through seed and fruits are present from late May through July (Kagan 1986).

Cook's lomatium is endemic to Jackson and Josephine counties in southwestern Oregon. In Josephine County, 27 populations of Cook's Lomatium occur within the Illinois River Valley. In Jackson County 15 populations occur in the Agate Desert within the Rogue River drainage (Oregon Natural Heritage Information Center, 2004). In Jackson County, In Jackson County, Cook's lomatium occurs in and around vernal pools within a 32 square mile (83 square kilometer) landform known as the Agate Desert. In Josephine County, Cook's lomatium occurs in seasonally wet meadows within a 50 square mile (128 square kilometer) landform in the Illinois Valley.

Many of the Cook's lomatium populations occurs in and around vernal pools within a 32 square mile (83-square kilometer) landform in southwestern Oregon known as the Agate Desert in Jackson County. Located on the floor of the Rogue River basin north of Medford, the Agate Desert is characterized by shallow, Agate-Winlow complex soils, a relative lack of trees, sparse prairie vegetation, and agates commonly found on the soil surface (Oregon Natural Heritage Program 1997, as cited in Oregon Department of Transportation 2003). In the Agate Desert, the species grows in vernal pool-mound

topography, where it mainly occurs along the vernal pool margins and less frequently on the pool bottom or on top of the mound.

In the French Flat/Illinois Valley area, Cook's lomatium grows in wet meadow areas underlain with floodplain bench deposits that contain sufficient clay to form a clay pan at 24 to 35 inches below the soil surface (U.S. Department of Agriculture 1983). The clay pan creates seasonally wet areas similar to the vernal pools of the Agate Desert, but mostly lacking the distinctive mound-swale topography of the latter.

Annual monitoring of three populations in the French Flat/Illinois Valley area on BLM lands since 1994 has revealed large variation in population densities and reproduction, with numbers fluctuating year to year seemingly in response to undefined environmental changes. The total in the Illinois Valley is not known, but is estimated to be less than 250,000 plants on 150 acres of occupied habitat. Because of the small amount of occupied acreage, scattered distribution, and threats to its habitat, the trend for populations in the Illinois Valley is thought to be downward (U.S. Forest Service/Bureau of Land Management 2003).

Within the action area, Cook's lomatium has not been documented, and is only suspected on the Siskiyou National Forest, which is adjacent to the Illinois Valley populations. No U.S. Forest Service lands occurs near the Agate Desert populations. Very little potential habitat exists on Siskiyou National Forest land. Surveys have taken place for the species throughout its potential habitat, but no populations have been found. This species is found at low elevations; specifically valley bottom wet grassland and oak woodland communities. The majority of its known occurrences in the Illinois Valley are on BLM lands at lower elevations than Siskiyou National Forest.

### ***Effects of the Action***

Because Cook's lomatium has not been documented within the action area, and suitable habitat has been surveyed, effects to the species could only occur if it has become established since the previous survey. In addition, the site must have invasive plants within or nearby in order to result in activities under the Invasive Plant Program and neither situation has arisen to date. The following is based on the assumption that populations and invasive plants may eventually be found on National Forest land.

While trampling could occur during manual treatments and could damage this low growing plant, such damage would be limited primarily to injury of above ground structures with little risk of individual mortality. Mowing or string trimming and the use of heavy equipment could sever or crush plants or plant parts and would have the most potential for impact if timed to conflict with flowering or fruit or seed development. By the remote chance that effects do occur, the most likely damage would be to above ground structures; there is little risk of individual mortality to individuals or within populations. Chemical treatments with herbicides that affect broadleaf species may affect individual Cook's lomatium plants. Although individual plants could be damaged or killed from the accidental application or drift of the herbicide from ground-based applications, there would not be any significant loss to the populations.

***U.S. Forest Service Determination***

The U.S. Forest Service has determined that the Invasive Plant Program may affect, but is not likely to adversely affect Cook's lomatium, based on the following:

- The potential of finding invasive plants within population Cook's lomatium or its habitat on U.S. Forest Service lands that is so low as to be discountable.
- Even if found, in all treatment scenarios the potential for negative effects would be outweighed by the benefits of reducing or removing invasive plant species.
- Any damage caused by trampling, mowing or string trimming, or the use of heavy equipment would likely be to above ground structures and present little risk of individual mortality to individuals or within populations.
- Although individual plants could be damaged or killed from the accidental application or drift of the herbicide from ground-based applications, there would not be any significant loss to the populations.

***U.S. Fish and Wildlife Service Concurrence***

The USFWS concurs with the U.S. Forest Service's determination of may affect, not likely to adversely affect for Cook's lomatium based on the following:

- Because Cook's lomatium has not been documented within the action area, and suitable habitat has been surveyed, the potential of finding the species and its habitat on U.S. Forest Service lands that is also occupied by invasive plants is so low as to be discountable.
- Even if found and invasive plants occur in the area, any damage that might be caused by trampling, mowing or string trimming, or the use of heavy equipment, would likely be to above ground structures and present little risk of mortality to individuals or within populations. Although individual plants could be damaged or killed from the accidental application or drift of the herbicide from ground-based applications, there would not be any significant loss to the populations.

***Ute ladies'-tresses (*Spiranthes diluvialis*)***

***Life History, Population, and Distribution***

Detailed accounts of the life history, taxonomy and ecology can be found in the Final Rule listing Ute ladies' tresses as threatened (U.S. Fish and Wildlife Service 1992a).

Ute ladies' tresses is a perennial herb with erect, glandular-pubescent stems 5 to 20 inches tall. The inflorescence begins to emerge in June or July, producing tubular white flowers in a loose spike arranged in a spiral. It typically begins flowering at the end of July and continues until early September depending on moisture and site conditions.

Shaded plants tend to flower later. Fruit set occurs in late August through September. At the end of the growing season, small rosettes often emerge at the base of the orchid plants and persist through the winter months.

Very little is known about the life history and demography of the Ute ladies' tresses. Other species of *Spiranthes* can remain dormant while in the early mycorrhizal stage, prior to emergence above ground, for multiple years. They can also remain dormant and below ground for multiple years during their lifespan. Some related species are long lived and do not flower for up to 20 years. Reproduction appears to be strictly sexual, with bumble bees as the primary pollinator. More research is needed to document early life history stages for the Ute ladies' tresses (U.S. Fish and Wildlife Service 1995a). Populations of the species tend to fluctuate dramatically from one year to the next, making it difficult to assess the population status and distribution.

Ute ladies' tresses populations occur in relatively low elevation riparian meadows, stream terraces, islands in rivers, gravel bars, old oxbows and along the edges of lakes and ponds. All reported populations are below 6,500 feet (U.S. Forest Service 2003). The species occurs primarily in areas where the vegetation is relatively open and not overly dense or overgrown. It appears to be well adapted to disturbances caused by water movement through floodplains over time, often growing on point bars or other early successional riparian habitat. The presence of the orchid is often considered an indicator of watershed health.

Rangewide, Ute ladies' tresses is known from over 60 locations representing 30 distinct biological populations (Fertig 2000). The majority of populations are found in Colorado and Utah; the largest population, containing about 5,500 plants, is located in Colorado.

Invasion of exotic species are a threat to Ute ladies' tresses. Canada thistle, purple loosestrife (*Lythrum salicaria*), whitetop, Russian olive (*Elaeagnus angustifolia*) and reed canarygrass (*Phalaris arundinacea*) are documented to be threatening known populations. In addition to these threats, the small, scattered pattern of distribution and the orchid's very low reproductive rate cause the species to be vulnerable to localized catastrophic events.

At the time of listing in 1992, Ute ladies' tresses was known to occur in Colorado, Utah and Nevada. Since 1992, the species has been found in Idaho, Montana, Wyoming, Nebraska and Washington. It is currently known from western Nebraska, southeastern Wyoming, north-central Colorado, northeastern and southern Utah, east-central Idaho, southwestern Montana, and north-central Washington. The population once found in Nevada is thought to be extirpated (U.S. Fish and Wildlife Service 1995a).

Four populations of Ute ladies' tresses are known in the state of Washington. One in Okanogan County and three in Chelan County; none of which are within the action area. Potential habitat was modeled for the species in the Hells Canyon National Recreation Area (Murray 2001). Estimating conservatively from that model, the U.S. Forest Service determined that only 373 acres of potential habitat was found within U.S. Forest Service

lands. Potential U.S. Forest Service habitat is surveyed regularly for this species, but no occurrences have been documented to date. The species is also suspected to exist on the Okanogan and Wenatchee and Wallowa-Whitman National Forests.

***Effects of the Action***

Because Ute ladies' tresses tends to have long periods of dormancy, the potential to overlook the plant during surveys is high. Also, because this species has a long growing season and the tendency to form fall and winter rosettes, known sites would be difficult to treat during a seasonally dormant stage. If the plant were to be threatened by invasive species, manual, mechanical or chemical methods would be used. The following is based on the assumption that populations and invasive plants may eventually be found on National Forest land.

For manual, mechanical, and chemical treatment type, the potential of affecting additional unsurveyed habitat or individual plants in the action area is very low. The risk of these effects will be minimized by such techniques as flagging areas with Ute ladies' tresses prior to treatments and careful hand pulling of invasives closer to populations (as directed by Standard 20 in the Biological Assessment), so workers, and equipment may avoid individual plants.

Potential habitat is regularly surveyed for this species on the three forests where it is suspected and Ute ladies' tresses have not been located to date. The low risk of negative effects is clearly outweighed by the benefits of removing of invasive species from populations of Ute ladies' tresses.

Accidental pulling or trampling would be the most likely effects to this plant and are limited primarily to injury of above ground structures with a low risk of individual mortality. If mowing, string trimming and the use of heavy equipment are used, they could sever or crush plants or plant parts and would have the most potential for impact if timed to conflict with flowering or fruit and seed development. In the unlikely event that they are found within the action area near an invasive plant location, Ute ladies' tresses plants could be damaged or killed from the accidental application or drift of the herbicide from ground based applications. In this case, herbicide applicators could potentially sever or crush plants or plant parts.

***U.S. Forest Service Determination***

The U.S. Forest Service has determined that the Invasive Plant Program may affect, but is not likely to adversely affect Ute ladies' tresses, based on the following:

- The U.S. Forest Service has determined that only 373 acres of potential habitat are found within U.S. Forest Service lands. Potential U.S. Forest Service habitat is surveyed regularly for this species, but no occurrences have been documented to date.
- The potential of affecting additional unsurveyed habitat or individual plants with manual, mechanical, and chemical treatment type in the action area is very low.

- The risk of these effects will be minimized by such techniques as flagging areas with Ute ladies' tresses prior to treatments and careful hand pulling of invasives closer to populations (as directed by Standard 20 in the Biological Assessment), so workers, and equipment may avoid individual plants. Potential habitat is regularly surveyed for this species on the three forests where it is suspected and Ute ladies' tresses have not been located to date.
- Any damage caused by trampling, mowing or string trimming, or the use of heavy equipment, would likely be to above ground structures and present little risk of mortality to individuals or within populations.
- The low risk of negative effects is clearly outweighed by the benefits of removing of invasive species from populations of Ute ladies' tresses.

***U.S. Fish and Wildlife Service Concurrence***

The USFWS concurs with the U.S. Forest Service's determination of may affect, not likely to adversely affect Ute ladies' tresses for based on the following:

- Because Ute ladies' tresses has not been documented within the action area, and suitable habitat has been surveyed regularly, the potential of finding the species and its habitat on U.S. Forest Service lands that is also occupied by invasive plants is so low as to be discountable.
- Even if found and invasive plants occur in the area, any damage that might be caused by trampling, mowing or string trimming, or the use of heavy equipment, would likely be to above ground structures and present little risk of individual mortality to individuals or within populations

**Kincaid's lupine (*Lupinus sulphureus kincaidii*)**

***Life History, Population, and Distribution***

Detailed accounts of the life history, taxonomy and ecology for this species can be found in the final rule listing Kincaid's lupine as threatened (U.S. Fish and Wildlife Service 2000b). It was listed concurrently with the endangered Fender's blue butterfly (*Icaricia icarioides fenderi*). The butterfly is dependent upon Kincaid's lupine as a food plant for its larvae.

Kincaid's lupine is a long-lived perennial forb species with a maximum reported age of 25 years (Wilson et al. 2003). Individual plants are capable of spreading by rhizomes, producing clumps of plants exceeding 65 feet in diameter. Subterranean spread from the root crown may connect shoots as far as 33 feet apart; population counts are thus unreliable, and apparently large populations may consist of few genetically distinct individuals. The long rhizomes do not produce adventitious roots, apparently do not

separate from the parent clump, and the clumps may be short-lived, regularly dying back to the crown (Kuykendall and Kaye 1993b). The species is distinguished from other sympatric members of the genus *Lupinus* with its low growing habit and unbranched inflorescence. Its aromatic flowers have a slightly reflexed banner, and are yellowish-cream colored, often showing shades of blue on the keel. The plants are 16 to 32 inches tall, with single to multiple unbranching flowering stems and basal leaves that remain after flowering (Kuykendall and Kaye 1993a).

Historically, burning has played a regenerative role in native prairies of western Oregon and prescribed burning has resulted in larger, robust Kincaid's lupine plants (Wilson and Clark 1997). Studies have shown that mowing and burning during plant dormancy contributed to more robust plants with taller spikes (Wilson and Clark 1997, Wilson et al. 2003). Additional studies have shown mowing outside of the growing season to be effective on reducing invasive plant competition and maintaining or enhancing populations (Barnes 2004, Wilson and Clark 2001, 1998, 1997, Kaye 2002).

A summary of Kincaid's lupine populations as of 2002 was provided to the USFWS by the Oregon Natural Heritage Information Center. Because of the difficulties in determining individuals, populations were reported by numbers of habitat patches distributed over acres of available habitat. Habitat status were reported as being either sufficient to support a self-sustaining population, sufficient to prevent demographic stochastic extinction, too small to prevent a local population from being extirpated or the population was reported extirpated. For 85 percent of the populations, habitat status was reported as either being sufficient to support a self-sustaining population or sufficient to prevent an extinction event.

Kincaid's lupine is restricted primarily to upland prairie remnants in the Willamette Valley where the species occurs as small populations at widely scattered sites on the ecotone between grasslands and forests. It is usually associated with native fescue upland prairies. Remnant prairie habitat may be threatened by agricultural practices, urban development, activities associated with forestry practices, grazing, and roadside maintenance. Herbicides were reportedly widely used during tree planting, along roadsides adjacent to agricultural fields, and for roadside weed control. Loss of Kincaid's lupine was reported at several sites due to herbicide spraying.

Kincaid's lupine populations have also been documented as being affected by invasive plants. Tall oat-grass (*Arrhenatherum elatius*) and Himalayan blackberry (*Rubus discolor*) are acknowledged threats to populations. Both are currently being managed with mowing in some locations. False brome (*Brachypodium sylvaticum*), an extremely aggressive grass, is also threatening populations. Experimentation with herbicides is providing successful preliminary results. Initial responses show no significant effect on Kincaid's lupine or Fender's blue butterfly larvae when treatments were performed late in the season while the plants were dormant (Clark et al. 2003).

As of 2002, Oregon Natural Heritage Information Center mapped 354 acres of occupied habitat divided in 104 habitat patches. Recent surveys have located two new populations

in Douglas County; one of which is now the largest known population in Oregon (Barnes 2004). Because it is difficult to count individual Kincaid's lupine plants, little information is available detailing the absolute abundance of this species.

Within the action area, only one population of Kincaid's lupine (Callahan Meadows) is documented on the Umpqua National Forest. It consists of one habitat patch distributed across approximately 5 acres. It does not occur along a roadside. It is located in an open stand of oaks adjacent to a meadow consisting of non-native annual grasses, near a known population on BLM lands.

### ***Effects of the Action***

The occurrence of Kincaid's lupine within the action area is very small, covering less than two percent of known occurrences. The species occupies habitat susceptible to infestation by invasive plant species. Potential effects to this plant would be accidental pulling or trampling, because vegetative individuals are difficult to see. These effects are limited primarily to injury of above ground structures with little risk of individual mortality.

The risk of accidental pulling or trampling of Kincaid's lupine and other non-target species will likely be minimized by techniques such as flagging occupied areas prior to treatments, and careful hand pulling of invasive species close to individuals or populations, as directed by Standards 19 and 20 in the Biological Assessment. Workers, operators, and applicators could then avoid effects to individual Kincaid's lupine plants. The potential of affecting additional undiscovered populations of Kincaid's lupine on U.S. Forest Service lands is low because the amount of potential habitat is limited. Potential negative effects to Kincaid's lupine are clearly outweighed by the benefits of reducing or removing invasive plant species.

Accidental pulling or trampling may occur because vegetative individuals are difficult to see. These effects are limited primarily to injury of above ground structures with little risk of individual mortality. The most likely mechanical methods used would be mowing, string trimming, hot foam application, and the use of heavy equipment. These activities could sever or crush individual plants or plant parts, and if timed to conflict with flowering or fruit/seed development, would have the most potential for impact. Individual plants could be damaged or killed by accidental application or drift of the herbicide from ground based applications. Personnel applying the herbicide could crush or damage individual plants. However, experimentation with herbicides to control false brome, the primary potential invasive, is providing successful preliminary results. Initial responses show no significant effect on Kincaid's lupine or Fender's blue butterfly larvae when treatments were performed late in the season when the plants were dormant (Clark et al. 2003).

### ***U.S. Forest Service Determination***

The U.S. Forest Service has determined that the Invasive Plant Program may affect, but is not likely to adversely affect Kincaid's lupine, based on the following:

- The potential of affecting additional undiscovered populations of Kincaid's lupine on U.S. Forest Service lands is low because the amount of potential habitat is limited.
- Potential negative effects to Kincaid's lupine are clearly outweighed by the benefits of reducing or removing invasive plant species.
- The risk of accidental pulling or trampling of Kincaid's lupine and other non-target species will likely be minimized by techniques such as flagging occupied areas prior to treatments, and careful hand pulling of invasive species close to individuals or populations, as directed by Standards 19 and 20 in the Biological Assessment.
- Potential effects to this plant would be accidental pulling or trampling, because vegetative individuals are difficult to see. These effects are limited primarily to injury of above ground structures with little risk of individual mortality.
- Individual plants could be damaged or killed by accidental application or drift of the herbicide from ground based applications. However, experimentation with herbicides to control false brome, with limited effect to Kincaid's lupine, is providing successful preliminary results.

***U.S. Fish and Wildlife Service Concurrence***

The USFWS concurs with the U.S. Forest Service's determination of may affect, not likely to adversely affect for Kincaid's lupine based on the following:

- Kincaid's lupine has been documented at only a single location within the action area. The location is known and the species is easily protected.
- Application of Standard 20 in the Biological Assessment is expected to further minimize the small potential for negative effects.
- Because little habitat exists within the action area, the possibility of affecting additional unknown plants or populations is low.
- Initial trials using herbicides to control a primary invasive grass is showing successful preliminary results.
- Potential physical effects to plants carry a relatively low risk of individual mortality. In total, these circumstances render the potential for effects so low as to be discountable.

## **Warner sucker (*Catostomus warnerensis*)**

### ***Life History, Population, and Distribution***

Documented accounts of the taxonomy, life history and behavior can be found in the final rule listing Warner sucker as threatened (U.S. Fish and Wildlife Service 1985a) and the final recovery plan (U.S. Fish and Wildlife Service 1998a). The distribution of this species is fairly well known, but limited information is available on stream habitat requirements and spawning habits. Relatively little is known about feeding, fecundity, and recruitment, age at sexual maturity, natural mortality, or interactions with introduced game fishes.

The Warner sucker is a moderately-large catostomid reaching a maximum size of 20 inches. The Warner sucker currently inhabits the lake and low gradient stream reaches of the Warner Valley, and is represented by a larger lake morph and a small stream morph.

Sexual maturity occurs at an age of 3 to 4 years. Spawning usually occurs in April and May when fish migrate up streams, although variation in water temperature and stream flow may result in either earlier or later spawning. The Warner sucker spawns in sand or gravel in slow pools and along lakeshores (U.S. Fish and Wildlife Service 1998a).

Larvae are found in shallow backwater pools or on stream margins where there is no current, often among or near macrophytes. Young of the year are often found over deep, still water from midwater to the surface, but also move into faster flowing areas near the heads of pools (Coombs et al. 1979).

Larvae venture near higher flows during the daytime to feed on planktonic invertebrates but avoid the mid-channel water current at night. This aversion to downstream drift may indicate that spawning habitat is also used as rearing grounds during the first few months of life (US Fish and Wildlife Service 1998). None of the studies conducted thus far have succeeded in capturing suckers younger than 2 years old in the lakes, and it has been suggested that they do not migrate down from the streams for 2 to 3 years (Coombs et al. 1979). The absence of young suckers in the lakes, even in years following spawning in the lakes, could be due to predation by introduced fishes (White et al. 1991).

As the suckers grow, they gradually become generalized benthic feeders on diatoms, filamentous algae, and detritus. Juvenile suckers (1 to 2 years old) are usually found at the bottom of deep pools or in other habitats that are relatively cool and permanent such as near springs. As with adults, juveniles prefer areas of the streams that are protected from the main flow (Coombs et al. 1979).

Submersed and floating vascular macrophytes are often a major component of sucker-inhabited pools, providing cover and harboring planktonic crustaceans which make up most of the young of the year sucker diet. Rock substrates such as large gravel and boulders are important in providing surfaces for epilithic (living on the surface of stones, rocks, or pebbles) organisms upon which adult stream resident suckers feed, and finer gravels or sand are used for spawning. Siltation of sucker stream habitat increases the

area of soft stream bed necessary for macrophyte growth, but embeds the rock substrates utilized by adult suckers for foraging and spawning. Embeddedness, or the degree to which hard substrates are covered with silt, has been negatively correlated with total sucker density (Tait and Mulkey 1993a).

Habitat use by lake resident Warner suckers appears to be similar to that of stream resident suckers in that adult suckers are generally found in the deepest available water where food is plentiful. Not surprisingly, this describes much of the habitat available in Hart, Crump, and Pelican Lakes as well as the ephemeral lakes north of Hart Lake. Most of these lakes are shallow and of uniform depth (the deepest is Hart Lake at 11.3 feet maximum depth), and all have mud bottoms that provide the suckers with abundant food in the form of invertebrates, algae, and organic matter.

Historically abundant and widely-distributed in the basin, the Warner sucker still maintains sizable numbers in a few habitats. Drought in the 1980's and 1990's dried most lake and slough habitats and basin-wide surveys conducted from 1993 to 1997, after the lakes had refilled, documented the recolonization of these habitats by native and non-native fish. In the Warner lakes, predation on Warner suckers by largemouth bass (*Micropterus salmoides*) and white crappie (*Pomoxis annularis*) is thought to be one of the most important mortality factors controlling their population. Large numbers of sucker fry are thought to be consumed by bass and crappie as they enter the lakes from tributaries. Diversions and weirs impede sucker spawning migrations into the tributaries and magnify the impact of the predation that occurs in the lakes. As a result, the population of suckers in the lake is primarily older individuals. Recently, only stream morph suckers have exhibited frequent recruitment, indicated by a high percentage of young of the year and juveniles in Twelvemile and Honey Creeks (Tait and Mulkey 1993 a, b).

The Warner sucker is endemic to the Warner Valley in southeast Oregon, an endoreic (closed) sub-basin of the Great Basin area. When adequate water is present, Warner suckers may inhabit all the lakes, sloughs, and potholes in the Warner Valley. Stream resident populations are found in Honey Creek, Snyder Creek, Twentymile Creek, and Twelvemile Creek. Most of the habitat occupied by Warner suckers is located on BLM administered lands in southeast Oregon and a small portion in northwest Nevada. Additional habitat is located on private lands, and the Hart Mountain National Antelope Refuge. The upper portions of two creeks, Deep Creek and Honey Creek, lie on lands administered by the Fremont National Forest, but a barrier on Deep Creek prevents Warner suckers from accessing the National Forest land. Warner suckers could access Honey Creek when and if their populations and water flow are sufficient. However, several years of inventory efforts have failed to find Warner suckers on the National Forest. The closest resident populations of Warner suckers on Honey Creek are known to exist 2 to 3 miles downstream from U.S. Forest Service lands. Resident populations in Deep Creek and Twentymile Creek exist even further downstream from U.S. Forest Service lands.

### ***Effects of the Action***

Some treatment methods, including mechanical (working with mechanical equipment adjacent to stream), cultural (grazing disturbance adjacent to streams), and prescribed fires (removing upland vegetation) immediately adjacent or within the drainage of occupied sucker habitat may have the potential to result in localized increases in sediment which may affect Warner suckers if present. Delivery of fine sediment could create conditions which may embed the rock substrates utilized by adult suckers for foraging and spawning. This is unlikely to occur, however, because of the low incidence of weeds currently inventoried on National Forest land in the entire Warner Lakes sub-basin, which greatly reduces the likelihood of overlap between projects and Warner sucker habitat.

Some herbicide applications may affect aquatic vegetation used by larval, juvenile, and adult for habitat and cover and/or food resources. Chemicals which may affect aquatic plants include chlorsulfuron, imazapic, imazapyr, metsulfuron methyl, picloram, sulfometuron methyl, and triclopyr. Exposure scenarios are based on the SERA evaluations of potential herbicide delivery calculated for 10 acres treated adjacent to a 1.8 cubic feet per second stream with no buffers, a conservative scenario. Triclopyr is limited to direct application methods, so it would not reach the concentrations resulting from this scenario. If herbicides enter the system in sufficient quantity to affect aquatic vegetation used by Warner sucker for habitat, hiding cover, and/or food resources, it may increase predation potential and temporarily reduce food resources. Glyphosate with surfactant and triclopyr TEA have a potential to affect invertebrates, an important prey resource for Warner suckers. If herbicide entered slow margins of streams or lakes, treatments could affect food resources for Warner suckers, potentially resulting in a temporary reduction in food supply.

Current fish distribution is 2 to 3 miles downstream of U.S. Forest Service lands. It is unlikely that projects would be large enough to deliver any negative effects (sediment or herbicides) downstream to that distance. Warner sucker presently does not occur within the action area, but potentially could into the future. It is unlikely that treatment methods would increase delivery of sediment or herbicide to nearby streams because there are only 29 acres of invasive plants currently inventoried on National Forest land in the entire Warner Lakes sub-basin, greatly reducing the likelihood of overlap between projects and occupied habitat. If Warner sucker is located within the action area in the future in Honey Creek, it is unlikely projects would occur in or adjacent to occupied habitat and therefore would not result in adverse effects to Warner sucker.

### ***U.S. Forest Service Determination***

The U.S. Forest Service determined that the Invasive Plant Program may affect, but is not likely to adversely affect the Warner sucker based on the following:

- Warner suckers do not occur within the action area, though they could occur in the future.

- There is very little, if any, overlap between inventoried invasive plants and Warner sucker habitat, indicating a low likelihood that treatment projects would occur in proximity to their habitat.
- Low acreages of invasive plants inventoried indicate a low likelihood that projects could be large enough to create effects 2 to 3 miles downstream to the current Warner sucker population.
- Low acreages of invasive plants inventoried indicate a low likelihood that projects could substantially affect food resources in areas that might be occupied in the future.

### ***U.S. Fish and Wildlife Service Concurrence***

The USFWS concurs with the U.S. Forest Service's determination of may affect, not likely to adversely affect the Warner sucker based on the following reasons:

- It is unlikely projects would occur in or adjacent to habitat occupied by Warner suckers. Currently Warner suckers are not located on National Forest lands, and even though there is a possibility suckers may occur into the future, several years of inventory efforts have failed to locate them.
- It is highly unlikely that any treatment methods which increase delivery of sediment or herbicide in or adjacent to Warner sucker habitat because invasive weed inventories indicate only 29 acres of invasive plants are currently inventoried on National Forest land in the entire Warner Lakes sub-basin, greatly reducing the likelihood of overlap between projects and occupied habitat.

## **BIOLOGICAL OPINION AND CONFERENCE REPORT**

This section contains the USFWS Biological Opinion on the effect of the U.S. Forest Service's determination that the Invasive Plant Program on the bald eagle (*Haliaeetus leucocephalus*), northern spotted owl (*Strix occidentalis caurina*), marbled murrelet (*Brachyramphus marmoratus*), western snowy plover (coastal population) (*Charadrius alexandrinus nivosus*), Oregon silverspot butterfly (*Speyeria zerene hippolyta*) and its critical habitat, showy stickseed (*Hackelia venusta*), MacFarlane's four o'clock (*Mirabilis macfarlanei*), Spalding's catchfly (*Silene spaldingii*), Lost River sucker (*Delistes luxatus*), shortnose sucker (*Chasmistes brevirostris*), Oregon chub (*Oregonichthys crameri*), and bull trout (*Salvelinus confluentus*) (Coastal/Puget Sound, Columbia River, and Klamath distinct population segments) and critical habitat for the Columbia River and Klamath distinct population segments of bull trout. It also contains the Formal Conference Report on proposed critical habitat for the western snowy plover and Coastal/Puget Sound distinct population segment of bull trout.

## **Bald eagle**

### ***Status and baseline***

A detailed account of the taxonomy, ecology, and reproductive characteristics of the bald eagle is found in the Pacific States Bald Eagle Recovery Plan (U.S. Fish and Wildlife Service 1986), the final rule to reclassify the bald eagle from endangered to threatened in all of the lower 48 states (U.S. Fish and Wildlife Service 1995b), the proposed rule to remove the bald eagle from the Endangered Species List in the lower 48 states (U.S. Fish and Wildlife Service 1999d), and the Biological Assessment (U.S. Forest Service 2005).

### *Listing History*

In response to species decline, the Secretary of the Interior, on March 11, 1967, listed those populations of the bald eagle south of the 40<sup>th</sup> parallel as endangered under the Endangered Species Preservation Act of 1966. On February 14, 1978, the bald eagle was listed throughout the lower 48 states as endangered except in Michigan, Minnesota, Wisconsin, Washington, and Oregon, where it was designated as threatened. The bald eagle was reclassified in 1995 from endangered to threatened as a result of the significant increase in numbers of nesting pairs, increased productivity and expanded distribution.

On July 6, 1999, the USFWS published a proposal to remove bald eagle from the list of threatened and endangered species (U.S. Fish and Wildlife Service 1999d). This proposal is based on goals having been met or exceeded in all five recovery areas (Northern, Chesapeake Bay, Southeast, Southwest, and Pacific). Further, threats to the species had been eliminated or substantially reduced. At the time of writing this biological opinion, a final decision had not been made on the delisting proposal.

### *Distribution*

The bald eagle ranges throughout much of North America, nesting on both coasts and north into Alaska, wintering as far south as Baja California. The largest breeding populations in the contiguous United States occur in the Pacific Northwest states, the Great Lake states, Chesapeake Bay and Florida. Oregon and Washington are important for wintering bald eagles in the conterminous United States.

Bald eagles are found throughout the action area on all National Forests and Scenic Areas. The National Forests in the action area are located within a portion of the seven-state Pacific Recovery Area (Idaho, Nevada, California, Oregon, Washington, Montana, and Wyoming). More than 25 percent of all wintering bald eagles in the lower 48 states occur in the Pacific Recovery Area, with the majority occurring in western Washington and the Klamath Basin of Oregon and California.

Most nesting territories in Washington are located on the San Juan Islands, along the coastline of the Olympic Peninsula, along the Straits of Juan de Fuca, Puget Sound, Hood Canal, and the Columbia River. In Oregon, nesting eagles are more evenly distributed with about 70 percent occurring adjacent to large bodies of water in the inland mountains and valleys in the western half of the state (Rees and Lee 1990). Wintering concentration

areas for bald eagles in Washington and Oregon are along salmon spawning streams and waterfowl wintering areas (Stinson et al. 2001).

### *Life History*

Suitable habitat for bald eagles is characterized by accessible foraging areas and trees that are large enough for nesting and roosting (Stalmaster 1987). Food availability, such as aggregations of waterfowl or salmon runs, is a primary factor attracting bald eagles to wintering areas and influences nest and territory distribution (Stalmaster 1987, Keister et al. 1987).

Bald eagles generally nest in the same territories each year and often use the same nest repeatedly, although alternate nests in the territory may be used as well. Bald eagle nests in the Pacific Recovery Area are usually located in uneven-age stands of coniferous trees with old-growth forest components (U.S. Fish and Wildlife Service 1986) that are located within 1 mile of large bodies of water (Stalmaster 1987). Factors such as relative tree height, diameter, tree species, position in the surrounding topography, distance from the water, and distance from disturbance influence nest site selection. Nest trees must be sturdy and open to support a nest that is often 5 feet wide and 3 feet deep. Suitable perch trees, which bald eagles use for guarding the nest, loafing, and foraging, are also a component of suitable nesting habitat (Stalmaster 1987, Buehler 2000).

Nesting eagles are sensitive to disturbance (U.S. Fish and Wildlife Service 1986). The critical period in Washington and Oregon when human activities could disturb occupied nest sites extends from January 1 until August 31. Nest initiation, including courtship and nest building, occurs from January through March. Incubation occurs from March until late May, and young are in nests from early April through mid-August. Young usually remain in the area of the nest through August.

Bald eagles feed primarily on fish during the breeding season, and feed on waterfowl, seabirds and carrion during the winter (U.S. Fish and Wildlife Service 1995b).

### *Population Dynamics*

The USFWS (1999) estimated that the current nesting population in the lower 48 States constitutes more than a tenfold increase from the known population level in 1963. There were over 5,700 occupied breeding areas in 1998. The bald eagle population has essentially doubled every 7 to 8 years during the past 30 years. The Pacific Northwest contains a significant concentration of reproducing bald eagles and the bald eagle population in the Pacific Recovery Area experienced a 50 percent increase between 1985 and 1989 (Rees and Lee 1990).

In the Pacific Recovery Area population delisting goals have been met since 1995, the productivity objective of an average of 1.0 young per occupied breeding area has been met since 1990, and the average success rate for occupied breeding areas of 65 percent has been exceeded since 1994 (U.S. Fish and Wildlife Service 1999d). However, as of 1999, the distribution objective among management zones within the recovery area had not yet been fully achieved.

Of the seven states covered in the Pacific Recovery Area, Washington State supports the largest breeding and wintering populations (U.S. Fish and Wildlife Service 1986). In 2001, 684 nest territories were occupied in Washington (WDFW 2003, unpub. data). Most nesting territories in Washington are located on the San Juan Islands, along the coastline of the Olympic Peninsula, along the Straits of Juan de Fuca, Puget Sound, Hood Canal, and the Columbia River. Wintering concentration areas in Washington are along salmon spawning streams and waterfowl wintering areas (Stinson et al. 2001). Oregon supports approximately 200 nesting pairs of bald eagle which places the population of the eagles in the action area at approximately 12 percent of the total listed population.

### *Threats*

Contaminants, in particular organochlorine compounds such as dichloro-diphenyl-trichloroethane (DDT), are recognized as one of the primary causes of the decline of bald eagle populations (U.S. Fish and Wildlife Service 1986, 1999). DDT was banned, and registrations cancelled for other toxic persistent chemicals such as dieldrin, heptachlor and chlordane for all but the most restricted uses. The use of polychlorinated biphenyls has also been phased out. The reduction of these chemicals in the environment has resulted in a reduction of these levels of contaminants in bald eagles and a steady increase in bald eagle numbers (Schmitt and Bunck 1995). However, residues of PCBs and dichloro-diphenylethylene continue to depress productivity in certain locations such as the Channel Islands in California, the Great Lakes and the Lower Columbia River (U.S. Fish and Wildlife Service 1999d). Bald eagles continue to be affected by accumulated chemicals such as mercury (U.S. Fish and Wildlife Service 1999d), as well as poisoning by lead, organophosphorus and carbamate (Franson et al. 1995).

Human disturbance is a continuing threat to bald eagles, which may increase with increasing human populations and development (U.S. Fish and Wildlife Service 1999d). Bald eagles vary in their sensitivity to disturbance, but generally nest away from human disturbance (Stinson et al. 2001). Distance, duration, visibility and position of an activity affect bald eagle response, with distance being the most important factor (Grubb and King 1991, Grubb et al. 1992, Watson 2004). The response of nesting bald eagles to human activity can range from behavioral, such as flushing or reduced nest attendance, to nest failure (Frazier et al. 1985, McGarigal et al. 1991, Grubb and King 1991, Grubb et al. 1992, Anthony et al. 1995, Steidl and Anthony 1996, Watson and Pierce 1998a). Wintering bald eagles may also be displaced from foraging areas by human activities (Stalmaster and Newman 1978, Stalmaster and Kaiser 1998). The magnitude of response varies inversely with distance, and increases with disturbance duration, the number of vehicles or pedestrians per event, visibility, sound, and position in relation to nest (above, at eye-level, or below the nest) (Grubb and King 1991, Watson 2004). Watson and Pierce (1998a) found that vegetative screening and distance were the two most important factors determining the impact of disturbances. Heavy vegetative screening can dramatically reduce bald eagle response to human activity. Human activities that are distant, of short duration, out of sight, few in number, below the level of the nest, and quiet have the least impact (Grubb and King 1991, Watson 2004).

### *Ongoing Conservation*

The bald eagle is provided comprehensive statutory and regulatory protection under Federal and State law. The recovery of bald eagles is due in part to habitat protection and management action initiated under the ESA. Sections 7 and 9 of the ESA (16 U.S.C. 1531 et seq.) protect individual bald eagles and their active nests on public and private land.

The Bald Eagle Protection Act (16 U.S.C 668) prohibits without specific authorization the possession, transport, or take of any bald or golden eagle, their parts, nests, or eggs. The Migratory Bird Treaty Act (16 U.S.C. 703) prohibits without specific authorization the possession, transport, or take of any migratory bird (including bald eagles), their parts, nests, or eggs. The Lacey Act (16 U.S.C. 3372 and 18 U.S.C. 42-44) among other provisions, makes it unlawful to export, import, transport, sell, receive, acquire, or purchase any bald eagle taken or possessed in violation of any law.

### *Conservation Needs*

Human related impacts will continue into the future, and may increase locally with the continued growth of the eagle population and subsequent conflicts with expanding human activities. However, through existing statutes, knowledge gained and partnerships developed in the recovery process, many of these conflicts can be avoided or minimized. Conservation measures and goals for the five regions and the attainment of those goals are described in the federal register notice proposal to delist the bald eagle (U.S. Fish and Wildlife Service 1999d).

Conservation efforts on the National Forests within the action area consist of regional guidelines for management of bald eagles (Rees and Lee 1990) using local management guides and guidelines as appropriate; producing site management plans for nest and roost sites as appropriate; and participating in, and providing funding for, annual surveys. Guidelines generally restrict activity in proximity to eagle nests or roosts, including activities that may be an adequate distance but are within a direct line of sight from the nest.

### *Effects of the Action*

Manual, mechanical, cultural, prescribed fire, and herbicide treatments may involve human activity or equipment that introduces an increased level of sound or visual stimuli into the environment. The disturbance from noise or activity near or within line of sight of a bald eagle nest or roost may disrupt nesting and feeding behaviors, causing them to flush from the nest or miss a feeding attempt. Biological treatments are not anticipated to have any effect on bald eagles due to the very limited human presence on the ground involved in these treatments.

Disturbance to nesting bald eagles is expected to be rare because most of the eagles in Oregon and Washington nest outside of the action area and therefore there is a low likelihood of treatments occurring in occupied nesting territories. Most projects will be conducted along roads or in disturbed sites and bald eagle nests are often located away from these areas reducing the likelihood that treatments and bald eagle nests will

intersect. National Forests on the eastern slopes of the Cascades anticipate the greatest number of invasive plant treatments and have the smallest number of bald eagles, further reducing the likelihood of eagle nests and invasive plant treatments overlapping. Bald eagles that nest near disturbed sites are often more habituated to disturbance than eagles nesting in remote locations and may be more tolerant to treatment activities.

The smoke generated from prescribed burning of invasive plants is not anticipated to be heavy enough to impact a bald eagle nest, due to the light nature of the fuels and therefore, adverse effects are not anticipated from smoke during prescribed burning activities.

The U.S. Forest Service found that the results of exposure scenarios to bald eagle indicate that no herbicide included in the Invasive Plant Program is likely to adversely affect bald eagle. Bald eagles are not likely to be directly sprayed or encounter vegetation that has been directly sprayed because infestations in forested habitat are not suitable for aerial applications and only aerial application could result in herbicide application in a manner likely to be encountered by bald eagles. In addition, there was no risk to bald eagles from eating contaminated fish because expected doses to fish-eating birds for all herbicides, even with very conservative assumptions, are well below any known NOAEL (U.S. Forest Service 2005, Appendix B).

Wintering bald eagles are not as restricted to one location and are not as sensitive to disturbance as nesting eagles and there will be few, if any, invasive plant treatments in the winter, therefore, no adverse effects from treatments to wintering bald eagle are anticipated.

#### *Summary*

Manual, mechanical, cultural, prescribed fire, and herbicide treatments have the potential to result in short-term disturbance to bald eagles where treatments occur near occupied nests. These activities will be scattered in small patches throughout the eagles range, will impact a very small portion of the eagles in the action area, and will generally be short term and infrequent, requiring one to two treatments over 1 or 2 days. Effects from activities are not anticipated to last longer than the duration of the treatments.

#### ***Cumulative Effects***

Cumulative effects for the purposes of consultation under ESA are defined as, “the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area...” (50 CFR, Part 402). Future federal actions will be subject to the consultation requirements established in Section 7 of the ESA, and therefore, are not considered cumulative to the proposed action.

Timber harvest on private and State lands, as well as increased development in rural areas and increased recreation will continue to cause habitat loss and disturbance to bald eagles.

Oregon Forest Practices Rules and Washington's Bald Eagle Protection Rule protect bald eagle territories from timber harvest and disturbance during the breeding season. Because of these State required protections, it is unlikely that any currently occupied sites will be lost on non-federal land in the short term. These impacts are expected to have localized effects and not pose a threat to the stability of the species population (U.S. Fish and Wildlife Service 1999d).

### ***Conclusion***

The Invasive Plant Program will not jeopardize the continued existence of the bald eagle by, directly or indirectly, reducing appreciably the likelihood of survival and recovery of the bald eagle in the wild by reducing reproduction, numbers, or distribution of the species.

- The primary potential effect from this project would be disturbance of nesting bald eagles. Because treatments under this plan are of short duration and infrequent, we do not anticipate any substantial reduction in productivity and we do not expect these actions to lead to nest abandonment or other reductions in reproduction.
- No individual mortality (adult or young) is anticipated from treatments under this plan, therefore no change in distribution is anticipated.
- Bald eagle nests are scattered throughout the action area. Forests with the greatest anticipated weed treatment programs occur in areas with the fewest bald eagle nests (e.g. eastern Washington, Blue Mountains). Therefore, most projects are not likely to intersect bald eagle nest sites. Even if disturbed, eagles do not generally permanently abandon nesting territories. Further, only a small portion of the nesting eagles in Oregon and Washington occur within or immediately adjacent to the National Forests. Therefore, we do not anticipate any change in distribution as a result of actions under the Invasive Plant Program.

Therefore, the U.S. Forest Service Pacific Northwest Region Invasive Plant Program Plan is not anticipated to reduce the reproduction, numbers, or distribution of bald eagles.

### ***Conservation Recommendations***

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

Conduct treatments in the vicinity of bald eagle nest sites outside of the breeding season (January through August) where practicable. Avoid treatments within 0.25 miles (0.5 line of sight) of nests during the breeding season, when practicable.

## **Northern spotted owl**

### ***Status and baseline***

Detailed accounts of the taxonomy, ecology, and reproductive characteristics of the northern spotted owl (spotted owl) are found in the 1987 and 1990 USFWS Status Reviews (U.S. Fish and Wildlife Service 1987, U.S. Fish and Wildlife Service 1990b), the 1989 Status Review Supplement (U.S. Fish and Wildlife Service 1989), the Interagency Scientific Committee Report (Thomas et al. 1990), the Forest Ecosystem Management Assessment Team Report (USDA and USDI 1993), the final rule listing the spotted owl as a threatened species (U.S. Fish and Wildlife Service 1990c), the final rule designating critical habitat (U.S. Fish and Wildlife Service 1992b), the draft recovery plan (U.S. Fish and Wildlife Service 1992c), and the 5 Year Review for the Northern Spotted Owl (U.S. Fish and Wildlife Service 2004b). The northern spotted owl is one of three subspecies of spotted owls currently recognized by the American Ornithologists' Union and is typically associated with old-growth forested habitats throughout the Pacific Northwest. The taxonomic separation of these three subspecies is supported by genetic (Barrowclough and Gutierrez 1990), morphological (Gutierrez et al. 1995), and biogeographic information (Barrowclough and Gutierrez 1990).

### ***Listing History***

The northern spotted owl was listed as threatened on June 26, 1990 (U.S. Fish and Wildlife Service 1990c). It was listed due to widespread habitat loss across the entirety of its range and the inadequacy of existing regulatory mechanisms to provide for its conservation. Critical habitat for the northern spotted owl was designated on January 15, 1992 (U.S. Fish and Wildlife Service 1992b).

On November 18, 2004, the USFWS completed a 5-year review of the northern spotted owl. As a result of the review, the USFWS has concluded that the species continues to warrant protection under the ESA as a threatened species.

### ***Distribution***

The current range and distribution of the northern spotted owls extends from southern British Columbia through western Washington, Oregon, and California, as far south as Marin County (U.S. Fish and Wildlife Service 1990b). The southeastern boundary of its range is the Pit River area of Shasta County, California. The range of the northern spotted owl is partitioned into 12 physiographic provinces (provinces), based upon recognized landscape subdivisions exhibiting different physical and environmental features (Thomas et al. 1993), including four in Washington (Washington Cascades East, Olympic Peninsula, Washington Cascades West, Western Lowlands), five in Oregon (Oregon Coast Range, Willamette Valley, Oregon Cascades West, Oregon Cascades East, Klamath Mountains), and three in California (California Coast, California Klamath, California Cascades). Although the current range of the spotted owl is similar to its historical range where forested habitat still exists, the owl is extirpated or very uncommon in certain areas where habitat no longer common, such as in southwest Washington.

Within the action area, spotted owl are found on the Columbia River Gorge National Scenic Area, and the Deschutes, Gifford Pinchot, Mount Baker-Snoqualmie, Mount Hood, Okanogan, Olympia, Rogue River, Siskiyou, Siuslaw, Umpqua, Wenatchee, Willamette, and Winema National Forests. These administrative units encompass almost 16.5 million acres of federally managed land, which equates to about 68 percent of the nearly 24.1 million acres of federally managed land within the range of the northern spotted owl. Not all of the acreages on these forests provide suitable habitat for spotted owls.

### *Life History*

The spotted owl is a relatively long-lived nocturnal bird (average life span approximating eight years) with a naturally low reproductive rate. Spotted owls do not generally reach sexual maturity until after 2 years and once an adult, females lay an average of two eggs per clutch (range 1-4 eggs). They do not necessarily nest every year. Nest sites are usually located within stands of old-growth and late-successional forest dominated by Douglas-fir, and consist of existing structures such as cavities, broken tree tops, or mistletoe (*Arceuthobium* spp.) brooms (Forsman et al. 1984, Blakesley et al. 1992, LaHaye and Gutierrez 1999). In general, courtship and nesting behavior begins in February or March with nesting occurring from March to June. The timing of nesting and fledging varies with latitude and elevation (Forsman et al. 1984). After the young fledge from the nest, they are still dependent on their parents until they are able to fly and hunt on their own. Parental care continues post-fledging into September (U.S. Fish and Wildlife Service 1990b), and sometimes into October (Forsman et al. 1984). During this time the adults may not roost with the young during the day, but they will respond to begging vocalizations by bringing food to the young (Forsman et al. 1984).

The nesting season for the spotted owl has been defined by early and late seasons. The early season includes egg laying, incubation, hatching, and fledging of chicks. The late season includes post fledging parental care within the nesting stand. The early nesting season for the spotted owl in Washington has been identified as the period from March 1 through July 15. For the Fremont-Winema National Forest in Oregon, the early nesting season occurs from March 1 through August 15. For the Siuslaw National Forest in Oregon, the early nesting period occurs from March 1 through July 7. On the Deschutes National Forest, where data are lacking for fledging dates, the period extends from March 1 through September 30. Post fledging care varies geographically but generally extends into September. Spotted owls are considered to be more sensitive to disturbance in the early nesting season.

Composition of prey in the spotted owl's diet varies geographically and by forest type. Generally, flying squirrels (*Glaucomys sabrinus*) and red tree voles (*Arborimus longicaudus*) are more prominent prey items for spotted owls in Douglas-fir and western hemlock forests (Forsman et al. 1984), whereas dusky-footed woodrats (*Neotoma fuscipes*) dominate the diet in the Oregon and California Klamath provinces (Forsman et al. 1984, Ward et al. 1998). Depending on location, other prey species (*i.e.*, mice, birds, and insects) also comprise a small portion of the spotted owl diet (Forsman et al. 1984).

Spotted owl home range size varies by physiographic province and generally increases from south to north (U.S. Fish and Wildlife Service 1990c). Based on available radio-telemetry data (Thomas et al. 1990), the USFWS estimated median annual home range size for the spotted owl by physiographic province throughout the range of the owl. Because the actual configuration of the home range is rarely known, the estimated home range of an owl pair is represented by a circle centered upon an owl activity center, with an area approximating the provincial median annual home range. The outer extent of an owl's territory is represented by a 1.2 to 2.1 mile radius circle.

Spotted owls exhibit high site fidelity, often using the same nest each year. Both members of a pair vigorously defend their territory through vocalizations and visual displays.

Spotted owls rely on older forested habitats because they contain the structures and characteristics required for nesting, roosting, foraging, and dispersal. These characteristics include a multilayered, multi-species canopy dominated by large overstory trees; moderate to high canopy closure; a high incidence of trees with large cavities and other types of deformities; numerous large snags; an abundance of large, dead wood on the ground; and open space within and below the upper canopy for owls to fly (Thomas et al. 1990, U.S. Fish and Wildlife Service 1990c). Forested stands with high canopy closure also provide thermal cover as well as protection from predation. In some ecotypes, recent landscape-level analyses suggest that a mosaic of late-successional habitat interspersed with other vegetation types may benefit spotted owls more than large, homogeneous expanses of older forests (Franklin et al. 2000, Meyer et al. 1998).

#### *Population Dynamics*

The spotted owl embodies a life-history strategy typically referred to as "K-selected". It is a relatively long-lived organism, produces fewer and larger young, invests significantly in parental care, experiences later or delayed maturity, and exhibits high adult survivorship (Begon and Mortimer 1986). The life-history pattern of spotted owls appears to be one in which a long reproductive life span allows for some eventual recruitment of offspring even if recruitment does not occur each year (Franklin et al. 2000).

In 1994 there were 5,431 known spotted owl pairs or resident singles: 851 sites (16 percent) in Washington, 2,893 (53 percent) in Oregon, and 1,687 (31 percent) in California (U.S. Fish and Wildlife Service 1995c). The actual population of owls across the range was undoubtedly larger than either of these counts because some areas were unsurveyed (U.S. Fish and Wildlife Service 1992c, Thomas et al. 1993).

Because existing survey coverage and effort are insufficient to produce reliable population estimates, researchers use other indices, such as demographic data, to evaluate trends in spotted owl populations. In January 2004, two meta-analyses were conducted on the rate of population change (Anthony et al. 2004). Data were analyzed separately for 13 individual study areas, as well as simultaneously across all study areas (true meta-analysis). Estimates of  $\lambda_{RJS}$  ranged from 0.896-1.005 for the 13 areas, and all but one of

the estimates were  $<1.0$  suggesting population declines for most areas (Anthony et al. 2004).

### *Threats*

The draft recovery plan for the northern spotted owl (U.S. Fish and Wildlife Service 1992c) identified significant threats to the owl by physiographic province. These threats included low populations, overall population decline, limited habitat, declining habitat, distribution of habitat or populations, isolation of provinces, predation and competition, lack of coordinated conservation measures, and vulnerability to natural disturbance.

The amount of spotted owl habitat continues to decline on a range-wide basis across all ownerships, although at a rate that is less than in the years prior to the listing of the spotted owl, particularly on Federal lands within the Northwest Forest Plan boundary (Courtney et al. 2004). Approximately 7.4 million acres of suitable habitat were estimated to exist on Federal lands in 1994. As of December 2003, action agencies have consulted with the USFWS on the removal of 155,999 acres (2.11 percent) of suitable habitat on Federal lands.

The expansion of barred owls into spotted owl habitat has is also a threat to spotted owls. Barred owls apparently compete with spotted owls through a variety of mechanisms, including prey overlap (Hamer et al. 2001), habitat overlap (Hamer et al. 1989, Dunbar et al. 1991, Herter and Hicks 2000, Pearson and Livezey 2003) and agonistic encounters (Leskiw and Gutiérrez 1998, Pearson and Livezey 2003). New information on encounters between barred owls and northern spotted owls comes primarily from anecdotal reports which corroborate initial observations that barred owls react more aggressively towards northern spotted owls than the reverse (Courtney et al. 2004, pg. 7-25). There is also limited circumstantial evidence of barred owl predation on northern spotted owls (Leskiw and Gutiérrez 1998, Johnston 2002). Information collected to date indicates that encounters between these two species tend to be agonistic in nature, and that the outcome is unlikely to favor the northern spotted owl (Courtney et al. 2004).

At the time of listing, there was recognition that catastrophic wildfire posed a threat to the spotted owl (U.S. Fish and Wildlife Service 1990c). New information suggests that fire may be more of a threat than was previously thought. In particular, the rate of habitat loss in the relatively dry East Cascades and Klamath provinces has been greater than expected (see Habitat Trends). Furthermore, we now recognize that our ability to protect spotted owl habitat and viable populations of spotted owls from these large fires through risk-reduction endeavors is largely uncertain (Courtney et al. 2004).

West Nile virus has been identified as a potential threat of unknown magnitude to the northern spotted owl (Courtney et al. 2004). West Nile virus has killed millions of wild birds in North America since it arrived in 1999 (McLean et al. 2001, Caffrey 2003, Marra et al. 2004). Mosquitoes are the primary carriers (vectors) of the virus which causes encephalitis in humans, horses, and birds. Mammalian prey may also play a role in spreading West Nile virus among predators, like northern spotted owls. Owls and other predators of mice can contract the disease by eating infected prey (Garmendia et al. 2000,

Komar et al. 2001). Recent tests of tree squirrels (which includes flying squirrels) from Los Angeles County, California, found over 70 percent were positive for West Nile virus (Courtney et al. 2004). One captive northern spotted owl in Ontario, Canada, is known to have died from West Nile virus.

Health officials expect that West Nile virus will eventually spread throughout the range of the northern spotted owl (Courtney et al. 2004), but it is unknown how it will ultimately affect spotted owl populations. Susceptibility to infection and mortality rates of infected individuals vary among bird species, even within groups (Courtney et al. 2004), although owls appear to be quite susceptible.

#### *Ongoing Conservation*

The Northwest Forest Plan is the current conservation strategy for the spotted owl on Federal lands. It is designed around the conservation needs of the spotted owl and based upon the designation of a variety of land-use allocations to protect large blocks of habitat for spotted owl population clusters and to maintain connectivity between population clusters.

The conservation strategy for spotted owls on Federal Lands, as described in the Northwest Forest Plan, does not include non-federal lands. On non-federal lands, timber harvest is governed by rules within each State that provide varying degrees of protection to spotted owls and/or their habitat. Private lands, especially those addressed in Habitat Conservation Plans for the spotted owl, contribute to the overall conservation of the spotted owl (Courtney et al. 2004). There are currently 16 active HCPs that address spotted owls, 4 in Washington, 4 in Oregon, and 4 in California.

#### *Conservation Needs*

The conservation needs of the spotted owl address three primary threats: declining populations, declining habitat, and isolation of provinces. Current conservation efforts are based on the following biological principles: 1) presence of large blocks of habitat to support clusters or local population centers of spotted owls, 2) habitat conditions and spacing between local populations of spotted owls to facilitate survival and movement, and 3) managing habitat across a variety of ecological conditions within the spotted owl's range to reduce risk of local or widespread extirpation (U.S. Fish and Wildlife Service 1992c).

#### *Effects of the Action*

Mechanical, prescribed fire, and herbicide treatments may involve human activity with equipment that introduces an increased level of sound and visual stimuli into the environment. The disturbance from sound or activity near a spotted owl nest may disrupt nesting and feeding behaviors by causing them to flush from the nest or miss a feeding attempt. The most critical period when human activity could disturb nesting spotted owls is during the early breeding season when adults are incubating eggs or are feeding chicks in the nest from March 1 through mid July (depending on the location). Manual, cultural, and biological treatments are not anticipated to affect spotted owls due to the limited nature of noise and human presence from these activities.

Disturbance to spotted owls is expected to be rare because invasive plant infestations within or near suitable spotted owl habitat are limited to roadsides, administrative sites, and small, disturbed sites in areas that are most likely currently exposed to human activity. If a spotted owl nest is located near a U.S. Forest Service road or administrative site, invasive plant treatments in these areas are not likely to add to the current use levels. Treatments will be scattered in small patches throughout the owl's range and will generally be short term and infrequent, requiring one to two treatments over 1 or 2 days. The effects from activities are not anticipated to last longer than the duration of the treatments.

National Forests on the eastern slopes of the Cascades anticipate the greatest number of invasive plant treatments and many of these Forests are outside the range of the spotted owl. Only projects that cause an increase in human activity, generate sound above ambient levels, and occur within disturbance distances (ranging from 35 yards to 65 yards depending on equipment type) of an active nest have the potential to cause adverse effects to spotted owls. Therefore, the likelihood that invasive plant treatments would fall within this limited area and therefore have a potential to adversely affect spotted owls is greatly reduced. If a project does occur near a nest it is likely to impact only one nest because of the territory size for a pair of owls.

We assume that young spotted owls can miss a feeding without dying or suffering significant nutritional deprivation, and we expect that adult owls can flush from the nest without crushing their eggs or injuring their young. Since we expect that disturbance would be short term and infrequent and that spotted owls can sustain this disturbance without permanent injury, we do not anticipate any direct mortality to spotted owl adults, chicks, or eggs.

Invasive plant infestations within or near suitable spotted owl habitat are limited to roadsides and small, disturbed sites, which are not generally appropriate for treatment with prescribed fire. In the event that prescribed fire is used in these areas, the smoke generated from prescribed burning of invasive plants is not anticipated to be heavy enough to impact spotted owls due to the light nature of the fuels and therefore, adverse effects to spotted owls are not anticipated from smoke during prescribed burning activities.

The U.S. Forest Service found that the results of exposure scenarios to spotted owls indicate that no herbicide included in the Invasive Plant Program is likely to adversely affect spotted owls. Spotted owls are not likely to be directly sprayed or encounter vegetation that has been directly sprayed because infestations in forested habitat are not suitable for aerial applications and only aerial application could result in herbicide application in a manner likely to be encountered by spotted owls. In addition, there was no risk to spotted owls from eating contaminated small mammals because expected doses to predatory birds eating mammals for all herbicides except triclopyr, even with very conservative assumptions, are well below any known NOAEL (Cite BA, Appendix B). Triclopyr is limited to direct application only so it is unlikely that small mammals would

be sprayed and enter the food chain, or consume enough vegetation to become contaminated.

### *Summary*

Mechanical, prescribed fire, and herbicide treatments have the potential to result in short-term adverse effects to spotted owls through disturbance if treatments occur less than 65 yards from occupied suitable nesting habitat during the early nesting season. These activities will be scattered in small patches throughout the spotted owls range, will impact a very small portion of the owls in the action area, and will generally be short term and infrequent, requiring one to two treatments over 1 or 2 days. Effects from activities are not anticipated to last longer than the duration of the treatments.

### *Cumulative Effects*

Cumulative effects for the purposes of consultation under ESA are defined as, “the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area...” (50 CFR, Part 402). Future federal actions will be subject to the consultation requirements established in Section 7 of the ESA, and therefore, are not considered cumulative to the proposed action.

Effects to spotted owls can occur from non-federal activities that may include, but are not limited to, use of existing roads, maintenance of right-of-ways, recreational activities, grazing on private land, development of adjacent land or inholdings, and timber harvest on non-federal land.

### *Conclusion*

The Invasive Plant Program will not jeopardize the continued existence of the spotted owl by, directly or indirectly, reducing appreciably the likelihood of survival and recovery of the spotted owl in the wild by reducing reproduction, numbers, or distribution of the species.

- The primary potential effect from this project would be disturbance of nesting spotted owls. Because treatments under this plan are of short duration and infrequent, we do not anticipate any substantial reduction in productivity as we do not expect these actions to lead to nest abandonment or reduced ability to successfully fledge young.
- No individual mortality (adult or young) is anticipated from treatments under this plan.
- National Forests east of the crest of the Cascades anticipate the greatest number of invasive plant treatments and many of these Forests are outside of the spotted owl’s range (e.g. Colville, Fremont, Umatilla, Wallowa-Whitman National Forests). Therefore, many projects are not likely to intersect spotted owl nest sites. Even if exposed to disturbance, because spotted owls exhibit high site fidelity, we do not expect they will permanently abandon nesting territories, we do not anticipate any change in the species distribution from these actions.

Therefore, the U.S. Forest Service Pacific Northwest Region Invasive Plant Program Plan is not anticipated to reduce the reproduction, numbers, or distribution of northern spotted owls.

### ***Conservation Recommendations***

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

Schedule treatments involving heavy equipment or other high-noise techniques to avoid the nesting season when within the proximity of know nesting spotted owls or unsurveyed suitable nesting habitat, where practicable.

Conduct surveys in unsurveyed suitable nesting habitat to determine presence of species in treatment areas where extensive heavy machinery or other high-noise techniques are to be used, where practicable. Surveys would only need to include areas within 0.25 miles of the activity and only in nesting quality habitat.

## **Marbled Murrelet**

### ***Status and baseline***

Detailed accounts of the taxonomy, ecology, and reproductive characteristics of the marbled murrelet is found in the 1988 Status Review (Marshall 1988), the final rule listing the marbled murrelet as threatened (U.S. Fish and Wildlife Service 1992d), the final rule designating critical habitat for the species (U.S. Fish and Wildlife Service 1996a), the Final Supplemental EIS on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Spotted Owl (USDA and USDI 1994), the Recovery Plan for the Threatened Marbled Murrelet (U.S. Fish and Wildlife Service 1997), and the 2004 Evaluation Report prepared by EDAW, Inc. for the murrelet 5-year review (McShane et al. 2004).

### ***Listing History***

On October 1, 1992, the USFWS issued a final notice listing the marbled murrelet as threatened in Washington, Oregon, and California (U.S. Fish and Wildlife Service 1992d). Critical habitat was designated for this species on May 24, 1996 (U.S. Fish and Wildlife Service 1996a). On August 31, 2004, the USFWS announced the completion of the 5-year review of the marbled murrelet. As a result of its review, the USFWS has concluded that the population of marbled murrelets in California, Oregon, and Washington does not satisfy the criteria for designation as a Distinct Population Segment (DPS) under the USFWS 1996 policy (USDI and USDC 1996). However, the marbled murrelet remains listed at this time pending any further regulatory action.

### *Distribution*

The range of the marbled murrelet, defined by breeding and wintering areas, extends along the western North American coast up to approximately 50 miles inland from the northern terminus of Bristol Bay, Alaska to the southern terminus of Monterey Bay in central California. The listed portion of the species' range extends from the Canadian border south to central California. The distribution of murrelets becomes more disjunct at the southern extreme of their range. In Washington, Oregon, and California, there are distinct gaps between breeding populations that are thought to relate to availability of onshore nesting habitat.

Marbled murrelet are found on the Mt. Baker-Snoqualmie, Olympic, Siskiyou, and Siuslaw National Forests within the action area. The marbled murrelet Recovery Plan (U.S. Fish and Wildlife Service 1997) identified six recovery zones for the marbled murrelet: Puget Sound (Zone 1), Western Washington Coast Range (Zone 2), Oregon Coast Range (Zone 3), Siskiyou Coast Range (Zone 4), Mendocino (Zone 5), and Santa Cruz Mountains (Zone 6). The action area includes lands within Zones 1 to 4. The Olympic, Mount Baker-Snoqualmie, and Gifford Pinchot National Forests are included in Zones 1 and 2. The Siuslaw National Forest is included in Zone 3 and the Rogue River-Siskiyou National Forest is included in Zone 4.

### *Life History*

The murrelet is a small robin-sized seabird of the family Alcidae in the order Charadriiformes. These small, fast flying seabirds are unique among North American alcids in their use of coastal coniferous forest, primarily late-successional trees as nesting habitat. Although they feed on fish and invertebrates primarily in nearshore marine waters, they nest as far as 50 miles inland from the marine environment, on large limbs of mature conifers. Murrelets are mostly pelagic during the winter.

Nesting season occurs from late March to September. Their solitary nests are usually concealed within the forest canopy and breeding birds are cryptic and primarily crepuscular at nest sites. Egg laying, incubation, and hatching generally occurs before August 5, and feeding of young takes place after hatching until approximately September 1, at which point most murrelets have fledged (Hamer and Nelson 1995). After young hatch, murrelet adults spend their time foraging at sea, returning to the nest only long enough to feed the young. Approximately 90 percent of feedings take place during the 2 hours after sunrise and the 2 hours before sunset (Nelson and Hamer 1995).

Murrelets are solitary to semi-colonial in their nesting habits, and simultaneous detections of more than one bird are frequently made at inland sites. Murrelets are long-lived, and have high fidelity to nesting areas (Divoky and Horton 1995). Murrelets nest on mossy platforms of large branches in old-forest trees (Lank et al. 2003). Suitable habitat for murrelets includes contiguous forested areas with conditions that contain potential nesting structure. These forests are generally characterized by large trees greater than 18 inches diameter at breast height, multistoried canopies with moderate closure, sufficient limb size and substrate (moss, duff, etc.) to support nest cups, flight accessibility, and

protective cover from ambient conditions and potential avian predators (Manley 1999, Burger 2002, Nelson and Wilson 2002).

Nest stands are typically composed of low elevation conifer species. In California, nest sites have been located in stands containing old-growth redwood and Douglas-fir, while nests in Oregon and Washington have been located in stands dominated by Douglas-fir, western hemlock, and Sitka spruce. Murrelets appear to select forest stands greater than 124 acres (Burger 2002), but are found nesting in stands as small as one acre (Nelson and Wilson 2002). In surveys of mature or younger second-growth forests in California, murrelets were only found in these forests where there was nearby old-growth stands or where residual older trees remained (U.S. Fish and Wildlife Service 1992d, Singer et al. 1995).

#### *Population Dynamics*

The present population estimate for the murrelet in Oregon is 9,500 ( $\pm$  3,000). Spiech and Wahl (1995) concluded murrelet populations in Puget Sound are lower now than they were at the beginning of this century, and total estimates for Washington are still about 9,800 murrelets (Huff et al. 2003). California populations estimated to be between 4,000 and 6,500 birds (Huff et al. 2003, Ralph and Miller 1995, Strong 2003a, 2003b, McShane et al. 2004). Overall, there are approximately 23,700 ( $\pm$  5,200) within the conterminous United States (Huff et al. 2003, Strong 2003a, 2003b).

Beissinger (1995) constructed a demographic model of the murrelet and concluded that the population may be declining at rates of 4 to 6 percent per year, but this estimate is hampered by the possibility that the age-ratio data used in the model are reflective of a relatively temporary decline due to unusual ocean conditions (Ralph et al. 1995). Boulanger et al. (1996) found change in adult survivorship is the single most important factor when projecting demographic trends for murrelets. Similarly, Strong and Carten (2000) suggest there may have been a 50 percent decline from 1992 to 1996 in the Oregon population, which appears to have stabilized since (Strong 2003a, 2003b). Ralph et al. (1995) summarized some of the reasons for variability in population estimates among researchers, including differences in methodology, assumptions, spatial coverage, and survey and model errors.

McShane et al. (2004) produced a demographic model of murrelet populations in Washington, Oregon, and California by each of the six conservation zones. Similar to previous studies, they found that populations in all conservation zones are in decline, with mean annual rates of decline between 2.1 and 6.2 percent. The highest rates of decline were in zone 6 at the southern extent of the range. Furthermore, they conclude it is likely that populations in zone 5 and 6 could become non-viable in the near future.

#### *Threats*

The Marbled Murrelet Recovery Plan (U.S. Fish and Wildlife Service 1997) identified the primary threats to the species to include predation, loss of nesting habitat, by catch in gill nets, and oil pollution (both chronic and from major spills). More recently, McShane et al. (2004) has concluded that all threats are still present although rate of loss of nesting

habitat, particularly on Federal lands, has declined. New gill-netting regulations in northern California and Washington have reduced the threat from catch in gill-nets. The threat from oil pollution continues to be unpredictable and effects are variable. Threats to marbled murrelets within the action area are limited to inland threats such as predation and loss of nesting habitat.

Beissinger (1995) estimated the rangewide juvenile-to-adult ratio for murrelets at about 5 percent, a low productivity level. One reason for such a low productivity level is that murrelets experience high rates of predation, particularly of their eggs and young. Murrelets are believed to be highly vulnerable to nest predation compared to other alcids and forest nesting birds (Nelson and Hamer 1995, U.S. Fish and Wildlife Service 1997). Also, murrelets have no protection at nest sites other than the ability to remain hidden and predation appears to be the number one cause of nest failure for murrelets (Nelson and Hamer 1995, McShane 2004)).

Predation rates are influenced mainly by habitat stand size, habitat quality, nest placement (on the edge of a stand vs. the interior of a stand), and proximity of the stand to human activity centers. As stands of habitat get smaller, their quality decreases as the amount of forest edge increases in relation to the amount of interior forest. Nests placed near the edge of a stand are more likely to be subject to predation (Ralph et al. 1995). Forest stands near human activity centers (<0.6 miles), regardless of size, can experience increased nest predation because human food sources attract corvids (Marzluff et al. 2000).

Corvids (crows and ravens) have been implicated as the primary predator of murrelet nestlings (Nelson and Hamer 1995, Raphael et al. 2002). Nelson and Hamer (1995) compiled and analyzed murrelet nest records throughout the species range between 1974 and 1993. Adequate information was available to determine nest success for 32 of the 65 nest sites. Of these 32 sites, 72 percent failed. Predation accounted for 49 percent of nest failures throughout the range of the murrelet, or 57 percent in Washington, Oregon, and California. Nelson and Hamer (1995) hypothesized that small increases in murrelet predation would have deleterious effects on murrelet population viability due to their low reproductive rate (one egg per clutch).

Extensive harvest of late-successional and old-growth forests was the primary reason for listing the marbled murrelet. Although the rate of habitat loss on Federal lands has been reduced, suitable nesting habitat continues to be lost on Federal and non-federal lands through both timber harvest and natural events such as wildfire, insect outbreak, and windthrow. Habitat loss is expected to continue in the near future, but at an uncertain rate (McShane 2004).

#### *Ongoing Conservation*

When the U.S. Forest Service and BLM adopted the Northwest Forest Plan as the management framework for public lands, a long-term habitat management strategy for murrelets was established (USDA and USDI 1994). The Northwest Forest Plan instituted the protection of existing habitat at sites that are determined to be occupied by murrelets.

Over 80 percent of murrelet habitat on Federal lands in Washington occurs within land management allocations that protect the habitat from removal or significant degradation.

Four Habitat Conservation Plans addressing marbled murrelets in Washington have been completed for private/corporate forest land managers within the range of the marbled murrelet. Habitat Conservation Plans have also been completed for the City of Tacoma and the City of Seattle, and one State land-management agency. The Plans which address marbled murrelets cover approximately 500,000 acres of non-federal (private/corporate) lands, over 100,000 acres of municipal watershed, and over 1.6 million acres of State-managed lands. There are currently no active incidental take permits for murrelets in Oregon. There is one active HCP addressing murrelets in California, the Palco HCP which covers 211,700 acres of privately owned Palco lands and up to 25,000 acres of additional lands adjacent to the main contiguous portion of the ownership.

The Bureau of Indian Affairs works with Tribal governments to develop management strategies for reservation lands and trust resources. Management for murrelets focus on avoiding take of murrelets when feasible, to facilitate the trust responsibilities of the United States.

#### *Conservation Needs*

In the short-term, specific actions necessary to stabilize the population include maintaining occupied habitat, maintaining large blocks of suitable habitat, maintaining and enhancing buffer habitat, decreasing risks of nesting habitat loss due to fire and windthrow, reducing predation, and minimizing disturbance.

Long-term conservation needs include increasing productivity (abundance, juvenile:adult ratio, and nest success) and population size; increasing the amount (stand size and number of stands), quality, and distribution of suitable nesting habitat; protecting and improving the quality of the marine environment; and reducing or eliminating threats to survivorship by reducing predation in the terrestrial environment and anthropogenic sources of mortality at sea.

#### *Effects of the Action*

Manual, mechanical, prescribed fire, and herbicide treatments may involve human activity or equipment that introduces an increased level of sound or visual stimuli into the environment. The disturbance from noise or activity near a murrelet nest may disrupt nesting and feeding behaviors by causing them to flush from the nest or miss a feeding attempt. The most critical period when human activity could disturb nesting murrelets is during the early breeding season when adults are incubating eggs or are feeding chicks in the nest from April 1 through August 5. We anticipate that disturbance from sound or visual stimuli is the only effect to murrelets likely to occur from these treatments. Cultural and biological treatments are not anticipated to affect spotted owls due to the limited nature of noise and human presence from these activities.

Disturbance to marbled murrelets is expected to be rare because invasive plant infestations within or near suitable murrelet habitat are limited to roadsides,

administrative sites, and small, disturbed sites in areas that are most likely currently exposed to human activity. If a murrelet nest is located near a U.S. Forest Service road or administrative site, invasive plant treatments in these areas are not likely to add to the current use levels. Treatments will be scattered in small patches throughout the murrelet's range and will generally be short term and infrequent, requiring one to two treatments over 1 or 2 days. The effects from activities are not anticipated to last longer than the duration of the treatments.

National Forests on the eastern slopes of the Cascades anticipate the greatest number of invasive plant treatments and are generally outside the range of the murrelet. Only projects that cause an increase in human activity or generate sound above ambient levels and occur within disturbance distances (ranging from 45 yards in Washington to 100 yards in Oregon) have the potential to cause adverse effects to murrelets, further reducing the likelihood of murrelets and invasive plant treatments overlapping. Murrelets are not present in the action area from mid-September to mid-March. Adults are most often at the nest during the 2 hours after sunrise and the 2 hours before sunset during the late season (August 6 thru September 15) and will not be impacted by disturbance when they are not in the action area. Therefore, the most critical time for disturbance is from mid March to early August.

We assume that young murrelets can miss a feeding without dying or suffering significant nutritional deprivation once the adults cease brooding, and we expect that adult murrelets can flush from the nest without crushing their eggs or injuring their young. Since we expect that disturbance would be short term and infrequent and that murrelets can sustain this disturbance without permanent injury, we do not anticipate any direct mortality to murrelet adults, chicks, or eggs.

Invasive plant infestations within or near suitable marbled murrelet habitat are limited to roadsides and small, disturbed sites, which are not generally appropriate for treatment with prescribed fire. In the event that prescribed fire is used in these areas, the smoke generated from prescribed burning of invasive plants is not anticipated to be heavy enough to impact marbled murrelets due to the light nature of the fuels and therefore, adverse effects to murrelets are not anticipated from smoke during prescribed burning activities.

Although predation by corvids is a significant threat to murrelets, activities associated with invasive plant treatments in suitable murrelet habitat are not anticipated to influence corvid populations or distribution. Treatments that take 1 to 2 days in a given area are not anticipated to generate concentrated human activity or associated garbage to a degree that would attract corvids to the site.

The U.S. Forest Service found that the results of exposure scenarios to marbled murrelets indicate that no herbicide included in the Invasive Plant Program is likely to adversely affect murrelets. Marbled murrelets are not likely to be directly sprayed or encounter vegetation that has been directly sprayed because infestations in forested habitat are not suitable for aerial applications and only aerial application could result in herbicide

application in a manner likely to be encountered by marbled murrelets. Because they feed on ocean fish, there is no potential for contamination of their food chain.

### *Summary*

Manual, mechanical, prescribed fire, and herbicide treatments have the potential to result in short-term adverse effects to marbled murrelets through disturbance, if treatments occur less than 100 yards from occupied suitable nesting habitat during the early nesting season. These activities will be scattered in small patches throughout the murrelets range, will impact a very small portion of the murrelets in the action area, and will generally be short term and infrequent, requiring one to two treatments over 1 or 2 days. Effects from activities are not anticipated to last longer than the duration of the treatments.

### *Cumulative Effects*

Cumulative effects for the purposes of consultation under ESA are defined as, “the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area...” (50 CFR, Part 402). Future federal actions will be subject to the consultation requirements established in Section 7 of the ESA, and therefore, are not considered cumulative to the proposed action.

Private lands within the range of the marbled murrelet are expected to continue to be used for timber production. Forests on private lands are not expected to develop into nesting habitat for the marbled murrelet due to the short rotation ages used in commercial timber harvest. These timber management practices are expected to continue into the foreseeable future.

### *Conclusion*

The Invasive Plant Program will not jeopardize the continued existence of the marbled murrelet by, directly or indirectly, reducing appreciably the likelihood of survival and recovery of the marbled murrelet in the wild by reducing reproduction, numbers, or distribution of the species within any of the Recovery Zones for marbled murrelet.

- The primary potential effect from this project would be disturbance of nesting marbled murrelets. Because treatments under this plan are of short duration and infrequent, we do not anticipate any substantial reduction in productivity as we do not expect these actions to lead to nest abandonment or reduced ability to successfully fledge young.
- No individual mortality (adult or young) is anticipated from treatments under this plan.
- National Forests east of the Cascade crest anticipate the greatest number of invasive plant treatments and these Forests are outside of the murrelet’s range (e.g. eastern Washington, Blue Mountains). Therefore, most projects are not likely to intersect marbled murrelet nest sites. Even if exposed to disturbance, because marbled murrelets exhibit high site fidelity we do not expect they will

permanently abandon nesting territories, we do not anticipate any change in the species distribution from these actions.

Therefore, the U.S. Forest Service Pacific Northwest Region Invasive Plant Program Plan is not anticipated to reduce the reproduction, numbers, or distribution of marbled murrelets.

***Conservation Recommendations***

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

Ensure that treatment areas in or near marbled murrelet habitat are free of trash during and following treatments to avoid attracting predators.

Conduct surveys, as practicable, when activities will result in noise above ambient levels and occur within 35 to 45 yards of unsurveyed marbled murrelet habitat

When treating in occupied or unsurveyed suitable murrelet habitat, time treatments to avoid the nesting season (April to September) and feeding times (the 2 hours after sunrise and 2 hours before sunset) where possible.

**Western snowy plover (coastal population)**

***Status and baseline***

Detailed accounts of the taxonomy, ecology, and reproductive characteristics of the western snowy plover are found in the final rule listing the species as threatened (U.S. Fish and Wildlife Service 1993b), in the draft recovery plan for the western snowy plover (U.S. Fish and Wildlife Service 2001b), and the Biological Assessment (U.S. Forest Service 2005).

***Listing History***

The Pacific coast population of the western snowy plover was federally listed as threatened on March 5, 1993 (U.S. Fish and Wildlife Service 1993b). The western snowy plover is currently designated as threatened within 50 miles of the Pacific Ocean in California, Oregon, and Washington.

A Draft Recovery Plan for the Pacific coast population of the western snowy plover was published in August 4, 2001 and is currently being finalized by the USFWS (U.S. Fish and Wildlife Service 2001b).

On December 7, 1999, the USFWS published a final rule to designate critical habitat for the listed population (U.S. Fish and Wildlife Service 1999e). This rule was remanded

and critical habitat was partially vacated. In December 2004, the USFWS issued a new proposed rule for critical habitat.

Recent court cases have directed that the USFWS complete or conduct specific actions, including revising the draft Recovery Plan, updating critical habitat designations, conducting a 5-year review of the listing, and completing a 12-month finding. These efforts are currently underway.

#### *Distribution*

The Pacific coast population of the snowy plover occurs primarily on coastal beaches from southern Washington to southern Baja California, Mexico. The largest number of breeding snowy plovers occurs from San Francisco Bay to southern Baja California (Page and Stenzel 1981, Palacios et al. 1994).

The Pacific coast population includes both resident and migratory individuals. Migratory individuals may move north or south from their nesting areas, though most tend to congregate in areas south of Bodega Bay, California (Page et al. 1986). Individuals from the interior population also migrate to the coast for the winter, thus a wintering area may support birds from both the coastal and interior populations.

Within the action area, snowy plovers occur at five sites on the Siuslaw National Forest along the Oregon coast, which contains approximately 10 percent of the total listed population.

#### *Life History*

The western snowy plover is a small shorebird in the family Charadriidae. Snowy plovers depend on open sandy or saline habitats adjacent to coastal waters. Wind, storms, tides, wave action, and colonization by native plants are important natural factors influencing this dynamic habitat. They forage on invertebrates in the intertidal zone, wrack line, dry sandy areas above the high tide line, sparsely vegetated dunes, salt pans, and the edges of salt marshes. Reported prey items include polychaetes, sand crabs, brine fly larvae, sand hoppers, beetles, flies, and caterpillars (U.S. Fish and Wildlife Service 2001b).

The breeding season generally begins in mid-February or March (March to April in northern latitudes), although courtship behavior has been observed as early as late January. In Washington, breeding generally starts in April or May. Preferred nesting habitats include un-vegetated or moderately vegetated dune-backed beaches, river mouths, sand spits, beach strands, and open areas around estuaries. Other less common nesting habitats include salt pans, dredge spoils, dry salt ponds, and salt pond levees (U.S. Fish and Wildlife Service 1999e). Nests consist of a shallow scrape or depression and are sometimes lined or ringed with mollusk shell fragments, bits of dead vegetation, and other small debris. Site fidelity has been observed across breeding seasons (Warriner et al. 1986).

The majority of snowy plovers are site-faithful, returning to the same breeding site in subsequent breeding seasons, some also disperse within and between years (Warriner et al. 1986, Stenzel et al. 1994). Birds occasionally nest in exactly the same location as the previous year.

Snowy plovers renest readily after loss of their eggs (Wilson 1980, Warriner et al. 1986). Renesting occurs 2 to 14 days after failure of a clutch and up to five renesting attempts have been observed for a pair in a single season (Warriner et al. 1986). Double brooding with polyandry is common in coastal California and Oregon (Wilson-Jacobs and Meslow 1984). On the California coast, the breeding season is long enough for some females to triple brood and for some males to double brood (Page et al. 1995).

The first nests are usually initiated in early to mid-March and final nests are usually initiated in mid to late July. Clutches typically consist of three highly cryptic eggs, although two egg nests are not uncommon, and are laid over a period of about 4 to 5 days (Page et al. 1977). Sustained incubation begins upon completion of the clutch and continues until hatching at 25 to 31 days. The female incubates most of the day and the male most of the night (Warriner et al. 1986). When incubating adults sense a predator or threat, they usually run away from the nest while engaging in distraction displays. If the clutch is destroyed before hatching, the pair typically lays a replacement clutch.

Western snowy plover chicks are highly cryptic and precocial, leaving the nest within hours after hatching. Both parents tend the chicks initially, leading them to suitable foraging areas, providing thermal cover, and protecting them from predators and other threats through alarm calls and distraction displays. However, within a few days of hatching, the female usually leaves the brood, establishes a pair with another male, and initiates a new nest. The male remains with the chicks until they fledge, generally in 28 to 32 days (Warriner et al. 1986). During this time, broods and the attending male usually move away from the nesting territory. Movement of up to 6 miles from the natal area has been reported (Castelein et al. 2001).

Wintering plovers are usually found roosting in flocks ranging in size from a few individuals to a few hundred birds and utilize the same foraging habitats as nesting plovers.

#### *Population Dynamics*

Historic records indicate that nesting Pacific coast western snowy plovers were once more widely distributed than they are currently. Because annual survey data cover the federally-listed Pacific coast population of the western snowy plover, all values described here are for the listed Pacific coast population. In California, 53 general nesting areas were known prior to 1970 (Page and Stenzel 1981). As of 1991, no evidence of breeding birds had been found at 33 of those 53 areas (Page et al. 1991). Nineteen nesting areas were reported in Oregon in 1974 (Oregon Coastal Conservation and Development Commission 1974). Only ten of those areas were used in 2002 (Castelein et al. 2002). In Washington, two of the five historical nesting sites are still used, and three new nesting

areas have been identified. Twenty-eight nesting areas were identified in Mexico in 1991 (U.S. Fish and Wildlife Service 1993b).

The western snowy plover breeding population in California, Oregon, and Washington is estimated to have declined by 17 percent, from about 2,300 to 1,900 adults, between 1977 and 1989 (Page et al. 1991). Results from the 2002 breeding season indicated that 1,504 adult plovers were present throughout their range in Washington (36), Oregon (81) and California (1387). Following increased predator control efforts and habitat enhancement, the populations in Oregon and Washington have increased; 2003 and 2004 were the most successful breeding seasons since 1990.

A 1999 population viability analysis model, constructed to support development of the recovery plan for this species found that the western snowy plover was likely to continue declining under current management efforts (U.S. Fish and Wildlife Service 2001b). When the population viability analysis was run using estimates of current conditions, it predicted that the population, on average, would decline at 0.92 percent per year representing a cumulative 69 percent decrease over 100 years.

The 2003 Annual report (Lauten et al. 2003) for the Oregon coast found an estimated 100 adult plovers, representing a relatively stable population over the last six years. Nest success averaged 51 percent, with 79 percent success rate within exclosures and 23 percent success rate among unexclosed nests. These percentages are higher than their respective 14-year averages. Depredation was the primary cause of nest failures (45 percent). Nest failure was also attributed to other factors including unknown cause (20 percent), abandonment (11 percent), infertility (11 percent), weather (7 percent), and overwashing (5 percent).

For 2003, overall fledgling success in Oregon was 46 percent. Of the 31 plovers fledged in 2002, 14 returned to Oregon in 2003 and all attempted to nest. In 2003, Oregon beaches produced 60 fledglings. The nesting success of plovers on Oregon beaches set a record in 2004, with 107 fledglings produced (U.S. Fish and Wildlife Service 2004c). This number is almost three times the average of 37 young produced each year. Washington beaches produced 27 fledglings in 2004.

Survey results indicate that the snowy plover population trend is increasing in Oregon as a direct result of predator control efforts and habitat enhancement (Lauten et al. 2003). However, there is still concern that overall productivity is not high enough to replace adults lost to depredation and winter mortality (Lauten et al. 2003).

The Siuslaw National Forest monitored plover nesting from 1990 to 2000 (Siuslaw National Forest 2001). The number of nests on the forest ranged from 0 in 1991 to 48 in 2000. In 2003, there were 47 nests on the Siuslaw National Forest, near the all-time high. The number of nests on Siuslaw National Forest lands that produced fledgling ranged from 5 in 1994 to 24 in 2000. In 2003, Siuslaw National Forest sites produced 23 fledglings (Lauten et al. 2003). The numbers of wintering plovers on the Forest ranged from 36 in 1994 to 62 in 1997.

### *Threats*

The primary threats leading to the listing of Pacific coast population of snowy plover were loss and modification of habitat resulting from introduced European and American beachgrass (*Ammophila arenaria*, *Ammophila breviligulata*), encroachment and urban development, extensive human recreational activity in plover habitat, predation exacerbated by human disturbance, and expanding predator populations. Natural factors, such as inclement weather, have also affected the quality and quantity of snowy plover habitat (U.S. Fish and Wildlife Service 1993b). The reasons for decline and degree of threats vary by geographic location. The Draft Recovery Plan for snowy plover states that intensive, ongoing management of plovers and their habitats is essential for recovery

### Predation

Predation has been identified as a major factor limiting western snowy plover reproductive success at many Pacific coast sites. Known predators of western snowy plover eggs, chicks, or adults include gray foxes (*Urocyon cinereoargenteus*), coyotes (*Canis latrans*), striped skunks (*Mephitis mephitis*), spotted skunks (*Spilogale putorius*), raccoons (*Procyon lotor*), California ground squirrels (*Citellus beecheyi*), long-tailed weasels (*Mustela frenata*), American crows (*Corvus brachyrhynchos*), common ravens (*Corvus corax*), ring-billed gulls (*Larus delawarensis*), California gulls (*Larus californicus*), western gulls (*Larus occidentalis*), glaucous-winged gulls (*Larus glaucescens*), American kestrels (*Falco sparverius*), peregrine falcons (*Falco peregrinus*), northern harriers (*Circus cyaneus*), loggerhead shrikes (*Lanius ludovicianus*), merlins (*Falco columbarius*), great horned owls (*Bubo virginianus*), burrowing owls (*Speotyto cunicularia*), great blue herons (*Ardea herodias*) as well as introduced eastern red foxes (*Vulpes vulpes regalis*), Norway rats (*Rattus norvegicus*), Virginia opossums (*Didelphis marsupialis*), domestic and feral dogs (*Canis familiaris*), and cats (*Felis domesticus*) (U.S. Fish and Wildlife Service 2001b).

Predator density is a significant factor affecting the quality of snowy plover nesting habitat (Stenzel et al. 1994). Predation can result in the loss of adults, chicks, or eggs; separation of chicks from adults is also caused by the presence of predators. The snowy plover generally cannot defend itself or its nests against predation but must rely on anti-predator adaptations, including (1) pale and cryptic coloration of adults, eggs, and young, which acts as camouflage against detection by predators; (2) attempting to lure predators from the nest with alarm calls and distraction displays; (3) extreme mobility and elusiveness of precocial young; and (4) low nesting densities. These adaptations may have worked well under historic conditions, but the introduction of exotic predators and changing conditions that favor native predators' populations or hunting techniques have likely resulted in predator densities far above normal levels.

On the Oregon coast, predation risk by mammals has increased as a result of the spread of European beachgrass, Scotch broom (*Cytisus scoparius*), and shore pine (*Pinus contorta*), which has transformed vast areas of open sand into dense grass-shrub habitat, providing excellent habitat for native and nonnative mammalian predators, such as skunks, raccoons, foxes, and feral cats (Stern et al. 1991). Also, widespread urbanization

has depleted native predator habitat, bringing increased predatory pressure into the few undeveloped areas that are left, including habitat for snowy plovers and other sensitive species. In Oregon, predators have accounted for up to 68 percent of nest losses (Wilson-Jacobs and Meslow 1984, Stern et al. 1991). Between 1990 and 2000, The Nature Conservancy (2000) found that predation accounted for 155 incidences of nest failures, or approximately 46 percent of all snowy plover nest failures along the Oregon Coast.

Protection from predation appears to be very effective at increasing nest success. In 2004, surveyors recorded a fourfold increase in nest success at the only Washington beach where protection from predators was provided, (U.S. Fish and Wildlife Service 2004c).

#### Human Disturbance

Direct human disturbance is a documented cause of snowy plover nest failures (The Nature Conservancy 2000). In Washington, many of the nesting beaches are open to motorized vehicle use, which increases the percentage of nest failures related to human activities (Martha Jensen, USFWS, pers. comm.2005). Driving vehicles in breeding habitat may cause destruction of eggs, chicks, and adults, abandonment of nests, and considerable stress and harassment to plover family groups. In Oregon, vehicle tracks have been found near nests at a number of beaches. Off-road vehicles at Coos Bay North Spit, Oregon, ran over one clutch and scattered broods from other nests (Stern et al. 1990). Although vehicle traffic was prohibited on the beach west of Floras Lake, Oregon, all-terrain vehicle tracks were observed only 6 inches away from unprotected nests with eggs on two occasions during the 1993 breeding season.

Pedestrians can cause both direct mortality and harassment of snowy plovers. Pedestrians on beaches may crush eggs or chicks and chase snowy plovers off their nests. Separation of plover adults from their nests and broods can cause mortality through exposure of eggs or chicks to heat, cold, blowing sand, and/or predators. People may also cause snowy plovers to avoid favored feeding areas. Page et al. (1977) observed snowy plovers' response to human disturbance at two coastal beaches and found that pedestrians caused adults to leave their nests 78 percent of the time when people were within 164 feet.

Dogs on beaches can pose a serious threat to snowy plovers during both the breeding and non breeding seasons. Unleashed pets, primarily dogs, sometimes chase snowy plovers and destroy nests. Repeated disturbances by dogs can interrupt brooding, incubating, and foraging behavior of adult plovers and cause chicks to become separated from their parents. Pet owners frequently allow their dogs to run off-leash on beaches where it is clearly signed that dogs are not permitted or are only permitted if on a leash. Even when not deliberately chasing birds, dogs on a beach may disturb snowy plovers. Page et al. (1977) found that snowy plovers flushed more frequently and remained off their nests longer when a person was accompanied by a dog than when alone.

Horseback riders on the beach sometimes enter coastal dunes or upper beach areas where they may crush clutches or disturb plovers. At New River, Oregon, Craig et al. (1992)

observed a snowy plover nest that was almost destroyed by a pair of horseback riders and equestrians were suspected of being the cause of no nesting at Wilder beach (California) in 1988 (Page 1988).

#### Habitat Loss

The wide, flat, sparsely-vegetated beach strands preferred by snowy plovers are an unstable habitat, subject to the dynamic processes of accretion and erosion and dependent on natural forces for replenishment and renewal.

Beach stabilization efforts may interfere with coastal dune formation, causing beach erosion and loss of snowy plover nesting and wintering habitat. Shoreline stabilization features such as jetties may cause significant habitat degradation by robbing sand from the downdrift shoreline (U.S. Fish and Wildlife Service 1996b), but can also redirect sand deposition, causing an increase in available habitat. Construction of homes, resorts, and parking lots on coastal sand dunes constitutes permanent loss of habitat for snowy plovers. Construction of these and other facilities adjacent to sand dunes also results in loss of breeding and wintering habitat by increasing human disturbance to levels where beaches are no longer suitable for snowy plovers.

One of the most significant causes of habitat loss for coastal breeding snowy plovers has been encroachment of introduced European beachgrass and American beachgrass. Foredunes dominated by introduced European beachgrass have replaced the original low, rounded, open mounds formed by the native American dunegrass (*Leymus mollis*) and other beach plants. Similarly, American beachgrass greatly depresses the diversity of native dune plant species (Seabloom and Wiedemann 1994). Native dune plants do not bind sand like *Ammophila*, and thus allow for sand movement and regenerating open expanses of sand. However, *Ammophila* forms a dense cover that excludes many native taxa. On beaches dominated by this invasive grass, species richness of vegetation is halved, in comparison with foredunes dominated by the native dune grass (Barbour and Major 1990).

Stabilizing sand dunes with introduced beachgrass has reduced the amount of unvegetated area above the tideline, decreased the width of the beach, and increased its slope. These changes have reduced the amount of potential snowy plover nesting habitat on many beaches and may hamper brood movements. The spread of this nonnative species was greatly enhanced by aggressive stabilization programs in the State of Oregon in the 1930's and 1940's (Wiedemann 1987). In Oregon, the beachgrass community may provide habitat for snowy plover predators (e.g., skunks, weasels, coyotes, foxes, raccoons, and feral cats) that historically would have been largely precluded by the lack of cover in the dune community (Stern et al. 1991).

In addition to the loss of nesting habitat, introduced beachgrass may also adversely affect snowy plover food resources. Slobodchikoff and Doyen (1977) found that introduced beachgrass markedly depressed the diversity and abundance of sand burrowing arthropods at coastal dune sited in central California. Because snowy plovers may feed

on insects above the high-tide line, the presence of this invasive grass may also result in loss of food supplies for plovers (Stenzel et al. 1981).

#### Other concerns

Environmental contaminants have been found in some snowy plovers using areas that are adjacent to agricultural production or sewage or industrial waste discharge. Hothem and Powell (2000) analyzed snowy plover eggs from southern California and detected several organochlorines, including byproducts of DDT, at low levels (below those associated with reproductive problems and eggshell thinning).

#### *Ongoing Conservation*

Several existing plans contain objectives and guidelines for snowy plovers, including the Draft Recovery Plan for the Western Snowy Plover (U.S. Fish and Wildlife Service 2001b), Oregon Dunes National Recreation Area Management Plan (U.S. Forest Service 1994), Coos Bay Shorelands Final Management Plan (Bureau of Land Management 1995a), New River Area of Critical Concern Management Plan (Bureau of Land Management 1995b), Habitat Conservation Plan for the Western Snowy Plover (Oregon Parks and Recreation Department 2005), Draft Snowy Plover Management Plan for Ocean Beach, Golden Gate National Recreation Area (Hatch 1997), and draft Western Snowy Plover Management Plan for the Point Reyes National Seashore (White and Allen in prep.).

Conservation efforts appear to have benefited the western snowy plover in portions of its range. Monitoring, nest protection, predator management, habitat restoration, and recreation management efforts coincided with an increase in Oregon from 30 adult birds counted during the 1992 nesting season to 82 birds in 2004 (L. Kelly, pers. comm. 2005).

Since 1993, there have been multiple projects on the North Spit of Coos Bay, Oregon, to control beachgrass on dredged material disposal sites and to clear and maintain adjacent areas. The BLM has cleared over 150 acres of vegetation dominated by European beachgrass, shore pine, Sitka spruce, and Scotch broom. The objective of these treatments is to remove predator cover, remove encroaching beachgrass, and expand the existing habitat, creating nesting areas for snowy plovers that are large enough to lessen possible detection of nests and chicks by predators. Many of the cleared areas were used almost immediately by nesting plovers or for brood rearing activities.

Oregon Parks and Recreation Department submitted a Habitat Conservation Plan to the USFWS that included 362 miles of ocean shore and adjacent state lands. The proposal would establish 16 coastal emphasis areas, approximately 48 miles of shoreline, primarily on state and federal lands to be managed for snowy plover recovery.

Within the action area, the U.S. Forest Service employs a combination of mechanical, manual, and herbicide treatments to control European beachgrass. Currently, the forest conducts approximately 24 acres of beachgrass removal and dune restoration each year. Since the early 1990's, the forest has conducted treatments on about 500 acres of snowy plover habitat.

***Effects of the Action***

Manual, mechanical, cultural, prescribed fire and herbicide treatments have the potential to adversely affect snowy plovers on the Siuslaw National Forest through disturbance or direct harm. All are generally caused by the presence of people or equipment working in the area. These activities could potentially disturb western snowy plover during the breeding season, causing the adults to leave nests. Disturbance that causes the adults to leave the nest may increase vulnerability of the eggs or newly-hatched young to predators or losses from inclement weather. People and vehicles can also trample the eggs or young of snowy plovers, resulting in direct mortality. Smoke from prescribed burning of beachgrass has the potential to flush an adult from a nest if the fuels are heavy enough to generate thick smoke, which could also leave eggs vulnerable to predation, or exposure. Adults and chicks could be expected to leave the area during treatments since chicks are mobile within a few hours of hatching, and would likely not be substantially affected by these activities. There are no biological control agents currently available for beachgrass, nor are we aware of any being developed.

Disturbance and direct mortality from invasive plant treatments on the Siuslaw National Forest are expected to be rare. The Siuslaw National Forest is currently conducting these treatments outside the plover breeding season, and is expected to continue this in the future. If treatments for beachgrass do occur in the vicinity of snowy plover habitat during the breeding season, they would likely only impact a small number of nests. Areas invaded with beachgrass generally do not provide suitable nesting habitat for plovers, therefore only birds nesting in suitable habitat on the boundaries of treatment areas have the potential to be impacted by invasive plant treatments. Snowy plovers often produce more than one brood each year and will renest if eggs are lost, so even if losses of individual nests do occur, the loss will not likely eliminate an individual's productivity for a given year. Therefore, the effect of nest losses on plover populations and productivity is less than if the species only nested once a year or did not renest.

The action area currently contains approximately 2 percent of the listed population. Therefore, even if widespread, treatments on U.S. Forest Service lands could affect no more than 2 percent of the total rangewide population. Treatments are unlikely to occur over a large portion of the area at any one time, and will be short term and infrequent, requiring one to two treatments over 1 or 2 days. The effects from activities are not anticipated to last longer than the duration of the treatments. The possibility of impacting an individual nest is restricted to a 30 to 40 day window (egg laying and incubation period) because chicks are mobile shortly after hatching and can escape from hazards. Therefore, even in suitable habitat during the nesting season, the likelihood that treatments in adjacent non-habitat (invaded by beachgrass) would occur during this limited time-frame is very low, and therefore we expect few, if any, nests to be disturbed.

Invasive plant treatments are likely to have long-term beneficial effects to snowy plovers by improving or providing nesting habitat and reducing predation. In addition to eliminating habitat for nesting, invasive plants such as beachgrass, shore pine, and Scotch broom provide cover for native and non-native predators, resulting in the loss of eggs,

chicks, and adults. Successful nesting has been documented in areas where beachgrass removal and habitat restoration projects have been conducted.

It is unlikely that western snowy plovers could be directly affected by herbicide exposure. They will readily move away from applicators, even as chicks, so direct spray is highly unlikely. They feed in a variety of areas, including the intertidal zone, wrack line, dry sandy areas above the high tide line, sparsely vegetated dunes, salt pans, and the edges of salt marshes. Few, if any, of these areas would be likely to be treated with herbicides, so the majority of their food is unlikely to be contaminated. Snowy plovers generally do not feed within areas dominated by exotic beach grass, and are therefore not likely to be exposed to herbicides. Herbicides considered in the proposed action do not accumulate in body tissues because they are rapidly excreted and remain largely unchanged. The herbicides do not concentrate in the food chain

#### *Summary*

Manual, mechanical, cultural, prescribed fire, and herbicide treatments have the potential to result in short-term adverse effects to snowy plovers through disturbance or direct harm by treating nesting habitat when plovers are present. These activities could occur on approximately 2 percent of the listed population of snowy plover. Treatments will generally be short term and infrequent; requiring one to two treatments over 1 or 2 days. Treatments will have long-term beneficial effects by improving snowy plover nesting habitat and reducing predation on plovers. Plovers have successfully nested in restored habitat, indicating that treatments have the potential to improve or provide nesting habitat and reduce predation which may increase productivity.

#### *Cumulative Effects*

Cumulative effects for the purposes of consultation under ESA are defined as, “the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area...” (50 CFR, Part 402). Future federal actions will be subject to the consultation requirements established in Section 7 of the ESA, and therefore, are not considered cumulative to the proposed action.

A variety of activities are adversely affecting snowy plovers. Recreational activities and associated pet dogs disturb adults and can trample eggs or young. Illegal access, intentional vandalism has resulted in mortality to eggs and chicks. Intensive nesting season monitoring conducted by State or private individuals and organizations creates short-term disturbance to adults and nests when data is being gathered and protective exclosures are being placed around nests. Future invasive plant projects conducted outside of federal beaches could cause disturbance and risk to nesting plovers.

#### *Conclusion*

The Invasive Plant Program will not jeopardize the continued existence of the Pacific coast population of snowy plover by, directly or indirectly, reducing appreciably the likelihood of survival and recovery of the snowy plover in the wild by reducing the reproduction, numbers, or distribution of the species.

- The primary potential effect from invasive plant treatments would be disturbance or direct harm of nesting snowy plovers. Because treatments under this plan are generally conducted outside of the breeding season, are of short duration and infrequent, and because plovers often produce more than one brood and will renest if eggs are lost, we do not anticipate any substantial reduction in productivity or reproduction as a result of this plan.
- Invasive plant treatments have the potential to impact only a relatively small portion, up to 2 percent, of the listed population of snowy plovers. Because these effects are anticipated to be short term and not result in significant mortality or reproductive failure, populations within this portion of the range will remain well distributed and not significantly reduced in numbers.
- Beachgrass does not provide suitable nesting habitat for snowy plover, therefore, most projects that treat beachgrass are not likely to impact snowy plover nest sites. Even if disturbed, plovers often renest and produce young generally in the same area, therefore, we do not anticipate any change in the species distribution from these actions.
- Treatments may restore nesting habitat and reduce predation and may therefore increase productivity. Failure to treat invasive plants may result in further habitat loss and continued or increased predation which may further reduce productivity.

Therefore, the Invasive Plant Program is not anticipated to reduce the reproduction, numbers, or distribution of snowy plover.

### ***Conservation Recommendations***

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

Where practicable, avoid treatments in or near snowy plover habitat during the nesting season (March through August).

If treatments are conducted during the snowy plover nesting season, have a biologist present on site during treatments in occupied snowy plover habitat to assist in location and avoidance of nests.

### **Western snowy plover critical habitat**

#### ***Status and baseline***

A detailed account of critical habitat for western snowy plover can be found in final rule to designate critical habitat for the Pacific coast population of the western snowy plover

(U.S. Fish and Wildlife Service 1999e) and the western snowy plover Pacific coast population draft recovery plan (U.S. Fish and Wildlife Service 2001b).

#### *Listing History*

On March 2, 1995 the USFWS published a proposed rule to designate critical habitat at 28 areas along the coast of California, Oregon, and Washington (U.S. Fish and Wildlife Service 1995d). The final rule designating critical habitat for the western snowy plover was published on December 7, 1999 (U.S. Fish and Wildlife Service 1999e).

In July 2003, a court order partially vacated the critical habitat designations and remanded the previous designation for preparation of a new analysis of the economic impacts. A Proposed Rule to designate (or re-designate) critical habitat was published in the Federal Register on December 17, 2004 (U.S. Fish and Wildlife Service 2004d).

#### *Description of Critical Habitat*

Proposed critical habitat for snow plover includes 28 areas totaling approximately 18,000 acres and 180 miles of coastline (U.S. Fish and Wildlife Service 1999e). Nineteen of these areas are in California, seven are in Oregon, and two are in Washington. In the ten years preceding designation of critical habitat, these sites had provided habitat for about 65 percent of nesting and 60 percent of wintering plovers in California, 95 percent of nesting and wintering plovers in Oregon, and 100 percent of nesting and 90 percent of wintering plovers in Washington.

Four of the 28 areas of designated critical habitat occur in the action area on the Siuslaw National Forest (U.S. Fish and Wildlife Service 1999e), which comprises approximately 18 percent of all designated critical habitat for the snowy plover. These areas include Baker Beach, Siltcoos Beach, Tahkenitch Creek, and Ten Mile Creek.

#### *Primary Constituent Elements*

In determining which areas to propose as critical habitat, the USFWS considers those physical and biological features that are essential to the conservation of the species and that may require special management considerations or protection. These include, but are not limited to, the following: space for individual and population growth, and for normal behavior; food, water, air, light, minerals, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal; and habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species.

The primary constituent elements for the western snowy plover are those habitat components that are essential for the primary biological needs of foraging, nesting, rearing of young, roosting, and dispersal, or the capacity to develop those habitat components. The primary constituent elements for snowy plover include areas that are free from disturbance and that support or have the potential to support intertidal beaches (between mean low water and mean high tide), associated dune systems, or river estuaries. Important components of the beach/dune/estuarine ecosystem include surf-cast kelp, sparsely vegetated foredunes (beach area immediately in front of a sand dune),

interdunal flats (flat land between dunes), spits, washover areas, blowouts (a hole or cut in a dune caused by storm action), intertidal flats (flat land between low and high tides), salt flats, flat rocky outcrops, and gravel bars. Several of these components (sparse vegetation, salt flats) are mimicked in artificial habitat types used less commonly by snowy plovers (i.e., dredge spoil sites and salt ponds and adjoining levees).

### ***Effects of the Action***

Because the primary constituent elements for snowy plover critical habitat includes habitat that is protected from disturbance, the effects of the Invasive Plant Program to snowy plover critical habitat are similar to those previously described for effects from disturbance to snowy plover. Invasive plant treatments are designed to improve and benefit snowy plover critical habitat. Because treatments occur in habitat that has been invaded by European beachgrass, impacts to other primary constituent elements are not anticipated.

Manual, mechanical, cultural, prescribed fire and herbicide treatments have the potential to adversely affect snowy plover critical habitat on the Siuslaw National Forest through disturbance. These treatments may lead to a short-term increase in the number of people and motorized vehicles in snowy plover critical habitat.

Disturbance from invasive plant treatments in critical habitat is expected to be rare because treatments for invasive European beachgrass on the Siuslaw National Forest are currently conducted outside the plover breeding season and therefore plovers will not be present during treatments and will not be exposed to disturbance. This timing of treatments is expected to continue in the future. If treatments for beachgrass need to be conducted during the breeding season, it is likely that only a small portion of critical habitat in the action area could potentially be impacted. Beach grass does not provide suitable nesting habitat for plovers, therefore only critical habitat on the boundaries of treatment areas occupied by snowy plovers between March and August has the potential to be impacted by invasive plant treatments.

Treatments will generally be short term and infrequent, requiring one to two treatments over 1 or 2 days, and the effects to snowy plover critical habitat will only last as long as the treatment.

Despite the potential for short term disturbance, invasive plants have eliminated the primary constituent elements in some areas of critical habitat. The long term goal of invasive plant treatments in snowy plover critical habitat is to improve habitat, therefore, treatments may have long term beneficial effects.

### ***Summary***

Manual, mechanical, cultural, prescribed fire, and herbicide treatments have the potential to result in short-term adverse effects to snowy plover critical habitat through disturbance if critical habitat is treated when plovers are present. These activities could occur over time in most of the snowy plover critical habitat in the action area, which represents approximately 18 percent of all critical habitat designated for the snowy plover.

Treatments will generally be short term and infrequent, requiring only one to two treatments over 1 or 2 days. Activities causing disturbance in critical habitat will only last as long as treatments and other primary constituent elements will not be impacted, therefore, the function of critical habitat is anticipated to remain unchanged. Plovers have successfully nested in restored habitat, indicating that treatments have the potential to improve critical habitat.

### ***Cumulative Effects***

Cumulative effects for the purposes of consultation under ESA are defined as, “the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area...” (50 CFR, Part 402). Future federal actions will be subject to the consultation requirements established in Section 7 of the ESA, and therefore, are not considered cumulative to the proposed action.

A variety of activities are adversely affecting snowy plovers. Recreational activities and associated pet dogs disturb adults and can trample eggs or young. Illegal access, intentional vandalism has resulted in mortality to eggs and chicks. Intensive nesting season monitoring conducted by State or private individuals and organizations creates short-term disturbance to adults and nests when data is being gathered and protective exclosures are being placed around nests. Future invasive plant projects conducted outside of federal beaches could cause disturbance and risk to nesting plovers.

### ***Conclusion***

The Invasive Plant Program will not destroy or adversely modify proposed critical habitat by, directly or indirectly, appreciably diminishing the value of critical habitat for the recovery of the snowy plover.

- Only 18 percent of snowy plover CH occurs in the action area. Only a small portion of this habitat would be disturbed at any particular time. Therefore, we do not anticipate any significant change in use of critical habitat by plovers.
- Invasive plant treatments are short term (1 to 2 days) and short duration. Impacts to critical habitat will only last as long as the treatments.
- Treatments for invasive European beachgrass on the Siuslaw National Forest are currently conducted outside the plover breeding season and this timing of treatments is expected to continue.
- Beachgrass does not provide quality nesting habitat for plovers, therefore treatments in these areas are not likely to cause disturbance to plovers because the birds are not likely to be utilizing unsuitable habitat.
- Invasive plant treatments have been demonstrated to improve critical habitat for the western snowy plover. Failure to treat invasive plants may result in further habitat loss.

Therefore, the Invasive Plant Program is not anticipated to have any significant short term or long term adverse effects to any of the physical or biological features that were the basis for determining the habitat to be critical and the Program has the potential to improve critical habitat for the snowy plover.

## **Oregon silverspot butterfly**

### ***Status and baseline***

Detailed accounts of the taxonomy, life history and behavior of the Oregon silverspot butterfly can be found in the final rule listing the species as threatened (U.S. Fish and Wildlife Service 1980), in the revised recovery plan for Oregon silverspot butterfly (U.S. Fish and Wildlife Service 2001c), and in the Siuslaw National Forest implementation plan for the Oregon silverspot butterfly (Siuslaw National Forest, undated).

### ***Listing History***

On July 2, 1980, the USFWS issued a final rule listing the Oregon silverspot butterfly as threatened and designated critical habitat (U.S. Fish and Wildlife Service 1980). This decision gave full protection of the ESA within the entire range of the species. A recovery plan was completed for the Oregon silverspot butterfly in 1982 (U.S. Fish and Wildlife Service 1982) and a revised recovery plan was finalized on November 30, 2001 (U.S. Fish and Wildlife Service 2001c).

### ***Distribution***

The Oregon silverspot butterfly historically occurs along the coastal zone of southern Washington, central and northern Oregon, and in Del Norte County in northern California. At least 20 separate localities were known for the butterfly in the past. The butterfly has been extirpated from at least 11 colonies (two in Washington, eight in Oregon, and one in California). The butterfly and its coastal grassland habitat were probably much more common in the past.

At present, the subspecies occurs at only six sites. They include one in Del Norte County, California, two in Lane County, Oregon, (Rock Creek-Big Creek and Bray Point), two in Tillamook County, Oregon (Cascade Head and Mt. Hebo), and one in Clatsop County, Oregon (Clatsop Plains). The Clatsop Plains site has declined according to recent surveys, with only one Oregon silverspot butterfly documented in 1998 (VanBuskirk 1993, 1998). In addition, surveys in 1990 confirmed continued presence of a population on the Long Beach Peninsula in Washington, however, subsequent surveys in 1992, 1996, 1997, and 1998 did not document any Oregon silverspot butterflies.

Of the six known sites for Oregon silverspot butterfly, three are within the action area on the Siuslaw National Forest: Mt. Hebo, Bray Point, and Rock Creek-Big Creek. The Mt. Hebo site appears to be an isolated population, but a marking study by The Nature Conservancy documented butterflies moving from the Bray Point population to the Rock Creek-Big Creek population.

### *Life History*

The Oregon silverspot butterfly is a darkly marked coastal subspecies of the *Zerene fritillary*, a widespread species in California, Oregon, and Washington. The silverspot is a medium sized butterfly, usually ranging from 1.0 inch for males and 1.1 inches for females (McCorkle et al. 1980). The silverspot has orange and brown markings with black veins and spots on the upper wing surface and bright metallic silver spots on the underwing surface. The Oregon silverspot butterfly differs from other subspecies of the *bremnerii* group by its coloration and small size (McCorkle and Hammond 1988).

Mating takes place in the fringe zone and salt-spray meadow proper when the summer winds diminish. Mating occurs in August and September. Females that have mated successfully wander over the forest canopy and into flowered clearings up to a mile inland, using a variety of different nectar sources. Males normally remain near the meadows in the forest fringe, nectaring within this area. Gravid females oviposit up to 200 or more eggs singly amongst the salt-spray meadow vegetation near the violet host plant, usually in late August and early September. Sites with good sun exposure are favored. The eggs hatch in approximately 16 days and the newly-hatched larvae wander short distances to find a suitable site for diapause (suspended growth during overwintering). The larvae end diapause sometime in early spring and begin to feed on the violet leaves. As the larvae grow, they pass through 5 molts before they pupate. Approximately 2 or more weeks later, the butterflies emerge (McCorkle et al. 1980).

Adult emergence starts in June and extends into September, with peak adult flight in August. Many males appear several weeks before most females emerge, as is typical of *Speyeria* butterflies. Mating usually takes place in relatively sheltered areas. Adults will often move long distances for nectar or to escape windy and foggy conditions. The Oregon silverspot differs from related taxa in slow larval development rates. This appears to be an adaptation to a harsh, coastal environment characterized by fog and cold wind throughout much of the year. A slow caterpillar development rate synchronizes the adult flight season with best coastal weather conditions.

The adult butterflies generally move out of the meadows into the fringe of conifers or brush where there is shelter for more efficient heat conservation and nectaring flights. The forest shelter may also be used for courtship and mating purposes. Where such sheltered conditions exist, the adults will use various nectar sources, both native and exotic species of plants.

The western blue violet (early blue violet) (*Viola adunca*) is normally the only species on which the Oregon silverspot larvae can successfully feed and develop, although they are known to feed on a few other species of the genus *Viola* as well. On Mt. Hebo, both oviposition and caterpillar feeding have been observed on yellow stream violets (*V. glabella*). The adult females seek out violet host plants and lay their eggs on or near them. Larvae feed on violets through the following spring and summer. This plant is part of the salt-spray meadow vegetation and is an obligatory component of the butterfly's habitat.

Nectar plants most frequently used by the Oregon silverspot adults are members of the aster (Composite) family, including goldenrod (*Solidago canadensis*), dune goldenrod (*Solidago spathulata*), California aster (*Aster chilensis*), pearly everlasting (*Anaphalis margaritacea*), and yarrow (*Achillea millefolium*).

The Oregon silverspot butterfly occupies an early successional, coastally-influenced grassland habitat that contains the caterpillar host plant, early blue violet, adult nectar sources, and adult courtship areas. Soil and climatic conditions, salt-spray or mist, and disturbance regimes (such as fire) historically contributed to maintaining low, open grasslands within the species' range by suppressing encroaching trees and shrubs

Stands of early blue violets sufficient to provide enough food for Oregon silverspot butterfly caterpillars on the Oregon Coast occur only in relatively open and low-growing grasslands (Hammond and McCorkle 1984). Small stands of violets found in small forest clearings isolated from open grasslands are not adequate to support the butterfly. Early blue violet abundance has declined at all Oregon silverspot habitat areas in Oregon, likely due in part to competition from non-native vegetation (U.S. Fish and Wildlife Service 2001c).

Historically, fire is thought to be the dominant factor that maintained Oregon's coastal grassland communities and their endemic species. Other disturbances such as landslides, small mammal activities, wind throw, and herbivory by invertebrates, small mammals and large native ungulate grazers are thought to have played a secondary role in opening early successional habitat conditions. Severe fires in 1845 and 1910 converted substantial portions of Mt. Hebo from forest to grassland. Since that time fire frequencies on the Oregon coast have been greatly reduced and the extent of coastal grasslands has declined dramatically.

#### *Population Dynamics*

Historically, Oregon silverspot butterflies likely exhibited a metapopulation structure; a group of populations inhabiting a mosaic of habitat patches where extinction of local populations in particular patches were re-colonized by individuals from adjacent patches (Hanski and Gilpin 1997). Habitat fragmentation and subsequent isolation of Oregon silverspot butterfly populations on the present-day landscape have resulted in discrete populations which are presumed to be isolated from one another. One notable exception is the Rock Creek-Big Creek / Bray Point habitat complex. The Nature Conservancy marked butterflies at both sites and documented interchange from the northerly Bray Point south to Rock Creek-Big Creek (VanBuskirk and Pickering 1999), indicating that Oregon silverspot butterflies are able to disperse at least 5 miles) in the direction of the prevailing wind.

Oregon silverspot butterfly populations at the four central coast sites appeared to have been relatively stable between 1985 and 1990 (Hammond 1988) however, populations at all four sites exhibited a marked decline in 1993 following cool, wet spring weather conditions (Pickering 1998, 2000). Populations at Rock Creek-Big Creek in 1993 were reduced to nearly 80 percent below the 11-year mean for that site, Cascade Head and

Mount Hebo each dropped by approximately 60 percent from their respective historic means, and Bray Point dropped by 20 percent.

In 2004, another detrimental weather year, all central coast sites had index of abundance values significantly below their 15 year mean. At Mount Hebo the 2004 index value was 588 while the 15 year index mean was 2,344 butterflies. The 2004 index of abundance value at Bray Point was 2 butterflies (15 year mean index value is 82) and at Rock Creek Big Creek the 2004 index value was 131 butterflies (15 year index value is 184). Despite two small scale augmentation efforts at Cascade Head, in 200 and 2003, and one at Bray Point and Rock Creek-Big Creek in 2004 the population levels remain low and have not rebounded following the 1993 decline (Pickering 2005). The index values from 1990 to 2004 indicate that the Oregon silverspot butterfly population status at Mount Hebo, Cascade Head, Rock Creek-Big Creek, and Bray Point are at great risk and future efforts to simultaneously augment populations and improve habitat conditions will be vital in preventing the extinction of the species.

### *Threats*

The primary criterion for listing the Oregon silverspot butterfly was the present or threatened destruction, modification, or curtailment of habitat or range (U.S. Fish and Wildlife Service 1980). Non-native grasses and other introduced species commonly invade meadows, crowding out low-growing early blue violet and nectar plants needed by the butterfly. Tree species are invading meadows in silverspot habitat as succession progresses. Vegetation management techniques, such as mowing, used effectively to control brush species have been relatively non-effective in the long run or even beneficial for non-native grass species. Invasive grasses have become a significant threat to Oregon silverspot butterfly and currently limit recovery of the species (U.S. Fish and Wildlife Service 1982).

Development and human activity has also reduced available habitat. Seaside meadow sites have been used for residential and business establishments, public parkland development, and parking areas or lawns. Excessive use of the salt-spray meadows by grazing animals or off-road vehicles has directly eliminated habitat (McCorkle et al. 1980). Secondary impacts of people's activities, introduction of exotic plants, and alteration of the natural fire regime with subsequent succession of meadows to brush and woodlands, have also contributed to a reduction in suitable habitat (U.S. Fish and Wildlife Service 1982). Road kills (collisions with vehicles) and pesticides have also been identified as a threat to the Oregon silverspot butterfly.

### *Ongoing Conservation*

The Siuslaw National Forest and the Nature Conservancy have developed interim plans for implementing recovery actions and management plans were completed for five habitat areas on the Forest including Mt. Hebo, Roads End, Rock Creek-Big Creek, Bray Point, and Fairview Mountain. Habitat rehabilitation for the Oregon silverspot butterfly has begun, mainly at Rock Creek-Big Creek, Mt. Hebo, Cascade Head, Clatsop Plains, and Long Beach Peninsula. Monitoring has been conducted to determine responses of early blue violets, other vegetation, and butterflies to various treatments.

Evaluation of potential sites for expansion of existing populations or establishment of additional populations was initiated in the 1980's. The Siuslaw National Forest identified two possible sites and implemented management and restoration actions. These sites were Fairview Mountain near the Central Coast Habitat Conservation Area, and Roads End near Cascade Head Habitat Conservation Area. Attempts to introduce butterflies from Rock Creek-Big Creek and from Mt. Hebo populations to Fairview Mountain in 1985 and again in 1991 were unsuccessful (Hammond and McCorkle 1991a).

The USFWS entered into cooperative agreements with each state resource agency with jurisdiction for invertebrates in the range of the Oregon silverspot butterfly. These agreements allow the state resource agency to develop conservation programs for the species and apply for Federal funds through section 6 of the ESA. A number of research projects, surveys, and recovery actions for the species have been cooperatively funded as part of the section 6 program of grants to the States.

The Oregon silverspot butterfly Recovery Plan grouped habitat into six conservation areas based upon geographic proximity and/or similarity of habitat. Each habitat conservation area includes one or more existing populations of the Oregon silverspot butterfly and four have potential habitat for management of at least two populations. There are three Conservation Areas on the Siuslaw National Forest: the Coastal Mountains Habitat Conservation Area, the Cascade Head Habitat Conservation Area, and the Central Coast Habitat Conservation Area.

#### *Conservation Needs*

The recovery needs of Oregon silverspot butterflies are described in detail in the revised Recovery Plan (U.S. Fish and Wildlife Service 2001c). To achieve recovery, the butterfly should be secure in all six of the habitat conservation areas to maintain its existing distribution and to maintain the genetic diversity of its existing populations (U.S. Fish and Wildlife Service 2001c). At the present time, four of the six conservation areas support at least one existing population of the Oregon silverspot butterfly. For recovery, each of these four habitat conservation areas should support at least two viable populations. Currently available information suggests the minimum size for a population to be viable is approximately 200 to 500 butterflies (Franklin 1980).

More habitat may be needed to sustain a viable population at the Long Beach or the Clatsop Plains habitat conservation area than at the Coastal Mountain or Cascade Head habitat conservation areas. However, data are not yet available to determine specific habitat acreage objectives for each habitat conservation area. Additionally, data on mortality rates, dispersal, and habitat variables are needed to refine habitat conservation area boundaries, develop alternative habitat conservation area designs, and to analyze or better model population viability.

Until significant new information can be obtained about the species' habitat requirements, the highest priority (or need) is to protect habitat to maintain existing populations of Oregon silverspot butterflies, especially in areas where most of the habitat

remains unprotected or unmanaged (such as at Long Beach, Clatsop Plains, and Del Norte habitat conservation areas) or where population numbers are low or declining, which is currently most of the range of the butterfly. Additional habitat surveys and inventories will be needed to identify areas that need protection and areas that require management to maintain or increase available habitat.

The Recovery Plan states that augmentation should be implemented to bolster small existing populations before they become so low that they are at risk of extirpation. Augmentation of existing populations should be a priority over attempts to reintroduce or establish new populations, especially in situations where captive rearing facilities or donor stock may limit the number and scale of augmentation events that are possible in a given year.

Comprehensive management plans are needed for all Oregon silverspot butterfly habitats, particularly for habitat conservation areas with multiple land ownerships. Habitat management techniques should be continually refined to evaluate habitat conditions and effectiveness of management, and management plans should be periodically updated based upon new information.

### ***Effects of the Action***

Some manual, mechanical, cultural, prescribed fire and herbicide treatments have the potential to adversely affect Oregon silverspot butterfly on the Siuslaw National Forest if applied to occupied habitat. These effects are caused by the presence of people, grazing animals, or equipment working in occupied habitat and have the potential to burn, crush, or trample larvae or butterflies. Biological treatments are not anticipated to have any effect on Oregon silverspot butterflies.

### ***Herbicides***

Of the herbicides included in the Invasive Plant Program, only glyphosate, and triclopyr have the potential for direct adverse effects to the Oregon silverspot butterfly, based on currently available data, if it is directly sprayed. The effects from triclopyr are expected to be minimal because the application method used (hand application only) will reduce the size of an area that can be treated, provides selectivity, and therefore, reducing the chances for directly spraying or crushing larvae or butterflies. All herbicides in the Invasive Plant Program have the potential to harm early blue violets, the primary larval food source, with the possible exception of sethoxydim, which is a grass specific herbicide.

Although herbicides are not currently used on the Siuslaw National Forest in occupied habitat for the Oregon silverspot butterfly, the new tools incorporated in the Invasive Plant Program will provide the Forest additional tools to manage invasive plants. The inclusion of the grass-specific herbicide sethoxydim provides a method to treat invasive grasses which are currently a large threat to the butterfly.

A study investigating the effects of controlling false brome within areas containing the federally listed Fender's blue butterfly and Kincaid's lupine, found that although a

variety of herbicides were tested, no treatment caused a significant decline in the number of Kincaid's lupine leaves or the number of Fender's blue butterfly larvae (Clark et al. 2003). The most promising treatment used a grass-specific herbicide. This treatment reduced the cover of the invasive false brome, while producing 70 percent more lupine leaves and the highest numbers of butterfly larvae.

Based on discussions with the U.S. Forest Service, we do not anticipate wide-spread application of herbicides to occupied Oregon silverspot butterfly habitat. Herbicides are generally used only in unoccupied habitat and in a selective manner (John Sanchez, Siuslaw National Forest, pers. comm. 2005). If sethoxydim proves to be effective in reducing non-native grasses with little risk to the butterflies or the early blue violet, it may be used more widely in occupied habitat in the future. Even then, spot treatments are more likely to protect desirable native grasses.

#### *Mechanical*

Mechanical treatments, such as mowing, are currently conducted on the Siuslaw National Forest to control the encroachment of woody brush and trees into meadows, as well as some treatment of invasive grasses. Mowing to control encroachment of native woody species is not considered part of the Invasive Plant Program. Mowing was also initially successful at controlling exotic bentgrass (*Agrostis alba*), but currently the grasses are forming a thick sod and are suppressing violet growth (Hammond 2000).

Research on habitat management at the Nature Conservancy's Cascade Head Preserve has shown that mowing encouraged non-native grasses which are more sod forming and produce more thatch than native grasses, thus suppressing the early blue violets more quickly than natural seral succession of native species (Pickering et al. 2001). Therefore, mowing may be useful for controlling invasion of brush and young trees, but current management and research has shown that mowing is not successful at long term control of invasive grasses, which places further emphasis on the importance of the ability to use a grass specific herbicide to treat in silverspot butterfly habitat.

Mowing, with weed eaters or large equipment, is used to reduce grass density and allow butterflies access to violets for egg laying. This mowing is conducted in early summer, prior to the pupation when butterflies and larvae are less likely to be damaged. Based on discussions with the U.S. Forest Service, we anticipate that this timing of mowing will continue (J. Sanchez, pers. comm. 2005).

#### *Prescribed Fire*

Prescribed fire has consisted of pile burning woody debris and broadcast burning of meadows on a limited basis. Research on habitat management at the Nature Conservancy's Cascade Head Preserve has shown that broadcast burning increased early blue violets seedling recruitment as compared to mowing or no treatment, although the effect was short term due to fire induced increases in non-native velvet grass (*Holcus lanatus*) and common sheep sorrel (*Rumex acetosella*) (Pickering et al. 2001). The U.S. Forest Service does not anticipate burning in occupied silverspot butterfly habitat,

therefore we do not anticipate any losses of butterflies to prescribed fire (J. Sanchez, pers. comm. 2005).

### *Cultural*

Grazing has not been used in Oregon silverspot butterfly habitat. Hammond (2000) advises against heavy grazing in butterfly habitat, due to the spread of exotic grasses and trampling of habitat. Light grazing may be a way to control grasses in Oregon silverspot butterfly habitat. The advantage to light grazing over mowing is that grazing animals can remove thick sod and they recycle nutrients.

### *Summary*

Because the various butterfly sites on the Siuslaw National Forest have different encroachment and invasive plant issues, the U.S. Forest Service may need to utilize varying combinations of treatments to effectively manage Oregon silverspot butterfly habitat. Careful site specific planning and future consultation will allow the U.S. Forest Service to treat silverspot butterfly habitat in a manner that will have minimal adverse effects and may provide long term beneficial effects.

Manual, mechanical, cultural, prescribed fire, and herbicide treatments have the potential to result in adverse effects to Oregon silverspot butterfly through direct harm by treating occupied habitat. The U.S. Forest Service continues to apply these methods in a manner to minimize adverse affects to the butterflies and will continue to do so under Standard 20. Although these treatments have the potential to cause the loss of a few individuals, failure to treat the invasive plant problems may pose a much greater threat to the species by increasing the risk of extinction. Populations continue to decline despite the effort to improve silverspot butterfly habitat with existing methods. The incorporation of new tools, such as sethoxydim (grass-specific herbicide), has the potential for long term beneficial effects to the species and may be vital for the survival and recovery of the silverspot butterfly.

### *Cumulative Effects*

Cumulative effects for the purposes of consultation under ESA are defined as, “the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area...” (50 CFR, Part 402). Future federal actions will be subject to the consultation requirements established in Section 7 of the ESA, and therefore, are not considered cumulative to the proposed action.

State and private actions within the action area that may influence the future availability or management of habitat include ongoing residential development, off-road vehicle use, and grazing. We are unaware of any specific plans for additional development in Oregon silverspot butterfly habitat within the action area.

### *Conclusion*

The Invasive Plant Program will not jeopardize the continued existence of the Oregon silverspot butterfly by, directly or indirectly, reducing appreciably the likelihood of

survival and recovery of the butterfly in the wild by reducing the reproduction, numbers, or distribution of the species.

- While there is a risk of loss of a few individuals from treatments under this plan, failure to treat invasive plants in Oregon silverspot butterfly habitat will likely result in an increased risk of extinction by further degradation of suitable habitat.
- The incorporation of new tools, such as sethoxydim (grass-specific herbicide), has the potential for long term beneficial effects to the species and may be vital for the survival and recovery of the Oregon silverspot butterfly.
- Standard 20 requires that projects be designed to minimize or eliminate adverse effects to listed species. Based on the U.S. Forest Service's continuing commitment to managing for Oregon silverspot butterfly habitat, site specific project designs will be unlikely to incorporate treatment types that will not accomplish the goals of restoring habitat with minimal impacts to the silverspot butterfly. Future consultation will be required prior to implementation of any projects that may affect the butterfly.

Therefore, the Invasive Plant Program is not anticipated to reduce the reproduction, numbers, or distribution of the Oregon silverspot butterfly.

### ***Conservation Recommendations***

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

Conduct trials with sethoxydim in unoccupied butterfly habitat to determine the effectiveness in treating invasive grasses with minimal impacts to the early blue violet. If sethoxydim proves successful, consider utilizing this tool to treat invasive grass in occupied butterfly habitat.

Avoid herbicide treatment of a large portion of a single Oregon silverspot butterfly population in a given year, unless sethoxydim (grass-specific herbicide) is proven to not be harmful to the butterfly or its host plant.

Avoid the use of glyphosate in butterfly habitat, due to its potential toxicity to Oregon silverspot butterflies.

### **Oregon silverspot butterfly critical habitat**

#### ***Status and baseline***

A detailed account of critical habitat for the Oregon silverspot butterfly can be found in the final rule to list the Oregon silverspot butterfly as a threatened species with critical

habitat (U.S. Fish and Wildlife Service 1980) and the Revised Recovery Plan for the Oregon silverspot butterfly (U.S. Fish and Wildlife Service 2001c).

#### *Listing History*

On July 3, 1978 the USFWS published a proposed rule to designate critical habitat for the Oregon silverspot butterfly at two sites in Lane County, Oregon (U.S. Fish and Wildlife Service 1978). On March 6, 1979, this proposal was withdrawn because of procedural and substantive changes in the Endangered Species Act Amendments of 1978. On March 26, 1980, critical habitat for the Oregon silverspot butterfly was re-proposed and the final rule designating critical habitat was published on July 2, 1980 (U.S. Fish and Wildlife Service 1980).

#### *Description of Critical Habitat*

The Rock Creek – Big Creek site in Lane County, Oregon, is the only designated critical habitat for the Oregon silverspot butterfly. Within the 437.5 acres of designated critical habitat in Rock Creek-Big Creek, approximately 235 acres of meadow, shrubland, and forest are within the action area on the Siuslaw National Forest. Of the 235 acres of designated critical habitat on the Siuslaw National Forest, only about 50 acres contain potential butterfly habitat (U.S. Fish and Wildlife Service 2001c).

#### *Primary Constituent Elements*

In determining which areas to propose as critical habitat, the USFWS considers those physical and biological features that are essential to the conservation of the species and that may require special management considerations or protection. These include, but are not limited to, the following: space for individual and population growth, and for normal behavior; food, water, air, light, minerals, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal; and habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species.

The constituent biological elements essential to the continued existence of the Oregon silverspot butterfly within the Critical Habitat include the larval food plant the early blue violet, native grasses and forbs in which the larvae find shelter, the composite plants from which the adults obtain nectar, and the spruce woods adjacent to meadows in which the adults find shelter.

#### *Threats*

Within the critical habitat unit, Japanese knotweed has invaded the watershed, forming a virtual monoculture along the waterways and posing a threat to early blue violet (Paul Bridges, USFWS, pers. comm., 2005)

#### *Effects of the Action*

Invasive plant treatments in Oregon silverspot butterfly critical habitat are implemented to protect and restore the larval food plant (early blue violets) populations and nectar sources for this species. However, treatment methods that are successful at affecting the invasive and competing vegetation may also have the potential to impact early blue

violets. Mowing may crush some individuals of early blue violets, and may favor some exotic grasses in the long term. Burning or herbicides have the potential to kill violets in the short term, but may reduce grasses in the long term. All herbicides in the Invasive Plant Program have the potential to harm early blue violet with the possible exception of sethoxydim, which is a grass specific herbicide. Manual and mechanical treatments may include people or vehicles that may trample violets. For a complete discussion on the effects to habitat, see the “Effects of the Action” under the silverspot butterfly above.

Although herbicides are not currently used on the Siuslaw National Forest in critical habitat for the Oregon silverspot butterfly, the new tools incorporated in the Invasive Plant Program may provide the Forest with an effective method to treat invasive grasses which are currently outcompeting the early blue violets.

Implementation of habitat restoration projects, especially when considering the use of a grass specific herbicide, is essential for slowing or reversing the continued degradation of Oregon silverspot critical habitat.

#### *Summary*

Manual, mechanical, cultural, prescribed fire, and herbicide treatments have the potential to result in adverse effects to Oregon silverspot butterfly habitat by killing early blue violets. Although these treatments have the potential to cause the loss of a few individual plants, failure to treat may pose a much greater threat to critical habitat. Silverspot butterfly habitat continues to degrade despite the effort to improve it with existing methods. The incorporation of new tools, such as sethoxydim (grass specific herbicide), has the potential for long term beneficial effects to critical habitat.

#### ***Cumulative Effects***

Cumulative effects for the purposes of consultation under ESA are defined as, “the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area...” (50 CFR, Part 402). Future federal actions will be subject to the consultation requirements established in Section 7 of the ESA, and therefore, are not considered cumulative to the proposed action.

Because critical habitat for the Oregon silverspot butterfly is located entirely within Federal lands, there are no cumulative effects.

#### ***Conclusion***

The Invasive Plant Program will not destroy or adversely modify Oregon silverspot butterfly critical habitat by, directly or indirectly, appreciably diminishing the value of critical habitat for the recovery of the butterfly.

- While there is a risk of loss of some individual plants from treatments under this plan, failure to treat or continuing the current approach to treating invasive plants in silverspot butterfly critical habitat may increase the risk of extinction by further degradation of critical habitat.

- The incorporation of new tools, such as sethoxydim (grass-specific herbicide), has the potential for long term beneficial effects to critical habitat.
- Standard 20 requires that projects be designed to minimize or eliminate adverse effects to listed species. Site specific project designs will be unlikely to incorporate treatment types that will not accomplish the goals of restoring habitat with minimal impacts to the Oregon silverspot butterfly's critical habitat. Future consultation is required prior to implementation of any projects that may affect silverspot butterfly critical habitat.

Therefore, the Invasive Plant Program is not anticipated to have any significant long term adverse effects to any of the physical or biological features that were the basis for determining the habitat to be critical and has the potential to improve critical habitat for the Oregon silverspot butterfly.

### **Showy stickseed**

#### ***Status and baseline***

Detailed accounts of life history, taxonomy and ecology can be found in the final rule listing for showy stickseed as endangered (U.S. Fish and Wildlife Service 2002b).

#### *Listing History*

The USFWS published a final rule listing showy stickseed as endangered on February 6, 2002. Critical habitat has not been designated for this species.

#### *Distribution*

The range of showy stickseed is extremely small. The one known population of this species is entirely within the action area. The species is found directly adjacent to State Route 2 in Tumwater Canyon within the Tumwater Botanical Area. This site near Leavenworth, in Chelan County, Washington is managed by the Wenatchee and Okanogan National Forest.

#### *Life History*

Showy stickseed is a showy perennial of the Boraginaceae family. It is a short, moderately stout species, 8 to 16 inches tall, often with numerous, erect to ascending stems from a slender taproot. It has large, showy, five-lobed white flowers. Showy stickseed is morphologically uniform and distinct from other *Hackelia* occurring in central Washington. It can be distinguished by its small stature, shorter leaf length, fewer basal leaves and larger flowers. It is genetically distinct from a high elevation population that was once considered the same species (U.S. Fish and Wildlife Service 2002b).

Showy stickseed begins flowering in late April. The inflorescence will lengthen with maturity, producing new flowers until late June or early July. By mid-June, the lowest flowers have nearly mature fruits. Full maturity is probably reached in early July, with fruit dispersal soon following. Little is known about the reproductive biology of this species. Its taxon is assumed to be an obligate to outcrossing. Pollinator species are

unknown, but bees, moths and thrips have been reportedly documented at the site. High seed abortion rates have been documented in the past for this species. In 1984, an estimated 60 to 70 percent of the seeds in the population aborted (Gamon 1997).

Showy stickseed is somewhat shade intolerant and grows in openings within ponderosa pine and Douglas fir forest types. It is found on open, steep slopes (minimum of 80 percent inclination) of loose, well drained, weathered and broken, rock and granitic soils at elevations of about 1,600 feet, though scattered individuals occur in a state highway roadcut and within the right-of-way.

#### *Population Dynamics*

Population estimates for the species have been reported regularly since the 1980's. During the late 1990s and since the publication of the proposed rule to list in 2000, the population of showy stickseed has been monitored nearly on an annual basis. Population estimates have fluctuated over this time period. Recent surveys have located several new groups of individuals; all in the same vicinity of the original population. The discovery of these populations has raised the number of known plants from around 500 in 2001 to roughly 772 in 2004. The original population covered an area less of than 2.5 acres in size at an elevation ranging from 1,600 to 1,800 feet. The sub-populations extend the site approximately one half mile downriver and upslope to 2,700 feet. The species was found in two types of habitat; open, loose granitic sand with scattered rock and talus, and on granite cliff crevices and ledges with pockets of granitic sand. Some larger clusters of plants seemed to be associated with drainages or gullies with some active erosion (Florence Caplow, Washington Department of Natural Resources, pers. comm., 2005, Caplow 2004).

In 1994, a wildfire burned through Tumwater Canyon, resulting in mixed effects to showy stickseed habitat. The primary outcome was that the forest canopy was reduced, creating less shade and competition and more open growing space. This created new, suitable sites for the natural regeneration and establishment of seedlings. A negative impact of the fire was an increased potential for landslides where wildfire removed the upper and lower forest canopy.

A fieldwork summary in 2004 concluded that it was a successful growing season for showy stickseed based on the size, vigor, and seed production of the plants. Approximately 272 more plants were discovered over a much larger area than the original population. Most of the sub-populations appeared to be composed of adult flowering plants in 2004. Seedlings were only seen at a few sites, including 15 seedlings at one cliff site.

#### *Threats*

Major threats to showy stickseed include collection, physical disturbance to the plants and habitat by humans, mass wasting, competition and shading from native trees and shrubs, encroachment onto the site by nonnative noxious weed species, wildfire, fire suppression and associated activities, and low seedling establishment. Highway maintenance activities also threaten portions of the population. Reproductive vigor may

be depressed because of the species' small population size, a limited gene pool, and loss of pollinators.

Wildflower collection poses a serious threat to showy stickseed. The species has been collected by scientists and wildflower enthusiasts for over 30 years. The population is easily accessible because it is located adjacent to a busy highway with a turnout directly across the road. Collecting has been witnessed in past site visits (U.S. Fish and Wildlife Service 2002b).

Potential landslides, small or large are considered a threat. Soil movement, dislodging or burying plants below has been witnessed (U.S. Fish and Wildlife Service 2002b). The potential for larger scale slumping has increased since the wildfire in 1994.

Highway maintenance activities remain an ongoing threat. After one small landslide event, the clearing of debris removed approximately 50 individuals. Roadside sanding and salting during the winter has also affected potential roadside habitat.

Invasive plants are also a threat. Two nonnative, invasive plants occur within the habitat of showy stickseed in Tumwater Canyon, dalmatian toadflax and diffuse knapweed, which are present along the roadside and have been increasing annually. Dalmatian toadflax is also located approximately 300 feet upslope of the original population (F. Caplow, pers. observation. 2004). The plants are scattered across roughly one-fourth acre, though not densely. The erosion potential is high due to the granitic, loose soils, which may make it difficult to treat the toadflax without damaging downhill stickseed plants. A narrow band of cliffs is present between the toadflax and the showy stickseed, which could reduce erosion potential. Native vegetation is present where the toadflax is growing so removal efforts will not leave bare soil. Both species of these invasive plants are known to compete with many native plant species for uptake of water and nutrients and interfere with photosynthesis and respiration of associated species. They also produce chemical compounds that may directly affect seed germination and seedling growth and development of indigenous plants.

#### *Ongoing Conservation*

The Tumwater Canyon Botanical Area was designated in 1938 to protect another species, *Lewisia tweedyi*. Since then, the species has been found to be more common, but the discovery of the showy stickseed within the botanical area, as well as *Silene seelyi* has allowed the U.S. Forest Service to maintain the designation. Specific management targeted to conserve the species has taken place. In 2000, the U.S. Forest Service developed a habitat restoration plan in which they conducted an environmental analysis, conferenced with the USFWS and implemented restoration activities for both species. For example, during the winter of 2000, the U.S. Forest Service, in cooperation with the Washington Department of Transportation and the USFWS, implemented a restoration project involving the felling and removal of 35 small trees and one very large standing dead tree. The project was done under a heavy snowpack to protect the showy stickseed plants. The project provided reduction in shade, reducing competition for light and water. The Washington Department of Transportation also developed a management

plan, “Final Management Plan for Rare Plant Species in Tumwater Canyon, Wenatchee National Forest, with Associated Best Management Practices” (Washington Department of Transportation 2000). The plan provided guidance and Best Management Plans for road crews conducting maintenance activities that are undertaken along the stretch of the highway in Tumwater Canyon that showy stickseed occupies.

Some invasive plant management has taken place along the roadsides close to showy stickseed habitat. The project incorporated hand pulling and careful herbicide application in habitat directly adjacent to the road to keep invasive plants from spreading upslope to the showy stickseed population. In the past, the Washington Department of Transportation applied 2,4-D, Oust and Roundup. Specific effects to showy stickseed from such applications in the past are unknown. The Washington Department of Transportation currently applies herbicides one-half mile outside of the population along the highway. Within the population area, dalmation toadflax and diffuse knapweed are hand-pulled.

#### *Conservation Needs*

The continued existence of this species depends on the adequate planning, protection of the current population, removal of threats, and expanding the population into additional suitable habitat. Protecting the site from direct effects of habitat destruction or degradation and the indirect effects of encroachment by invasive non-native species should be pursued among other recovery efforts.

#### *Effects of the Action*

As noted above, a dalmation toadflax population is located upslope of the population in very loose soil and covers roughly approximately one-fourth acre. Invasive plant species are considered a threat to showy stickseed in the listing documentation (U.S. Fish and Wildlife Service 2002b). The steep and loose nature of the habitat precludes the use of mechanical, cultural, or prescribed fire near showy stickseed. Biological treatments are not anticipated to have any effect on showy stickseed because they would not require additional disturbance of the area. Insects would be unlikely to affect showy stickseed because the target species are not closely related to stickseed, reducing the potential that they might feed on stickseed.

Manual or chemical herbicide treatments could affect showy stickseed. Chemical options would not be used unless manual treatments prove to be ineffective by themselves. Adverse effects could occur during manual treatment causing the loose soil upslope or below showy stickseed to move or erode. This activity contains a moderate probability that it could bury, uproot or damage individual plants. The risk of these effects can be lowered significantly by limiting the number and location of people implementing the manual treatments and directing foot traffic through unoccupied or rocky areas when approaching the toadflax infestation. Another effective minimization technique would be to clip flower heads and only pull new seedlings of dalmation toadflax in areas if they are ever found to occupy the same site (this has not happened yet). With one annual visit, expected to last one to two days, the size of the toadflax infestation could be suppressed with less soil disturbance.

Due to the steep and loose nature of the habitat, manual treatments will likely be limited to hand pulling of weeds. During manual treatments, the mechanism of effect is most likely through direct crushing of germinants, individual sub-mature, and mature plants by access on foot. In addition, the related sloughing and displacement of soils, rock, and woody debris by workers could uproot, bury, or otherwise damage showy stickseed plants. The potential use of chemical treatments could cause loss or damage to individual plants through unintended herbicide exposure from spot treatments, and the related physical effects described above caused by movement of workers.

A band of cliffs lies between the approximate 300 foot expanse between the current uphill toadflax infestation and the showy stickseed population, providing a buffer that may reduce the amount of erosion from upslope treatments. Also, the toadflax exists amongst native vegetation, meaning that removal of the invasive plant will not leave large areas of bare soil.

The risk of adverse effects from manual treatments is expected to be low due to the distance, and the band of bedrock between the toadflax and the showy stickseed. Only small areas on the perimeter of the current population are at risk of invasion, and therefore, treatment. However, manual treatments may not be completely effective due to the size and depth of taproots and the length of horizontal roots of the dalmation toadflax. Because of these characteristics, manual control of dalmation toadflax may take years. Chemical treatments combined with periodic manual treatments may be an appropriate solution at this site. Because invasive plant invasion is unlikely to occur in all parts of the population, only small spot treatments would be performed.

Herbicides with soil residual potential may be used in selected locations and could cause unintended adverse effects. Herbicides adhered to soils could move downslope toward the population through erosion or through surface water runoff and potentially affect showy stickseed plants, although the band of cliffs will likely minimize such risk. Damage is less likely to occur when an herbicide such as imazapic, which has less potential for soil residual effects, is used. This herbicide is more selective than glyphosate, which has less potential for soil residual effects and greater potential to impact non-target plants. Runoff potential would be reduced and the native plant community growing with showy stickseed would be less affected.

Exposure to herbicide by overspray or drift is very unlikely, because the plants are fairly conspicuous to the trained eye, and are easily avoided. Additionally, selective application methods would likely be used if manual treatments were not effective, such as defined spot spray, shielding spray or hand wiping.

#### *Summary*

Manual or chemical herbicide treatments could affect showy stickseed, though chemical options would not be used unless manual treatments prove to be ineffective. Adverse effects could occur if the loose soil upslope or below showy stickseed is moved and buried, uproots, or damages individual plants. During manual treatments, germinants,

individual sub-mature, and mature plants may be crushed. This may be minimized by limiting the number and location of people and directing foot traffic through unoccupied or rocky areas. The potential use of chemical treatments could cause loss or damage to individual plants through unintended herbicide exposure, and the related physical effects described above caused by movement of workers.

The risk of adverse effects from manual treatments is expected to be low due to the distance, and the band of bedrock between the current toadflax infestation and the showy stickseed. However, manual treatments may not be completely effective due to the size and depth of taproots and horizontal roots of the dalmatian toadflax. Exposure to herbicide by overspray or drift is very unlikely, because the plants are fairly conspicuous to the trained eye, and are easily avoided. Additionally, selective application methods would likely be used if manual treatments were not effective, such as defined spot spray, shielding spray or hand wiping.

### ***Cumulative Effects***

Cumulative effects for the purposes of consultation under ESA are defined as, “the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area...” (50 CFR, Part 402). Future federal actions will be subject to the consultation requirements established in Section 7 of the ESA, and therefore, are not considered cumulative to the proposed action.

Cumulative effects are not anticipated for showy stickseed due to its existence only on lands administered by the U.S. Forest Service. Washington Department of Transportation does not spray herbicides along the highway right-of-way within one-half mile of the current population.

### ***Conclusion***

The Invasive Plant Program will not jeopardize the continued existence of the showy stickseed by, directly or indirectly, reducing appreciably the likelihood of survival and recovery of showy stickseed in the wild by reducing reproduction, numbers, or distribution of the species.

- The potential effects from invasive plant treatments are expected to be insignificant, because they are expected to occur infrequently (once per year), on only a small portion of the area where showy stickseed is found.
- Although treating a small population in small area magnifies an ordinarily low risk of potential effects, the effects are offset by the potential benefits to showy stickseed of early invasive plant treatments.
- Minimization and avoidance measures such as those calling for site-specific project design and flagging of individuals and habitat in Standard 19 and 20 of the Biological Assessment will minimize the probability of effects from manual and chemical treatments to showy stickseed plants.

- The possible loss of scattered individuals or small groups due to unintended manual or chemical treatments will not significantly affect showy stickseed at the population level.

Therefore, the Invasive Plant Program is not expected to appreciably reduce the reproduction, numbers, or distribution of showy stickseed.

### ***Conservation Recommendations***

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

During manual or chemical treatments, limit the number, routes, and locations of people at the site. Direct ingress and egress through unoccupied or rocky areas to limit effects to showy stickseed habitat .

If they are ever found to occupy the same site as showy stickseed, clip the flower heads and pull new seedlings of invasive plants where practicable to limit soil disturbance. Use non-persistent herbicides in known habitat of showy stickseed plants, where possible. This will likely reduce the risk of effects to dormant individuals.

Where practicable, schedule applications to coincide with the most period of dormancy for showy stickseed, this would minimize the chances for exposure.

Where downslope movement of persistent herbicide is possible during runoff events, consider the use of an herbicide such as imazapic, which has less potential for soil residual effects. This herbicide is more selective than glyphosate, which has less potential for soil residual effects and greater potential to impact non-target plants. Potential exposure through runoff would be reduced and the native plant community would be less affected.

### **MacFarlane's four o'clock**

#### ***Status and baseline***

Detailed accounts of the life history, habitat requirements and ecology can be found in the revised recovery plan prepared by the USFWS (2000). Detailed descriptions of populations within the action area can be found in the Hells Canyon National Recreation Area Final EIS Comprehensive Management Plan (U.S. Forest Service 2003).

#### *Listing History*

MacFarlane's four-o'clock was originally listed as endangered by the USFWS in 1979 (US Fish and Wildlife Service 1979). A recovery plan was completed in 1985 (U.S. Fish and Wildlife Service 1985b). At the time of listing, only three populations were known, totaling 20-25 individual plants. Since the species was first listed, nine additional

populations have been discovered in Idaho and Oregon. As a result of recovery efforts and the discovery of additional populations, MacFarlane's four-o'clock was downlisted to threatened status on March 15, 1996 (U.S. Fish and Wildlife Service 1996c). Critical habitat has not been designated for this species.

#### *Distribution*

All currently known populations of MacFarlane's four-o'clock occur in two counties: Idaho County, Idaho and Wallowa County, Oregon. The 12 known populations are found in the Snake River Canyon area, the Salmon River drainage, and the Imnaha River drainage (U.S. Forest Service 2003). The Salmon River occurrences are not within the action area. The total geographic range of the species is approximately 29 by 18 miles (Kaye 1992).

#### *Life History*

MacFarlane's four-o'clock is a long-lived perennial with a deep seated, thickened root, growing in river canyon grassland habitats between 1,000 and 3,000 feet in elevation. These grasslands are characterized by regionally warm and dry conditions. Habitat for this species is generally open with scattered shrubs. Soils vary from sandy to talus substrate and plants are found on all aspects and slopes.

This species typically blooms from May through June. The bright pink flowers are conspicuous, up to 1 inch long by 1 inch wide. Each flower has the potential to produce one fruit and one seed (Kaye et al. 1990). The flower cluster is sparsely branched. The flowers consist of fused floral bracts that form a flaring tube about 0.5 inches long and enclose the majority of the five flower petals. Ten distinctive veins run along the length of this tube. Individual plants have been observed to live for over 20 years. Seeds are typically dispersed in June and July, and seed germination probably occurs in early spring. In addition to reproducing by seed, plants reproduce clonally from a thick, woody tuber that sends out many shoots. Studies on its genetic structure show that the species has lower genetic diversity than species with a similar life history (Barnes et al. 1994, 1995, Wolf et al. 1994). Some populations are comprised of several clones, others only a single clone. Since individuals within a clone are genetically identical, extensive reproduction by selfing may reduce genetic diversity. The greatest gene flow (pollen or seed dispersal) occurred between populations that were less than 1.2 miles apart.

Although MacFarlane's four-o'clock is self-compatible, it is thought to require a vector for pollination (Barnes 1996). Researchers have observed several types of insect visitors to this species including bumblebees (*Bombus* spp.), solitary bees (*Anthophora* and *Tetralonia* spp.), (Kaye and Mienke 1992, Barnes et al. 1995) and several genera of long-tongued bees. These species are considered to be vital to successful sexual reproduction of MacFarlane's four-o'clock (Barnes 1996).

Habitat analysis conducted in Oregon showed that distribution appeared to be influenced by slope aspect, soil development, topographic position and the density of non-native plants (Kaye 1992). At least two populations experienced burning from wildfire. Both populations survived with no apparent effects from burning.

### *Population Dynamics*

Within the action area, occurrences cross into different ownerships. The three Snake River occurrences are located on U.S. Forest Service lands, containing and estimated 3,300 plants. Two populations are found in the Imnaha River drainage, two of which inhabit both private and U.S. Forest Service lands. Population estimates at this site do not differentiate by ownership. This population contains 350 plants on an estimated 20 acres. Approximately 6,000 plants occur on U.S. Forest Service lands out of the current total population estimate of 8,000 to 9,000 individuals (39,000 to 44,000 stems).

Monitoring conducted by the BLM from 1981 to 1998 has documented significant annual fluctuation in stem counts and foliar cover, which are influenced by annual climatic conditions such as temperature and precipitation. Estimates of population size are complicated because new individuals produced by sexual reproduction are very difficult to distinguish from new stems produced clonally. The number of stems counted does not accurately reflect the number of genetic individuals (Barnes et al. 1994). U.S. Forest Service botanists have not observed seedling recruitment in areas of soil disturbance since these areas are subsequently invaded by weedy species (Jerry Hustafa, Wallowa Whitman NF 1999 *in*: U.S. Fish and Wildlife Service, 2000).

In a cooperative venture with the Oregon Heritage program potential habitat was modeled in the Hells Canyon National Recreation Area (U.S. Forest Service 2003). The predictive model identified 39,090 acres that may support MacFarlane's four-o'clock. The fraction of the Recreation Area that has actually been surveyed for the species is unknown.

### *Threats*

Among other sources of impacts, MacFarlane's four-o'clock is currently threatened by competition from non-native plant species, grazing by native and domestic ungulates, herbicide and pesticide spraying, and impacts from landslides and flooding.

Non-native teasel (*Dipsacus fullonum*), yellow starthistle (*Centaurea solstitialis*), scotch thistle (*Onopordum acanthium*), dalmation toadflax, rush skeletonweed (*Chondrilla juncea*), Himalaya blackberry and puncture vine (*Tribulus terrestris*) occur in the vicinity of MacFarlane's four o'clock populations. All occur directly adjacent to populations, except teasel and toadflax are found within populations. Yellow starthistle is the number one invasive threat to the species within the Salmon River Canyon (Craig Johnson, *in litt.* 1999 *in*: U.S. Fish and Wildlife Service 2000c).

Potential impacts from grazing include direct ingestion, trampling, erosion from trampling, introduction and spread of non-native plants and changes in species composition. In the action area, all of the U.S. Forest Service occurrences of MacFarlane's four o'clock fall within grazing allotments. However, all but one of the allotments are currently unused. While grazing is not a direct threat to U.S. Forest Service populations, invasive plants infestation enabled by grazing are a potential threat.

Herbicide and pesticide spraying in the vicinity of MacFarlane's four o'clock could also lead to adverse effects if not carefully implemented. An unauthorized aerial herbicide spraying incident affected the species in the vicinity of the Salmon River in Idaho County, Idaho. At least 2,750 stems on BLM land exhibited foliar kill as a result of spraying in 1997. Subsequent monitoring in 1998 found that most of the plants did survive, although long term effects on the population are unknown (U.S. Forest Service 2003).

Damage from landslides and flooding could also impact the species. Associated effects from flood damage repair work due to flooding and landslides in 1996 and 1997 in occupied MacFarlane's four o'clock habitat led to degraded habitat and contributed to a population decline.

#### *Ongoing Conservation*

Surveys have been conducted in Idaho and Oregon, management plans have been developed by the BLM for three sites in the Salmon River drainage, and monitoring has taken place on both BLM and U.S. Forest Service lands. Seed collection and long term storage at Berry Botanic Garden in Portland, Oregon, has been initiated. As part of the original 1985 recovery plan objectives, a new population was established at Lucile Caves along the Salmon River Canyon in 1988. In addition to demographic studies, monitoring has taken place following fires and herbicide applications.

In the action area, fencing and reduced grazing in allotments where the species is located has had a positive effect on MacFarlane's four-o'clock. Mitigations put into place under the Hells Canyon National Recreation Area Final EIS Comprehensive Management Plan Biological Assessment (U.S. Forest Service 2003) included protection for the species, surveys for potential habitat, assessment of enclosure fencing for repairs, and avoidance measures during road maintenance. The Environmental Protection Agency has placed limitations on pesticide use for Wallowa County, Oregon where MacFarlane's four-o'clock is found. These restrictions state that the active ingredient, picloram, cannot be applied within 100 yards of MacFarlane's four-o'clock habitat during aerial applications or within 20 yards of the species' habitat during ground applications. Further restrictions on the active herbicide ingredient, sulfometuron methyl state that it cannot be applied on rights-of-way within MacFarlane's four-o'clock habitat (U.S. Environmental Protection Agency 2003). The U.S. Forest Service does not typically use aerial application methods with picloram. Under the Invasive Plant Program, aerial application of chlorsulfuron, metsulfuron methyl, and sulfometuron methyl are not allowed on U.S. Forest Service lands. Nor is the U.S. Forest Service likely to use aerial application methods with sethoxydim, or clopyralid (Shawna Bautista, Pacific Northwest Region, U.S. Forest Service, pers. comm., 2005), thereby reducing the potential for accidental herbicide treatment of MacFarlane's four-o'clock.

#### *Conservation needs*

Implementation of revised recovery actions, such as protecting essential habitat, controlling threats, and monitoring population trends and habitat conditions are important conservation needs for MacFarlane's four-o'clock.

Effective grazing management is recommended in the revised recovery plan (U.S. Fish and Wildlife Service 2000c) to include construction and maintenance of exclusion fencing and revision of grazing practices. Surveys should be conducted in all allotments where grazing is authorized and suitable habitat exists.

Weed control measures within one-half mile of all known populations are recommended in the revised recovery plan, emphasizing coordination between the USFWS, private citizens, county, and State agencies to ensure the conservation of MacFarlane's four-o'clock individuals and habitat. At the same time, herbicides and pesticides should be managed to avoid negative impacts to MacFarlane's four-o'clock, including the use of selective herbicides to control invasive plants and enhance habitat. Again, close and frequent coordination is necessary between federal agencies and all other entities that plan to employ herbicide use in the vicinity of MacFarlane's four-o'clock (U.S. Fish and Wildlife Service 2000c).

### ***Effects of the Action***

If invasive species treatments are found to be necessary, only manual, mechanical or chemical methods are proposed in the habitat of MacFarlane's four-o'clock. The conspicuous nature of the plant would help avoid accidental pulling or trampling occurrences from manual, mechanical, and ground based chemical treatments. Minimization methods and techniques such as flagging areas with prior to treatments and careful hand pulling of invasive plants near populations (Standard 20) would avoid most physical effects to individuals. Injury would likely be limited to above ground structures only with a very low risk of individual mortality. Using ground based application of herbicide, the risk of impacts would be low due to minimization and avoidance techniques described in Standard 20, such as timing of application during dormancy, defined spot spray, shielding spray, or hand wiping in the vicinity of individuals.

Biological treatments are not anticipated to have any effect on MacFarlane's four-o'clock because it is not closely related to the target species, reducing the potential that they might feed on the four-o'clock. Biological treatments would not require additional disturbance of the area. Although prescribed fire is not currently proposed in MacFarlane's four-o'clock habitat, there would likely be no adverse effects because it is adapted to grassland fire and has been documented to recover successfully from fire. The U.S. Forest Service is not proposing to use grazing treatments in MacFarlane's four-o'clock sites.

Of the proposed treatment types, only chemical herbicide treatment is expected to rise to the level of a potential adverse effect, and then only if applied by aerial methods. The potential source of adverse effect is through the unintended application or drift of herbicide from fixed-wing or helicopter applications. Drift has a higher potential to occur from aerial spray because the long distance application could cause an increase in errors even with mitigating measures such as increasing droplet size. Unfavorable wind direction and speed cannot always be predicted and could occur unexpectedly during

application. Difficulties in determining the exact location of populations from the air also complicates precision and accuracy in application.

Potential habitat for MacFarlane's four-o'clock in Hells Canyon has been predicted to exist through modeling, though much of it has not been surveyed. Hells Canyon contains many areas where aerial spray may be necessary because ground access is precluded by steep slopes. If populations are later found within suitable habitat in Hells Canyon, these may intersect future potential aerial herbicide treatments.

The majority of MacFarlane's four-o'clock plants occur within the action area on U.S. Forest Service lands (6,000 out of 9,000 plants). Many of these groups of plants are known to have invasive plant species within them or near their periphery. Though individual plants could be damaged or killed from the accidental application or drift of herbicide from aerial applications, the risk is low, and is likely to occur on a very small portion of the population at any time. Should treatments for invasive species need to be administered, the low risk of impact to individual plants would be outweighed by long term benefits the species may gain from invasive plant control. The duration of exposure would likely be very short, but may not indicate the actual level of effect because the duration of sub-lethal toxic effects is unknown and dose-dependant.

A population of MacFarlane's four-o'clock has recovered from 100 percent foliar kill in an accidental aerial herbicide application on BLM land in Idaho, indicating some level of resistance. Because the known population of MacFarlane's four-o'clock covers approximately 12 by 18 miles, only a small fraction of that area could be accidentally exposed at any time.

The application of standards and minimization techniques for chemical applications in Hells Canyon National Recreation Area will reduce the potential for effects to the species due to fairly conservative buffers. Minimization and avoidance measures calling for site-specific project design in Standard 20 of the Biological Assessment will reduce the probability of accidental exposure to herbicide. MacFarlane's four-o'clock is very conspicuous, removing some of the additional risk associated with treating invasive plants near more cryptic species. The risk of effects would be further reduced through timing application to occur during dormancy, flagging areas for avoidance around individuals and populations, and through selective application methods such as defined spot spray, shielding spray or hand wiping within such buffers.

Aerial herbicide treatments address a recovery criterion by reducing recognized threats to the species (U.S. Fish and Wildlife Service 2000c). However, both herbicide applications and competition from invasive plants are also noted as potential threats to the species, emphasizing the need for due care in project planning and execution. The risk of potential damage to individuals and groups of MacFarlane's Four-o'clock is outweighed by the benefits of removing competition from invading species.

### *Summary*

Of the proposed treatment types, only aerial chemical herbicide treatment may result in adverse effects, and then only through the unintended application or drift of herbicide. Potential but unsurveyed habitat for MacFarlane's four-o'clock occurs in Hells Canyon where aerial spray may be necessary because ground access is precluded by steep slopes. If populations are later found within suitable habitat in Hells Canyon, these may intersect planned aerial herbicide treatments.

The majority of MacFarlane's four-o'clock plants occur within the action area on U.S. Forest Service lands. Though individual plants could be damaged or killed from the accidental application or drift of herbicide from aerial applications, the risk is low, is likely to occur on a very small portion of the population at any time, and would be outweighed by long term benefits the species may gain from invasive plant control. A population of MacFarlane's four-o'clock has recovered from 100 percent foliar kill in an accidental aerial herbicide application, indicating some level of resistance.

MacFarlane's four-o'clock is very conspicuous, removing some of the additional risk associated with treating invasive plants near more cryptic species. The risk of effects could be further reduced through timing application to occur during dormancy, flagging areas for avoidance around individuals and populations, and through selective application methods such as defined spot spray, shielding spray or hand wiping in some areas, as practicable.

### *Cumulative Effects*

Cumulative effects for the purposes of consultation under ESA are defined as, "the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area..." (50 CFR, Part 402). Future federal actions will be subject to the consultation requirements established in Section 7 of the ESA, and therefore, are not considered cumulative to the proposed action.

Potential cumulative effects to MacFarlane's four-o'clock include the continued application of invasive plant treatments on private lands. If applied following label restrictions and the Environmental Protection Agency restrictions imposed for Wallowa County, cumulative effects should not be substantial, and could benefit this species within the action area. Competition for resources would be reduced, populations of invasive species could become more fragmented, and additional area for expansion of populations could be made available.

### *Conclusion*

The Invasive Plant Program will not jeopardize MacFarlane's four-o'clock by directly or indirectly, reducing appreciably the likelihood of survival and recovery of MacFarlane's four-o'clock in the wild by reducing the reproduction, numbers, or distribution of the species.

- The primary potential effect from this project would be short term damage to individuals or small groups of plants due to unintended direct application or drift

from aerial spray herbicide treatments. Under the Invasive Plant Program, aerial treatments are expected to be infrequent, widely spaced, and of short duration.

- Because the 12 known populations are widely spaced and individuals and groups are scattered within them, the likelihood of an unintended application affecting the population as a whole is very low. The potential effects will be further minimized by the implementation of Standards 19 and 20 in the Biological Assessment, calling for protection of non-target plants, site-specific project design and surveys of suitable habitat for plants.
- The possible loss of scattered individuals or small groups due to unintended herbicide exposure will not significantly affect MacFarlane's four-o'clock at the population level.

Therefore, the Invasive Plant Program is not expected to appreciably reduce the reproduction, numbers, or distribution of MacFarlane's four-o'clock.

### ***Conservation Recommendations***

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

Use non-persistent herbicides in known habitat of MacFarlane's four-o'clock plants, where possible. This will likely reduce the risk of effects to dormant individuals.

Where practicable, schedule applications to coincide with the period of dormancy for MacFarlane's four-o'clock to minimize the chances of exposure.

Where downslope movement of persistent herbicide is possible during runoff events, consider the use of an herbicide such as imazapic, which has less potential for soil residual effects. This herbicide is more selective than glyphosate, which has less potential for soil residual effects and greater potential to impact non-target plants. Potential exposure through runoff would be reduced and the native plant community would be less affected.

To minimize potential effects to the primary pollinators, consider avoiding the direct spraying of glyphosate in the proximity of MacFarlane's four-o'clock during the blooming period. While the U.S. Forest Service analysis did not find that glyphosate was likely to reach toxic levels for bees, it represents the highest potential of all the herbicides and the U.S. Forest Service did indicate some concern in their discussion of general effects to plants.

## **Spalding's catchfly**

### ***Status and baseline***

Detailed accounts of the life history, habitat requirements and ecology of Spalding's catchfly (*Silene spaldingii*) can be found in the Conservation Strategy prepared for the USFWS (Hill and Gray 2004) and the final rule to list Spalding's catchfly as threatened (U.S. Fish and Wildlife Service 2001d).

### *Listing History*

Spalding's catchfly was listed as threatened on October 10, 2001 under the authority of the Endangered Species Act (U.S. Fish and Wildlife Service 2001d). This decision conferred protection of the ESA on Spalding's catchfly within its entire range. It also included the finding that the identification of critical habitat would be prudent for this species. It further stated that due to budget constraints, critical habitat designation would be postponed in order to pursue other listing actions.

### *Distribution*

The number of occurrences of Spalding's catchfly individuals reported since petitioning and final listing has increased as a result of increased survey efforts. A total of 66 populations: 12 in Idaho, 8 in Montana/British Columbia, Canada, 8 in Oregon, and 38 in Washington have been documented. The majority of Spalding's catchfly populations are small in size, and located on privately-owned parcels (52 percent of populations have less than 100 plants each). Five extirpations have been recorded to date rangewide. Potential unsurveyed habitat exists in all physiographic regions in which Spalding's catchfly occurs, particularly the Canyon Grasslands.

A total of nine populations with greater than 500 plants occur under a variety of ownerships. These include:

Montana: Dancing Prairie, greater than 10,023 plants (Private/TNC).

Idaho: Garden Creek Ranch, 3,995 plants (Private/TNC and BLM).

Oregon: Zumwalt Prairie, 1,721 plants (Private/TNC); Wallowa Lake, 513 plants (Private and USFS); Crow Creek, 844 plants (Private and USFS).

Washington: Miller Ranch, 540 plants (BLM), Twin Lakes, 627 plants (Private and BLM); Sheep Ridge, Blue Mountains, 997 plants (USFS); Coal Creek, 500 plants (BLM).

In the Oregon portion of the action area, Spalding's catchfly is found on the Wallowa-Whitman National Forest on the Wallowa Plateau. Here, two larger populations share ownership between the U.S. Forest Service and private landowners, therefore the total area occupied and numbers of plants can only be approximated. About 38 percent of the plants in Oregon are found on U.S. Forest Service lands (1,357 out of 3502 plants). Those occurrences entirely on U.S. Forest Service lands cover about 8 acres; those on shared ownership cover roughly 60 acres. In the Washington portion of the action area, two populations are located entirely on the Umatilla National Forest in the Blue

Mountains. Roughly 18 percent of the plants in Washington are found on U.S. Forest Service lands (997 out of 5,264 plants).

Habitat modeling predicted that over 24,000 acres of habitat in the Hells Canyon National Recreation Area has a high probability of containing Spalding's catchfly, though no populations have been located to date. About 42 percent of this acreage is located within active grazing allotments or administrative horse pastures (U.S. Forest Service 2003). The extent that this area has been surveyed for Spalding's catchfly is not known.

#### *Life History*

Spalding's catchfly is an herbaceous perennial plant usually growing 8 to 24 inches in height, and occasionally to 30 inches (Hill and Gray 2000). One to several erect stems arise from a persistent underground stem just beneath the soil surface which sits atop a long, narrow taproot, up to 85 cm in length (Menke 2003). The late bloom time for Spalding's catchfly, mid-July through September (Kagan 1989, Gamon 1991), and occasionally into October (J. Hill, in litt., 2003 in Hill and Gray 2004), helps distinguish it from associated *Silene* species that flower from May or June through August (Hitchcock et al. 1964).

Spalding's catchfly is long-lived. Vegetative portions of this herbaceous geophyte that are above ground die back at the end of the growing season. Plants emerge in the spring or may remain dormant underground through the growing season for up to three consecutive years. Recruitment does not appear to occur every year (Lesica 1997a). Seeds germinate mainly in the spring and form rosettes the first year. Generally, vegetative stems are produced the second year, and plants begin flowering during or after the third season. Growth forms may vary from year to year and are not necessarily correlated with age of the plant (Lesica 1997a, 1999).

Spalding's catchfly occurs in grassland, shrub and forest habitat types across its range. The grassland habitat preferred by this species is found in mesic fescue grasslands of the Pacific Northwest Bunchgrass Grasslands type (Tisdale 1983). This habitat is often characterized by high cover of perennial bunchgrasses, a relatively abundant and diverse perennial forb component, often a minor shrub component, and a well-developed cryptogamic crust layer. Shrub and forest habitat types include sagebrush-fescue and open canopy pine-fescue types. The fescue associations in these shrub- and tree-dominated communities are very similar to the mesic fescue grassland habitat types (Daubenmire 1968b, 1970). Within Washington, Oregon, and Idaho, Spalding's catchfly is associated with Idaho fescue (*Fescue idahoensis*). Drought conditions have a negative effect on Spalding's catchfly populations by limiting growth and reproduction and exacerbating impacts from livestock grazing and invasive weeds (Hill and Gray 2000, Lesica 1988c, B. Benner, in litt., 2003a in Hill and Gray 2004).

#### *Population Dynamics*

Spalding's catchfly occurs within a wide range of elevations, reaching its extremes in the Hells Canyon in northeastern Oregon, eastern Washington and adjacent Idaho. It occurs as low as 1,380 feet along the lower Salmon River in Idaho to 5,100 feet on the Wallowa

Plateau in northeastern Oregon. Spalding's catchfly appears to be located in areas where enough soil moisture accumulates or is retained to provide the necessary mesic conditions it requires well into the growing season. The species is found in swales, on northerly aspects, and in association with other microtopographic features. Spalding's catchfly shows a close association with northerly aspects, particularly in the drier portions of its range, such as canyon grasslands and channeled scablands.

Flowering Spalding's catchfly plants may produce vegetative plants or occasionally, rosettes in subsequent years. Flowering, growth, and recruitment demonstrated a strong biennial periodicity with high levels occurring every other year, suggesting performance in one year may impact performance in the subsequent year (Lesica 1997a, 1999). A mutually beneficial interaction exists with Spalding's catchfly's primary pollinator, *Bombus fervidus*. Pollination by the bee is essential to reproduction and outcrossing of the plant (which only reproduces by seed), which in turn provides a nectar and nutritional source for the bee. However, interactions with other fauna, i.e., predation and herbivory by native ungulates and domestic livestock, rodents, and insects, appear to be detrimental by varying degrees.

Because of its late blooming and cryptic nature, the species can difficult to locate. Most rare plant surveys are done earlier in the season when this species has not bloomed yet. It may be easily overlooked at this time and usually cannot be found through casual surveys or using untrained personnel. Later, when the surrounding native bunchgrass community dries up during the summer drought period (July through October), the pale green foliage of Spalding's catchfly contrasts with the surrounding dried, straw-colored grasses (Daubenmire 1970). This feature aids greatly in field surveys for this species (Kagan 1989, B. Benner, in litt., 1993 in Hill and Gray 2004). Spalding's catchfly apparently tolerates some competition and shading from the dominant bunchgrasses and the shrubs and other perennial forbs in the native community in which it occurs; however, it does not appear to persist in areas where the native vegetation has been displaced by invasive, non-native plant species.

#### *Threats*

Rangewide, Spalding's catchfly is threatened by several factors. Threats of greatest concern to the continued existence of Spalding's catchfly include, in order of priority, habitat degradation from weed invasion and livestock grazing; habitat loss and fragmentation and associated genetic pressures of small populations; alteration of fire regimes, increasing fire frequencies and unseasonable fires; predation by herbivores, including domestic livestock, native ungulates, rodents and insects; herbicide drift; and prolonged drought related to global warming.

Non-native invasive plant species have superior adaptations for exploiting resources, particularly in disturbed areas, and can cause irreversible ecological changes in the plant community. Invasive plant species are considered a threat at nearly all sites currently supporting Spalding's catchfly. Specifically, the threats posed by these species are competition for water, nutrients, light, and pollinators (U.S. Fish and Wildlife Service 2001d).

Predation of Spalding's catchfly by herbivores (deer, elk, domestic livestock, rodents and insects) has caused reductions in reproductive effort and seed crop. In addition to direct consumption of plants, grazing animals may also trample the plant community that supports Spalding's catchfly, thereby altering its composition and allowing the invasion of non native plant species.

Substantial portions of Spalding's catchfly habitat in the Palouse grasslands, Wallowa plateau, channeled scablands, and intermontane valleys have been converted to human uses. These uses are: croplands, urban and residential development, and non-native range grasses. The effects of this habitat fragmentation threaten the small patches of native vegetation that remain in these areas. Fifty-two percent of known Spalding's catchfly plants are located on private land, and are likely threatened by land-use changes, livestock grazing, agricultural practices, and urbanization (U.S. Fish and Wildlife Service 2001d).

Spalding's catchfly and the plant communities with which it is associated, have evolved with fire and have acquired adaptations to survive normal fire regimes (Daubenmire 1970, Tisdale 1986, Johnson 1998). However, historic fire intervals for these communities are difficult to determine (Weddell 2001, Gray 2001), and the presence of invasive non-native weed species, habitat fragmentation, excessive livestock grazing, fire suppression, and increasing human activity have altered fire regimes (D'Antonio and Vitousek 1992, R. Crawford, in litt., 2003 in Hill and Gray 2004).

Prolonged drought has negative impacts on growth and reproduction, and global warming has potential to threaten the long-term existence of Spalding's catchfly. Climatic fluctuations may adversely affect this species and may contribute to the extirpation of small communities. These effects are often exacerbated by other factors, including pollinator competition, and depressed reproductive success.

Within the action area, all three populations on U.S. Forest Service lands in Oregon are located within grazing allotments. Two populations are currently not grazed and one population is reported to be degraded due to grazing (Hill and Gray 2004). The population that spans both private and U.S. Forest Service lands, which is located on the terminal moraine at the north end of Wallowa Lake, is currently grazed and is heavily infested with invasive plants. Diffuse knapweed, Kentucky bluegrass (*Poa pratensis*) and ventenata (*Ventenata dubia*), an exotic annual grass, have been documented in the Crow Creek population. Other annual grasses, yellow starthistle and sulfur cinquefoil occur within one-fourth to one-half mile of populations on the Wallowa plateau.

In Washington, the Spalding's catchfly population on U.S. Forest Service lands is located on grazing allotments that is currently not being grazed (and were moderately grazed in the past). Additional grazing by native ungulates has been documented. No invasive plant species are currently found growing within the populations, but yellow starthistle and scotch thistle occur nearby. Monitoring to track the movement of invasive plant species has recently been initiated on the Washington populations within the action area.

### *Ongoing Conservation*

In Oregon, The TNC inventories and monitors Spalding's catchfly in the Zumwalt Prairie area. The group is also developing a management plan for the area with a primary emphasis on grazing studies. Grazing will be managed to mitigate effects to Spalding's catchfly through restrictions on timing and by means of enclosures

In Washington, the primary conservation focus is on grazing management and biological control of invasives, inventory and extensive monitoring. The BLM implements grazing management practices that include assessments of livestock use, pasture rotation, monitoring of use, and removal of livestock if use criteria are exceeded, and evaluation of plant community composition and population trends (B. Benner in litt., 2003b in Hill and Gray 2004). A biological weed control program was implemented at Fairchild AFB in 1996 and four biocontrol agents were introduced to control Canada thistle, diffuse knapweed, and spotted knapweed (Rush and Gamon 1999, Caplow 2001).

In Idaho, extensive inventory work has taken place. Several permanent transects have been established to study population dynamics and the effects of fire on the species. Also, genetic studies, pollination studies, and mapping of yellow starthistle within Spalding's catchfly populations have been implemented.

In the action area, new grazing allotment management plans are being developed for all allotments where Spalding's catchfly populations are located on both the Wallowa-Whitman and Umatilla National Forests. Modeling for potential habitat was developed for Wallowa-Whitman allotments, and then overlaid by a model that predicted capable grazing land within the allotment. Such modeling efforts should help to focus conservation efforts for this species on U.S. Forest Service lands.

### *Conservation Needs*

Conservation recommendations published in the Conservation Strategy (Hill and Gray 2004), are designed to reduce the most imminent and pervasive threats to Spalding's catchfly and its habitat. In order of priority, the Conservation Strategy provides the following recommendations:

- Habitat Degradation; guidelines for effective weed, livestock, and fire management, and habitat restoration,
- Inventory of Potential Unsurveyed Habitat; identify areas with immediate survey needs,
- Habitat Fragmentation; help protect pollinators, provide suggestions to reduce further habitat fragmentation and protect small populations on isolated habitat fragments, retain genetic diversity of threatened small populations, and suggest areas that would allow protection of groups of small populations, and

- Monitoring: identify priority monitoring needs and provide suggestions of appropriate monitoring methodology for accurate determination of population size, trends, and geographic differentiation to assess threats and management activities and provide guidance for future conservation and management decisions, and
- Reporting and Record-keeping: standardize and improve reporting and record-keeping across the four-state region of Spalding's catchfly occurrence.

### ***Effects of the Action***

If invasive species treatments are found to be necessary, only manual, mechanical or chemical methods are proposed in Spalding's catchfly habitat. The conspicuous nature of the plant would help avoid accidental pulling or trampling occurrences from manual, mechanical, and ground based chemical treatments. Minimization methods and techniques such as flagging areas with prior to treatments and careful hand pulling of invasive plants near populations (Standard 20) would avoid most physical effects to individuals. Injury would likely be limited to above ground structures only with a very low risk of individual mortality. Using ground based application of herbicide, the risk of impacts would be low due to minimization and avoidance techniques described in Standard 20, such as timing of application during dormancy, defined spot spray, shielding spray, or hand wiping in the vicinity of individuals.

Biological treatments are not anticipated to have any effect on Spalding's catchfly because it is not closely related to the target species, reducing the potential that they might feed on the four-o'clock. Biological treatments would not require additional disturbance of the area. Although prescribed fire is not currently proposed in Spalding's catchfly habitat, there would likely be no adverse effects because it is adapted to grassland fire and has been documented to recover successfully.

Of the proposed treatment types, only chemical herbicide treatment is expected to rise to the level of a potential adverse effect, and then only if applied by aerial methods. The potential source of adverse effect to Spalding's catchfly is through the unintended application or drift of herbicide from fixed-wing or helicopter applications. Drift has a higher potential to occur from aerial spray because the long distance application could cause an increase in errors even with mitigating measures such as increasing droplet size. Unfavorable wind direction and speed cannot always be predicted and could occur unexpectedly during application. A difficulty in determining the exact location of populations from the air also complicates precision and accuracy in application.

Potential habitat for Spalding's catchfly in Hells Canyon has been predicted to exist through modeling, though much of it has not been surveyed. Hells Canyon contains many areas where aerial spray may be necessary because ground access is difficult due to steep slopes. If populations of Spalding's catchfly are later found within suitable habitat in Hells Canyon, they may intersect planned aerial herbicide treatments.

Approximately 38 percent of the plants found in Oregon, and 18 percent of the plants found in Washington are located on U.S. Forest Service lands. These estimates are approximate because land ownerships overlap with the occurrences of Spalding's catchfly; separate population information divided by ownership is not available. Many of these groups of plants are known to have invasive plant species within them or near their periphery.

Though individual plants could be damaged or killed from the accidental application or drift of herbicide from aerial applications, the risk is low, and would expose a very small portion of the population. The duration of exposure would likely be very short, but may not indicate the actual level of effect for some time, therefore, the duration of sub-lethal toxic effects is unknown and dose-dependant. Because the known populations of Spalding's catchfly are found over such a large geographic area, (Idaho, Montana, British Columbia, Canada, Oregon, and Washington), only a very small fraction of that area could be accidentally exposed to aerial herbicide drift at any time. The low risk of effect to individual plants from the treatment of invasive species would be outweighed by long term benefits the species may gain from chemical treatments.

The application of standards and minimization techniques for chemical applications in Hells Canyon National Recreation Area will reduce the potential for effects to Spalding's catchfly due to fairly conservative buffers. Minimization and avoidance measures calling for site-specific project design in Standard 20 of the Biological Assessment will minimize the probability of accidental exposure to herbicide. The risk of adverse effects would be further reduced through timing herbicide application to occur during dormancy, flagging areas around individuals and populations, and through selective application methods where possible, such as defined spot spray, shielding spray or hand wiping within such buffers.

Applications of aerial herbicide treatments are expected to reduce a recognized threat to Spalding's catchfly, although herbicide applications are also noted as a threat to the species (U.S. Fish and Wildlife Service 2001d). This emphasizes the need for due care in project planning and execution. The risk of potential damage to individuals and groups of Spalding's catchfly is outweighed by the benefits of removing competition from invading species.

#### *Summary*

Of the proposed treatment types, only aerial chemical herbicide treatment may result in adverse affects, and then only through the unintended application or drift of herbicide. Potential but unsurveyed habitat for Spalding's catchfly occurs in Hells Canyon where aerial spray may be necessary because ground access is precluded by steep slopes. If populations are later found within suitable habitat in Hells Canyon, these may intersect planned aerial herbicide treatments.

Approximately 38 percent of the plants found in Oregon, and 18 percent of the plants found in Washington are located on U.S. Forest Service lands. Though individual plants could be damaged or killed from the accidental application or drift of herbicide from

aerial applications, the risk is low, and would expose a very small portion of the population. The low risk of effect to individual plants from the treatment of invasive species would be outweighed by long term benefits the species may gain from chemical treatments.

Though individual plants could be damaged or killed from the accidental application or drift of herbicide from aerial applications, the risk is low, is likely to occur on a very small portion of the population at any time, and would be outweighed by long term benefits the species may gain from invasive plant control.

### ***Cumulative Effects***

Cumulative effects for the purposes of consultation under ESA are defined as, “the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area...” (50 CFR, Part 402). Future federal actions will be subject to the consultation requirements established in Section 7 of the ESA, and therefore, are not considered cumulative to the proposed action.

Potential cumulative effects to Spalding’s catchfly include the continued application of chemical herbicide treatments on private lands. If applied following label restrictions, cumulative effects should not be substantial, and could benefit this species within the action area. Competition for resources would be reduced, populations of invasive species could themselves become smaller and more fragmented, and additional area for Spalding’s catchfly populations could be made available.

### ***Conclusion***

The Invasive Plant Program will not jeopardize Spalding’s catchfly by directly or indirectly, reducing appreciably the likelihood of survival and recovery of the Spalding’s catchfly in the wild by reducing the reproduction, numbers, or distribution of the species.

- The primary potential effect from this project would be short term damage to individuals or small groups of plants due to unintended direct application or drift from aerial spray herbicide treatments. Under the Invasive Plant Program, aerial treatments are expected to be infrequent, widely spaced, and of short duration.
- Because the 66 known populations of Spalding’s catchfly are widely spaced over several states; with individuals and groups scattered within them, the likelihood of an unintended application affecting the population as a whole is very low. The potential effects will be further minimized by the implementation of Standards 19, and 20 in the Biological Assessment, calling for protection of non-target species, site-specific project design, and surveys of suitable habitat for listed plants.

The possible loss of scattered individuals or small groups due to unintended herbicide exposure will not significantly affect Spalding’s catchfly at the population level.

Therefore, the Invasive Plant Program is not expected to appreciably reduce the reproduction, numbers, or distribution of Spalding’s catchfly.

***Conservation Recommendations***

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

Use non-persistent herbicides in known habitat of Spalding's catchfly plants, where possible. This will likely reduce the risk of effects to dormant individuals.

Where practicable, schedule applications to coincide with the most period of dormancy for Spalding's catchfly, this would minimize the chances for exposure.

Where downslope movement of persistent herbicide is possible during runoff events, consider the use of an herbicide such as imazapic, which has less potential for soil residual effects. This herbicide is more selective than glyphosate, which has less potential for soil residual effects and greater potential to impact non-target plants. Potential exposure through runoff would be reduced and the native plant community would be less affected.

To minimize potential effects to the primary pollinators, consider avoiding the direct spraying of glyphosate in the proximity of Spalding's catchfly during the blooming period. While the U.S. Forest Service analysis did not find that glyphosate was likely to reach toxic levels for bees, it represents the highest potential of all the herbicides and the U.S. Forest Service did indicate some concern in their discussion of general effects to plants.

**Effects of the Action Common to Aquatic Species**

Implementation of the Invasive Plant Program for the Pacific Northwest Region may result in some projects that have adverse effects on ESA listed aquatic species. However, the ultimate long-term effect of the Invasive Plant Program is likely to be a benefit to aquatic species by restoring native vegetation and thereby helping restore ecosystem and riparian function. Most potential adverse effects are expected to be short-term and more than offset by benefits to riparian function, and thus may improve the ability of the habitat to support listed species over the long-term.

The greatest likelihood of effects to listed aquatic species and their habitat is associated with projects that include aerial herbicide applications, broadcast herbicide applications (e.g., backpack or boom spray), the use of heavy equipment in riparian areas, and indirect treatment of water corridors (i.e., ditches) directly feeding streams with federally-listed aquatic species or critical habitat. A sample of invasive plant treatment projects that pose a risk to federally-listed species will be monitored.

This Biological Opinion analyzes the effects of the proposed treatment methods and standards as a package, although some standards have no effects to aquatic species.

Proposed treatment methods and their potential effects are covered in this section. Most of the treatment methods supported by the Invasive Plant Program are not new to Pacific Northwest Region National Forests. These include planting, manual, mechanical, biological, and cultural treatments of invasive plant species, along with a few prevention actions, such as vehicle washing. The primary change resulting from this action is associated with a change in the available herbicides. Under the Invasive Plant Program 2,4-D and dicamba are no longer available for use. Use of seven additional herbicides (chlorsulfuron, clopyralid, metsulfuron methyl, sulfometuron methyl, imazapic, imazapyr, and sethoxydim) are allowed under the Invasive Plant Program.

***Pathways for effects***

Listed and proposed aquatic organisms and their critical habitat may be affected by different invasive plant treatment methods through various pathways. The pathways through which the Invasive Plant Program could result in direct or indirect effects to listed aquatic species and critical habitat through effects to essential features or primary constituent elements are displayed in Table 1.

**Table 1. Pathways of effects to listed aquatic species from treatment methods.**

Treatment Methods	Pathways of Effects							
	Disturbance*	Chemical toxicity	Dissolved oxygen and nutrients	Water temperature	Turbidity and fine sediment	Instream Habitat structure	Food resources	Riparian structure
Manual	X						X	X
Mechanical	X		X	X	X	X	X	X
Biological								
Cultural – fertilization & soil amendment, planting, grazing	X	X	X	X	X		X	X
Herbicides		X	X	X		X	X	X
Prescribed Fire			X		X			

\*stepping on redds, displacing, interrupting feeding, disturbing banks

The following sections discuss the direct and indirect effects of the proposed treatment methods on listed aquatic species and their habitat.

***Direct and Indirect Effects***

Under some conditions, manual, mechanical, and some cultural (e.g. planting, use of livestock) treatments may be conducted by workers standing in the water. People working from the water may disturb species to the point of harassment, step on redds, or accidentally step on listed species. The extent and intensity of these effects depend on whether the species is present and life stage present, the number of humans or animals in

the water, the magnitude of the in-stream disturbance, and the amount of time spent in the water.

Listed aquatic species and their habitat could be affected by an accidental direct application of an herbicide to surface water through overspray or drift, resulting in chemical toxicity. In addition to active ingredients in formulations, inerts, adjuvants, metabolites, and impurities could also result in effects to federally-listed aquatic species. However, the U.S. Forest Service has limited the available herbicides to those with the least potential impact, while still meeting the needs for weed control. The mere presence of an herbicide does not necessarily result in effects to aquatic species. The toxicity of the herbicide and associated compounds, the concentration and duration of exposure, as well as species presence and life stage, determine the potential for effects to aquatic species.

If effects to listed aquatic species from herbicide exposure do occur, they will most likely be sub-lethal rather than direct mortality from herbicide exposure. Mortality from herbicide exposure is only plausible for accidental spills, which are not part of the Invasive Plant Program. Sub-lethal effects include changes in behavior that render federally-listed species susceptible to predation, compromised immune system, and effects to organs. The ultimate consequence of many “sub-lethal” effects to juveniles may not manifest until later in the life cycle (reproductive success, etc). Sub-lethal effects are further described below.

Prescribed fire for invasive plant control could create conditions that allow sediment to enter streams, increase nutrients, decrease dissolved oxygen, and change vegetative structure of the neighboring upland or riparian areas. However, these effects are not likely for invasive plant control in Region 6 because prescribed fire is rarely used specifically for invasive plant control, and when it is used, native riparian vegetation would not likely be burned. There is a low probability that projects of this type could generate effects to dissolved oxygen, temperature, food resources or riparian structure. Some effects to turbidity and fine sediment could occur.

Effects to aquatic species habitat are analyzed and discussed below by addressing certain components of the matrix of pathway indicators and cross-walking those indicators with critical habitat elements or primary constituent elements.

#### Disturbance

Effects to federally-listed individuals resulting from workers walking instream to apply herbicide treatment are covered under the direct and indirect section within the effects to non-herbicide treatment methods below.

#### Chemical Toxicity

Herbicides and fertilizers (along with inert ingredients, adjuvants, metabolites, and impurities) can indirectly enter surface water through a variety of routes. Runoff and leaching can carry herbicide into surface and ground water. Plants treated with herbicides may release chemicals into the soil via root systems or rinsing during rainfall events, treated plant biomass containing slowly decaying herbicides can become

incorporated with soil organic matter, or overspray onto soil can result in soil contamination. Soil can be moved into surface water through wind and water erosion. The U.S. Forest Service risk assessments conducted by Syracuse Environmental Research Associates include extensive review of the available literature regarding the effects of herbicides and herbicide formulations to aquatic species. The concentration resulting in lethal effects to fifty percent of fish exposed to an herbicide or herbicide formulation (LC<sub>50</sub> value) is the most commonly identified toxicity level for each herbicide. The chronic no observed effect concentration (NOEC) was identified where data was available, and estimated using a variety of methods when chronic toxicity data was not available.

Sub-lethal effects can include changes in behaviors or body functions that are not directly lethal to the aquatic species, but could have consequences to reproduction, juvenile to adult survival, or other important components to health and fitness of the species. Sub-lethal effects could also result from effects to habitat or food supply.

Cultural (fertilization or soil amendments) and herbicide treatment methods can result in indirect introduction of chemicals to surface water. Chemical concentrations, duration of exposure, and sensitivity of the species to the chemical (which can vary with life stage) affect the level of toxicity to federally-listed aquatic species. Chemical characteristics such as decay rate and strength of bond to soil particles affect the concentration of the chemical in water. Environmental factors such as soil particle size, amount of organic matter in the soil, moisture level, and temperature affect decay rate, which in turn affects chemical concentrations in water.

Manual, mechanical, biological, and prescribed fires do not involve the use of herbicides. Therefore, effects from chemical toxicity as a result of these treatment methods are not expected.

#### Dissolved Oxygen and Nutrients

Mechanical, cultural, herbicide, and prescribed fire are treatment methods most likely to result in increases in nutrient delivery and have possible effects on dissolved oxygen. Fertilizer application, particularly in riparian areas, can introduce a concentrated amount of nutrients to streams. Manual and biological treatments for invasive plants do not negatively impact significant portions of the total riparian vegetation resulting in a sudden influx of nutrients to surface water. Prescribed fire for invasive plant control is not typically used in riparian areas and would not likely be conducted in such a way that native riparian vegetation would be removed. It would be counterproductive to remove large amounts of native riparian vegetation in an invasive plant treatment project because that would only provide additional area for invasive plant colonization. However, prescribed fire could be used on adjoining uplands and erosion from upland burned areas could introduce nutrients into nearby streams.

Herbicides leaching into surface water can result in indirect effects to listed aquatic species via adverse effects to phytoplankton, algae, rooted aquatic macrophytes, and other aquatic plants. However, quantities of herbicide entering streams from this method

are estimated to be low by the U.S. Forest Service based on the SERA Risk Assessments and result in only localized effects to aquatic plants because of the dilution created by flowing streams. Mortality to aquatic plants from herbicide use substantial enough to affect dissolved-oxygen or nutrient loading in river and stream systems is not plausible for U.S. Forest Service applications.

An influx of nutrients can cause algal blooms, which in turn can decrease the amount of oxygen dissolved in water. Runoff from areas treated by prescribed fire or planted areas receiving fertilizer could cause an increase in nutrient delivery to surface water. Algal blooms can result in photosynthesis-driven high diurnal dissolved oxygen levels (including super saturation), and low nocturnal dissolved oxygen levels due to high respiration levels. In addition, algal decay following significant die-offs can also reduce dissolved oxygen levels. Region 6 has used very little prescribed fire and fertilizer for managing invasive plants, so the potential for these effects to occur is very limited.

#### Water Temperature

Listed aquatic species have specific needs in terms of water temperature, which affects metabolism and food requirements. In the summer, increasing water temperatures decreases the solubility of dissolved oxygen in water, decreasing dissolved oxygen and generally affecting aquatic species. In cold climates, riparian vegetation aids in moderating radiant heat loss from the stream.

Many factors affect water temperature. Shade from vegetation is the factor that could be affected by invasive plant treatment. In addition to vegetation, shade is provided by topography and influenced by stream aspect. Other factors influencing water temperature include discharge, channel morphology, air temperature, and interactions with ground water, none of which would be influenced by invasive plant treatments. Manual, mechanical and herbicidal treatments of some invasive plant species (like knotweed) may decrease riparian vegetative shading in certain areas thereby increasing the amount of solar radiation striking the water. This is not likely to result in a warming effect because many other factors in addition to shade affect water temperature. A significant amount of vegetation would need to be removed to change water temperature in the stream, and shade would have to be provided only by the invasive plant removed. Any warming effect that would occur would be very localized (e.g., on a small portion of the entire stream or river), insignificant to overall stream temperature, and relatively short-term. Loss of shade is expected to be temporary, until appropriate vegetation reaches and surpasses the height of the invasive plants that were removed. Any warming that could occur would not likely be enough to adversely affect listed aquatic species and their habitat.

Effects from biological treatments occur slowly over a period of many years and are unlikely to change water temperature. Grazing for invasive plant control is typically not used on the species of invasive plants that could provide shade to streams and influence water temperature.

Prescribed fire for invasive plant control is not a viable tool for the species of invasive plants that could provide substantial shade (e.g. knotweed), and it would not be conducted in such a way that native riparian vegetation would be removed. It would be counterproductive to remove large amounts of native riparian vegetation in an invasive plant treatment project because that would only provide additional area for invasive plant colonization. Therefore, there are no likely effects to water temperature from prescribed fire used for invasive plant control.

#### Turbidity and Fine Sediment

Mechanical and cultural include treatment methods that incorporate ground-disturbing activities. If these occur in riparian areas, it would increase the potential delivery of fine sediment to surface water or increasing turbidity. Persistence of increased turbidity in the water depends on the size of the suspended particle and velocity of the water. Unless sediment continues to be introduced, flowing water systems dilute turbidity quickly. A significant increase in fine sediment depends on the amount of fine sediment introduced and the holding capacity of the surface water. Increased turbidity can reduce feeding ability or gill function in some fish species. Fine sediment can fill the interstitial spaces of redds and affect listed fish. Effects to listed aquatic species will vary with the proximity of the species and their habitat to the treatment area, sensitivity of the listed species to turbidity and fine sediment, and extent and magnitude of the area treated.

Biological and herbicide treatments do not kill invasive species immediately. As treated vegetation dies and loses root strength, soil can be moved into surface water through water movement or wind. However, there would have to be a significant amount of vegetation die-off next to the stream in order to significantly increase levels of turbidity and fine sediment. Biological controls work slowly over a period of many years, or even decades, and only on specific target species, so it is not plausible for biological controls to significantly increase turbidity and fine sediment. Similarly, most herbicides are selective, acting only on specific groups of plants and leaving non-target species on the treatment site. Selective herbicides are less likely to influence turbidity or sediment. Glyphosate is not selective and also has some formulations registered for aquatic use that would likely be used in riparian areas. However, it would be applied in a selective manner in order to achieve the objective of restoring the native riparian ecosystem. Some influence to turbidity and sediment from treatments sites is possible, but not very likely.

Manual treatment methods are not likely to be intensive and extensive enough to significantly increase turbidity or fine sediment in water. Prescribed fire for invasive plant control is not likely to be used within a riparian area, and would not be conducted in such a way that native riparian vegetation would be removed. It would be counterproductive to remove large amounts of native riparian vegetation in an invasive plant treatment project because that would only provide additional area for invasive plant colonization. However, prescribed fire could be used on adjoining uplands and erosion from upland burned areas could create turbidity and fine sediment in nearby streams.

### Instream Habitat and Riparian Structure

Riparian vegetation affects habitat structure in several important ways. Roots of riparian vegetation hold soil, which stabilizes banks, prevents addition of soil run-off to water bodies with subsequent increases in turbidity or filling substrate interstices, and helps to create overhanging banks. Instream large woody debris provided by riparian vegetation holds substrate, provides cover, and creates variations in habitat complexity important to meeting the needs of fish and other aquatic species through their life cycle. Large woody debris and substrate comes from riparian areas, upstream sources, and landslides that reach water bodies.

Riparian and emergent aquatic vegetation provide hiding cover or refuge for aquatic organisms. Riparian vegetation can be directly affected by invasive plant treatment, while emergent aquatic vegetation can be affected indirectly by herbicide treatment.

Invasive plant treatment in riparian areas is intended to change the vegetative structure to improve the function of riparian areas. Loss or reduction in riparian vegetation due to treatment of invasive plants is expected, and the length of time before suitable vegetation returns to perform important riparian functions will vary considerably across Region 6. In general, improved riparian function due to invasive plant treatment will benefit listed aquatic species, though potentially there could be localized, short-term adverse effects to their habitat.

Manual, biological, and cultural treatment methods do not affect large trees that provide large woody debris for habitat structure. These methods are not extensive or intensive enough to significantly affect the ability of riparian areas to hold soil, help create overhanging banks, or provide hiding cover or refuge. Intensive or extensive mechanical or herbicide treatment methods could affect these riparian functions.

Prescribed fire for invasive plant control is not a viable tool for the species of invasive plants that could provide substantial shade (e.g. knotweed), and would not be conducted in such a way that native riparian vegetation would be removed. It would be counterproductive to remove large amounts of native riparian vegetation in an invasive plant treatment project because that would only provide additional area for invasive plant colonization. Therefore, there are no likely effects to instream habitat or riparian structure from prescribed fire used for invasive plant control.

### Food Resources

Listed aquatic species are indirectly affected when their food source is impacted. Aquatic food chains are dependent on primary production as a source of energy within the ecosystem. For aquatic systems, primary production can occur in the water (autochthonous) or out of the water in riparian areas (allochthonous inputs). Numerous invertebrate species feed directly on primary producers through feeding functions such as grazing, scraping, shredding, and collecting. Other invertebrate and fish species feed on these invertebrates, which then become food for fish or other predators.

Allochthonous inputs of plant matter and insects are important sources of nutrients and energy in some aquatic systems, particularly small, heavily vegetated headwater streams. Changes in the composition of riparian vegetation due to invasive plant treatment could potentially cause short-term changes in the timing and composition of these food sources. However, these changes are expected to favor native food sources and ultimately benefit federally-listed aquatic species.

Three pathways could affect allochthonous energy/food inputs from riparian areas. Any invasive plant treatment in riparian areas could result in loss of primary production that provides allochthonous energy inputs to the stream in the form of leaf or other vegetative material. The duration of this effect is limited by restoration of appropriate vegetation, which would provide a new source of vegetative matter. Insects using treated riparian vegetation may be lost because of removal of forage vegetation. The duration of this effect would also be limited by the restoration of appropriate vegetation. Herbicide treatment can be toxic to terrestrial and aquatic insects that are a source of food for listed aquatic species. The magnitude and duration of this effect to riparian insects is related to the sensitivity of the invertebrate to the herbicide, the time the herbicide is in the environment, the extent of the area treated, the toxicity of the herbicide, and the life stages of the invertebrates affected by the herbicide.

Mechanical, cultural, and herbicides methods in riparian areas could affect food sources for aquatic biota. The significance of this effect to federally-listed aquatic species is related to the intensity and extent of invasive plant treatment in riparian areas. Manual treatments are likely to have the least significant effects to aquatic food sources from riparian areas, while biological treatment methods are not expected to have an impact at all.

Prescribed fire for invasive plant control would not be conducted in such a way that native riparian vegetation would be removed. It would be counterproductive to remove large amounts of native riparian vegetation in an invasive plant treatment project because that would only provide additional area for invasive plant colonization. Therefore, prescribed fire used for invasive plant control is not likely to effect food resources from riparian areas.

As discussed above (under “dissolved oxygen and nutrients”), mechanical and cultural treatment methods could indirectly affect primary production or dissolved oxygen levels in streams and other water bodies. Changes in either or both of these water quality parameters could positively or negatively affect the quantity and diversity of invertebrates within a water body. For example, cultural (fertilization or soil amendments) or fire treatment can temporarily increase nutrients in surface water, to which the aquatic invertebrate community can respond. The significance of this influx of nutrients varies with the extent of the area treated, size of the water body affected, and the functional characteristics of the affected aquatic system. Significant inputs of fertilizer or nutrients can change the aquatic food supply and potentially effect listed aquatic species indirectly. However, the input of small quantities of fertilizer or nutrients may only cause

a short-term increase in productivity of a system, and not cause adverse effects to listed species.

Herbicides have the potential to damage aquatic periphyton and other aquatic plants, the sources of autochthonous production in surface water. The importance of autochthonous production to instream food webs varies significantly among stream systems. The extent of effects to aquatic plants is related to numerous factors, including the extent of the treatment area, proximity of the treatment area to the water body, half-life of the herbicide in water, tendency of the herbicide to bind to sediment, sensitivity of aquatic plants to a specific herbicide, and surface water characteristics such as pH, and for streams, the sediment size transported.

Both nutrient and herbicide input have the potential to affect instream productivity and nutrient processing. Instream nutrient processing could be affected by either reduced primary production from herbicide effects or increased primary production triggered by nutrient laden runoff from areas treated with prescribed fire or fertilizer application, or from other nutrient inputs. Reduced primary production from herbicide toxicity could result in less nutrient retention, resulting in longer nutrient “spirals” and lower overall productivity.

Some chemicals have sub-lethal effects that change the response of fish to predators, though this effect has not been studied for herbicides included in the Invasive Plant Program. Invasive plant treatments could result in changes in aquatic vegetation structure that temporarily favors predators of federally-listed species. For instance, herbicide treatment that affects emergent aquatic plants could reduce hiding cover for federally-listed fish and increase vulnerability to predators.

#### ***Effects of Non-herbicide Treatment Methods***

Non-herbicide methods considered in this Biological Opinion include, manual, mechanical, fire, cultural, restoration and revegetation, access management, and biological control. This section focuses on the potential direct and indirect effects from each non-herbicide method included in the Invasive Plant Program. Pathways include effects to riparian structure, instream habitat conditions, water quality, and food source.

Effects to federally-listed individuals resulting from non-herbicide treatment methods are most likely to occur from mechanical and cultural treatment methods. The degree of effects would depend on the life stages present (eggs, fry, spawning adults, etc.) during treatment and the extent of the project’s instream activity. However, due to the expected limited occurrence of instream related activities under manual and cultural treatment methods, adverse effects would likely be of short duration and confined to a local area. The intensity and extent of effects to listed aquatic species and their habitat as a result of non-herbicide treatment will vary. Effects will vary depending on amount of area treated, soil type, proximity of treatment to water, hydrologic regime and weather conditions during and after treatment, temperature, channel morphology and large woody debris, and biota present in surface water.

Most indirect effects from non-herbicide treatment methods are through activities or treatments within riparian areas. Riparian vegetation is important to preventing or slowing introduction of sediment, particularly fine sediment, to streams. Loss of vegetation in riparian areas during treatment may temporarily increase fine sediment, turbidity, or sedimentation in a stream. Stream shade provided by riparian vegetation prevents increased water temperature due to solar radiation. Where invasive plants prevent the growth of trees or other native vegetative cover, invasive plant treatment may restore shade in the long term. Alternately, treatment could result in a temporary loss of shade and increased stream temperatures.

*Manual and Mechanical Treatment Methods*

Manual and mechanical treatment effects to riparian function, water quality, and aquatic biota depend on soil properties, climate, distance to surface water, and the extent of the mechanical treatment. Manual and mechanical treatments are expected to cover relatively small areas within watersheds.

Manual and mechanical treatments of some invasive plant species (like knotweed) may decrease riparian vegetative shading in certain areas thereby increasing the amount of solar radiation striking the water. This is not likely to result in a warming effect because many other factors in addition to shade affect water temperature, there would have to be a significant amount of vegetation removed to change water temperature in the stream, and shade would have to be provided only by the invasive plant removed. Any warming effect that would occur would be very localized (e.g. on a small portion of the entire stream or river), insignificant to overall stream temperature, and relatively short-term.

Loss of shade is expected to be temporary, until appropriate vegetation reaches and surpasses the height of the invasive plants that were removed. Any warming that could occur would not be likely to adversely affect listed aquatic species and their habitat.

Mechanical treatments within riparian areas that result in significant ground disturbance and are carried out over a large area may lead to increased erosion and stream sedimentation. Sedimentation may adversely affect fish by covering eggs or spawning gravels, reducing prey availability, or directly harming fish gills. In lower intensity non-native plant infestations, non-target vegetation left on the treatment site can reduce the potential for erosion and subsequent sediment delivery to streams or water bodies.

The risk of harm to fish habitat due to fine sediment production from manual treatment or use of motorized hand tools is low. Effects would likely be localized and minor. Best management practices at the project and sub-regional scale are likely to prevent long-term negative effects. Depending on the scale of treatment, large riparian areas treated with motorized hand tools may slightly increase the risk to aquatic environments.

The risk of harm to fish habitat from use of wheeled or tracked machinery will vary depending on the extent of treatment area and proximity to aquatic environments. Soil compaction within riparian areas can prevent the establishment of native vegetative cover. Project design criteria or mitigation measures established at the project-level will

minimize effects of wheeled or tracked machinery to riparian and aquatic ecosystems due to soil compaction.

#### *Biological Treatment Methods*

Biological controls targeted to a single species of invasive plant are unlikely to result in adverse effects on riparian function, water quality, or aquatic species. Effects would likely be localized and short-term. Riparian areas made up entirely of invasive plants along small streams or ponds are most likely to be impacted by the use of biological controls because of the loss of cover and shade. However, biological controls act slowly and widespread killing of invasive plants in riparian areas and subsequent indirect effects to water quality and aquatic species are unlikely.

#### *Cultural Treatment Methods*

Fertilizer is used to promote native plant species at the expense of invasive plant species, but has been done infrequently in the Region and is not likely to have large-scale effects. Fertilizer use near streams could produce localized adverse effects if significant fertilizer was introduced into the water via runoff.

Negative effects to fish and aquatic ecosystems from planting or seeding are unlikely. Planting or seeding native or non-invasive plant species is likely to occur over small areas. Manual methods are generally used for planting and seeding; though hand carried power tools are sometimes used. Planting and seeding in riparian areas will establish vegetative ground cover and root strength preventing fine sediment introduction to streams.

Fertilization done in conjunction with seeding or planting may have minor and localized effects. Depending on fertilizer type, application method, soil type, weather during and after application, and proximity to surface water, nutrients can be delivered to streams. A result of high nutrient loads in water bodies can lead to algal blooms, increased biological demand, water chemistry effects, and changes in biota. Ammonia, a common ingredient in fertilizers, is listed in both Oregon and Washington with specific water quality criteria for 303(d) lists. Fertilization projects are likely to be small and affect small areas within watersheds. Project Design Criteria or mitigation measures established at the project-level will minimize effects of fertilizers used in riparian areas.

Mulch application is likely to be manual and any risk of harm to riparian function, water quality, or aquatic species from mulching is unlikely. There would have to be a significant amount of mulch or decayed mulch entering water bodies that is sufficient enough to impact the aquatic ecosystem. Mulching is unlikely to negatively affect riparian areas or the aquatic environments.

The use of livestock grazing as a specific tool for treating invasive plants is fairly new. The type of grazing animal and management of grazing will vary depending on the target plant species, land type, and proximity to water. In some cases grazing animals are fenced within target areas to protect native vegetation or leashed in a concentrated area of plant infestations. Where there are known sensitive areas for listed aquatic species (e.g.

known spawning grounds), there is a potential for negative effects resulting from grazing in riparian areas. The probability of occurrence and magnitude of adverse effects from grazing will depend on how efficiently livestock are excluded from stream channels. Cattle are not expected to be used as a treatment tool because they are not as effective at eating invasive plants. Goats and sheep are effective at consuming invasive plants, and have been used as treatment tools. Goats and sheep could potentially enter streams and disturb fish or redds, but are not expected to be present for extensive time periods. Standard 20 would further reduce the likelihood of disturbance during spawning periods.

#### *Prescribed Fire Treatment Methods*

The risk of harm to riparian function, water quality, or aquatic species from prescribed fire will depend on fire intensity, proximity to water, and land type. Prescribed burning has the potential to bare large areas of soil in adjoining uplands, and thus increase surface erosion and sedimentation of streams, and create potential effects to dissolved oxygen from nutrient input.

Prescribed fire for invasive plant control would not likely be used on the species of invasive plants that could provide instream habitat or riparian structure, provide food resources, or provide shade, and would not be conducted in such a way that native riparian vegetation would be removed. It would be counterproductive to remove large amounts of native riparian vegetation in an invasive plant treatment project because that would only provide additional area for invasive plant colonization. Therefore, there are no likely effects to instream habitat or riparian structure, food resources, or water temperature, from prescribed fire used for invasive plant control.

Heavy runoff from burned areas can increase water pH, and nutrient input, indirectly affecting listed aquatic species and directly affecting critical habitat. Effects to watersheds are dependent on the extent and intensity of the fire. Prescribed fire as a treatment for invasive plants has been, and is expected to be a very small portion of the prescribed fire program in Region 6.

#### *Effects of Herbicide Treatment*

U.S. Forest Service SERA Risk Assessments for the Proposed Action were modeled for each herbicide considered under the Invasive Plant Program (SERA 1999, 2001, 2003 *as cited* in U.S. Forest Service 2005). These risk assessments model the amount of chemical that can reach water under several different scenarios, then compares results to existing monitoring data to check the accuracy of the model. A stream or water body contaminated by runoff and percolation immediately after application of an herbicide is the scenario used to predict acute exposure to aquatic species (Worksheet F06 and Tables 3-1 and 3-2, Risk Assessments). Herbicide concentration levels in water are estimated from monitoring and modeling data. Dissipation, degradation and other environmental processes are considered to predict chronic exposure for aquatic species (Worksheet F09 and Tables 3-1 and 3-2, Risk Assessments).

The toxicology and risk assessment fields contain terms commonly used, and necessary to describe the technical information, which are not typically found in other technical fields. The following list of terms is included to assist the reader.

### **Terminology**

**a.i.** – active ingredient.

**a.e.** – acid equivalent

**EEC**- Estimated/expected environmental concentration: The estimated or expected pesticide concentration in an environmental media based on a particular set of assumptions and/or models.

**HQ** – Hazard Quotient: The ratio of the estimated level of exposure to a substance from a specific pesticide application to the reference dose for that substance, or to some other index of acceptable exposure or toxicity (e.g. toxicity index). A HQ less than or equal to one is presumed to indicate an acceptably low level of risk for that specific application.

**LC<sub>50</sub>** - lethal concentration<sub>50</sub> - 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.

**LOC** – Level of Concern: The concentration in media or some other estimate of exposure above which there may be effects.

**NOEL or NOEC** - No-observed-effect-level/concentration: exposure level at which there are no statistically or biological significant differences in the frequency or severity of adverse effects between the exposed population and its appropriate control.

**Toxicity index:** The benchmark dose used in this analysis to determine a potential adverse effect when it is exceeded. Usually a NOAEL, but when data are lacking other values may be used.

In the risk assessments, two types of estimates were used for the concentration of each herbicide in ambient water: acute and longer-term exposure. The acute exposure scenario is associated with peak concentrations in a pond or lake that might be expected after the application of an herbicide to a 10 acre block that is adjacent to and drains into a small stream or pond. The longer-term exposure scenario is based on average concentrations that might be expected after a similar application (i.e., a 10-acre block that is adjacent to and drains into a small stream or pond).

In order to understand and assess the effects from herbicides, one must be familiar with the exposures modeled in the risk assessments for each herbicide identified in the Proposed Action. The U.S. Forest Service/SERA Risk Assessments used a variety of models, including GLEAMS, to estimated environmental concentrations (EECs) of

herbicide after application. The risk assessments were conducted using standardized parameters in the models, because it is not possible to account for the variety of site-specific conditions in a nation-wide assessment. The relationship between site-specific conditions in the Pacific Northwest Region, and the standardized set of parameters used in the analysis was considered in the effects analysis for this Biological Opinion as described below.

*GLEAMS Model Estimates and Pacific Northwest Region Conditions*

The U.S. Forest Service/SERA Risk Assessments provide a matrix of EECs for each herbicide, with rainfall and soil type as the varied input parameters. For this plan-level consultation, the influence of local site-specific environmental conditions (such as slope, elevation, streamflow, etc.) on the generic EEC predictions were estimated by considering the potential influence of local conditions in five geographical settings or ecotypes present within Pacific Northwest Region (U.S. Forest Service 2005, Appendix D). The analysis was conducted to determine whether consideration of local conditions (known as the ecotype analysis), rather than the generic values used in the GLEAMS modeling in the risk assessments, has the potential to meaningfully alter the predicted stream concentrations. Conditions representing five local “ecotypes” were evaluated: Coast Range, western Cascades, eastern Cascades, eastern Oregon grasslands, and the Blue Mountains.

The results of the GLEAMS/ecotype analysis demonstrate that local conditions have the potential to meaningfully alter predicted concentrations in a range of environmental conditions. Use of input parameters for local environmental conditions may result in higher or lower predicted stream concentrations, depending on the values for, and the particular combination of, local factors (slope, vegetation cover, precipitation pattern, soil type, and stream flow). The consequence of variability in stream herbicide concentration predictions is that the calculation of HQ values will also vary, resulting in a different pattern of level of concern (LOC) exceedences. Concern for federally-listed aquatic species could also change according to site-specific conditions. More accurate estimates of risk to listed aquatic species can only be done at the project scale, where actual project locations and proposed treatments are known.

*Exposure to Herbicides*

Herbicides can enter water through, spray drift, surface water runoff, percolation, and direct application. Standards 18 to 22 are intended to minimize or avoid water contamination from herbicides. The likelihood of herbicides entering the water depends on the type of treatment and mode of transport, which are described below.

Water Contamination from Drift

Herbicide drift is one mechanism of herbicide movement when applied as a spray. Drift or off-target movement can result in unintended injury to native plant species and/or contamination of surface waters. Drift occurs when fine droplets of liquid herbicide become windborne and are transported to adjacent areas. It is a physical process that depends on droplet size and weather conditions rather than specific properties of an herbicide. Application pressure, nozzle size, nozzle type, spray angle, and spray volume

are all factors in determining droplet size. Droplet sizes increase with decreasing pressure and larger nozzle sizes. Height of the nozzle above ground greatly influences the potential for drift, with higher applications (like aerial) creating more drift than lower applications (like low boom or backpack). The actual amount of drift expected from an herbicide application is also highly dependant upon site-specific variables, such as wind speed, temperature, relative humidity, topography, and vegetation structure. U.S. Forest Service/SERA Risk Assessments modeled off-site drift for each herbicide using AGRIFT (Teske et al. 2001 *as cited* in U.S. Forest Service 2005). Further details of AGDRIFT are available at <http://www.agdrift.com/>. The upper estimates of water contamination in the analysis include consideration of drift to a small stream (U.S. Forest Service 2005), so the contribution of drift has been considered in the EECs.

Drift could deposit herbicide droplets on surface waters that either contain listed aquatic species or serve as runoff conduits to water containing listed aquatic species. Herbicide concentrations in water as a result of drift are more likely to result in levels of concern in a closed pond system than in a flowing stream. Flowing water would quickly dilute and transport the herbicide, resulting in a short-term pulse of herbicide concentration. In a closed pond system, herbicide from drift would not be readily transported or mixed to create a lower concentration.

Drift associated with backpack (directed foliar applications) is likely to be low, because of low volumes and low application heights, although studies quantitatively assessing drift after backpack applications have not been conducted. Aerial spraying can result in substantially more drift. Standards 20 to 22 in the Invasive Plant Program will reduce the risk of surface water contamination from spray drift. Standard 16 prohibits aerial application of the following three herbicides: chlorsulfuron, metsulfuron methyl, and sulfometuron methyl. In addition, the use of triclopyr is limited to selective application techniques only (e.g., spot spraying, wiping, basal bark, cut stump, injection). Therefore, listed aquatic species are not likely to be exposed to significant drift of these four herbicides. The use of aerial application in the region is expected to be rare based on the lack of aerial applications in the Region in the last 15 years and the limited predictions of use on most National Forests in the future (Appendix A). Site-specific analysis is necessary to further refine the likelihood of exposure from drift during specific applications.

#### Water Contamination from Runoff, Leaching, and Percolation

All herbicides can potentially enter streams and other water bodies through water transported by runoff, leaching, or percolation. Water contamination from rain events could transport chemicals to waterways, and convey them to listed aquatic species habitat. Soil type and chemical stability, solubility, and toxicity can determine the extent to which an herbicide will migrate and impact surface waters and groundwater. For example, picloram is highly soluble and readily leaches through the soil. Glyphosate, though very soluble, binds very tightly with organic matter in soils and is not easily leached. All of the herbicides proposed for use are susceptible to transport in surface runoff, especially if applications are followed immediately by high rainfall events.

*Direct and Indirect Effects*

Application of herbicides under the Invasive Plant Program is not expected to result in direct mortality to listed aquatic species. All EEC's that would result from applications conducted according to the standards in the Invasive Plant Program are below lethal doses. Direct effects from herbicide on listed aquatic species are likely to be from sub-lethal effects, rather than from direct mortality as a result of herbicide exposure, or from non-herbicide treatment methods. The ecological significance of sub-lethal effects depends on the degree to which they influence behavior essential to the survival and reproductive potential of individual listed aquatic species. Sub-lethal effects are not readily apparent. When small changes in the health of individual fish are observed (e.g., a small percent change in the activity of a certain enzyme, or an increase in oxygen consumption), it may not be possible to infer a significant loss of essential behavior patterns of listed aquatic species in the wild.

Most of the potential effects from the herbicides and adjuvants proposed for use have not been investigated in regards to sub-lethal toxicological endpoints that are generally considered important to the overall health and fitness of listed aquatic species. These sub-lethal toxicological endpoints are defined as:

- Increase or decrease in growth
- Changes in reproductive behavior
- Reduction in number of eggs produced, eggs fertilized, or eggs hatched
- Developmental abnormalities, including behavioral deficits or physical deformities
- Reduced ability to osmoregulate or adapt to salinity gradients
- Reduced ability to tolerate shift in other environmental variables
- Increased susceptibility to disease and/or predation
- Changes in migratory behavior

Standards 19 and 20 in the Proposed Action will minimize the potential for sublethal effects from project activities. Research regarding sublethal effects to fish from both the technical grade herbicides and formulations for picloram (Tordon K), clopyralid (Transline), imazapyr (Habitat), imazapic (Plateau), triclopyr (Garlon 3A and Renovate), and glyphosate (no formula tested for glyphosate) using zebra fish (*Danio rerio*) has been conducted by NMFS Northwest Fisheries Science Center, but the results have not yet been published. However, preliminary results suggest that the sub-lethal effects investigated do not occur in zebra fish for the herbicides and formulations tested. Based on an overall consideration of the information currently available, the potential for sub-lethal effects to occur to fish from the invasive plant treatment projects are low, but cannot be ruled out.

Product formulations sometimes include unspecified inactive ingredients and adjuvants with unknown toxic effects to listed fish. For example, the combination of the polyethoxylated tallow amine (POEA) surfactant in some glyphosate formulations (e.g. Roundup) has been shown to cause inflammation of gill tissue in fish, and to reduce survival rates especially for young fish (U.S. Forest Service 2005). Roundup is known to have the POEA surfactant and is therefore toxic to fish, while the product Rodeo, which

contains the same active ingredient (glyphosate), but no surfactants, has very low toxicity.

The risk of direct effects from drift as a result of broadcast spray applications (aerial, boom, and backpack) is primarily from overspray into small streams and stream margins, and small enclosed water bodies. Higher herbicide concentrations can result in smaller streams with limited dilution capacity. Stream margins providing rearing habitat to fry and juveniles are often poorly mixed relative to the main stream channel, and high herbicide concentrations can result from overspray/drift exposure. Thus, direct exposure of stream or lake margins to overspray or drift can result in a risk to vulnerable life stages.

Project design and/or mitigations required under Standard 20 will minimize the risk of surface water contamination from spray drift. Standard 20 requires that site-specific project design use wind speed and direction, nozzle type and size, buffers, and other unspecified factors to minimize or eliminate the risk of effects to listed aquatic species from herbicide exposure resulting from spray applications. The site-specific design criteria employed will be specified at the project level.

Potential effects from herbicides were analyzed separately for acute and chronic exposures. Acute exposures are short-term while chronic exposures occur over time. Both acute and chronic exposures to the most sensitive representatives of the aquatic community were evaluated. The acute and chronic toxicity indices were used to determine whether estimated herbicide concentrations may pose a toxicity risk to federally-listed aquatic species. Risk can be estimated by first calculating a hazard quotient (HQ), defined as the EEC of the herbicide divided by the most sensitive acute or chronic toxicity index available, such as a NOEC or a fraction of an LC<sub>50</sub>. If the EEC is greater than the toxicity index (i.e.  $HQ > 1$ ), then there is a potential to cause adverse effects (U.S. Environmental Protection Agency 2004 *as cited* in U.S. Forest Service 2005). If the HQ is  $<$  or  $=$  to 1, then the estimated exposure is less than or equal to the toxicity index. At this exposure, the risk of adverse effects to federally-listed aquatic species is expected to be discountable. A summary of the toxicity indices used for listed fish and calculated HQ's greater than 1.0 for listed aquatic species or their food base is provided in Appendix E of the Biological Assessment.

#### *Chronic Exposure*

The U.S. Forest Service/SERA risk assessments used application scenarios of a broadcast spray application on a 10 acre area immediately adjacent to a 1.8 cubic feet per second stream. For chronic exposures, degradation and dissipation of the herbicide over time are implicitly considered in the model used in the Risk Assessments. That is, over time there is less herbicide available on the treatment site to wash into the stream. The results of the analysis using the U.S. Forest Service/SERA risk assessment scenario, and the toxicity indices for listed fish and other aquatic organisms, indicated that no chronic exposures exceeded the toxicity indices (i.e. all HQ's were  $<1$ ) for any herbicide at any application rate.

To further evaluate the potential for chronic risk, additional analysis was conducted for chronic exposure to determine whether chronic exposures above toxicity thresholds were mathematically possible even if we assumed no degradation or dissipation of the herbicide. Toxicity thresholds (or “toxicity indices”) were determined using USEPA protocol for effects to federally-listed aquatic organisms (U.S. Forest Service 2005, see Appendix E).

More specifically, the question addressed was whether chronic toxicity indices (either measured or estimated NOEC) could be exceeded if 100% of the amount of herbicide applied to 10 acres at the highest application rate was steadily delivered directly into a stream flowing at 1.8 cubic feet per second over 90 days (for fish) or 21 days (for invertebrates and aquatic plants). If the resulting HQ was  $\leq 1$ , then chronic toxicity exposure is not mathematically possible. If the HQ was  $> 1$ , then information contained in the U.S. Forest Service SERA Risk Assessments was used to further assess chronic risk.

For fish and invertebrates, exposure above the chronic toxicity indices for 90 days is not mathematically possible for any of the 10 herbicides under “worst case” scenarios (U.S. Forest Service project file calculations). However, HQ values for aquatic plants were exceeded, using the 100 percent delivery assumption, for the following herbicides:

Sulfometuron methyl

Chronic toxicity HQ values for sulfometuron were exceeded for aquatic plants. Data cited in the SERA Risk Assessments indicates that detectable amounts of sulfometuron methyl (0.014 – 0.054 mg/L/pound a.i./acre applied) are present in streams only following storm events. Storm events would generate a short-term pulse and also serve to increase the streamflow, diluting the herbicide more than anticipated in the SERA Risk Assessment. Therefore, considering the tendency for storm-driven pulse delivery (an acute exposure) of sulfometuron methyl, chronic exposure of aquatic plants to toxic levels of sulfometuron methyl is unlikely to occur. The scenario analyzed in the SERA Risk Assessment likely overestimates risk and describes concentrations higher than are realistic or plausible for actual ground conditions.

Imazapyr, metsulfuron methyl, and chlorsulfuron

The chronic HQ values (assuming 100 percent steady delivery) for aquatic plants were also exceeded for imazapyr, metsulfuron methyl, and chlorsulfuron. Because U.S. Forest Service model resulted in  $HQ > 1$ , they reviewed the data in the U.S. Forest Service/SERA risk assessments to characterize risk. Upon further analysis of imazapyr using data from the SERA risk assessments, it was determined that exposure of aquatic plants to concentrations that exceed the chronic toxicity index may be mathematically possible, but is not plausible. The SERA risk assessment for imazapyr lists the highest average modeled stream concentration as 0.00002 mg/l. This concentration is approximately three orders of magnitude lower than the chronic toxicity index (NOEC) of 0.013 mg/l, so risk to aquatic plants is not plausible.

The U.S. Forest Service/SERA Risk Assessment for metsulfuron methyl does not report average modeled concentrations, and it was not possible to conclude whether the modeled “worst case” scenario results in a plausible risk of chronic toxicity to aquatic plants. The peak modeled stream concentration reported in the SERA risk assessment for metsulfuron of 0.006 mg/l is approximately equal to the 0.005 mg/l calculated as the mathematically highest possible average stream concentration (with 100 percent direct input), indicating that the true 21 day concentration for non-fish species is likely much lower. Based on this, the U.S. Forest Service cannot conclude that exposure to chronic toxicity of metsulfuron to plants will not occur. However, actual exposure exceeding the toxicity index is unlikely to occur because peak concentrations would not occur every day over the entire chronic exposure period.

For chlorsulfuron, using data from the U.S. Forest Service/SERA risk assessments, it was determined that exposure of aquatic plants to chronic toxicity concentrations is plausible. The risk assessment for chlorsulfuron lists the highest average modeled stream concentration as 0.0022 mg/l, approximately 46 times higher than the estimated chronic NOEC of 0.000047 mg/l. Therefore, for the “worst case” scenario modeled in the SERA risk assessments, exposure of aquatic plants to concentrations of chlorsulfuron above the estimated chronic NOEC value is plausible.

The above analysis estimates the level of chronic toxicity risk associated with an anticipated “worst case” project (10 acres treated adjacent to a 1.8 cubic feet per second stream with no buffers). Standards in the Invasive Plant Program would require project design criteria that would minimize the potential for these estimated concentrations to actually occur. For example, the “worst case” scenario assumes no buffers and a broadcast spray application immediately adjacent to the stream. Such an application would not comply with standards in the Invasive Plant Program, so actual exposures are likely to be much less. The degree of chronic exposure risk will ultimately be the result of site-specific project design, and will need to be analyzed at that level. As a result of the above analysis, chronic exposure of concern to aquatic listed species are not plausible and therefore are not further evaluated in this document for potential effects to each listed aquatic species.

#### *Acute Exposure*

Acute exposure scenarios in the U.S. Forest Service SERA Risk Assessments address herbicides entering streams from ground application through erosion and runoff, and how herbicides affect three different aquatic species groups (fish, invertebrates, and plants). Stream size used for the scenarios is at 1.8 cubic feet per second. Worksheets and toxicity indices used to determine whether the exposure scenarios resulted in exceedences of NOEC values by using hazard quotients (HQ) are in the U.S. Forest Service project file. The NOEC values (either estimated or measured) were designated as the concentration “level of concern” (LOC). Toxicity thresholds (or “toxicity indices”) were determined using USEPA protocol for effects to federally-listed aquatic organisms (U.S. Environmental Protection Agency 2004 *as cited* U.S. Forest Service 2005). The results of the analysis indicate that modeled concentrations (EEC’s) of glyphosate, picloram,

sethoxydim, and triclopyr exceed the toxicity indices (i.e. HQ's >1) for federally-listed fish at typical and highest application rates (Table 2).

Exceedences in LOC indicate occasions where the EEC is greater than the NOEC value used for that aquatic species group, which may lead to an adverse effect to listed aquatic species. Diamonds (◆) in Table 2 indicate where the LOC is exceeded only at the highest application rates, stars (\*) indicate where the LOC is exceeded at both the typical and highest application rates. The LOC exceedences occur when the HQ value (the EEC/NOEC ratio) exceeds 1. Two types of adverse effects are possible; those toxic to the listed aquatic species and those causing toxic effects to an ecosystem component that is part of the primary constituent elements or associated essential habitat features.

Table 2. Acute exposure results for sensitive aquatic organisms using USEPA Protocol.

Aquatic Species Group	Chlorsulfuron	Clopyralid	Glyphosate w/o surfactant	Glyphosate with surfactant	Imazapic	Imazapyr	Metsulfuron Methyl	Picloram	Sethoxydim	Sulfometuron Methyl	Triclopyr TEA	Triclopyr BEE	NPE surfactant
Fish	--	--	*	*	--	--	--	*	*	--	*	*	--
Aquatic invertebrates	--	--	--	◆	--	--	--	--	--	--	--	◆	--
Aquatic plants	*	--	--	--	◆	*	*	◆	--	*	*	*	--

'--' Predicted concentrations less than the estimated or measured 'no observable effect concentration'

'\*' Predicted concentrations greater than the estimated or measured 'no observable effect concentration' at typical and highest application rates

'◆' Predicted concentrations greater than the estimated or measured 'no observable effect concentration at highest allowed application rates only

The toxicity metric values (estimated or measured NOEC values) used in the analysis were selected as the most likely to protect against acute sub-lethal effects. Therefore, a LOC exceedence, indicated by a star or diamond in Table 2, represents at least a greater than discountable risk of acute sub-lethal effects.

Based on the information displayed in Table 2, herbicides proposed for use can be placed into one of three risk groups: low, medium, or high. The low risk group contains those herbicides for which LOCs were either not exceeded, or only exceeded the LOC for aquatic plants. The medium risk group contains those herbicides for which LOCs were exceeded for two aquatic species groups other than fish. The high risk group contains those herbicides for which LOCs for fish were exceeded.

Clopyralid, imazapic, and metsulfuron methyl

The low risk group contains clopyralid, imazapic, and metsulfuron methyl. This group was considered the lowest risk because LOC exceedences (i.e. HQ > 1) were for aquatic plants only, and were of a low magnitude (most HQ < 2). Minor effects to aquatic plants have a plausible, but low likelihood, of resulting in greater than discountable effects to listed aquatic species. There were no exceedences for clopyralid for any of the aquatic groups. Imazapic and metsulfuron methyl both exceeded the LOC for aquatic plants, with imazapic exceeding the LOC at the highest application rate only. The LOC exceedences for imazapic and metsulfuron methyl indicate that there are plausible effects to habitat for listed aquatic species under the scenario that was analyzed. Nonyphenol polyethoxylate (NPE) based surfactants were also classified as low risk.

Chlorsulfuron, imazapyr, and sulfometuron methyl

Chlorsulfuron, imazapyr, and sulfometuron methyl were considered as medium risk due to LOC exceedences for aquatic invertebrates, in addition to aquatic plants. Aquatic invertebrates provide additional significant components of the aquatic food chain base, upon which juvenile aquatic species depend. Minor adverse effects to multiple components of the food chain are plausible in this group, and are more likely to have greater than discountable effects to listed aquatic species. For all three herbicides in this group, the LOC exceedences indicate that effects to habitat for listed aquatic species are plausible. The degree of LOC exceedence for aquatic plants was markedly higher for chlorsulfuron, and it appears to present the highest risk of acute adverse effects to aquatic plants for any of the proposed herbicides.

Glyphosate, triclopyr, picloram, and sethoxydim

The highest risk group are herbicides that could plausibly cause acute adverse effects to listed aquatic fish. High risk herbicides are glyphosate (with and without surfactant), triclopyr (TEA and BEE), picloram, and sethoxydim. Glyphosate with surfactant also exceeded the LOC values for aquatic invertebrates. The combination of POEA surfactant and glyphosate has been shown to cause inflammation of gill tissue in fish, and to reduce survival rates for juvenile fish (Folmar et al. 1979). Folmar et al. (1979) demonstrated that the surfactant POEA is actually more toxic to fish than glyphosate. The LOC exceedences for glyphosate without surfactant appear to be a function of the high glyphosate application rates, rather than high glyphosate toxicity. Thus, the risks associated with glyphosate will depend largely on formulations applied in the vicinity of streams, and application rates and methods specified for site-specific projects.

The exposure scenario modeled in the SERA Risk Assessments as defined in the Invasive Plant Program probably significantly overestimates the risk of acute adverse effects resulting from triclopyr application. Standard 16 of the Invasive Plant Program states that triclopyr will only be used in spot applications, thus the risk assessment scenario of treating 10 acres at the maximum application rate of 10 lbs. acid equivalent (a.e.) per acre is likely to be well in excess of maximum rates actually used. Analysis conducted for site-specific projects should provide a greater understanding of the true risks associated with triclopyr under the Invasive Plant Program.

Standard 20 requires the use of project design criteria that would minimize the potential exposure to these herbicides, resulting in actual exposures that are substantially less than those modeled in the risk assessments. This would serve to minimize the risk to fish and other aquatic organisms from these herbicides.

The HQ values for sethoxydim were calculated using the toxicity data for the Poast formulation, and incorporates the toxicity of the naptha solvent. The toxicity of sethoxydim for fish and aquatic invertebrates is generally much less than that of the formulated product (about 30 times less toxic for invertebrates, and about 100 times less toxic for fish). Since the naptha solvent tends to volatilize or adsorb to sediments, using Poast formulation data to predict indirect aquatic effects from runoff may overestimate potential effects (SERA 2001 *as cited* in U.S. Forest Service 2005).

### **Lost River and shortnose suckers**

#### ***Status and baseline***

Detailed accounts of the taxonomy, life history and behavior of the Lost River sucker and shortnose sucker can be found in the final rule listing the species as endangered (U.S. Fish and Wildlife Service 1988) and the final recovery plan (U.S. Fish and Wildlife Service 1993c).

#### *Listing History*

On July 18, 1988, the USFWS issued a final rule listing the Lost River and shortnose sucker as endangered under the ESA (U.S. Fish and Wildlife Service 1988). These species occur in California and Oregon.

The USFWS proposed to designate critical habitat for the Lost River and shortnose sucker on December 1, 1994 (U.S. Fish and Wildlife Service 1994b). Critical habitat has not been finalized.

On July 21, 2004, the USFWS issued a notice of a revised 90-day petition finding and initiation of a 5-year review of the Lost River and shortnose suckers (U.S. Fish and Wildlife Service 2004e).

#### *Distribution*

The Lost River and shortnose sucker are endemic to the Upper Klamath Basin of Oregon and California. Within their range, early records indicate that they were widespread and abundant (U.S. Fish and Wildlife Service 1993c).

At the time of listing, Lost River and shortnose suckers were reported from Upper Klamath Lake and its tributaries, Lost River, Clear Lake Reservoir, the Klamath River, and the three larger Klamath River reservoirs (Copco, Iron Gate, and J.C. Boyle). The general range of Lost River and shortnose suckers has been substantially reduced from its historic extent by the total loss of major populations in Lower Klamath Lake, Sheepy Lake, and Tule Lake (U.S. Fish and Wildlife Service 1988). The Klamath River reservoir populations receive individuals carried downstream from upper reaches of the River, but

they are isolated from the Upper Klamath Basin by dams and show no evidence of self-sustaining reproduction (Desjardins and Markle 2000). The current geographic ranges of Lost River and shortnose suckers have not changed substantially since they were listed and only two additional shortnose sucker and one Lost River sucker populations have been recognized since 1988. They all occur in isolated sections of the Lost River drainage, within the historical ranges of the species, and include an isolated population of shortnose suckers in Gerber Reservoir and a small population (limited to several hundred adults) of each species in Tule Lake.

Currently, there are three major populations of shortnose suckers in the Upper Klamath Basin found in Upper Klamath Lake, Clear Lake, and Gerber Reservoir. There are two major populations of Lost River suckers in the Upper Klamath Basin found in Upper Klamath Lake and Clear Lake, along with a very small population in Tule Lake. Upper Klamath Lake contains the largest populations of Lost River and shortnose suckers and these populations are critical for the long-term survival of both species.

The Lost River sucker occurs within the Winema National Forest and the shortnose sucker occurs within the Fremont and Winema National Forests. The action area contains a limited amount of currently occupied range of the Lost River and shortnose suckers; the vast majority of sucker habitat occurs outside the National Forest land. Habitat and/or occupied areas of the Lost River and shortnose suckers on or adjacent to U.S. Forest Service lands are limited to a couple miles of the eastern shore of Upper Klamath Lake at Ouxy and Sucker Springs, a few miles of habitat on the Sprague and Williamson Rivers, and historical habitat in Sevenmile, Fourmile, and Crystal Creeks, and a small section of one upper tributary in the Clear Lake watershed. There is a very short section of habitat on Odessa Spring Creek on or adjacent to the Winema National Forest.

#### *Life History*

Lost River suckers and shortnose suckers are both large, long-lived, lake-dwelling fish that are found only in the Klamath Basin above Iron Gate Dam. Adult Lost River suckers can reach 39 inches in length, while shortnose suckers are generally less than 20 inches. Lost River suckers naturally live over 43 years, and shortnose suckers can live at least 33 years (Scoppettone 1988). Larvae reach about an inch in length by July. They are generally considered as young-of-the-year juveniles above that size (Buettner and Scoppettone 1990, Simon and Markle 2001). By October of their first year juveniles reach about 2 to 4 inches. Male Lost River suckers begin to enter the spawning population at about age 4 and a size of about 16 inches. Female Lost River suckers begin to spawn at about age 7 and a size of about 20 inches. (Buettner and Scoppettone 1990, Perkins et al. 2000). Male and female shortnose suckers begin to spawn at about age 4 to 5 when they reach a length of about 11 to 13 inches).

### Reproduction

Klamath suckers can be separated into three groups based on where they spawn. Adult Lost River and shortnose suckers primarily occupy lake habitats. Some migrate into tributaries to spawn, while others spawn in suitable near-shore lake habitats, primarily springs. There are also apparently some shortnose suckers that both live and spawn in streams, notably in the Clear Lake and Gerber Reservoirs. Stream and lake spawning populations appear to rarely exchange individuals and may be reproductively isolated (Perkins et al. 2000, Shively et al. 2000a, Hayes and Shively 2001).

Currently, most of the stream-spawning Lost River and shortnose suckers in Upper Klamath Lake move up the Williamson and Sprague River to spawn, while a small population may also utilize the Wood River (Markle and Simon 1993). Some individuals of both Lost River and shortnose suckers also spawn at shoreline sites within Upper Klamath Lake, especially at eastside springs and areas with a gravel substrate (Buettner and Scopettone 1990). Along the eastern shore of Upper Klamath Lake, known spawning occurs at Sucker, Silver Building, Ouxy, and Boulder Springs, and at Cinder Flats (Hayes and Shively 2001). Suckers in the Clear Lake and Gerber Reservoir drainages spawn primarily, if not entirely, in the tributary streams (Buettner and Scopettone 1991, Koch and Contreras 1973, Perkins and Scopettone 1996).

Spawning generally occurs from February to June and peaks between mid-April and early May. The timing of spawning migration is somewhat variable from year to year and is apparently dependent on age, species, sex, and environmental conditions (Andreasen 1975, Buettner and Scopettone 1990, Hayes and Shively 2001, Klamath Tribes 1996, Markle et al. 2000, Perkins and Scopettone 1996, Shively et al. 2000, Ziller in litt. 1985).

Lost River and shortnose suckers typically spawn at night in shallow areas with gravel substrate where eggs are broadcast or slightly buried (Bienz and Ziller 1987, Buettner and Scopettone 1990, 1991, Klamath Tribes 1995, Perkins and Scopettone 1996, Perkins et al. 2000). Water depth for most spawning sites ranges from about 1 to 4 feet.

In a single spawning season, a Lost River or shortnose sucker female can produce 18,000 to 72,000, and 44,000 to 236,000 eggs, respectively (Perkins et al. 2000). Larger, older females produce substantially more eggs and therefore can contribute relatively more to recruitment than a recently matured female. Only a small percentage of the eggs survive to become larvae.

### Larvae (less than 1 inch in length)

Soon after hatching, sucker larvae move out of the gravel. They are about a third of an inch long and are mostly transparent with a small yolk sac (Buettner and Scopettone 1990). Larval suckers need to begin feeding quickly, before they exhaust their yolk sac and starve (Cooperman and Markle 2000, Klamath Tribes 1996). The availability of appropriate habitat, which provides sufficient food soon after hatching, is critical to the survival of larvae.

Larvae apparently spend relatively little time upriver before drifting downstream to the lakes (Buettner and Scopettone 1990, Cooperman and Markle 2000, Klamath Tribes 1996, Markle et al. 2000, Perkins and Scopettone 1996). In the Williamson River, larval sucker out-migration from spawning sites begins by at least May and is generally completed by mid-July. Downstream movement takes place at night and near the water surface. During the day, larvae appear to move to the river margins and to seek cover in the emergent shoreline vegetation.

In Upper Klamath Lake, larval suckers are first captured in early April during most years, with peak catches occurring in June, and densities dropping to very low levels by late July (Cooperman and Markle 2000, Simon et al. 1996). Larval suckers are found throughout Upper Klamath Lake, with highest concentrations generally at the mouth of the Williamson River and just to the east and west of the mouth, apparently depending on flow patterns. At the Link River, larval suckers have been collected as early as April 28 and as late as July 18 (Gutermuth et al. 1999).

Larval habitat in Upper Klamath Lake is generally along the shoreline, in water 4 to 20 inches deep and associated with emergent aquatic vegetation, such as bulrush (Buettner and Scopettone 1990, Cooperman in litt. 2002, Cooperman and Markle 2000, Dunsmoor 1993, Dunsmoor et al. 2000, Klamath Tribes 1995, 1996, Markle and Simon 1993, 1994, Reiser et al. 2001, Simon et al. 1995, 1996). Emergent vegetation provides cover from predators, protection from currents and turbulence, and abundant prey (including zooplankton, macroinvertebrates, and periphyton). Larvae do not use submerged vegetation (e.g., pondweeds) as an alternative to emergent vegetation (Cooperman in litt 2002, Klamath Tribes 1995). This is apparently due to habitat preferences of the larvae and due to the absence of submerged vegetation, which dies back in the winter and do not reappear until mid summer, when larvae are transforming into juveniles.

Larval sucker ecology and habitat use within Clear Lake and Gerber Reservoirs is unstudied at present. Permanent emergent vegetation is generally scarce or absent along the reservoir shorelines. However, some vegetative cover may be provided by flooded annual grasses and herbs remaining from the previous growth season prior to lake level rising in the spring. Additional cover may be provided by high turbidity, and larvae may utilize shallow shoreline areas to avoid predators. The lower reaches of the primary spawning tributaries do provide emergent shoreline vegetation and extensive submerged vegetation during the spring and early summer when larvae would be present.

Larvae transform into the juveniles at about an inch in length. This generally occurs by the end of July.

#### First Year Juveniles ( 1 to 4 inches in length )

Juvenile sucker habitat is generally in nearshore areas less than 4 feet in depth (Markle and Simon 1993, Reiser et al. 2001, Simon et al. 2000a, Simon and Markle 2001, VanderKooi 2002). Juveniles in unvegetated habitats occur primarily over rocky substrates (rock, gravel, and gravel and sand mix) and appear to avoid sandy and softer muddy bottoms. Recent evidence suggests that emergent vegetation also provides

important habitat for juvenile suckers (Reiser et al. 2001, VanderKooi 2002). Rocky bottoms occur along the shoreline primarily in the southern portion of Upper Klamath Lake while emergent shoreline vegetation occurs primarily in the northern half of the lake, and soft, mucky bottoms occupy the vast majority of the deeper offshore areas.

In mid-summer, juveniles are concentrated in the northern and eastern sections of Upper Klamath Lake, near the mouth of the Williamson River and along the eastern shoreline. In late summer and fall most juveniles are concentrated in the south end of Upper Klamath Lake and along the eastern shoreline (Simon et al. 2000a, Simon and Markle 2001, Simon, unpub. data 2002).

Juvenile sucker abundance drops dramatically from late July to October in Upper Klamath Lake (Simon and Markle 2001, Simon, unpub. data 2002). Catches of juveniles in emergent vegetation also declined significantly near the end of August in both 2000 and 2001, coinciding with lake levels dropping below 4,140 feet (VanderKooi 2002). Near 4,140 feet, vegetated bulrush habitat becomes increasingly unavailable as water level drops, and below 4,140 feet is essentially unavailable (Dunsmoor et al. 2000, Reiser et al. 2001). The late summer declines in juvenile abundance are associated with substantially increased entrainment of juveniles into the A-canal and Link River diversion channels during the same period (Gutermuth et al. 1999, 2000). It is uncertain whether the increased entrainment is due to a juvenile migration out of the Lake, concentration of juveniles in habitat provided by the south end of Upper Klamath Lake after dropping lake levels have reduced available shoreline habitat in the north, or avoidance of poor water quality conditions in Upper Klamath Lake. Since 2002, the Bureau of Reclamation has installed a new fish screen at the A-Canal, which is the largest diversion off Upper Klamath Lake. Monitoring of the suckers in Upper Klamath Lake shows a slight recovery from the die-offs in the 1990's especially for the Lost River suckers, but age class distributions do not indicate much recruitment entering the population. Monitoring for juveniles is showing very low production for most years (Ron Larson, USFWS, pers. comm., 2005).

Adults (greater than 10 inches in length ) and Sub-adults (greater than 4 inches in length)

Adult Lost River suckers are generally limited to lake habitats when not spawning, and no large populations are known to occupy stream habitats. Shortnose suckers, on the other hand, have resident populations in both lake and some riverine habitats, including Lost River, Miller Creek, Willow Creek, and other tributaries of Clear Lake and Gerber Reservoir.

Cover is a primary habitat feature required by fish. For fish like lake suckers that primarily occupy open water, depth and turbidity provide needed cover. In streams, while deeper pools provide some cover, additional cover is provided by instream and overhanging structure (Buettner and Scopettone 1991, Perkins and Scopettone 1996). Adults, and probably subadults, of both species are bottom-oriented, consistently staying within 1 foot of the bottom (Buettner and Scopettone 1991, Reiser et al. 2001, Bureau of Reclamation 2000a). Adults rarely enter water shallower than 3 feet, except to spawn at

night, and show a strong preference for water deeper than 4 feet (Bureau of Reclamation 2000a, Reiser et al. 2001). In Tule Lake, where most habitat is shallower than 3 feet, adult suckers are found only in the very limited areas with available habitat over 3 feet in depth (Hicks et al. 2000, Bureau of Reclamation 2000b).

In the summer and fall, adult suckers generally occupy the northern third of Upper Klamath Lake (Bienz and Ziller 1987, Buettner and Scopettone 1990, Golden 1969, Perkins 1996, Perkins et al. 2000, Reiser et al. 2001, Simon et al. 2000b, Bureau of Reclamation 1996, 2000a). However, suckers apparently avoid shallow, clear water in Upper Klamath Lake except when showing ill effects of poor water quality (Bienz and Ziller 1987, Buettner and Scopettone 1990, Bureau of Reclamation 1996). Avoidance of shallow depths by adult suckers may be related to increased vulnerability to predators, including pelicans, osprey, bald eagles, and humans. The need to seek adequate depth in Upper Klamath Lake may make suckers more vulnerable to the adverse effects of poor water quality as they avoid inflow areas where the water quality is high but there is a lack of cover owing to shallow depths and relatively high water clarity. Water quality in deeper water is frequently worse than shallows near inflow areas.

#### *Population Dynamics*

The action area contains a limited amount of ownership within the range of the Lost River and shortnose suckers. Current occupied habitat and one historical site (Odessa Spring Creek) occurs within the Upper Klamath Lake watershed and historical habitat is located in a small section of one upper tributary to Clear Lake watershed in California. Summary of Lost River and shortnose suckers' population dynamics will focus on these two watersheds. Additional information on Lost River and shortnose sucker population dynamics within their range can be located in the 2002 Biological Opinion for the Bureau of Reclamation proposed 10-year operation plan for the Klamath Project (U.S. Fish and Wildlife Service 2002c).

#### Upper Klamath Lake

Accurate population estimates of the adult sucker populations in Upper Klamath Lake do not exist. The highly complex ecological and physical variability of the Upper Klamath Lake system, the large size of the Lake, sampling constraints, and substantive unmet statistical assumptions in the calculation of tag/recapture results make absolute population estimates unavailable from current information at this time and quantitative inter-annual comparisons of estimates inappropriate (Shively 2002).

Prior to listing, several spawning populations of suckers were apparently lost from Upper Klamath Lake, as evidenced by the absence of suckers at many historical spawning areas in the lake (Andreasen 1975, Markle and Cooperman 2002). In the late 1980's and early 1990's, at least six additional spawning areas, including the Wood River, have either ceased to show evidence of use or shown severe declines in use (Markle and Cooperman 2002, Markle and Simon 1993).

Given the above difficulties in estimating sucker population sizes, the available information suggests that Lost River and shortnose suckers population numbers have

fluctuated somewhere between a few thousand to a few hundred thousand adults of each species in Upper Klamath Lake since 1988 (Markle and Cooperman 2002). While these estimates are very broad, it is important to consider that recovery of the suckers depends not on absolute numbers, but rather, on the viability of the populations and their ability to sustain themselves into the future. This aspect of viability is dependent on the ability of the species to balance adult mortality with successful recruitment of new individuals into the adult spawning population.

In Upper Klamath Lake, the major source of adult mortality is periodic catastrophic fish die-offs. Adult mortality must be compensated by the production of successful juvenile year classes (cohorts) and then by the survival and recruitment of those cohorts into the spawning population at a rate in excess of adult mortality.

Water quality in Upper Klamath Lake consistently reaches levels known to be stressful to suckers and periodically reaches lethal levels in August to September, resulting in catastrophic die-off events (Bienz and Ziller 1987, Buettner 1997, Gilbert 1898, Holt 1997, Loftus 2001, Perkins et al. 2000, Scoppettone 1986, Scoppettone and Vinyard 1991, Bureau of Reclamation 1996). Major fish die-offs have been recorded since the late 1800's but have increased in frequency in the last few decades (Figure 1). Small, localized fish die-offs have been observed annually on Upper Klamath Lake since 1992, when extensive research and monitoring activities began.

The magnitude of fish kills in the 1990's have been estimated by scientific observers to be approximately tens of thousands of suckers for each event (Bienz and Ziller 1987, Buettner 1997, Gilbert 1898, Perkins et al. 2000, Scoppettone 1986, Scoppettone and Vinyard 1991).

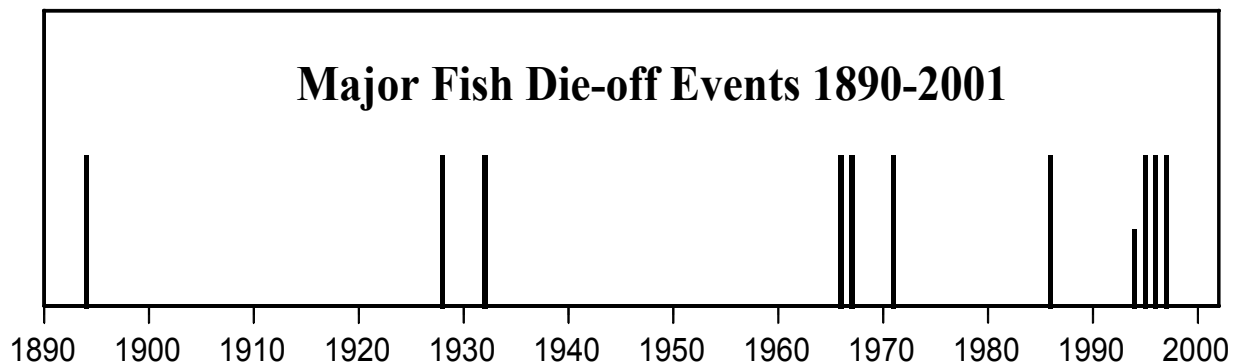


Figure 1. Major fish die-off events in Upper Klamath Lake from 1890 to 2001 (U.S. Fish and Wildlife Service 2002c)

Accurate estimates are not possible due to the difficulty of counting dead, floating fish in a lake the size of Upper Klamath Lake and due to the undeterminable numbers of dead suckers that are out of sight on the bottom. A general estimate of the magnitude of the 1996 die-off, based on estimates of population numbers before the 1996 die-off and the 1997 estimate, suggests that the 1996 die-off killed about 50 percent of the adult

populations. Although there are no absolute figures for the magnitude of the die-offs, it is clear that three major die-offs in 1995 to 1997 reduced the pre-1995 population by a substantial amount. This is further supported by substantial declines in the abundance index values of adults spawning in the Williamson River during the years following the die-offs (Cunningham et al. 2002).

#### *Production of Larvae and Juveniles*

Oregon State University scientists (Markle et al. 2000, Simon 2002, Simon et al. 2000b, 2000b, Simon and Markle 2001) have monitored the relative abundance of larval suckers in Upper Klamath Lake consistently since 1995. Larval catch rates were similar in 1995, 1996, 1997 and 1999, but were significantly lower in 1998 and 2000 (Simon and Markle 2001). Juvenile abundance was low in 1995, 1997, 1998 and 2001, but relatively high in 1996, 1999 and 2000 (Simon 2002).

There was little correlation between adult spawning run indices and larval or juvenile indices from 1995 to 1999 (Cunningham et al. 2002, Markle et al. 2000, Simon et al. 2000b). However, there was a relatively good correlation between larval and juvenile beach seine indices (Simon et al. 2000a, Simon and Markle 2001). This suggests that successful spawning and production of a strong juvenile year class may be more dependent on environmental conditions and larval/juvenile mortality than on adult spawning effort. In most years there is almost an order of magnitude decline in age 0 sucker abundance from late July to October. The exact cause of this decline is unknown but increased mortality, habitat shifts, dispersal, adverse water quality, and entrainment losses are potential factors (Gutermuth et al. 2000, Simon 2002, Simon and Markle 2001).

Spring catch rates of older juveniles in Upper Klamath Lake are consistently low (Simon et al. 2000a, 2000b, Simon and Markle 2001). This trend may suggest that late fall/winter juvenile mortality is high, resulting in little or no survival into the second year, even though larval and juvenile numbers appear substantial in summer and fall samples (Simon and Markle 2001). However, the absence of larger juveniles in catches may also be caused by sampling difficulties. Therefore, survival and recruitment of juveniles into the spawning population is better assessed by examination of adult spawning populations.

#### *Recruitment to the Adult Spawning Population*

Some information on relative abundance changes in the adult spawning population can be obtained from variation in the number of suckers migrating up the Williamson River each spring to spawn. These numbers showed drastic declines during the three fish die-offs (1995 to 97) and the hiatus in 1998 to 1999 before the population began to increase in 2000 (Cunningham et al. 2002). The increase in 2000 to 2001 spawning index probably represents the recruitment of a single dominant year class over a period of two years, rather than recruitment of two distinct year classes. For Lost River suckers that would be the 1991 year class, and for shortnose suckers it would probably be the 1993 year class. Assessment of the relative strength of the cohort is confounded by declines in the absolute numbers of older adults caused by mortality events, such as the 1995 to 97 fish kills. Records of annual adult length distributions are available from the Williamson

River spawning run and from Upper Klamath Lake east-side, shoreline springs (e.g., Sucker, Silver Building and Ouxy Springs). The spawning run up the Williamson River represents the vast majority of tributary spawning suckers and a large percentage of the adult spawning population in Upper Klamath Lake (Bienz and Ziller 1987, Buettner and Scopettone 1990, Cunningham et al. 2002, Perkins 1996, Perkins et al. 2000, Scopettone and Vinyard 1991). Records are available for 1984 to 85, 1987 to 1991 and 1994 to 2001. The available data show evidence for relatively substantial recruitment of smaller fish into the Williamson spawning populations for Lost River and shortnose suckers in only a few of the last eighteen years. Records of the lake-spawning populations at eastside springs are available for Lost River suckers in 1987 to 1990, 1993 and 1996 to 2001 (Hayes and Shively 2002, Perkins et al. 2000). Shortnose suckers are rarely caught at the springs and records are too limited to draw conclusions on recruitment. Data again show that there is substantial recruitment into the shoreline spawning populations of Lost River suckers for only a few of the last fifteen years.

Age distribution data are available based on suckers recovered fish die-off events during 1995 (Bureau of Reclamation 1996), 1996 (Perkins 1996) and 1997 (Shively 2002). These data showed that in 1995, 95 percent of the suckers were age 7 years or younger, with most age 4 (1991 year-class) and 5 (1990 year-class). Examination of about 860 suckers from the 1996 fish kill documented that the Lost River and shortnose suckers were mostly 2 to 8 years old (U.S. Geological Survey, unpublished data, 2000). Eighteen year-classes of Lost River suckers and 11 year-classes of shortnose suckers were identified. The most abundant year-class of both species was 1991 while the 1988 to 1993 year classes were also fairly well represented. In 1997 die-off, older Lost River and shortnose suckers were more prevalent than in other years. Preliminary data from adult suckers collected during 2001 indicated that the current total population of Lost River suckers in Upper Klamath Lake is dominated by fish 18 to 26 inches (45-65 cm) in length, which represent the 1988 to 1994 year classes exclusively (U.S. Geological Survey, unpublished data, 2000). The current population of shortnose suckers contains fish 14 to 22 inches (36-55 cm), which represents the 1989 to 1996 year classes. The dominant year class for Lost River suckers is 1991, while the dominant class for shortnose suckers is now 1993.

#### Clear Lake

Sucker populations in Clear Lake exhibit a broad range of sizes, indicative of a relatively diverse age structure. However, Lost River suckers, in particular, are generally dominated by younger individuals, suggesting some recruitment but relatively low adult survivorship (California Department of Fish and Game 1993). Drought conditions severely reduced sucker habitat in the Clear Lake watershed in the early 1990s. The reservoir reached its lowest level since 1935 and only 5 percent of the water remained, and many tributaries went dry (U.S. Fish and Wildlife Service 1994c). Populations of suckers in small reservoirs above Clear Lake were apparently eliminated, but may have reestablished themselves. Within Clear Lake itself, the sucker population showed signs of stress and reduced condition during the drought due to adverse temperatures, turbidity and dissolved oxygen conditions at low water levels, but had apparently recovered by the next year. Clear Lake contains large populations of introduced warm-water predatory

fishes while specific impacts on the sucker population are not known. No population estimates are available for the Clear Lake Lost River and shortnose sucker populations.

The Clear Lake sucker populations are currently isolated from suckers in the rest of the Klamath basin by Clear Lake Dam, which provides no fish passage. This isolation prevents genetic exchange with other populations and provides no opportunity for natural recolonization of the sub-basin in the event of local extirpation. Generally the populations of Lost River and shortnose suckers in the Clear Lake sub-basin appear to be relatively stable, and the primary threat to their persistence would be prolonged drought conditions and possible adverse water quality during prolonged ice-cover.

#### *Threats*

At the time of listing, perceived threats to the species included: 1) loss of historical populations and range; 2) habitat loss, degradation and fragmentation; 3) drastically reduced adult populations; 4) overharvesting by sport and commercial fishing; 5) large summer fish die-offs caused by declines in water quality; 6) lack of sufficient recruitment; 7) hybridization with other two sucker species native to the Klamath River basin; 8) potential competition with introduced exotic fishes; and 9) the inadequacy of existing regulatory mechanisms to provide for the conservation of the species (U.S. Fish and Wildlife Service 1993c). Two additional threats recognized since listing include lack of passage by dams and entrainment into irrigation and hydropower diversion canals.

More detailed information regarding threats to Lost River and shortnose suckers can be found in the final listing rule listing Lost River and shortnose suckers as endangered (U.S. Fish and Wildlife Service 1988) and in the 2002 Bureau of Reclamation Biological Opinion (U.S. Fish and Wildlife Service 2002c).

#### *Ongoing Conservation*

Restoration of aquatic habitats to improve sucker habitat and water quality, and restoration in uplands to improve watershed function has occurred in the Upper Klamath Basin and is likely providing benefits to suckers. For example, Walker (2001) stated that some improvement in water quality has already been detected since total phosphorus levels in Upper Klamath Lake have been reduced by about 10 percent in the past decade. If anthropogenic phosphorus can be cut another 20 to 40 percent, it is anticipated that water quality in Upper Klamath Lake will significantly improve, perhaps to the point where fish kills will be less frequent and smaller in magnitude.

Since the Klamath Basin Ecosystem Restoration Office was established in 1993, several habitat restoration programs have been implemented. Restoration projects done under these programs include wetland restoration, riparian vegetation re-establishment, management of livestock grazing, road rehabilitation, stream bank erosion control, flood-plain restoration, and related assessments, research and outreach activities. Activities in the last five years have emphasized actions in the Upper Klamath Lake systems above Link River Dam and secondarily, the Lost River system. It is recognized that this effort accounts for only a portion of the many state agency and other Federal programs, as well

as private landowner initiated projects that are having positive benefits to water quality and endangered sucker habitat in the Upper Klamath Basin.

The Wood River Wetland Project initiated by BLM in 1994 was the first major restoration project in the upper basin. It re-flooded 3,000 acres of drained wetlands near Agency Lake. Management of these drained wetlands have reduced total phosphorus loading from the property to Upper Klamath Lake by 91 percent (1.4 tons) (Turaski and Watkins 2001). This is 3 percent of total phosphorus of the average nutrient load in the Wood River measured by Kann and Walker (1999). Summer warming rates have decreased approximately 1.2 °F per stream mile over the 3-mile project reach, when climatic variables were accounted for. Reduction in warming rates was attributed to reduced stream width.

Less quantifiable benefits from the Wood River project include increased quantity and quality of shoreline and flood-plain habitat along the lower Wood River. The Wood River project created shoreline vegetation that remains flooded and accessible to larvae when at lower lake and river levels. Wetland and riverine function has been improved by the restoration of 25 acres of a well vegetated flood-plain on the west side of the river and an increase in differential head between the river and surrounding marsh. Increased over-bank flow on approximately 700 acres of existing deltaic wetlands has likely increased nutrient and particulate filtering capacity and access for feeding larval and juvenile fish.

Other promising Upper Klamath Lake wetland projects include the Lower Williamson River Delta Project implemented by The Nature Conservancy (6,400 acres), Reclamation's Agency Lake Ranch water storage project (7,200 acres), Running Y Wetlands (550 acres), and Lakeside Farms (50 acres). These projects, totaling nearly 15,000 acres, are in various stages of implementation and are expected to yield similar habitat and water quality benefits as the BLM Wood River Wetland project.

Restoration projects in the Sprague River and Williamson River watersheds have targeted floodplain wetland and stream-side riparian vegetation rehabilitation as a means to address issues of channel stability (bank erosion), riparian and stream habitat and thermal inputs to waterways. A major challenge in restoring stream channel function in the Sprague River is the amount of channel incision in smaller tributary streams, and major increases in width to depth ratios in the mainstem rivers. Initial observations and monitoring are encouraging. They include dramatic improvements in streamside vegetation and substantial improvements in substrate composition, channel width, and bank stability. Most projects implemented to date have employed passive restoration techniques such as riparian fencing. Physical channel or floodplain modifications have also been effective but they are often cost prohibitive or are inconsistent with landowner constraints or surrounding infrastructure.

Significant progress is anticipated to be made in the restoration of ecosystem function in the Upper Klamath basin over the next few years. There are many collateral restoration efforts ongoing in the upper basin. Federal efforts by the U.S. Forest Service, BLM, National Park Service, National Resources Conservation Service, and the Klamath Tribes

have complimented those of the USFWS and Bureau of Reclamation. State agencies, such as OSU Extension, Oregon Department of Fish and Wildlife, Oregon Watershed Enhancement Board, and Oregon Department of Environmental Quality have made major contributions to watershed improvements. For example fish passage, screening, and riparian fence projects in the Wood River area have largely been accomplished with State and private funding sources. In many cases Klamath Basin Ecosystem Restoration Office program funds have been matched with other programs to further compliment restoration projects. The Klamath Soil and Water Conservation District, Lava Butte and Butte Valley Rural Conservation District are actively implementing water conservation and restoration projects. The Klamath Watershed Council was formed in 1997 to coordinate and assist local communities in restoration and water quality improvement efforts. The Upper Klamath Basin Working Group, a community advisory committee, was formed in 1995 to advise then Senator Mark O. Hatfield of issues relating to ecological restoration, reduction of drought impacts and economic conditions. Many private landowners have made individual efforts to improve watersheds and fish habitat. The Upper Klamath Basin Working Group and Klamath Basin Ecosystem Restoration Office have initiated a long range strategic planning process for restoration of the watershed and recovery of the two listed suckers. The collective actions of the entire basin are difficult to ascertain and quantify. Given recent congressional initiatives, it is likely that funding levels for restoration will increase substantially over the next ten years.

#### *Conservation Needs*

Conservation goals for these species include the establishment of a sufficient number of viable, self-sustaining populations of the Lost River and shortnose suckers in as much of their historical range as possible. Multiple populations provide resiliency in response to localized extirpations caused by adverse conditions such as prolonged drought, contaminant spills, disease and catastrophic water quality declines. Multiple populations also help ensure the genetic diversity of the species and improve its ability to adapt to changing environmental conditions. The conservation needs for Lost River and shortnose suckers include:

- Providing adequate quantity and quality of habitat to meet the needs of all life-history stages of the Lost River and shortnose suckers. Adequate habitat is crucial to ensure recruitment and support viable populations.
- Increasing and maintaining population sizes of the Lost River and shortnose suckers. Populations must be maintained at levels that ensure genetic viability and provide sufficient genetic variability to allow the species to respond to environmental and ecological variability.
- Providing for adequate passage for all life-stages of suckers past dams. Both sucker species are dependent on free-passage along river corridors to ensure genetic exchange between populations, to gain access to spawning areas, and to allow young fish entrained downstream to return to their parent populations

- Improving water quality to a level where adverse effects are not sufficient to threaten the continued persistence of the Lost River and shortnose suckers. Lethal water quality conditions in Upper Klamath Lake are the primary cause of mortality in adult suckers.
- Increasing the frequency and magnitude of recruitment into the spawning populations of both Lost River and shortnose suckers. For a population to survive, survival and recruitment of young fish into the spawning population must be sufficient to offset adult mortality and allow populations to increase to sustainable levels that provide adequate resiliency against fish kills, disease, infrequent recruitment, and other factors.
- Substantially reducing entrainment of larval, juvenile and adult Lost River and shortnose suckers. Entrainment represents a major cause of mortality in young suckers and adults within the Upper Klamath Basin. For recovery of Lost River and shortnose suckers it is crucial to increase survival of young life-stages so that they can recruit into the adult spawning population, and reduce mortality of adults; both are necessary for the establishment of viable, self-sustaining, natural populations.
- Maintaining rates of hybridization appropriate to the evolutionary framework in which the suckers are evolving. Excessive hybridization can result in the loss of genetic diversity, fitness, and need to explain effect to lineage, evolutionarily unique lineages.
- Ensuring that Lost River and shortnose suckers' populations can withstand the adverse effects of competition and predation from introduced fishes.

### ***Effects of the Action***

For information on general effects, see **Effects of the Action Common to Aquatic Species** section.

#### *Effects to individuals and local populations*

Some treatment methods, including mechanical (working with mechanical equipment adjacent to stream), cultural (grazing disturbance adjacent to streams), and prescribed fires (removing upland vegetation) immediately adjacent or within the drainage of sucker habitat have the potential to result in localized increases in sediment which could adversely affect Lost River and shortnose suckers. Delivery of fine sediment could create conditions which may prevent retention of spawned eggs, smother eggs decreasing hatching success, and/or reduce the ability of larvae to emerge from the substrate.

Most treatment methods are not expected to result in mortality, with the following two exceptions. First, mechanical and cultural (grazing) treatments resulting in ground-disturbing activities in riparian areas may occasionally result in significant amounts of sediment entering sucker habitat. This is only anticipated to occur in very rare cases when activities occur adjacent to Lost River and shortnose suckers habitat, create bare

ground or areas susceptible to erosion, and are then followed by unusually high runoff events such as from locally intense thunderstorms. This increase in sediment may, although rare, deposit within occupied spawning habitat, potentially dislodging eggs which could be carried downstream, smother eggs decreasing hatching success, or reduce the ability of larvae to emerge from the substrate. This could result in the loss of small number of eggs, and/or larvae. Treatment methods which would result in excessive sediment to streams and lakes occupied by Lost River and shortnose suckers, however, is expected to be uncommon in riparian areas, and extensive exposure is expected to be unlikely because water flow in streams and mixing in lakes quickly limits sedimentation to local areas for invasive plant treatments. Therefore, effects from sediment to Lost River and shortnose suckers are generally expected to be rare, short-term, and localized.

Some herbicide applications may result in adverse effects to emergent and submerged vegetation necessary for larval and juvenile habitat and cover and/or food resources for larvae. Chemicals which may affect aquatic plants include chlorsulfuron, imazapic, imazapyr, metsulfuron methyl, picloram, sulfometuron methyl, and triclopyr. Exposure scenarios are based on the SERA evaluations of potential herbicide delivery calculated for 10 acres treated adjacent to a 1.8 cubic feet per second stream with no buffers, a conservative scenario. Triclopyr is limited to direct application methods, so it would not reach the concentrations likely to adversely affect sucker habitat. Adverse affects to emergent and submerged aquatic plants, used by larval and juvenile suckers for habitat, hiding cover, and/or food resources, may increase predation potential and temporarily reduce larval food resources, however, any effects to aquatic plants are expected to be localized and short-term, due to their extremely rapid growth rate. Also, water flow in streams and mixing in lakes quickly dilutes herbicide. The potential for herbicide delivery to occupied sucker habitat is rendered more unlikely because the Invasive Plant Program does not allow the direct spraying of herbicides to the water column for the treatment of aquatic weeds. However, high runoff events such as heavy thunderstorms could transport herbicides to Lost River and shortnose suckers habitat if they follow soon after treatment. This would be a rare event. Herbicides are not expected to cause lethal effects to individual suckers.

Secondly, glyphosate with POEA surfactant and triclopyr BEE have a potential to affect invertebrates, a main prey resource for Lost River and shortnose suckers larvae. As previously described, Triclopyr is unlikely to enter the water in sufficient concentrations to affect invertebrates. If herbicide entered slow margins of streams or lakes, treatments could adversely affect food resources for Lost River and shortnose suckers larvae, potentially resulting in the loss of a few larvae. This could only be expected if a substantial amount of herbicides reached the water with known populations. The loss of even a few larvae, however, is expected to be rare.

#### *Summary*

Mechanical, cultural (grazing), herbicide, and prescribed fire treatments have the potential to result in short-term adverse effects to Lost River and shortnose suckers, but are expected to be rare and transitory. Treatments are expected to provide for long-term ecosystem maintenance or restoration.

Multiple, large scale (>10 acres) invasive plant treatments immediately adjacent to Lost River and shortnose suckers populations or substantial roadside treatments where roadside ditches and culverts directly flow into waters inhabited by suckers would have the greatest potential to adversely affect Lost River and shortnose suckers. However, water flow in streams and mixing in lakes quickly dilutes herbicide, reducing exposure below toxic thresholds, and limits sedimentation to local areas.

The vast majority of the treatment methods are not expected to result in mortality. Only in rare cases would treatments result in delivery of significant amounts of sediment to spawning habitat and persist long enough to cause the loss of some eggs or larvae. The vast majority of treatments in riparian areas would not produce excessive sediment or sediment that persists long enough to cause mortality.

On rare occasions, some herbicide treatments could reduce larval food resources which could potentially result in the loss of a few larvae. These situations are expected to be unlikely and would only be happen if a substantial amount of herbicides entered occupied lakes and riverine habitats inhabited by suckers. Even if this occurred, the dilution and mixing would normally reduce exposure below toxic levels.

Some herbicide treatments could reduce emergent and submerged vegetation in Lost River and shortnose suckers habitat, which could potentially reduce hiding cover, and/or prey base. Any potential adverse effects associated with predation on larvae and juveniles, and/or to larval prey base is expected to be localized and short-term, due to aquatic plants ability to grow at extremely high rates. Levels of herbicide exposure are not anticipated to result in mortality to fish.

Loss of a few eggs (due to sediment smothering or washing eggs downstream) would only be expected when activities occur adjacent to sucker spawning habitat, create bare ground or areas susceptible to erosion, and are followed by high runoff events such as from locally intense thunderstorms. Loss of a few larvae (via reduction in food resources) would only follow high runoff events that could transport herbicides to sucker habitat if events follow soon after treatment. However, this is expected to be rare.

Treatments are not anticipated to result in the loss or significant reduction of any population and therefore no reduction to the species or its range. Additionally, the majority of the treatments conducted according to the standards in the Invasive Plant Program are not likely to adversely affect suckers and their habitat because design criteria will be able to avoid the addition of substantial amounts of sediment into aquatic habitats, and minimize the introduction of herbicides into these same habitats.

### ***Cumulative Effects***

Cumulative effects include the effects of future state, tribal, or private actions, not involving Federal actions, that reasonably are certain to occur within the action area of a Federal action subject to consultation (50 CFR 402.2). Cumulative effects analysis of

foreseeable state and private actions provide greater insight to understanding the current environmental factors and likely trends that might affect a species.

The action area may include some surrounding and interspersed tracts of non-federal land, predominantly private land. Land use on non-federal land includes timber harvest, agricultural development, grazing, and water withdrawals. Urban development is not currently a significant issue for this species.

Cooperative efforts are underway in the Klamath basin where the Oregon Department of Agriculture is assisting the agricultural community to meet total maximum daily load standards set by the Oregon Department of Environmental Quality. Grazing has occurred historically in the Klamath basin and will continue in the future maintaining already degraded site conditions on non-federal lands. Water withdrawals are strictly regulated and therefore, the USFWS does not anticipate that the average amount of water available to Lost River and shortnose suckers will change significantly over time.

Chemical fertilizers or pesticides are used on many of these lands, but no specific information is available regarding their degree of use or have potential for transport into sucker habitat.

### ***Conclusion***

The Invasive Plant Program will not jeopardize the continued existence of Lost River or shortnose suckers, by directly or indirectly, reducing appreciably the likelihood of survival and recovery of Lost River and shortnose suckers in the wild by reducing reproduction, numbers, and distribution of the species.

- Loss of eggs or larvae is expected to be very uncommon, and confined to a small number of eggs, and/or larvae. The duration of treatments under this action would be temporary, and effects would be localized and confined to a small area. While there may be small localized losses of eggs or individuals in rare cases, we do not anticipate any significant reduction in the reproduction from this action.
- Adverse effects are expected to be rare and treatments will not result in a significant direct mortality to Lost River or shortnose suckers. In rare instances, treatments may produce excessive sediment into occupied spawning habitat which may reduce survival of eggs or larvae. On rare occasions, some herbicide treatments could affect larval food supply, potentially resulting in a small loss of larvae, leading to small localized reductions. However, these small losses are not anticipated to have a lasting effect on Lost River and shortnose suckers numbers.
- We do not anticipate the loss of any population or a reduction in distribution of Lost River and shortnose suckers. Within the action area, the majority of occupied habitat is located off U.S. Forest Service lands. Historical and current distribution within the action area is limited. Occupied habitat occurs in only a couple of miles of habitat on the eastern shore of Upper Klamath Lake and a few miles of habitat on Sprague and Williamson Rivers which feed Upper Klamath

Lake. Although some limited activities may occur adjacent to historical and occupied habitat of Lost River and shortnose suckers, current invasive plant inventories indicate only about 250 acres of invasive plants are within 300 feet of the water on National Forest land within the entire Oregon Closed Basins watershed, greatly reducing the likelihood of overlap between projects and occupied habitat. We do not anticipate any change in distribution as a result of this action.

Therefore, the U.S. Forest Service Pacific Northwest Region Invasive Plant Program is not anticipated to reduce the reproduction, numbers, or distribution of Lost River and shortnose suckers.

### ***Conservation Recommendations***

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

If manual, mechanical, or herbicide treatments require working in the water when Lost River and shortnose suckers or their eggs are present, survey the area prior to the activity to identify the location of presence of fish and/or eggs, as possible. Mark the locations or have the fish biologist on site during the activity to avoid locations and minimize impacts, when possible.

To reduce adverse effects from manual or mechanical treatments within riparian areas that may disturb Lost River sucker or shortnose sucker eggs, observe in-water work period as designated by the State for the area in which they occur, where possible.

Establish buffers in riparian areas of sufficient size to avoid delivering herbicide and sediment into streams or lakes where Lost River and shortnose suckers are present, where possible. Choose techniques for treating invasive plants in riparian areas that minimize the potential delivery of herbicides or sediment to the streams or lakes.

### **Oregon chub**

#### ***Status and baseline***

Detailed accounts of the taxonomy, ecology, and life history of the Oregon chub can be found in the final rule listing the species as endangered (U.S. Fish and Wildlife Service 1993d), the annual progress reports for Oregon chub investigations (Scheerer et al. 2001, 2002, 2003, 2004) and the Recovery Plan for the Oregon chub (U.S. Fish and Wildlife Service 1998b).

### *Listing History*

On October 18, 1993, the USFWS issued a final rule listing the Oregon chub as endangered (U.S. Fish and Wildlife Service 1993d). The Oregon chub occurs only in Oregon. Critical habitat has not been designated for this species.

### *Distribution*

The Oregon chub is a small minnow (Family: Cyprinidae) endemic to the Willamette River drainage of western Oregon (Markle et al. 1991). This species was formerly distributed throughout the Willamette River Valley in off-channel habitats such as beaver ponds, oxbows, side channels, backwater sloughs, low gradient tributaries, and flooded marshes (Snyder 1908). Historical records show Oregon chub were found as far downstream as Oregon City and as far upstream as Oakridge. Records of Oregon chub collections exist for the Clackamas River, Molalla River, Mill Creek, South Santiam River, North Santiam River, Luckiamute River, Long Tom River, McKenzie River, Calapooia River, Muddy Creek, Mary's River, Coast Fork Willamette River, Middle Fork Willamette River, and the mainstem Willamette River (Markle et al. 1991, Scheerer and McDonald 2000).

Based on a 1987 survey (Markle et al. 1989) and compilation of all known historical records, at the time of the petition for listing in 1991, viable populations of the Oregon chub occurred in Dexter Reservoir, Shady Dell Pond, Buckhead Creek near Lookout Point Reservoir, Elijah Bristow State Park, William L. Finley National Wildlife Refuge, Greens Bridge, and East Fork Minnow Pond. These locations represented a small fraction (estimated as 2 percent based on stream miles) of the species' formerly extensive distribution within the Willamette River drainage.

Within the action area, the Oregon chub is currently found on the Willamette National Forest within the Middle Fork Willamette River subbasin (four populations), and the Umpqua National Forest within the Coast Fork Willamette River subbasin (one population). Because the chub was historically associated with off-channel areas of mainstem Willamette Basin Rivers and low-gradient tributaries, the extent of Oregon chub habitat on U.S. Forest Service lands, which is located primarily in the upper reaches of the basins, is limited.

### *Life History*

Individual Oregon chub as old as eight years have been found (Paul Scheerer, Oregon Department of Fish and Wildlife, pers. comm., 2000). The largest Oregon chub on record was collected from the Santiam River and measured 3.5 inches (89 mm) (Scheerer et al. 1995). Oregon chub spawn from April through September. Individuals are not known to spawn more than once a year. Before and after spawning season, chub are social and non-aggressive. Spawning activity has only been observed at water temperatures exceeding 61 °F. Males over 1.4 inches have been observed exhibiting spawning behavior (Pearsons 1989). Egg masses have been found to contain 147 to 671 eggs (Pearsons 1989).

Oregon chub are obligatory sight feeders (Davis and Miller 1967). They feed throughout the day and stop feeding after dusk (Pearsons 1989). Chub feed mostly on water column fauna. The diet of Oregon chub adults collected in a May sample consisted primarily of minute crustaceans including copepods, cladocerans, and chironomid larvae (Markle et al. 1991). The diet of juvenile chub also consisted of minute organisms such as rotifers, copepods, and cladocerans (Pearsons 1989).

Oregon chub are found in slack water off-channel habitats such as beaver ponds, oxbows, side channels, backwater sloughs, low gradient tributaries, and flooded marshes. These habitats usually have little or no water flow, silty and organic substrate, and considerable aquatic vegetation providing cover for hiding and spawning (Pearsons 1989, Markle et al. 1991, Scheerer and McDonald 2000). The average depth of Oregon chub habitats is typically less than 6 feet and the summer temperatures typically exceed 61 °F. Adult Oregon chub seek dense vegetation for cover and frequently travel in the mid-water column in beaver channels or along the margins of aquatic plant beds. Larval chub congregate in shallow near-shore areas in the upper layers of the water column (Pearsons 1989). Juvenile Oregon chub venture farther from shore into deeper areas of the water column (Pearsons 1989). In the winter months, Oregon chub can be found buried in the detritus or concealed in aquatic vegetation (Pearsons 1989). Fish of similar size classes, school and feed together. In the early spring, Oregon chub are most active in the warmer, shallow areas of the ponds.

The Oregon chub evolved in a dynamic network of slack water habitats in the floodplain of the Willamette River. Major alteration of the Willamette River for flood control and navigation improvements has eliminated a large proportion of the River's historic floodplain. This alteration has also impaired or eliminated the environmental conditions in which the Oregon chub evolved. Many of the remaining suitable habitats have been invaded by non-native fish predators and competitors.

The current pattern of distribution and abundance of Oregon chub populations reflects the fundamental alteration in the natural processes under which the species evolved. Sites with Oregon chub can be categorized as having high or low connectivity to the Willamette River and its tributaries; those sites with low connectivity tend to have large populations of chub and fewer species of non-native fish (Scheerer et al. 2002). Thus, Oregon chub now thrive particularly in habitats that are isolated and bear little resemblance to the species' dynamic natural environment. Efforts to restore floodplain function and connectivity may facilitate the introduction of non-native fishes into isolated habitats, which could have devastating effects to populations of Oregon chub (Scheerer et al. 2002).

Of the known Oregon chub populations, the sites with the highest diversity of native fish, amphibian, and reptile species have the largest populations of Oregon chub (Scheerer and McDonald 2000). Beavers (*Castor canadensis*) appear to be especially important in creating and maintaining habitats that support these diverse native species assemblages (Scheerer and Apke 1998).

*Population Dynamics*

At present, Oregon chub occur at approximately 30 locations in the North and South Santiam River, McKenzie River, Middle Fork Willamette River, Coast Fork, and several tributaries to the mainstem Willamette River downstream of the Coast Fork Willamette River/Middle Fork Willamette River confluence (Scheerer et al. 2003). Of the 30 populations, 12 currently contain 500 or more individuals and have exhibited a stable or increasing trend for the past 5 years.

There are four locations for Oregon chub on the Middle Fork Willamette River in the Willamette National Forest: Shady Dell Pond, Oakridge Slough, Buckhead Creek Enhancement Ponds, and Wicopee Pond (Scheerer et al. 2003). Three of these locations contain some of the highest population levels of known Oregon chub locations (Table 3) and are very important for the recovery of the species. The Oregon chub was recently introduced into a small pond (Herman Pond) in the Coast Fork Willamette River subbasin on the Umpqua National Forest by the Oregon Department of Fish and Game.

Table 3. Known Oregon Chub Populations (from Scheerer et al. 2004). Shaded populations occur on U.S. Forest Service lands.

Site	Landowner	Population Estimate (2004)	Trend
<b>Santiam River Subbasin</b>			
Geren Island	City of Salem	2,290	Increasing
Santiam Conservation Easement	Private	1	Declining
Santiam I-5 Backwaters	Oregon Dept. of Transportation	320	Unknown
Foster Pullout Pond*	U.S. Army Corps of Engineers	570	Increasing
Gray Slough	Private	340	Unknown
Santiam Public Works Pond	City of Stayton	1	Unknown
<b>Middle Fork Willamette River Subbasin</b>			
East Fork Minnow Creek Pond	Oregon Dept. of Transportation	3,140	Declining
Shady Dell Pond	Willamette National Forest	4,210	Stable
Elijah Bristow State Park - Berry Slough	Oregon Dept. of Parks and Rec.	2,950	Stable
Elijah Bristow State Park - North Slough	Oregon Dept. of Parks and Rec.	1,340	Stable
Elijah Bristow Island Pond	Oregon Dept. of Parks and Rec.	420	Unknown
East Fork Middle Creek Pond	Oregon Dept. of Transportation	3,140	Declining

Site	Landowner	Population Estimate (2004)	Trend
Hospital Pond	U.S. Army Corps of Engineers	4,940	Stable
Dexter Reservoir Alcove - DEX 3	U.S. Army Corps of Engineers	790	Stable
Dexter Reservoir Alcove - PIT 1	U.S. Army Corps of Engineers	70	Declining
Oakridge Slough	Willamette National Forest	1	Unknown
Buckhead Creek	Willamette National Forest	3,600	Stable
Wicopee Pond*	Willamette National Forest	4,780	Stable
Fall Creek Spillway Ponds*	U.S. Army Corps of Engineers	5,850	Stable
Barnhard Slough	Oregon Dept. of Transportation	2	Unknown
<b>Upper Mainstem Willamette River Subbasin</b>			
William L. Finley National Wildlife Refuge - Display Pond*	U.S. Fish and Wildlife Service	70	Declining
William L. Finley National Wildlife Refuge - Gray Swamp	U.S. Fish and Wildlife Service	520	Stable
Cheadle Pond	U.S. Fish and Wildlife Service	220	Unknown
Dunn Wetland*	Private	25,810	Stable
Little Muddy Creek tributary	Private	5	Unknown
Dry Muddy Creek	Private	1	Unknown
<b>McKenzie River Subbasin</b>			
Big Island	McKenzie River Trust and G. Grier	310	Unknown
Shetzline Pond.	Private	1,050	Unknown
Russell Pond*	Private	720	Unknown
<b>Coast Fork Willamette River</b>			
Coast Fork Side Channels	Oregon Dept. of Transportation	190	Unknown
Herman Pond*	Umpqua National Forest	350	Unknown

\* denotes reintroduction site

### Santiam River Subbasin

Oregon chub are currently known at six sites in the Santiam River subbasin: Geren Island, Santiam Conservation Easement, Foster Pullout Pond, Gray Slough, Santiam Public Works Pond, and at I-5 Backwater, which is downstream of the confluence of the North and South Santiam Rivers (Scheerer et al. 2004). Oregon chub populations in the North Santiam River subbasin have been declining in recent years. No chub were detected at three previously occupied sites (Pioneer Park Backwater, Green Bridge and Meener's Bend Pond) in 2004, all of which had small populations of the fish in 2002 (Scheerer et al. 2004). The USFWS is currently working with the Santiam Water Control District to reestablish the Pioneer Park Backwater population (Jennifer Lord, USFWS, pers. comm., 2005). Only four populations in this subbasin have more than 100 fish (Geren Island, Gray Slough, Foster Pullout Pond, and I-5 Backwater). Many of the sites in the North Santiam subbasin (e.g., Geren Island, Santiam Conservation Easement sloughs) have seen chub populations decline as non-native fishes invaded the habitats (Scheerer et al. 1998).

The largest Oregon chub population in the subbasin is at Geren Island, in the ponds and channels of the City of Salem's municipal water treatment facility. Oregon chub were first detected there in 1996. At the time, the population was the largest known, with over 8,000 Oregon chub. From 1996 to 2002 numbers of chub declined, but the population appears to be increasing with 1,590 chub in 2003 and 2,290 chub in 2004. The City of Salem is completing a Habitat Conservation Plan for Oregon chub at this facility. A number of conservation measures to protect the chub are already in place, including screening and monitoring for chub in the sand filters.

There are two introduced populations of Oregon chub in the South Santiam River subbasin. In 1999, Oregon Department of Fish and Wildlife introduced Oregon chub into Foster Pullout Pond, on the north shore of Foster Reservoir. The spring-fed pond is perched above the full-pool reservoir level, is free of any other fish species, and contains a diverse assemblage of native amphibians, western pond turtles (*Clemmys marmorata marmorata*), and bullfrogs (*Rana calesbeiana*) (Scheerer and McDonald 2000). The population was estimated at 570 fish in 2004 (Scheerer et al. 2004).

Fifteen Oregon chub were introduced into Meener's Bend Pond in 2000. The site is a small series of beaver ponds on U.S. Army Corps of Engineer land upstream of Foster Reservoir on a small unnamed tributary to the South Santiam River. Twenty-nine chub were found at the site in 2002 (Scheerer et al. 2003), however, no chub were captured at this site in 2004 (Scheerer et al. 2004).

### Middle Fork Willamette River Subbasin

The Middle Fork Willamette River subbasin contains the largest number of Oregon chub populations, and many of the largest populations (>500 fish) in the Willamette Valley. Oregon chub are currently known to persist at 14 locations in the subbasin: Fall Creek Spillway Pond, East Fork Minnow Creek Pond, Elijah Bristow State Park (three sites), Hospital Pond, Buckhead Creek, Shady Dell Pond, Dexter Reservoir Alcoves (two sites), Oakridge Slough, Wicopee Pond, and Barnhard Slough. Reintroductions have been

conducted at four sites (i.e., Fall Creek Spillway, Wicopee Pond, East Ferrin and West Ferrin). For several years, no chub have been collected from East and West Ferrin Ponds. Surveys by Oregon Department of Fish and Wildlife between 1992 and 2004 have found 8 of 14 Oregon chub populations in the Middle Fork Willamette River to be stable (Scheerer et al. 2004). Three of the eight stable populations are found on U.S. Forest Service lands (Shady Dell, Buckhead Creek, and Wicopee Pond).

Shady Dell Pond is on a small tributary to the Middle Fork between Hills Creek and Lookout Point. The population in 2002 was estimated at 2,420 and the population in 2004 was estimated at 4,210 Oregon chub (Scheerer et al. 2004). Shady Dell Pond is unaffected by Willamette River flow regimes.

The Buckhead Creek Enhancement Ponds consist of three shallow, off-channel ponds with surface areas of 3,000 to 5,000 ft<sup>2</sup> each. The ponds were created by the Willamette National Forest in 1998 to increase the amount of off-channel habitat available to Oregon chub in the Middle Fork Willamette drainage. The ponds are connected to Buckhead Creek in high flow events, but are not affected by flows in the Middle Fork Willamette River. In 2001, surveys detected 1,230 chub in the middle pond, 200 chub in the lower pond, and no chub in the upper pond (Scheerer et al. 2002). In 2004, the two ponds contained 1,130 chub.

Wicopee Pond was the site of a 1988 introduction of 50 Oregon chub. The pond is a former borrow pit adjacent to Salt Creek in the Middle Fork Willamette River drainage. Few chub were found between 1992 and 1999, but in 2000, the population increased dramatically to over 4,000 individuals, and is the third largest population in the drainage (Scheerer et al. 2004).

The Oregon chub habitat at Oakridge Slough has connections to the Middle Fork Willamette River at both upstream and downstream ends. There may also be a subsurface connection to the River. In 2002, surveys found just nine Oregon chub at the site and only one chub was captured in 2003 and in 2004 (Scheerer et al. 2004).

#### Upper Mainstem Willamette River Subbasin

Oregon chub occur at four sites in the Upper Mainstem Willamette River subbasin: Gray Swamp and Display Pond in the Muddy Creek drainage at William L. Finley National Wildlife Refuge, Cheadle Pond, and the Dunn Wetland Ponds in the Beaver Creek drainage. The population at Gray Creek Swamp appears to be stable with an estimated population of 520 (Scheerer et al. 2004). The Display Pond population is the result of an introduction in 1998. The numbers of chub in Display Pond have decreased from 1,750 fish in 2000 to 70 in 2004 (Scheerer et al. 2004). The population in Cheadle Pond increased from 50 in 2003, to 220 in 2004 (Scheerer et al. 2004). In 1997, Oregon chub were introduced into the Dunn Wetland Ponds in the Beaver Creek drainage, with the permission of the private landowner (Scheerer et al. 1998). The project included a large wetland restorations and construction of a spring-fed pond (Scheerer et al. 2003). In 2004, this was the most abundant population in the Willamette Valley, with an estimated population 25,810 (Scheerer et al. 2004).

A new population of Oregon chub was discovered in 2004 in a small unnamed tributary to Muddy Creek (Linn County) in the mid-Willamette River drainage (population numbers are not available). In 2004, 500 Oregon chub from Dunn Wetlands were introduced into Willow Marsh, a large pond on Ankeny National Wildlife Refuge. The pond was modified in 2003 and 2004 to deepen the pond and isolate it from an adjacent marsh that contains non-native fish. Also in 2004, 500 Oregon chub from Dunn Wetlands were introduced into Jampolsky Ponds in the Amazon Creek drainage (Long Tom River). These ponds are part of a wetland restoration project completed in 2000 on private land (Scheerer et al. 2004).

#### McKenzie River Subbasin

Historical records show that Oregon chub were collected in the McKenzie River subbasin, but until recently, no extant populations were known from the basin. In October 2001, Oregon chub were introduced into Russell Pond in the Mohawk drainage on private land under the terms of a Safe Harbor Agreement among the landowner, the USFWS and Oregon Department of Fish and Wildlife (Scheerer et al. 2002). The current estimated population in Russell Pond is 720 chub (Scheerer et al. 2004). A population of Oregon chub was discovered in April 2002 in Shetzline Pond, a small man-made pond near Marcola in the Mohawk drainage. The population grew from an estimated 120 in 2002 to about 1,050 individuals in 2004 (Scheerer et al. 2003). Oregon Department of Fish and Wildlife has recently expanded the wetland to create more habitats for the chub. Neither of these two populations in the Mohawk drainage is affected by flows in the mainstem McKenzie River.

In 2002, a population of Oregon chub was found in side channels of the McKenzie River just east of Springfield in an area called Big Island, upstream of the confluence with Cedar Creek (Scheerer et al. 2003). The population was estimated at 940 chub in 2002 and has decreased to 420 fish in 2005 (J. Lord, pers. comm. 2005). This site is connected to the mainstem McKenzie River.

In 2005, Oregon Department of Fish and Wildlife recently confirmed a new chub location at a site across the River from Big Island on private land (J. Lord, pers. comm. 2005).

#### Coast Fork Willamette River Subbasin

Oregon chub are known from three sites in the Coast Fork subbasin. Surveys in 1992 and 1993 found very low numbers of chub in poor quality habitat in Camas Swale and subsequent surveys have failed to detect any chub at all (Scheerer and McDonald 2000). In April 2002, surveys by the Oregon Department of Transportation and Oregon Department of Fish and Wildlife found a few Oregon chub in side channels of the mainstem Coast Fork at River Mile 16, upstream of Camas Swale. In 2004, 190 chub were found at this site (Scheerer et al. 2004). The habitat at the site is influenced by releases out of both Dorena and Cottage Grove Reservoirs. The site has abundant non-native fishes. Four hundred Oregon chub were introduced in 2002 into Herman Pond, an isolated, spring-fed pond located in the Row River subbasin on U.S. Forest Service lands. In 2004, the estimated chub population abundance is at 350 fish (Scheerer et al. 2004).

### *Threats*

A variety of factors are likely responsible for the decline of the Oregon chub. These include habitat loss and alteration; the proliferation of non-native fish and amphibians; accidental chemical spills; runoff from herbicide or pesticide application on farms and timberlands or along roadways, railways, and power line rights-of way; the application of rotenone to manage sport fisheries; desiccation of habitats; unauthorized water withdrawals, diversions, or fill and removal activities; sedimentation resulting from timber harvest in the watershed, and possibly the demographic risks that result from a fragmented distribution of small, isolated populations (U.S. Fish and Wildlife Service 1998b).

The decline of Oregon chub has been correlated with the construction of dams. Based on the date of last capture at a site, Pearsons (1989) estimated that the most severe decline occurred during the 1950s and 1960s. Ten of the 13 dams that make up the Willamette Valley flood control system were completed between 1953 and 1969 (U.S. Army Corps of Engineers 2000). Other structural changes along the Willamette River corridor such as revetment and channelization, diking and drainage, and the removal of floodplain vegetation have eliminated or altered the slack water habitats of the Oregon chub (Hjort et al. 1984, Sedell and Froggatt 1984, Li et al. 1987). Channel confinement, isolation of the Willamette River from the majority of its floodplain, and elimination or degradation of both seasonal and permanent wetland habitats within the floodplain began as early as 1872 and has significantly changed the system. For example, along the 15.5 mile reach of the Willamette between Harrisburg and the McKenzie River confluence, the length of shoreline has declined from over 155 miles of shoreline in 1854 to less than 40 miles currently (Sedell and Froggatt 1984, Sedell et al. 1990).

The establishment and expansion of non-native species in Oregon have contributed to the decline of the Oregon chub and limits the species' ability to expand beyond its current range. Many species of non-native fish have been introduced to, and are common throughout, the Willamette Valley, including largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), crappie (*Pomoxis sp.*), bluegill (*Lepomis macrochirus*), and western mosquitofish (*Gambusia affinis*). The bullfrog, a non-native amphibian, also occurs in the valley and breeds in habitats preferred by the Oregon chub (Willamette Basin Task Force 1969, Hjort et al. 1984, Li et al. 1984, Scheerer et al. 1992). Many sites formerly inhabited by the Oregon chub are now occupied by non-native species (Markle et al. 1991). Of the 30 sites currently known to contain Oregon chub, over half of these sites are also inhabited by non-native fishes or amphibians (Scheerer and McDonald 2000). Since 1995, non-native fish have been discovered for the first time in six locations containing Oregon chub. Oregon chub populations have subsequently declined or remained in low abundance in all of these sites. The 1996 flooding in the Santiam River was probably responsible for three of these movements of non-native fish. The other three sites, located in the Middle Fork Willamette River drainage, were likely the result of unauthorized introductions or spread of non-native fish from reservoirs (Scheerer and Jones 1997). Because all remaining population sites are easily accessible, there also continues to be a potential for unauthorized introductions of

non-native species, particularly mosquitofish and game fishes such as bass and walleye (*Stizostedion vitreum*).

Many of the known extant populations of Oregon chub occur near rail, highway, and power transmission corridors and within public park and campground facilities. These populations are threatened by chemical spills from overturned truck or rail tankers; runoff or accidental spills of vegetation control chemicals; overflow from chemical toilets in campgrounds; sedimentation of shallow habitats from construction activities; and changes in water level or flow conditions from construction, diversions, or natural desiccation (U.S. Fish and Wildlife Service 1998b). Oregon chub populations near agricultural areas may be subject to poor water quality as a result of runoff laden with sediment, pesticides, and nutrients. Logging in the watershed adjacent to Oregon chub populations can result in increased sedimentation and herbicide runoff.

At this time, non-native fish are not known to occur within Oregon chub populations on U.S. Forest Service lands in the action area, however, the potential for introduction is always possible. Because the five populations within the action area are surrounded by U.S. Forest Service lands, threats are likely limited to potential sediment associated with timber harvest, potential threats associated with roads adjacent Oregon chub habitat, and herbicide runoff. Invasive knotweed occurs immediately adjacent to Buckhead Creek Enhancement Ponds and knotweed is also found in the vicinity of other Oregon chub locations on the Willamette National Forest. The Willamette National Forest currently has plans to treat the knotweed in order to protect habitat for Oregon chub (U.S. Forest Service 2005).

#### *Ongoing Conservation*

The Oregon Chub Working Group was formed in 1991 and includes Federal and State agency biologists, academics, land managers, and other concerned people who are working to improve the status of the species. The Working Group has been proactive in conserving and restoring habitat for the Oregon chub and raising public awareness of the species since before the Federal listing in 1993.

In 1992, an interagency Conservation Agreement for the Oregon Chub in the Willamette Valley, Oregon was completed and signed by the USFWS, U.S. Forest Service, BLM, Oregon Department of Fish and Wildlife, and Oregon Parks and Recreation Department (U.S. Fish and Wildlife Service 1998b). The purpose of the coordinated plan was to facilitate Oregon chub protection and recovery and to serve as a guide for all agencies to follow as they conduct their missions. The management guidelines are to: 1) establish a task force to oversee and coordinate Oregon chub conservation and management actions; 2) protect existing populations; 3) establish new populations; and, 4) foster greater public understanding of the Oregon chub, its status, the factors that influence it, and the conservation agreement.

In February 1997, a draft habitat conservation plan was prepared by consultants for the City of Salem to protect and enhance the population of Oregon chub located in the drinking water treatment facility at Geren Island in the North Santiam River. In 1996, a

no-spray agreement with the Oregon Department of Transportation was formalized to protect Oregon chub sites located in the Middle Fork Willamette River drainage adjacent to Highway 58 in Lane County. The agreement prohibits spraying of herbicides in the vicinity of Oregon chub sites and limits vegetation control to mechanical methods if necessary.

Additional conservation measures that are implemented to improve the status of Oregon chub include reintroductions of Oregon chub within the historical range, habitat enhancement projects, and public education. Oregon translocation sites and population status of these sites are documented under the section “Population Dynamics” of this Biological Opinion.

### ***Effects of the Action***

For information on general effects, see **Effects of the Action Common to Aquatic Species** section.

#### *Effect to individuals and local populations*

Some treatment methods, including mechanical (working with mechanical equipment adjacent to stream), cultural (grazing disturbance adjacent to stream), and prescribed fires (removing upland vegetation), if they occur immediately adjacent or within the drainage feeding occupied chub habitat, have the potential to result in localized increases in sediment which could adversely affect Oregon chub. Delivery of fine sediment and increased turbidity may create conditions which reduce the ability of chub to see and capture prey.

Most treatment methods are not expected to result in mortality, with the following exception. Mechanical and cultural (grazing) treatments which result in ground-disturbing activities in riparian areas may occasionally result in significant amounts of sediment entering chub habitat, thereby increasing turbidity. This is only anticipated to occur in very rare cases when activities occur adjacent to Oregon chub habitat, create bare ground or areas susceptible to erosion, and are then followed by unusually high runoff events such as from locally intense thunderstorms. Because chub habitat is generally slack water with slow water exchange, this turbidity may remain in these isolated systems for long periods, potentially affecting the chub’s ability to see and capture prey. This disruption of feeding could result in the loss of a few chub. However, the treatment methods most likely to result in significant amounts of sediment to streams occupied by chub are not typically used within riparian areas. Effects to the five populations within the action area are generally expected to be short-term, and localized. Treatments conducted within or adjacent to the limited occupied chub habitat, will be focused on difficult-to-treat plants like knotweed species or rhizomatous grasses.

Some herbicide applications may result in adverse effects to aquatic plants used by chub for spawning habitat, hiding cover, and/or prey. Chemicals which may affect aquatic plants include chlorsulfuron, imazapic, imazapyr, metsulfuron methyl, picloram, sulfometuron methyl, and triclopyr. Exposure scenarios are based on the SERA evaluations of potential herbicide delivery calculated for 10 acres treated adjacent to a 1.8

cubic feet per second stream with no buffers, a conservative scenario. Because triclopyr is limited to direct application methods only under the Invasive Plant Program, it would not reach the concentrations likely to adversely affect chub habitat. Oregon chub habitat may be more susceptible than other aquatic systems to impacts from nearby invasive plant treatments due to limited size of the areas and slow exchange of water reducing the rate of dilution for any herbicides reaching the habitat. Any significant loss of aquatic vegetative cover could affect survival of Oregon chub, which seek dense vegetation for cover and frequently feed along the margins of aquatic plant beds. Adult Oregon chub spawn in dense aquatic vegetation and aquatic vegetation provides necessary habitat for their prey. However, effects to aquatic plants are expected to be localized and short-term, due to the plants' extremely rapid growth rates. The potential for herbicide delivery to occupied chub habitat is rendered more unlikely because the Invasive Plant Program does not allow the direct spraying of herbicides to the water column for the treatment of aquatic weeds. However, high runoff events such as heavy thunderstorms could transport herbicides to chub habitat if they follow soon after treatment. This would be a very rare event. Herbicide treatments are not expected to cause lethal effects to individual Oregon chub.

Glyphosate with POEA surfactant and triclopyr BEE have a potential to affect invertebrates. As previously described, triclopyr is unlikely to enter the water in sufficient concentrations to affect invertebrates. If herbicide entered these areas of limited flow, temporary adverse effects to chub could occur by reducing aquatic invertebrates, their main food source. This could only be expected if a substantial amount of herbicides reached the water with known populations. However, the loss of individuals due to a reduction in prey base is unlikely because the Invasive Plant Program does not allow the direct spraying of herbicides to the water column.

#### *Summary*

Currently no invasive plants are inventoried adjacent to chub habitat on the Umpqua National Forest (Herman Pond). While current weed inventories and anticipated treatments are low on the Willamette National Forest, they, (and potentially the Umpqua National Forest in the future) plan to treat knotweed to protect habitat for Oregon chub. Additional weed treatment needs may be identified in the future. Mechanical, cultural (grazing), herbicide, and prescribed fire treatments have the potential to result in short-term adverse effects to Oregon chub, but are expected to be rare and transitory. Treatments are expected to provide for long-term ecosystem maintenance or restoration.

Treatments immediately adjacent to populations or from direct feeder streams or channels have the greatest potential to adversely affect isolated, small systems inhabited by chub. Because of their size and slow exchange of water, these small systems have a potential to concentrate and maintain effects from herbicide or sediment.

The vast majority of the treatment methods are not expected to result in mortality of chub, except in rare cases where treatments result in delivery of significant amounts of sediment to the habitat and the associated turbidity persists long enough to cause the loss of a few individuals. The vast majority of treatments in riparian areas would not produce

excessive sediment or sediment that persists long enough to cause mortality. Therefore, only in rare circumstances would activities be expected to result in some limited mortality.

Some herbicide treatments could reduce food resources, and aquatic plants in the Oregon chub's habitat, which could potentially reduce available spawning habitat, hiding cover, and/or prey base. Any potential adverse effects to spawning habitat, predation, and/or prey base is expected to be localized and short-term, due to aquatic plants ability to grow at extremely high rates. Levels of herbicide exposure are not anticipated to result in mortality to fish.

Loss of a few individuals (via inability to locate sufficient prey) or adverse effects to the species would only be expected when activities occur adjacent to Oregon chub habitat, create bare ground or areas susceptible to erosion, and are followed by high runoff events such as from locally intense thunderstorms. High runoff events could also transport herbicides to chub habitat if they follow soon after treatment.

Treatments are not anticipated to result in the loss or significant reduction of any population and therefore no reduction to the species or its range. Additionally, the majority of the treatments conducted according to the standards in the Invasive Plant Program are not likely to adversely affect Oregon chub and their habitat because design criteria will be able to avoid the addition of substantial amounts of sediment into aquatic habitats, and minimize the introduction of herbicides into these same habitats.

### ***Cumulative Effects***

Cumulative effects include the effects of future state, tribal, or private actions, not involving Federal actions, that reasonably are certain to occur within the action area of a Federal action subject to consultation (50 CFR 402.2). Cumulative effects analysis of foreseeable state and private actions provide greater insight to understanding the current environmental factors and likely trends that might affect a species.

The action area may include some surrounding and interspersed tracts of private and State land. Land use on non-federal lands include timber production, agriculture, and rural and urban development. Management activities on non-federal lands which may affect Oregon chub such as habitat alteration, introduction of non-natives, runoff from herbicides and pesticide application, and unauthorized water withdrawals are reasonably certain to continue at current rates and may increase. Chemical fertilizers or pesticides are currently used on many of these lands, but no specific information is available regarding their degree of use within the project area or have potential for transport into Oregon chub habitat.

### ***Conclusion***

The Invasive Plant Program will not jeopardize the continued existence of Oregon chub by, directly or indirectly, reducing appreciably the likelihood of survival and recovery of Oregon chub in the wild by reducing reproduction, numbers, or distribution of the species.

- Loss of eggs or available spawning habitat is not anticipated. Any reduction in spawning habitat would be localized and short term due to the ability of aquatic plants to grow extremely fast. Effects to spawning habitat are further limited because the Invasive Plant Program does not allow the direct spraying of herbicides to the water column for the treatment of aquatic weeds. We do not anticipate any significant reduction in reproduction from this action.
- Adverse effects are expected to be rare and treatments will not result in a significant direct mortality to Oregon chub. In rare circumstances, treatments may produce excessive sediment and increase turbidity in occupied habitat. This may adversely affect the chub's ability to see and capture prey, potentially resulting in a small loss of individuals, leading to small localized reductions. However, these small losses are not anticipated to have lasting effect on chub numbers.
- We do not anticipate the loss of any population or a reduction in distribution of Oregon chub. This species occurs in Oregon in about 30 locations in the Willamette River Basin. Although some limited activities may occur adjacent to occupied habitat of Oregon chub, distribution on U.S. Forest Service lands are restricted to five of the 30 populations. While most of these areas contain some of the highest population levels known to Oregon chub, these locations represent only a small segment of the range for this species. We do not anticipate any change in distribution as a result of this action.

Therefore, the U.S. Forest Service Pacific Northwest Region Invasive Plant Program is not anticipated to reduce the reproduction, numbers, or distribution of Oregon chub.

***Conservation Recommendations***

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

Continue to support the ongoing reintroduction programs for the Oregon chub. Increasing the number of stable populations will reduce the risk of loss of the species if individual populations are affected.

If manual, mechanical, or herbicide treatments require working in the water when Oregon chub or eggs are present, survey the area prior to the activity to identify the location of presence of fish and/or eggs. Mark the locations or have the fish biologist on site during the activity to avoid eggs and minimize impacts, when possible.

Choose or modify techniques for treating invasive plants in riparian areas that minimize the potential deliver of herbicides or sediment to the streams and ponds. Consider establishing buffers for treatments with a potential to directly deliver herbicides to streams or ponds with Oregon chub populations (e.g. broadcast spray).

Employ extra care in treatments that may increase sediment and herbicide in areas adjacent to, or that feed into, occupied Oregon chub habitat. These slack-water habitats are more susceptible to sedimentation and chemical effects than running water systems.

### **Bull trout (Coastal/Puget Sound, Columbia River, and Klamath DPS)**

#### ***Status and baseline***

Detail accounts of life history, taxonomy and behavior can be found in the final rule listing the Columbia River and Klamath River populations of bull trout as threatened (U.S. Fish and Wildlife Service 1998c), in the determination of threatened status for bull trout in the coterminous United States (U.S. Fish and Wildlife Service 1999f), the draft recovery plan for Columbia River/Klamath River/St. Mary Belly River (U.S. Fish and Wildlife Service 2002d), the draft recovery plan for the Coastal-Puget Sound (U.S. Fish and Wildlife Service 2004f), and the Status of Oregon's bull trout; distribution, life history, limiting factors, management considerations, and status (Buchanan et al. 1997).

#### ***Listing History***

On June 10, 1998, the USFWS issued a final rule listing the Columbia River and Klamath River populations of bull trout (U.S. Fish and Wildlife Service 1998c). This decision conferred full protection of the ESA on bull trout occurring in four northwestern States. The Jarbidge River population was listed as threatened on April 8, 1999 (U.S. Fish and Wildlife Service 1999g). The Coastal-Puget Sound and St. Mary-Belly River populations were listed as threatened on November 1, 1999 (U.S. Fish and Wildlife Service 1999f). At this point, all bull trout in the coterminous United States were listed as threatened. The five populations discussed above are listed as distinct population segments, i.e., they meet the joint policy of the USFWS and National Marine Fisheries Service regarding the recognition of distinct vertebrate populations (U.S. Fish and Wildlife Service and National Oceanic and Atmospheric Administration 1996).

On April 13, 2004, the USFWS issued a notice of initiation of a 5-year review for bull trout (U.S. Fish and Wildlife Service 2004g). The 5-year review is still ongoing, and no completion date has been announced.

#### **Distinct Population Segments and Population Units**

Population units of bull trout exist in which all fish share an evolutionary legacy and which are significant from an evolutionary perspective (Spruell et al. 1999). These population units can range from a local population to multiple populations. Although such population units are difficult to characterize, genetic data have provided useful information on bull trout population structure. For example, genetic differences between the Klamath River and Columbia River populations of bull trout were revealed in 1993

(Leary et al. 1993). The boundaries of the five listed DPSs of bull trout are based largely on this 1993 information.

Since the bull trout was listed, additional genetic analyses have suggested that its populations may be organized on a finer scale than previously thought. Data have revealed genetic differences between coastal populations of bull trout, which includes the lower Columbia River and Fraser River, and inland populations in the upper Columbia River and Fraser River drainages (Williams et al. 1997, Taylor et al. 1999). There is also an apparent genetic differentiation between inland populations within the Columbia River Basin. This differentiation occurs between the (a) mid-Columbia River (John Day and Umatilla Rivers) and lower Snake River (Walla Walla, Clearwater, Grande Ronde, Imnaha Rivers, etc.) populations and the (b) upper Columbia River (Methow, Clark Fork, Flathead Rivers, etc.) and upper Snake River (Boise, Malheur, Jarbidge Rivers, etc.) populations (Spruell et al. 2003). Genetic data indicate that bull trout inhabiting the Deschutes River drainage of Oregon are derived from coastal populations and not from inland populations in the Columbia River basin (Leary et al. 1993, Williams et al. 1997, Spruell and Allendorf 1997, Taylor et al. 1999, Spruell et al. 2003).

#### *Distribution*

The bull trout (family Salmonidae) is a char native to the Pacific Northwest and western Canada. The historical range of the bull trout includes major river basins in the Pacific Northwest. Along the coast, the bull trout's current range includes Puget Sound, various coastal rivers of British Columbia, Canada, and southeast Alaska (Bond 1992). Bull trout occur in portions of the Columbia River and tributaries within the basin, including its headwaters in Montana and Canada. Bull trout also occur in the Klamath River Basin of south-central Oregon. East of the Continental Divide, bull trout are found in the headwaters of the Saskatchewan River in Alberta and Montana and in the Mackenzie River system in Alberta and British Columbia, Canada, (Cavender 1978, Brewin et al. 1997).

The Coastal/Puget Sound DPS, the Columbia River DPS, and the Klamath River DPS include Federal lands administered by the Pacific Northwest Region of the U.S. Forest Service. The Coastal/Puget Sound DPS includes portions of the Mt. Baker-Snoqualmie, Olympic, and Gifford Pinchot National Forests. The Columbia River DPS includes portions of the Columbia River Gorge National Scenic Area, Colville, Deschutes, Gifford Pinchot, Malheur, Mt. Hood, Ochoco, Umatilla, Okanogan-Wenatchee and Wallowa-Whitman National Forests. The Klamath River DPS includes portions of the Fremont and Winema National Forests.

#### *Life History*

Bull trout exhibit both resident and migratory life-history strategies (Rieman and McIntyre 1993). Resident bull trout complete their entire life cycle in the tributary (or nearby streams) in which they spawn and rear. Migratory bull trout spawn in tributary streams where juvenile fish rear one to four years before migrating to either a lake (adfluvial form), river (fluvial form) (Fraley and Shepard 1989, Goetz 1989), or in certain coastal areas, to saltwater (anadromous) (Cavender 1978, McPhail and Baxter 1996,

Washington Department of Fish and Wildlife et al. 1997). Bull trout on U.S. Forest Service lands exhibit both resident and migratory life history strategies and can be assumed to be present all year. Resident and migratory life-history forms may be found together but it is unknown if they represent a single population or separate populations (Rieman and McIntyre 1993). Either form may give rise to offspring exhibiting either resident or migratory behavior (Rieman and McIntyre 1993). The multiple life-history strategies found in bull trout populations represent important diversity (both spatial and genetic) that help protect these populations from environmental stochasticity.

Bull trout normally reach sexual maturity in 4 to 7 years and may live longer than 12 years. The species is iteroparous (i.e., can spawn multiple times in their lifetime) and adults may spawn each year or in alternate years (Batt 1996). Repeat-spawning frequency and post-spawning mortality are not well documented (Leathe and Graham 1982, Fraley and Shepard 1989, Pratt 1992, Rieman and McIntyre 1996) but post-spawn survival rates are believed to be high.

Spawning bull trout exhibit strong site fidelity. Bull trout typically spawn from late August to November during periods of decreasing water temperatures (below 48 °F). Redds are often constructed in stream reaches fed by springs or near other sources of cold groundwater (Goetz 1989, Pratt 1992, Rieman and McIntyre 1996). Migratory bull trout frequently begin spawning migrations as early as April and have been known to move upstream as far as 155 miles to spawning grounds in Montana (Fraley and Shepard 1989, Swanberg 1997). Eggs, fry, and juveniles are closely associated with cold streams. Depending on water temperature, egg incubation is normally 100 to 145 days (Pratt 1992), and after hatching, juveniles remain in the substrate. Time from egg deposition to emergence of fry may surpass 220 days. Fry normally emerge from early April through May, depending on water temperatures and increasing stream flows (Pratt 1992, Ratliff and Howell 1992).

Bull trout are opportunistic feeders, with food habits primarily a function of size and life-history strategy. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macro-zooplankton, and small fish (Boag 1987, Goetz 1989, Donald and Alger 1993). Adult migratory bull trout feed on various fish species (Leathe and Graham 1982, Fraley and Shepard 1989, Brown 1992, Donald and Alger 1993). In coastal areas of western Washington, bull trout feed on Pacific herring (*Clupea pallasii*), Pacific sand lance (*Ammodytes hexapterus*), and surf smelt (*Hypomesus pretiosus*) in the ocean (Washington Department of Fish and Wildlife et al. 1997).

Bull trout have more specific habitat requirements than most other salmonids (Rieman and McIntyre 1993). Habitat components that influence the species' distribution and abundance include water temperature, cover, channel form and stability, valley form, spawning and rearing substrate, and availability of migratory corridors (Fraley and Shepard 1989, Goetz 1989, Hoelscher and Bjornn 1989, Sedell and Everest 1991, Howell and Buchanan 1992, Pratt 1992, Rieman and McIntyre 1993, 1995, Rich 1996, Watson and Hillman 1997). Watson and Hillman (1997) concluded that watersheds must have specific physical characteristics to provide the habitat requirements necessary for bull

trout to successfully spawn and rear and that these specific characteristics are not necessarily present throughout these watersheds. Because bull trout exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993), individuals of this species should not be expected to simultaneously occupy all available habitats (Rieman et al. 1997). Many of the local populations are isolated in headwater tributaries or nearby streams.

Bull trout are found primarily in cold streams, although individual fish are found in larger, warmer river systems throughout the Columbia River Basin (Fraley and Shepard 1989, Rieman and McIntyre 1993, 1995, Buchanan and Gregory 1997, Rieman et al. 1997). Water temperature above 59 °F is believed to limit bull trout distribution, a limitation that may partially explain the patchy distribution within a watershed (Fraley and Shepard 1989, Rieman and McIntyre 1995). Most of the remaining quality spawning and rearing habitat is located in the higher elevation streams, which often coincide with Federal land ownership.

All life-history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Fraley and Shepard 1989, Goetz 1989, Hoelscher and Bjornn 1989, Sedell and Everest 1991, Pratt 1992, Thomas 1992, Rich 1996, Sexauer and James 1997, Watson and Hillman 1997). Jakober (1995) observed bull trout overwintering in deep beaver ponds or pools containing large woody debris in the Bitterroot River drainage, Montana, and suggested that, because of the need to avoid anchor ice in order to survive, suitable winter habitat may be more restricted than summer habitat. Maintaining bull trout habitat requires stability of stream channels and of flow (Rieman and McIntyre 1993). Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997). These areas are sensitive to activities that directly or indirectly affect stream channel stability and alter natural flow patterns. For example, altered stream flow in the fall may disrupt bull trout during the spawning period, and channel instability may decrease survival of eggs and young juveniles in the gravel from winter through spring (Fraley and Shepard 1989, Pratt 1992, Pratt and Huston 1993).

Preferred bull trout spawning habitat consists of low-gradient stream reaches with loose, clean gravel (Fraley and Shepard 1989). In the Swan River, Montana, abundance of bull trout redds was positively correlated with the extent of bounded alluvial valley reaches, which are likely areas of groundwater to surface water exchange (Baxter et al. 1999). Survival of bull trout embryos planted in stream areas of groundwater upwelling used by bull trout for spawning were significantly higher than embryos planted in areas of surface-water recharge not used by bull trout for spawning (Baxter and McPhail 1999). Pratt (1992) indicated that increases in fine sediment reduce egg survival and emergence.

Migratory corridors link seasonal habitats for all bull trout life-history forms. For example, in Montana, migratory bull trout make extensive migrations in the Flathead River system (Fraley and Shepard 1989), and resident bull trout in tributaries of the Bitterroot River move downstream to overwinter in tributary pools (Jakober 1995). The ability to migrate is important to the persistence of bull trout (Rieman and McIntyre

1993, M. Gilpin in litt. 1997, Rieman et al. 1997). Migrations facilitate gene flow among local populations when individuals from different local populations interbreed, or stray, to non-natal streams. Local bull trout populations that are extirpated by catastrophic events may also become re-established by migrants.

#### *Population Dynamics*

Although bull trout are widely distributed over a large geographic area, they exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993). Increased habitat fragmentation reduces the amount of available habitat and increases isolation from other populations of the same species (Saunders et al. 1991). Burkey (1989) concluded that when species are isolated by fragmented habitats, low rates of population growth are typical in local populations and their probability of extinction is directly related to the degree of isolation and fragmentation. Without sufficient immigration, growth for local populations may be low and probability of extinction high (Burkey 1989, 1995).

Metapopulation concepts of conservation biology theory have been suggested relative to the distribution and characteristics of bull trout, although empirical evidence is relatively scant (Rieman and McIntyre 1993, Dunham and Rieman 1999, Rieman and Dunham 2000). A metapopulation is an interacting network of local populations with varying frequencies of migration and gene flow among them (Meffe and Carroll 1994). For inland bull trout, metapopulation theory is likely most applicable at the watershed scale where habitat consists of discrete patches or collections of habitat capable of supporting local populations; local populations are for the most part independent and represent discrete reproductive units; and long-term, low-rate dispersal patterns among component populations influences the persistence of at least some of the local populations (Rieman and Dunham 2000). Ideally, multiple local populations distributed throughout a watershed provide a mechanism for spreading risk because the simultaneous loss of all local populations is unlikely. However, habitat alteration, primarily through the construction of impoundments, dams, and water diversions has fragmented habitats, eliminated migratory corridors, and in many cases isolated bull trout in the headwaters of tributaries (Rieman et al. 1997, Dunham and Rieman 1999, Spruell et al. 1999, Rieman and Dunham 2000). Accordingly, human-induced factors as well as natural factors affecting bull trout distribution have likely limited the expression of the metapopulation concept for bull trout to patches of habitat within the overall distribution of the species (Dunham and Rieman 1999). However, despite the theoretical fit, the relatively recent and brief time period during which bull trout investigations have taken place does not provide certainty as to whether a metapopulation dynamic is occurring (e.g., a balance between local extirpations and recolonizations) across the range of bull trout or whether the persistence of bull trout in large or closely interconnected habitat patches (Dunham and Rieman 1999) is simply reflective of a general deterministic trend towards extinction of the species where the larger or interconnected patches are relics of historically wider distribution (Rieman and Dunham 2000). Recent research (Whiteley et al. 2003) does, however, provide stronger genetic evidence for the presence of a metapopulation process for bull trout, at least in the Boise River Basin of Idaho.

Nuclear DNA analysis (Spruell and Allendorf 1997) using bull trout samples from Long Creek and South Fork Sprague River have concluded that Klamath bull trout populations are descended from Deschutes River Basin populations, a sub-population of Columbia River stocks. All investigators detected extremely low levels of genetic variation in Klamath bull trout, suggesting that the Klamath Basin was either founded by a few individuals or that the bull trout population has been held at low numbers for the past several generations (Spruell and Allendorf 1997). Aside from the small bull trout sub-population in the Jarbidge River Basin, Nevada, the Klamath Basin population is the only significant population at the southern end of the species range. Light et al. (1996) indicates the Klamath population has probably adapted to different conditions than northern populations, therefore represent an important adaptive component of the entire species.

In general, evidence since the time of listing suggests a need to further evaluate the distinct population segment structure of bull trout DPSs. This new information will be incorporated into the final recovery plans for bull trout and will be finalized after the five year status review for bull trout.

In the rules listing bull trout as threatened, the USFWS identified subpopulations (i.e., isolated groups of bull trout thought to lack two-way exchange of individuals), for which status, distribution, and threats to bull trout were evaluated. Because habitat fragmentation and barriers have isolated bull trout throughout their current range, a subpopulation was considered a reproductively isolated group of bull trout that spawns within a particular river or area of a river system.

The USFWS has recently published draft recovery plans for the Columbia River and Klamath River DPSs (U.S. Fish and Wildlife Service 2002d) and the Coastal-Puget Sound DPS (U.S. Fish and Wildlife Service 2004f). Through these efforts, the USFWS has identified “core areas”, divisions of the bull trout subpopulations described in listing documents. Core areas represent a combination of habitat that provides all elements for the long-term security of bull trout and the presence of bull trout inhabiting core habitat. Thus, core areas form the basis on which to gauge recovery. Core areas, by definition, are considered habitat occupied by bull trout that serves as biologically discrete units upon which to base bull trout recovery. Within core areas, groups of bull trout or local populations which spawn in various tributaries are generally characterized by relatively small amounts of genetic diversity within a tributary but high level of genetic divergence between tributaries (U.S. Fish and Wildlife Service 2002d, Chapter 1). Individual local populations may come and go or expand and contract over time, but the focus of the draft recovery plan is maintaining all existing core areas.

The 141 subpopulations within the Columbia River DPS would be represented by 88 core areas. The 34 Coastal/Puget Sound DPS subpopulations would be represented by 14 core areas, and the seven Klamath River PDS subpopulations would be represented by three core areas.

The final listing rule specifies that DPSs will serve as interim recovery units for the purposes of consultation and recovery planning until an approved recovery plan is completed. On that basis, the geographic scope of jeopardy analyses for actions under formal consultation will be at the DPS level. This Biological Opinion will evaluate the effect of the Invasive Plant Program on the Coastal/Puget Sound DPS, Columbia River DPS, and Klamath River DPS.

#### Coastal/Puget Sound Distinct Population Segment

The Coastal Puget Sound DPS of bull trout encompasses all Pacific Coast drainages within the State of Washington, including Puget Sound. The Coastal/Puget Sound DPS is separated from other populations of bull trout by the Columbia River Basin to the south and the crest of the Cascade Mountain Range to the east. This population segment is highly significant to the species as a whole, since all types of bull trout can live in the Puget Sound area, including the only known anadromous forms of bull trout in the coterminous United States. Also unique to this population segment is the overlap in distribution with Dolly Varden, another native char species extremely similar in appearance to bull trout, but distinct genetically.

The USFWS has identified 34<sup>1</sup> subpopulations of native char (bull trout and/or Dolly Varden) within the Coastal-Puget Sound DPS. These subpopulations were grouped into five analysis areas based on their geographic location: Coastal, Strait of Juan de Fuca, Hood Canal, Puget Sound, and Transboundary. These groupings were made to identify trends that may be specific to certain geographic areas. A total of 14 bull trout core areas occur within the Coastal/Puget Sound Distinct Population Segment, encompassing the 34 subpopulations.

At the time of listing, only the Lower Skagit River subpopulation was considered to have a “strong” status. The status of the other 14 subpopulations in the Puget Sound analysis area is either considered “unknown” or “depressed.” Within the Strait of Juan de Fuca analysis area, both the Lower Elwha River and the Lower Dungeness/Gray Wolf subpopulations were considered “depressed”, while the remaining three subpopulations were considered “unknown.” The ten subpopulations within the Coastal analysis area were considered “unknown,” with the exception of the Hoh River subpopulation which was considered to be “depressed.” Of three subpopulations in the Hood Canal analysis area, two were “depressed” and one was “unknown.” The Chilliwack River/Selesia Creek subpopulation is the single subpopulation in the Transboundary analysis area whose status was considered “unknown.”

Current known bull trout distribution on U.S. Forest Service lands within the Pacific Northwest Region includes two recovery units, Puget Sound Management Unit and

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<sup>1</sup>In the proposed rule to list the bull trout, the Service had delineated 35 subpopulations (U.S. Fish and Wildlife Service 1998c). Upon further review, the Service revised the total number to 34 based upon the conclusion that the Puyallup River Basin had two subpopulations instead of three. The Service made this revision to be consistent with established subpopulation criteria.

Olympic Peninsula Management Unit. A total of 14 bull trout core areas occur within these recovery units in Washington.

The Coastal/Puget Sound DPS includes portions of three National Forests (Gifford Pinchot National Forest, Mount Baker-Snoqualmie National Forest, and Olympic National Forest). This includes approximately 461 occupied stream miles approximately 15 percent of the bull trout range in the DPS. Forty percent of the bull trout's spawning and rearing habitat within the DPS is located within U.S. Forest Service lands. The entire DPS consists of approximately 3,081 occupied stream miles, and 52,575 acres of occupied lakes and reservoirs.

#### Columbia River Distinct Population Segment

At the time of listing, the USFWS recognized 141 subpopulations of bull trout in the Columbia River DPS within Idaho, Montana, Oregon, and Washington with additional subpopulations in British Columbia. Approximately 79 percent were considered unlikely to reestablish if extirpated and 50 percent were at risk of extirpation from naturally occurring events due to their depressed status (U.S. Fish and Wildlife Service 1998c). Many of the remaining bull trout occur as isolated subpopulations in headwater tributaries, or in tributaries where the migratory corridors have been lost or restricted. Few bull trout subpopulations are considered "strong" in terms of relative abundance and subpopulation stability. Those few remaining strongholds are generally associated with large areas of contiguous habitats such as portions of the Snake River Basin in central Idaho, the Flathead River in Montana, the Wenaha River Basin and the Blue Mountains in Washington and Oregon. The listing rule characterizes the Columbia River DPS as generally occurring as isolated subpopulations, with trends in abundance declining or of unknown status.

Bull trout in the Columbia River basin occupy about 45 percent of their estimated historic range (Quigley and Arbelbide 1997). Generally, where status is known and population data exist, bull trout populations in the Columbia River DPS are declining (Thomas 1992, Pratt and Huston 1993, Schill 1992). Quigley and Arbelbide (1997) considered bull trout populations strong in only 13 percent of the occupied range in the interior Columbia River basin. Rieman et al. (1997) estimated that populations were strong in 6 to 24 percent of the subwatersheds in the entire Columbia River Basin. Some strong populations are associated with large contiguous habitat on U.S. Forest Service lands (e.g., Wenaha River Basin, and the Blue Mountains).

The Columbia River bull trout distribution within the Pacific Northwest Region planning area includes recovery units in Oregon and Washington, and the Hells Canyon Complex within the Wallowa Whitman National Forest. There are 22 recovery units within the range of this DPS. Current known bull trout distribution on U.S. Forest Service lands within the Pacific Northwest Region includes portions of 15 recovery units in Oregon and Washington (approximately 12 percent of their range): Willamette River, Hood River, Deschutes River, Odell Lake, John Day River, Umatilla/Walla Rivers, Grande Ronde River, Imnaha-Snake River, Hells Canyon Complex, Malheur River, Lower Columbia River, Mid-Columbia River, Upper Columbia River, Northeast Washington, and Snake

River. A total of 38 bull trout core areas occur within these recovery units in Oregon and Washington.

The entire range of this DPS extends beyond the boundary of the Pacific Northwest Region and is known to occupy approximately 15,724 stream miles, and 79,390 acres of lakes and reservoirs. The Columbia River DPS includes portions of 12 Forests in the Pacific Northwest Region. Approximately 37 percent of known occupied streams within Oregon and Washington occur on U.S. Forest Service lands. Seventy-five percent of spawning and rearing habitat for bull trout in Oregon and Washington is on U.S. Forest Service lands.

#### Klamath River Distinct Population Segment

Historical records suggest bull trout were once widely distributed and exhibited diverse life-history traits in the Klamath River Basin (Dambacher et al. 1992, Ziller 1992, Oregon Chapter of American Fisheries Society 1993). The earliest records of bull trout in the Basin are from Fort Creek (formerly Linn Creek), a tributary to the Wood River (Dunsmoor and Bienz in litt. 1997). There is evidence of two remnant migratory (fluvial) populations (Long Creek and Upper Sprague River), and evidence that bull trout historically used Agency Lake seasonally as a migratory corridor. Bull trout are thought to have been extirpated from the Sycan River, the South Fork of the Sycan River, and four streams in the Klamath River Basin (Cherry, Sevenmile, Coyote, and Callahan Creeks) since the 1970s.

Abundance within the Klamath River DPS is severely reduced and remaining populations are fragmented. Overall, the DPS population is probably declining. Currently, bull trout in the Klamath River Basin occur only as resident forms isolated in higher elevation headwater streams (Goetz 1989) within three watersheds, Upper Klamath Lake, Sprague River, and Sycan River (Light et al. 1996). Factors contributing to isolation include habitat degradation, water diversion, and habitat fragmentation (Oregon Chapter American Fisheries Society 1993, Light et al. 1996). In addition, long distances separate each isolated subpopulation (Oregon Chapter American Fisheries Society 1993).

The entire DPS includes approximately 82 occupied stream miles, all spawning and rearing, with the exception of remnant migratory habitat. This DPS occurs on portions of two Forests (Fremont and Winema), including approximately 32 occupied stream miles. Approximately 39 percent of their current range is on U.S. Forest Service lands (Pacific Northwest Region).

#### *Threats*

Since listing, no substantial new threats have been identified. Bull trout distribution, abundance, and habitat quality have and continue to decline rangewide (Bond 1992, Schill 1992, Thomas 1992, Ziller 1992, Rieman and McIntyre 1993, Newton and Pribyl 1994, McPhail and Baxter 1996). These declines result from the combined effects of habitat degradation and fragmentation, the blockage of migratory corridors, poor water quality, angler harvest and poaching, entrainment (process by which aquatic organisms are pulled through a diversion or other device) into diversion channels and dams, and

introduced non-native species. Specific land and water management activities that may depress bull trout populations and degrade habitat include dams and other diversion structures, forest management practices, livestock grazing, agriculture, agricultural diversions, road construction and maintenance, mining, and urban and rural development (Beschta et al. 1987, Chamberlain et al. 1991, Furniss et al. 1991, Meehan 1991, Nehlsen et al. 1991, Sedell and Everest 1991, Craig and Wissmar 1993, Henjum et al. 1994, McIntosh et al. 1994, Wissmar et al. 1994, Montana Bull Trout Scientific Group 1995a-e, 1996a-f, Light et al. 1996, Department of Agriculture and Department of Interior 1995, 1996, 1997, Frissell 1997).

#### *Ongoing Conservation*

Federal conservation actions include: (1) the development of a draft Bull Trout Recovery Plan; (2) ongoing implementation of PACFISH (USDA and USDI 1995a) and INFISH (USDA and USDI 1995b); (3) ongoing implementation of the Northwest Forest Plan; (4) ongoing implementation of the Northwest Power and Conservation Council Fish and Wildlife Program targeting subbasin planning; (5) ongoing implementation of the Federal Caucus Fish and Wildlife Plan; and, (6) ongoing implementation of Department of Agriculture Conservation Reserve Programs.

Since 1990, the State of Oregon has taken several actions to address the conservation of bull trout, including: (1) Establishing bull trout working groups in the Klamath, Deschutes, Hood, Willamette, Odell Lake, Umatilla and Walla Walla, John Day, Malheur, and Pine Creek River Basins for the purpose of developing bull trout conservation strategies; (2) establishment of more restrictive harvest regulations in 1990; (3) reduced stocking of hatchery-reared rainbow trout and brook trout into areas where bull trout occur; (4) angler outreach and education efforts in river basins occupied by bull trout; (5) research to further examine life history, genetics, habitat needs, and limiting factors of bull trout in Oregon; (6) reintroduction of bull trout fry from the McKenzie River watershed to the adjacent Middle Fork of the Willamette River, which is historical unoccupied, isolated habitat; (7) the Oregon Department of Environmental Quality (DEQ) established a water temperature standard such that surface water temperatures may not exceed 50 °F in waters that support or are necessary to maintain the viability of bull trout in the State (State of Oregon 1996); and, (8) expansion of the Oregon Plan for Salmon and Watersheds (State of Oregon 1997) to include all at-risk wild salmonids throughout the State.

Conservation actions by the State of Washington include: (1) establishment of the Salmon Recovery Act (ESHB 2496) and Watershed Management Act (ESHB 2514) by the Washington State legislature to assist in funding and planning salmon recovery efforts; (2) abolition of a brook trout stocking in streams or lakes connected to bull trout-occupied waters; (3) changing angling regulations in Washington prohibit the harvest of bull trout, except for a few areas where stocks are considered "healthy"; (4) collecting and mapping updated information on bull trout distribution, spawning and rearing areas, and potential habitat; and, (5) adopted forest practice rules based on the "Forest and Fish Report" process. These rules address riparian areas, roads, steep slopes, and other elements of forest practices on non-federal lands.

### *Conservation Needs*

Conservation needs reflect those biological and physical requirements of a species for its long-term survival and recovery. Based on the best available scientific information (Rieman and McIntyre 1993, Montana Bull Trout Scientific Group 1998, Hard 1995, Healey and Prince 1995, Rieman and Allendorf 2001), the conservation needs of the bull trout are to: (1) maintain and restore multiple, interconnected populations in diverse habitats across the range of each DPS; (2) preserve the diversity of life-history strategies (e.g., resident and migratory forms, emigration age, spawning frequency, local habitat adaptations); (3) maintain genetic and phenotypic diversity across the range of each DPS; and, (4) protect populations from catastrophic fires across the range of each DPS. Conservation needs are discussed in more detail in the draft recovery plans (U.S. Fish and Wildlife Service 2002d, 2004e).

### *Effects of the Action*

For information on general effects, see **Effects of the Action Common to Aquatic Species** section.

#### *Effect to individuals and local populations*

Some treatment methods, including mechanical (working with mechanical equipment adjacent to stream), cultural (grazing disturbance adjacent to streams), and prescribed fires (removing upland vegetation), if they occur immediately adjacent or within the drainage of bull trout populations, have the potential to result in localized increases in sediment and turbidity which could adversely affect bull trout. Delivery of fine sediment could create conditions which could cover redds reducing egg survival and emergence, or reduce suitable spawning sites. Increased turbidity could also reduce prey availability, or directly harm fish gills.

Most treatment methods are not expected to result in mortality, with the following two possible exceptions. First, mechanical and cultural (grazing) treatments that result in ground-disturbing activities in riparian areas may occasionally result in significant amounts of sediment entering spawning habitat. This is only anticipated to occur in very rare cases when activities occur adjacent to spawning habitat, create bare ground or areas susceptible to erosion, and are then followed by unusually high runoff events such as from locally intense thunderstorms. This increase in sediment may occasionally deposit into bull trout spawning habitat, filling interstitial spaces of redds, smothering eggs or fry, which could result in the loss of a redd, a few redds, or a few individuals. Treatment methods which would result in excessive sediment to streams occupied by bull trout are not typically used within riparian areas, and water flow in bull trout habitat tends to quickly limit sedimentation to local areas for invasive plant treatments. Therefore, effects from sediment to bull trout are generally expected to be rare, short-term in duration, and localized.

Secondly, treatment of streamside vegetation which may involve people or animals entering streams could disturb individuals or redds causing harassment or mortality to bull trout. A small number of eggs or fry or individual redds could be lost if stepped on

during these activities. This is only anticipated to occur in very rare cases where projects occur adjacent to spawning areas while redds are present and result in people or animals in the stream. The overall likelihood of direct mortality or harassment is low because in-water work during invasive plant treatments is anticipated to be rare and grazing as a treatment method is new and not commonly used. Harassment to individuals is not expected to be significant because fish can move away from the activity. The duration of this activity is expected to be short and temporary. Any adverse effect from this activity is expected to be very localized and confined to a small footprint.

Some mechanical and herbicide treatments adjacent to streams could temporarily reduce streamside vegetation (albeit non-native) that provides cover for fish and therefore potentially reduce riparian function (bank stabilization). These effects are generally short-term (until native vegetation returns) and localized.

Some herbicide applications may result in adverse effects to aquatic plants used by bull trout for habitat and hiding cover, and/or food resources. Chemicals which may affect aquatic plants include chlorsulfuron, imazapic, imazapyr, metsulfuron methyl, picloram, sulfometuron methyl, and triclopyr. Exposure scenarios are based on the SERA evaluations of potential herbicide delivery calculated for 10 acres treated adjacent to a 1.8 cubic feet per second stream with no buffers, a conservative scenario. Because triclopyr is limited to direct application methods only under the Invasive Plant Program, it would not reach the concentrations resulting from this scenario and is not considered a risk to aquatic vegetation. Adverse effects to aquatic plants, used by bull trout for habitat and hiding cover, may increase predation potential. However, any effects to aquatic plants are expected to be localized and short-term, due to their extremely rapid growth rate. The potential for herbicide delivery to occupied bull trout habitat is rendered more unlikely because the Invasive Plant Program does not allow the direct spraying of herbicides to the water column for the treatment of aquatic weeds. However, high runoff events such as heavy thunderstorms could transport herbicides to bull trout habitat if they follow soon after treatment. This would be a very rare event. Herbicide treatments are not expected to cause lethal effects to individual bull trout.

Glyphosate with POEA surfactant and triclopyr BEE have a potential to affect invertebrates. As previously described, Triclopyr is unlikely to enter the water in sufficient concentrations to affect invertebrates. If herbicide entered habitat occupied by bull trout, temporary adverse effects could occur to food resources such as terrestrial and aquatic insects, macroinvertebrates, and small fish. Effects to bull trout via the food web are not likely to be substantial because bull trout are opportunistic feeders and water flow in streams quickly dilutes herbicide, generally reducing exposure below toxic levels. Effects could only be expected if a substantial amount of herbicides reached the water with known populations. However, the loss of individuals due to a reduction in prey base is expected to be unlikely.

#### *Summary*

Potential effects to bull trout are the same for all DPSs within the action area, but the number of future projects that may occur within each DPS will vary. The Columbia

River DPS is expected to have a larger amount of area treated due to the much larger amount of the Pacific Northwest Region National Forest System land within this DPS and much of this DPS occurs in an ecosystem where a greater proportion of invasive plant species exist. Manual, mechanical, cultural (grazing), herbicide and prescribed fire treatments have the potential to result in short-term adverse effects to bull trout and are expected to be rare and transitory. Treatments are expected to provide for long-term ecosystem maintenance or restoration.

Multiple, large scale (>10 acres) invasive plant treatments immediately adjacent to bull trout populations or substantial roadside treatments where roadside ditches and culverts directly flow into waters inhabited by bull trout would have the greatest potential to adversely affect bull trout. However, water flow in streams quickly dilutes herbicide, reducing exposure below toxic thresholds, and limits sedimentation to local areas.

The vast majority of the treatment methods are not expected to result in mortality. Only in rare cases would treatments result in delivery of significant amounts of sediment to effect spawning habitat to the degree that interstitial spaces of redds may become filled, resulting in some loss to eggs or fry. The vast majority of treatments in riparian areas would not produce excessive sediment or sediment that persists long enough to cause mortality.

On rare occasions, streamside treatments may include people or animals entering streams, inadvertently disturbing individuals or stepping on redds resulting in harassment to bull trout, and/or cause the loss of a few eggs or fry or individual redds. Harassment is not expected to be significant because fish can be expected to move away from the activity. The vast majority of the treatments, however, will not include entering the water. Therefore, only in rare circumstances would activities be expected to result in mortality.

Some mechanical and herbicide treatments adjacent to streams could temporarily reduce streamside vegetation (albeit non-native), adversely reducing streamside cover and potentially compromising bank stability. Some herbicide treatments could reduce food resources, and aquatic plants in bull trout habitat, which could potentially reduce, hiding cover, and/or prey base. Any potential adverse effect to cover, predation, and/or prey base is expected to be localized and short term. Replacement of invasive plants by native riparian vegetation, and growth of aquatic plants is expected to take up to a few years or one growing season, respectively. Any reduction in prey base is anticipated to be localized, and is not expected to be significant because bull trout are opportunistic feeders. Levels of herbicide exposure are not anticipated to result in mortality to fish.

The vast majority of the treatment methods are not expected to result in mortality. Any significant losses to populations or the species are not anticipated because direct mortality is very unlikely and would be scattered within any given watershed. Loss of a few individuals (via smothering or trampling of eggs or fry, or through harassment) or adverse effects to the species would only be expected when activities occur adjacent to bull trout habitat, create bare ground or areas susceptible to erosion, and are followed by

high runoff events such as from locally intense thunderstorms. High runoff events could also transport herbicides to bull trout habitat if they follow soon after treatment.

Treatments are not anticipated to result in the loss or significant reduction of any local population and therefore no reduction to the species or its range. Additionally, the majority of the treatments conducted according to the standards in the Invasive Plant Program are not likely to adversely affect bull trout and their habitat because design criteria will be able to avoid the addition of substantial amounts of sediment into aquatic habitats, and minimize the introduction of herbicides into these same habitats.

### ***Cumulative Effects***

Cumulative effects include the effects of future state, tribal, or private actions, not involving Federal actions, that reasonably are certain to occur within the action area of a Federal action subject to consultation (50 CFR 402.2). Cumulative effects analysis of foreseeable state and private actions provide greater insight to understanding the current environmental factors and likely trends that might affect a species.

The action area may include some surrounding and interspersed tracts of non-federal land. Land use includes timber harvest, agriculture, mining, and development. Management activities on non-federal lands which may affect bull trout, such as habitat alteration, water management activities that depress bull trout populations, grazing, introduction of non-native species, runoff from herbicide and pesticide application, are reasonably certain to continue at current rates and may increase. Chemical fertilizers or pesticides are used on many of these lands, but no specific information is available regarding their degree of use or have potential for transport into bull trout habitat.

The USFWS anticipates the majority of cumulative effects will occur within bull trout forage, migratory, and overwintering habitats where the greatest concentration of non-federal lands occur. Within the range of bull trout within the Pacific Northwest Region, approximately 86 percent of the known foraging, migratory, and overwintering habitat occurs on non-federal ownership. Conversely, approximately 75 percent of all spawning and rearing habitat within the Pacific Northwest Region occurs on Federal lands, with 84 percent on National Forests and 15 percent on National Park lands.

### ***Conclusion for the Coastal/Puget Sound DPS***

The Invasive Plant Program will not jeopardize the continued existence of the Coastal/Puget Sound DPS by, directly or indirectly, reducing appreciably the likelihood of survival and recovery of the Coastal/Puget Sound DPS in the wild by reducing the reproduction, numbers, or distribution of the DPS.

- Loss of eggs, fry, or spawning habitat is expected to be very rare, confined to one or few redds, and scattered throughout any one watershed. In rare circumstances, treatments may produce excessive sediment into occupied spawning habitat which may smother eggs, or people or animals may inadvertently step on eggs when operating in occupied spawning habitat when redds are present. The duration of this activity would be temporary, and effects would be localized and confined to a

small footprint. We do not anticipate any significant reduction in the reproduction from this action.

- Adverse effects are expected to be rare and treatments will not result in a significant direct mortality to the Coastal/Puget Sound DPS. In rare circumstances, treatments may produce excessive sediment into occupied spawning habitat which may smother fry, potentially resulting in loss of individuals. On rare occasions, people or animals could be present in occupied spawning habitat, which may inadvertently step on fry or result in harassment to a few older individuals. These actions could lead to small localized reductions in the numbers of bull trout. However, these small losses are not anticipated to have lasting effect on bull trout numbers.
- We do not anticipate the loss of any local population or a reduction in distribution of the Coastal/Puget Sound DPS. Only 15 percent of the DPS is on National Forest land in the Pacific Northwest Region. Treatments that may affect bull trout or their habitat are anticipated to be short-term and we do not anticipate that any populations would be significantly affected. Although some limited activities may occur adjacent to occupied habitat of the Coastal/Puget Sound DPS, current invasive plant inventories indicate westside Forests within the Pacific Northwest Region contain relatively few acres of weed infestations, within the project area, therefore, reducing the likelihood of overlap between projects and occupied habitat. We do not anticipate any change in distribution as a result of this action.

Therefore, the U.S. Forest Service Pacific Northwest Region Invasive Plant Program Plan is not anticipated to reduce the reproduction, numbers, or distribution of the Coastal/Puget Sound DPS.

***Conclusion for the Columbia River DPS***

The Invasive Plant Program will not jeopardize the continued existence of the Columbia River DPS, by directly or indirectly reducing appreciably the likelihood of survival and recovery of the Columbia River DPS in the wild by reducing the reproduction, numbers, or distribution of the DPS.

- Loss of eggs, fry, or spawning habitat is expected to be very rare, and confined to one or few redds and scattered throughout any one watershed. In rare circumstances, treatments may produce excessive sediment into occupied spawning habitat which may smother eggs, or people or animals may inadvertently step on eggs when operating in occupied spawning habitat when redds are present. The duration of this activity would be temporary, and effects would be localized and confined to a small footprint. We do not anticipate any significant reduction in the reproduction from this action.
- Adverse effects are expected to be rare and treatments will not result in a significant direct mortality to the Columbia River DPS. In rare circumstances, treatments may produce excessive sediment into occupied spawning habitat which

may smother fry, potentially resulting in loss of individuals. On rare occasions, people or animals could be present in occupied habitat, which may inadvertently step on fry or result in harassment to a few older individuals. These actions could lead to small localized reductions in the number of bull trout. However, these small losses are not anticipated to have lasting effect on bull trout numbers.

- We do not anticipate the loss of any local population or a reduction in distribution of the Columbia River DPS. National Forests in Oregon and Washington are within the action area, as is a small section of the Wallowa Whitman National Forest (Hells Canyon) in Idaho. While U.S. Forest Service lands contain some of the best spawning and rearing habitat for bull trout and are important areas to the recovery of this DPS, the majority of occupied habitat occurs off the Pacific Northwest Region U.S. Forest Service lands (88 percent). Therefore, these locations represent only a small segment of the range of this DPS. Treatments that may affect bull trout or their habitat are anticipated to be short-term and we do not anticipate that any populations would be significantly affected. Although some limited activities may occur adjacent to occupied habitat of the Columbia River DPS, and a greater proportion of this DPS occurs on the eastside of Oregon and Washington where the highest density of weed infestation occurs, compared to the Klamath DPS or Coastal/Puget Sound DPS, the likelihood of overlapping projects and occupied habitat for this DPS is still small. We do not anticipate any change in distribution as a result of this action.

Therefore, the U.S. Forest Service Pacific Northwest Region Invasive Plant Program Plan is not anticipated to reduce the reproduction, numbers, or distribution of the Columbia River DPS.

#### ***Conclusion for the Klamath River DPS***

The Invasive Plant Program will not jeopardize the continued existence of the Klamath River DPS, by directly or indirectly reducing appreciably the likelihood of survival and recovery of the Klamath River DPS in the wild by reducing the reproduction, numbers, or distribution of the DPS.

- Loss of eggs, fry, or spawning habitat is expected to be very rare, and confined to one or few redds and scattered throughout any one watershed. In rare circumstances, treatments may produce excessive sediment into occupied spawning habitat which may smother eggs, or people or animals may inadvertently step on eggs when operating in occupied spawning habitat when redds are present. The duration of this activity would be temporary, and effects would be localized and confined to a small footprint. We do not anticipate any significant reduction in the reproduction from this action.
- Adverse effects are expected to be rare and treatments will not result in a significant direct mortality to the Klamath River DPS. In rare circumstances, treatments may produce excessive sediment into occupied spawning habitat which may smother eggs, potentially resulting in a loss of individuals. On rare

occasions, people or animals could be present in occupied habitat, which may inadvertently step on or result in harassment to a few older individuals. These actions could lead to small localized reductions. However, these small losses are not anticipated to have lasting effect on bull trout numbers.

- We do not anticipate the loss of any local population or a reduction in distribution of the Klamath River DPS. While National Forest land contain some of the best spawning and rearing habitat for bull trout and are important areas to the recovery of this DPS, the majority of occupied habitat occurs off the Pacific Northwest Region U.S. Forest Service land (61 percent), representing greater than half of their range. Treatments that may affect bull trout or their habitat are anticipated to be short term and we do not anticipate that any populations would be significantly affected. Although some limited activities may occur adjacent to occupied habitat of the Klamath River DPS, current invasive plant inventories show only about 250 acres of invasive plants within 300 feet of the water on National Forest land in the entire Oregon Closed Basins watershed, greatly reducing the likelihood of overlap between projects and occupied habitat. We do not anticipate any change in distribution as a result of this action.

Therefore, the U.S. Forest Service Pacific Northwest Region Invasive Plant Program Plan is not anticipated to reduce the reproduction, numbers, or distribution of the Klamath River DPS.

#### ***Conservation Recommendations***

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

If manual, mechanical, or herbicide treatments require working in the water when bull trout fish or redds are present, survey the area prior to the activity to identify the location of presence of fish and/or redds. Mark the locations or have the fish biologist on site during the activity to avoid redds and minimize impacts, when possible.

To reduce adverse effects manual or mechanical treatments within riparian areas that may disturb bull trout, observe in-water work period as designated by the State for the area in which they occur, where possible.

Choose or modify techniques for treating invasive plants in riparian areas that minimize the potential deliver of herbicides or sediment to the streams and ponds. Consider establishing buffers for treatments with a potential to directly deliver herbicides to streams or ponds with bull trout populations (e.g. broadcast spray).

## **Bull Trout Critical Habitat**

Section 7(a)(2) of the Act requires that Federal agencies consult with the Service on any Federal action to insure that their action is not likely to result in the destruction or adverse modification of critical habitat. This biological opinion does not rely on the regulatory definition of “destruction or adverse modification” of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statute and the August 6, 2004 Ninth Circuit Court of Appeals decision in Gifford Pinchot Task force v. U.S. Fish and Wildlife Service (No. 03-35279) to complete the following analysis with respect to critical habitat. The following discussion includes designated critical habitat for the Klamath River and Columbia River bull trout DPS and proposed critical habitat for the Coastal Puget Sound DPS. Because effects and conclusions are the same for all critical habitat, the biological opinion and formal conference results are combined in this section.

### ***Status and Baseline***

#### *Listing History*

The USFWS proposed to designate critical habitat for the Klamath River and Columbia River bull trout DPS on November 29, 2002 (U.S. Fish and Wildlife Service 2002e) and Coastal Puget Sound DPS on June 25, 2004 (U.S. Fish and Wildlife Service 2004h). Final critical habitat was designated by the USFWS for the Klamath River and Columbia River DPS bull trout on September 21, 2004 (U.S. Fish and Wildlife Service 2004i). Changes made between proposed and final designation include but are not limited to: 1) removal of unoccupied lands from the designation, unless included by the Secretary of the Interior if she finds that those lands are essential to the conservation of the species; and 2) removal of designated land which do not meet the requirement of needing special management. For this biological opinion, this exclusion is pertinent to stream reaches administered under the Northwest Forest Plan and regulated under PACFISH/INFISH. On May 25, 2005, the USFWS opened the comment period for 30 days on its proposed and final critical habitat designation for bull trout in the Columbia River and Klamath River DPSs. The USFWS intends to use the information in a re-evaluation of critical habitat for the Columbia River Basin and Klamath River Basin populations of bull trout.

#### *Description of Critical Habitat*

The USFWS designated 1,748 miles of streams and 61,235 acres of lakes in Oregon, Idaho, and Washington as critical habitat for the Columbia River DPS and Klamath River DPS. In Oregon, 706 miles of streams and 33,939 acres of lakes and marshes are designated as critical habitat. The lakes and marshes are in the Klamath River Basin. In Washington, 737 miles of streams were designated in the Columbia River Basin (U.S. Fish and Wildlife Service 2004i). Within the Columbia River DPS in the Pacific Northwest Region, the Willamette River, Odell Lake, John Day River, Malheur River, and Upper Columbia River Recovery Units were removed from critical habitat designation. No U.S. Forest Service lands were included in the final designation of critical habitat within the Columbia River DPS. Within the Klamath River DPS, final designation within the Klamath River DPS totals approximately 42 miles of streams, and 33,939 acres of lakes on non-federal lands.

Within the Coastal/Puget Sound DPS, proposed critical habitat designation totals approximately 2,290 miles of streams, and 52,540 acres of lakes and reservoirs and marine habitat totaling 985 miles of shoreline in Washington (U.S. Fish and Wildlife Service 2004h). Thirty-two percent of proposed critical habitat is on Federal lands, five percent tribal, six percent State, and 57 percent on private lands. Critical habitat is proposed on 478 miles of streams and 4,750 acres of lakes on U.S. Forest Service lands in the Pacific Northwest Region.

#### *Primary Constituent Elements*

A brief summary of the primary constituent elements of bull trout proposed critical habitat is presented below. In accordance with section 3(5)(A)(i) of the ESA and regulations at 50 CFR 424.12, in determining which areas to propose as critical habitat, the USFWS is required to base their proposal on the best scientific data available, and to consider those physical and biological features that are essential to the conservation of the species and that may require special management considerations or protection.

The primary constituent elements of bull trout proposed critical habitat are derived from studies of bull trout habitat requirements, life history characteristics, and population biology. These primary constituent elements are: (1) permanent water having low levels of contaminants such that normal reproduction, growth and survival are not inhibited; (2) water temperatures ranging from 36 to 59 °F, with adequate thermal refugia available for temperatures at the upper end of this range. Specific temperatures within this range will vary depending on bull trout life history stage and for, geography, elevation, diurnal and seasonal variation, shade, such as that provided by riparian habitat, and local groundwater influence; (3) complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and instream structures; (4) substrates of sufficient amount, size, and decomposition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine substrate less than 0.25 inch in diameter and minimal substrate embeddedness are characteristic of these conditions; (5) a natural hydrograph, including peak, high, low, and base flows within historic ranges or, if regulated, a hydrograph that demonstrates the ability to support bull trout populations; (6) springs, seeps, groundwater sources, and subsurface connectivity to contribute to water quality and quantity; (7) migratory corridors with minimal physical, biological, or chemical barriers between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows; (8) an abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish; and (9) few or no predatory, interbreeding or competitive non-native species present. For more information on critical habitat, refer to the proposed listings (U.S. Fish and Wildlife Service 2002e, 2004a).

#### ***Effect of the Action to Bull Trout Critical Habitat***

Some treatment methods, including mechanical (working with mechanical treatment next to the stream, cultural (grazing disturbance adjacent to stream), and prescribed fire (removing upland vegetation) immediately adjacent or within the drainage of bull trout critical habitat have the potential to result in localized increases in sediment that could

adversely affect existing or potential spawning substrate filling interstitial spaces, reducing the suitability of existing or potential spawning sites in localized areas. Eggs stay in the gravel for a relatively long period compared to other salmonids, normally from 100 to 145 days. Juveniles remain in the substrate after hatching, such that the time from egg deposition to emergence of fry can exceed 200 days. During this time, bull trout eggs are especially vulnerable to fine sediments. Increases in fine sediment appear to reduce available spawning sites and reduce egg survival and emergence of bull trout (Fraley and Shephard 1989 *as cited* in U.S. Fish and Wildlife Service 2002e). As described in the effects to the species section, significant input of fine sediments is anticipated to be rare, scattered, and of short duration, the effects of sediment from invasive plant treatments to bull trout are also expected to be rare, short-term in duration, and localized.

Herbicide treatments could be introduced into water inhabited by bull trout and may have potential short-term effects to food resources. Bull trout require an abundant and varied food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish. Temporary adverse effects could occur to food resources such as terrestrial and aquatic insects, macro invertebrates, and small fish. However, the effects to bull trout via the food web are not likely to be substantial because bull trout are opportunistic feeders. Because effects of both sediment and herbicides are expected to be short term (as described in the effects to the species section), we do not anticipate any long term adverse affect on critical habitat.

#### *Summary*

Most projects conducted according to the standards in the Invasive Plant Program are not likely to adversely affect proposed and designated bull trout critical habitat because design criteria will be able to avoid the addition of substantial amounts of sediment into aquatic habitats, and minimize the introduction of herbicides into these same habitats. Some mechanical, cultural (grazing), and prescribed fire treatments have the potential to result in short-term adverse effects creating excessive sediment that may temporarily affect the embeddedness and availability of suitable substrate in localized areas (primary constituent elements 4). Loss of eggs, fry, or spawning habitat is expected to be very rare, and confined to one or few redds scattered throughout any one watershed. Sediment and herbicides could be introduced into the water and result in short-term localized adverse effects on aquatic plants and aquatic insects, which form the foundation for bull trout food resources (primary constituent elements 8). Some herbicide treatments could reduce food resources, however, effects to bull trout via the food web are not likely to be substantial because bull trout are opportunistic feeders and water flow in streams quickly dilutes herbicide, generally reducing exposure below toxic levels.

Invasive plant treatments have the potential to cause minor, short-term adverse degradation of bull trout habitat or food resources. Adverse effects to food supply or to existing or potential spawning habitat is expected to be very rare, and scattered throughout any one watershed. The duration of any activity which would result in the degradation of food supply or habitat would temporary, and any adverse effects localized and confined to a small footprint. Therefore, the magnitude of the effects from the

Invasive Plant Program does not significantly affect the abundance of bull trout within the overall Coastal/Puget Sound DPS, the Columbia River DPS, or the Klamath River DPS.

***Cumulative Effects***

Cumulative effects include the effects of future state, tribal, or private actions, not involving Federal actions, that reasonably are certain to occur within the action area of a Federal action subject to consultation (50 CFR 402.2). Cumulative effects analysis of foreseeable state and private actions provide greater insight to understanding the current environmental factors and likely trends that might affect a species.

The action area may include some surrounding and interspersed tracts of non-federal land. Specific land and water management activities that degrade habitat (primary constituent elements 4) and/or food supply (primary constituent elements 8) include dams and other diversion structures, forest management practices, including road construction, livestock grazing, agricultural practices, including diversions, mining, and development. Timber harvest as well as the above mentioned management activities are reasonably certain to continue at current rates and may increase. Chemical fertilizers or pesticides are used on many of these lands, but no specific information is available regarding their degree of use or have potential for transport into bull trout habitat.

The USFWS assumes future non-federal actions in Oregon and Washington are likely to continue over the next several years at similar intensities as in recent years and these actions will cumulatively affect bull trout critical habitat. The USFWS anticipates the majority of cumulative effects will occur within bull trout foraging, migratory, and overwintering habitats where the greatest concentration of non-federal proposed and designated critical habitat occurs. All designated critical habitat for the Columbia River DPS and the Klamath River DPS occur on non-federal lands, whereas, 68 percent of proposed critical habitat for the Coastal/Puget Sound occurs on non-federal lands.

***Conclusion***

The Invasive Plant Program will not destroy or adversely modify critical habitat by, directly or indirectly, appreciably diminishing the value of proposed bull trout critical habitat for Coastal/Puget Sound DPS and designated bull trout critical habitat for the Columbia River DPS and the Klamath River DPS.

- Project activities will have only localized and limited short-term effects on food supply and substrate due to the potential for increased herbicide and sediment to enter the stream channel.
- It is unlikely that potential effects will measurably affect bull trout habitat or food supply within or downstream of the Invasive Plant Program in the long term.
- Although the Invasive Plant Program has the potential to adversely affect bull trout critical habitat, the adverse affects to primary constituent elements 4 and 8 resulting from the Invasive Plant Program will be short-term, will not

permanently alter or destroy the quality or function of the habitat or food supply at the local scale, and remain functional to maintain the conservation role of the critical habitat for the Columbia DPS and Klamath DPS, and proposed critical habitat for the Coastal/Puget Sound DPS.

Therefore, the U.S. Forest Service Pacific Northwest Region Invasive Plant Program Plan is not anticipated to adversely affect any of the physical or biological features that were the basis for determining the habitat to be critical and will maintain the conservation role of proposed critical habitat for the Coastal/Puget Sound DPS, and designated critical habitat for the Klamath River DPS, and Columbia River DPS.

### **Summary of the Biological Opinion Conclusions**

After reviewing the current status, environmental baseline for the action area, effects of the proposed action, and cumulative effects for each species and critical habitat, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of any of the species and is not likely to destroy or adversely modify any designated or proposed critical habitat. The rationale for these decisions are described below.

#### ***Bald Eagle***

The Invasive Plant Program will not jeopardize the continued existence of the bald eagle by, directly or indirectly, reducing appreciably the likelihood of survival and recovery of the bald eagle in the wild by reducing reproduction, numbers, or distribution of the species.

- The primary potential effect from this project would be disturbance of nesting bald eagles. Because treatments under this plan are of short duration and infrequent, we do not anticipate any substantial reduction in productivity and we do not expect these actions to lead to nest abandonment or other reductions in reproduction.
- No individual mortality (adult or young) is anticipated from treatments under this plan, therefore no change in distribution is anticipated.
- Bald eagle nests are scattered throughout the action area. Forests with the greatest anticipated weed treatment programs occur in areas with the fewest bald eagle nests (e.g. eastern Washington, Blue Mountains). Therefore, most projects are not likely to intersect bald eagle nest sites. Even if disturbed, eagles do not generally permanently abandon nesting territories. Further, only a small portion of the nesting eagles in Oregon and Washington occur within or immediately adjacent to the National Forests. Therefore, we do not anticipate any change in distribution as a result of actions under the Invasive Plant Program.

Therefore, the U.S. Forest Service Pacific Northwest Region Invasive Plant Program Plan is not anticipated to reduce the reproduction, numbers, or distribution of bald eagles.

### ***Northern Spotted Owl***

The Invasive Plant Program will not jeopardize the continued existence of the spotted owl by, directly or indirectly, reducing appreciably the likelihood of survival and recovery of the spotted owl in the wild by reducing reproduction, numbers, or distribution of the species.

- The primary potential effect from this project would be disturbance of nesting spotted owls. Because treatments under this plan are of short duration and infrequent, we do not anticipate any substantial reduction in productivity as we do not expect these actions to lead to nest abandonment or reduced ability to successfully fledge young.
- No individual mortality (adult or young) is anticipated from treatments under this plan.
- National Forests on the eastern slopes of the Cascades anticipate the greatest number of invasive plant treatments and many of these Forests are outside of the spotted owl's range (e.g. eastern Washington, Blue Mountains). Therefore, most projects are not likely to intersect spotted owl nest sites. Even if exposed to disturbance, because spotted owls exhibit high site fidelity and we do not expect they will permanently abandon nesting territories, we do not anticipate any change in the species distribution from these actions.

Therefore, the U.S. Forest Service Pacific Northwest Region Invasive Plant Program Plan is not anticipated to reduce the reproduction, numbers, or distribution of northern spotted owls.

### ***Marbled Murrelet***

The Invasive Plant Program will not jeopardize the continued existence of the marbled murrelet by, directly or indirectly, reducing appreciably the likelihood of survival and recovery of the marbled murrelet in the wild by reducing reproduction, numbers, or distribution of the species within any of the Recovery Zones for marbled murrelet.

- The primary potential effect from this project would be disturbance of nesting marbled murrelets. Because treatments under this plan are of short duration and infrequent, we do not anticipate any substantial reduction in productivity as we do not expect these actions to lead to nest abandonment or reduced ability to successfully fledge young.
- No individual mortality (adult or young) is anticipated from treatments under this plan.
- National Forests on the eastern slopes of the Cascades anticipate the greatest number of invasive plant treatments and these Forests are outside of the murrelet's range (e.g. eastern Washington, Blue Mountains). Therefore, most projects are not likely to intersect marbled murrelet nest sites. Even if exposed to

disturbance, because marbled murrelets exhibit high site fidelity and we do not expect they will permanently abandon nesting territories, we do not anticipate any change in the species distribution from these actions.

Therefore, the U.S. Forest Service Pacific Northwest Region Invasive Plant Program Plan is not anticipated to reduce the reproduction, numbers, or distribution of marbled murrelets.

***Western Snowy Plover***

The Invasive Plant Program will not jeopardize the continued existence of the Pacific coast population of snowy plover by, directly or indirectly, reducing appreciably the likelihood of survival and recovery of the snowy plover in the wild by reducing the reproduction, numbers, or distribution of the species.

- The primary potential effect from invasive plant treatments would be disturbance or direct harm of nesting snowy plovers. Because treatments under this plan are generally conducted outside of the breeding season, are of short duration and infrequent, and because plovers often produce more than one brood and will renest if eggs are lost, we do not anticipate any substantial reduction in productivity or reproduction as a result of this plan.
- Invasive plant treatments have the potential to impact only a relatively small portion, up to 2 percent, of the listed population of snowy plovers. Because these effects are anticipated to be short term and not result in significant mortality or reproductive failure, populations within this portion of the range will remain well distributed and not significantly reduced in numbers.
- Beachgrass does not provide suitable nesting habitat for snowy plover, therefore, most projects that treat beachgrass are not likely to impact snowy plover nest sites. Even if disturbed, plovers often renest and produce young generally in the same area, therefore, we do not anticipate any change in the species distribution from these actions.
- Treatments may restore nesting habitat and reduce predation and may therefore increase productivity. Failure to treat invasive plants may result in further habitat loss and continued or increased predation which may further reduce productivity.

Therefore, the Invasive Plant Program is not anticipated to reduce the reproduction, numbers, or distribution of snowy plover.

***Western Snowy Plover Proposed Critical Habitat***

The Invasive Plant Program will not destroy or adversely modify proposed critical habitat by, directly or indirectly, appreciably diminishing the value of critical habitat for the recovery of the snowy plover.

- Only 18 percent of snowy plover CH occurs in the action area. Only a small portion of this habitat would be disturbed at any particular time. Therefore, we do not anticipate any significant change in use of critical habitat by plovers.
- Invasive plant treatments are short term (1 to 2 days) and short duration. Impacts to critical habitat will only last as long as the treatments.
- Treatments for invasive European beachgrass on the Siuslaw National Forest are currently conducted outside the plover breeding season and this timing of treatments is expected to continue.
- Beachgrass does not provide quality nesting habitat for plovers, therefore treatments in these areas are not likely to cause disturbance to plovers because the birds are not likely to be utilizing unsuitable habitat.
- Invasive plant treatments have been demonstrated to improve critical habitat for the western snowy plover. Failure to treat invasive plants may result in further habitat loss.

Therefore, the Invasive Plant Program is not anticipated to have any significant short term or long term adverse effects to any of the physical or biological features that were the basis for determining the habitat to be critical and the Program has the potential to improve critical habitat for the snowy plover.

### ***Oregon Silverspot Butterfly***

The Invasive Plant Program will not jeopardize the continued existence of the Oregon silverspot butterfly by, directly or indirectly, reducing appreciably the likelihood of survival and recovery of the butterfly in the wild by reducing the reproduction, numbers, or distribution of the species.

- While there is a risk of loss of a few individuals from treatments under this plan, failure to treat invasive plants in Oregon silverspot butterfly habitat will likely result in an increased risk of extinction by further degradation of suitable habitat.
- The incorporation of new tools, such as sethoxydim (grass-specific herbicide), has the potential for long term beneficial effects to the species and may be vital for the survival and recovery of the Oregon silverspot butterfly.
- Standard 20 requires that projects be designed to minimize or eliminate adverse effects to listed species. Based on the U.S. Forest Service's continuing commitment to managing for Oregon silverspot butterfly habitat, site specific project designs will be unlikely to incorporate treatment types that will not accomplish the goals of restoring habitat with minimal impacts to the silverspot butterfly. Future consultation will be required prior to implementation of any projects that may affect the butterfly.

Therefore, the Invasive Plant Program is not anticipated to reduce the reproduction, numbers, or distribution of the Oregon silverspot butterfly.

***Oregon Silverspot Butterfly Critical Habitat***

The Invasive Plant Program will not destroy or adversely modify Oregon silverspot butterfly critical habitat by, directly or indirectly, appreciably diminishing the value of critical habitat for the recovery of the butterfly.

- While there is a risk of loss of some individual plants from treatments under this plan, failure to treat or continuing the current approach to treating invasive plants in silverspot butterfly critical habitat may increase the risk of extinction by further degradation of critical habitat.
- The incorporation of new tools, such as sethoxydim (grass-specific herbicide), has the potential for long term beneficial effects to critical habitat.
- Standard 20 requires that projects be designed to minimize or eliminate adverse effects to listed species. Site specific project designs will be unlikely to incorporate treatment types that will not accomplish the goals of restoring habitat with minimal impacts to the Oregon silverspot butterfly's critical habitat. Future consultation is required prior to implementation of any projects that may affect silverspot butterfly critical habitat.

Therefore, the Invasive Plant Program is not anticipated to have any significant long term adverse effects to any of the physical or biological features that were the basis for determining the habitat to be critical and has the potential to improve critical habitat for the Oregon silverspot butterfly.

***Showy Stickseed***

The Invasive Plant Program will not jeopardize the continued existence of the showy stickseed by, directly or indirectly, reducing appreciably the likelihood of survival and recovery of showy stickseed in the wild by reducing reproduction, numbers, or distribution of the species.

- The potential effects from manual and chemical treatments are expected to be insignificant, because they are expected to occur infrequently (once per year), on only a small portion of the area where showy stickseed is found.
- Because treating a small population in small area magnifies an ordinarily low risk of potential effects, the effects are offset by the potential benefits to showy stickseed of early invasive plant treatments.
- Minimization and avoidance measures calling for site-specific project design in Standard 20 of the Biological Assessment will minimize the probability of accidental herbicide exposure to showy stickseed plants.

- The possible loss of scattered individuals or small groups due to unintended manual or chemical treatments will not significantly affect showy stickseed at the population level.

Therefore, the Invasive Plant Program is not expected to appreciably reduce the reproduction, numbers, or distribution of showy stickseed.

***MacFarlane's Four O'clock***

The Invasive Plant Program will not jeopardize MacFarlane's four-o'clock by directly or indirectly, reducing appreciably the likelihood of survival and recovery of MacFarlane's four-o'clock in the wild by reducing the reproduction, numbers, or distribution of the species.

- The primary potential effect from this project would be short term damage to individuals or small groups of plants due to unintended direct application or drift from aerial spray herbicide treatments. Under the Invasive Plant Program, aerial treatments are expected to be infrequent, widely spaced, and of short duration.
- Because the 12 known populations are widely spaced and individuals and groups are scattered within them, the likelihood of an unintended application affecting the population as a whole is very low. The potential effects will be further minimized by the implementation of Standards 19 and 20 in the Biological Assessment, calling for protection of non-target plants, site-specific project design and surveys of suitable habitat for plants.
- The possible loss of scattered individuals or small groups due to unintended herbicide exposure will not significantly affect MacFarlane's four-o'clock at the population level.

Therefore, the Invasive Plant Program is not expected to appreciably reduce the reproduction, numbers, or distribution of MacFarlane's four-o'clock.

***Spalding's Catchfly***

The Invasive Plant Program will not jeopardize Spalding's catchfly by directly or indirectly, reducing appreciably the likelihood of survival and recovery of the Spalding's catchfly in the wild by reducing the reproduction, numbers, or distribution of the species.

- The primary potential effect from this project would be short term damage to individuals or small groups of plants due to unintended direct application or drift from aerial spray herbicide treatments. Under the Invasive Plant Program, aerial treatments are expected to be infrequent, widely spaced, and of short duration.
- Because the 66 known populations of Spalding's catchfly are widely spaced over several states; with individuals and groups scattered within them, the likelihood of an unintended application affecting the population as a whole is very low. The

potential effects will be further minimized by the implementation of Standards 19, and 20 in the Biological Assessment, calling for protection of non-target species, site-specific project design, and surveys of suitable habitat for listed plants.

The possible loss of scattered individuals or small groups due to unintended herbicide exposure will not significantly affect Spalding's catchfly at the population level.

Therefore, the Invasive Plant Program is not expected to appreciably reduce the reproduction, numbers, or distribution of Spalding's catchfly.

***Lost River and Shortnose Suckers***

The Invasive Plant Program will not jeopardize the continued existence of Lost River or shortnose suckers, by directly or indirectly, reducing appreciably the likelihood of survival and recovery of Lost River and shortnose suckers in the wild by reducing reproduction, numbers, and distribution of the species.

- Loss of eggs or larvae is expected to be very uncommon, and confined to a small number of eggs, and/or larvae. The duration of treatments under this action would be temporary, and effects would be localized and confined to a small area. While there may be small localized losses of eggs or individuals in rare cases, we do not anticipate any significant reduction in the reproduction from this action.
- Adverse effects are expected to be rare and treatments will not result in a significant direct mortality to Lost River or shortnose suckers. In rare instances, treatments may produce excessive sediment into occupied spawning habitat which may reduce survival of eggs or larvae. On rare occasions, some herbicide treatments could affect larval food supply, potentially resulting in a small loss of larvae, leading to small localized reductions. However, these small losses are not anticipated to have a lasting effect on Lost River and shortnose suckers numbers.
- We do not anticipate the loss of any population or a reduction in distribution of Lost River and shortnose suckers. Historical and current distribution within the action area is limited and occupied habitat occurs in only a couple of miles of habitat on the eastern shore of Upper Klamath Lake and a few miles of habitat on Sprague and Williamson Rivers which feed Upper Klamath Lake. Current invasive plant inventories indicate only about 250 acres of invasive plants are within 300 feet of the water on National Forest land within the entire Oregon Closed Basins watershed, greatly reducing the likelihood of overlap between projects and occupied habitat. We do not anticipate any change in distribution as a result of this action.

Therefore, the U.S. Forest Service Pacific Northwest Region Invasive Plant Program is not anticipated to reduce the reproduction, numbers, or distribution of Lost River and shortnose suckers.

***Oregon Chub***

The Invasive Plant Program will not jeopardize the continued existence of Oregon chub by, directly or indirectly, reducing appreciably the likelihood of survival and recovery of Oregon chub in the wild by reducing reproduction, numbers, or distribution of the species.

- Loss of eggs or available spawning habitat is not anticipated. Any reduction in spawning habitat would be localized and short term due to the ability of aquatic plants to grow extremely fast. Effects to spawning habitat are further limited because the Invasive Plant Program does not allow the direct spraying of herbicides to the water column for the treatment of aquatic weeds. We do not anticipate any significant reduction in reproduction from this action.
- Adverse effects are expected to be rare and treatments will not result in a significant direct mortality to Oregon chub. In rare circumstances, treatments may produce excessive sediment and increase turbidity in occupied habitat. This may adversely affect the chub's ability to see and capture prey, potentially resulting in a minor loss of individuals, leading to small localized reductions. However, these small losses are not anticipated to have lasting effect on chub numbers.
- We do not anticipate the loss of any population or a reduction in distribution of Oregon chub. This species occurs in Oregon in about 30 locations in the Willamette Basin. Although some limited activities may occur adjacent to occupied habitat of Oregon chub, distribution on U.S. Forest Service lands are restricted to five of the 30 populations. While most of these areas contain some of the highest population levels known to Oregon chub, these locations represent only a small segment of the range for this species. We do not anticipate any change in distribution as a result of this action.

Therefore, the U.S. Forest Service Pacific Northwest Region Invasive Plant Program is not anticipated to reduce the reproduction, numbers, or distribution of Oregon chub.

***Bull Trout (Coastal/Puget Sound, Columbia River, and Klamath DPS)***

*Coastal/Puget Sound DPS*

The Invasive Plant Program will not jeopardize the continued existence of the Coastal/Puget Sound DPS by, directly or indirectly, reducing appreciably the likelihood of survival and recovery of the Coastal/Puget Sound DPS in the wild by reducing the reproduction, numbers, or distribution of the DPS.

- Loss of eggs, fry, or spawning habitat is expected to be very rare, confined to one or few redds, and scattered throughout any one watershed. In rare circumstances, treatments may produce excessive sediment into occupied spawning habitat which may smother eggs, or people or animals may inadvertently step on eggs when operating in occupied spawning habitat when redds are present. The duration of this activity would be temporary, and effects would be localized and confined to a

small footprint. We do not anticipate any significant reduction in the reproduction from this action.

- Adverse effects are expected to be rare and treatments will not result in a significant direct mortality to the Coastal/Puget Sound DPS. In rare circumstances, treatments may produce excessive sediment into occupied spawning habitat which may smother fry, potentially resulting in loss of individuals. On rare occasions, people or animals could be present in occupied spawning habitat, which may inadvertently step on fry or result in harassment to a few older individuals. These actions could lead to small localized reductions in the numbers of bull trout. However, these small losses are not anticipated to have lasting effect on bull trout numbers.
- We do not anticipate the loss of any local population or a reduction in distribution of the Coastal/Puget Sound DPS. Only 15 percent of the DPS is on National Forest land in the Pacific Northwest Region. Treatments that may affect bull trout or their habitat are anticipated to be short term and we do not anticipate that any populations would be significantly affected. Although some limited activities may occur adjacent to occupied habitat of the Coastal/Puget Sound DPS, current invasive plant inventories indicate westside Forests within the Pacific Northwest Region contain relatively the few acres of weed infestations, within the project area, therefore, reducing the likelihood of overlap between projects and occupied habitat. We do not anticipate any change in distribution as a result of this action.

Therefore, the U.S. Forest Service Pacific Northwest Region Invasive Plant Program Plan is not anticipated to reduce the reproduction, numbers, or distribution of the Coastal/Puget Sound DPS.

#### *Columbia River DPS*

The Invasive Plant Program will not jeopardize the continued existence of the Columbia River DPS, by directly or indirectly reducing appreciably the likelihood of survival and recovery of the Columbia River DPS in the wild by reducing the reproduction, numbers, or distribution of the DPS.

- Loss of eggs, fry, or spawning habitat is expected to be very rare, and confined to one or few redds and scattered throughout any one watershed. In rare circumstances, treatments may produce excessive sediment into occupied spawning habitat which may smother eggs, or people or animals may inadvertently step on eggs when operating in occupied spawning habitat when redds are present. The duration of this activity would be temporary, and effects would be localized and confined to a small footprint. We do not anticipate any significant reduction in the reproduction from this action.
- Adverse effects are expected to be rare and treatments will not result in a significant direct mortality to the Columbia River DPS. In rare circumstances, treatments may produce excessive sediment into occupied spawning habitat which

may smother fry, potentially resulting in loss of individuals. On rare occasions, people or animals could be present in occupied habitat, which may inadvertently step on fry or result in harassment to a few older individuals. These actions could lead to small localized reductions in the number of bull trout. However, these small losses are not anticipated to have lasting effect on bull trout numbers.

- We do not anticipate the loss of any local population or a reduction in distribution of the Columbia River DPS. National Forests in Oregon and Washington are within the action area, as is a small section of the Wallowa Whitman National Forest (Hells Canyon) in Idaho. While National Forest land contain some of the best spawning and rearing habitat for bull trout and are important areas to the recovery of this DPS, the majority of occupied habitat occurs off the Pacific Northwest Region U.S. Forest Service land (88 percent). Therefore, these locations represent only a small segment of the range of this DPS. Treatments that may affect bull trout or their habitat are anticipated to be short term and we do not anticipate that any populations would be significantly affected. Although some limited activities may occur adjacent to occupied habitat of the Columbia River DPS, and a greater proportion of this DPS occurs on the eastside of Oregon and Washington where the highest density of weed infestation occurs, compared to the Klamath DPS or Coastal/Puget Sound DPS, the likelihood of overlapping projects and occupied habitat for this DPS is still small. We do not anticipate any change in distribution as a result of this action.

Therefore, the U.S. Forest Service Pacific Northwest Region Invasive Plant Program Plan is not anticipated to reduce the reproduction, numbers, or distribution of the Columbia River DPS.

#### *Klamath River DPS*

The Invasive Plant Program will not jeopardize the continued existence of the Klamath River DPS, by directly or indirectly reducing appreciably the likelihood of survival and recovery of the Klamath River DPS in the wild by reducing the reproduction, numbers, or distribution of the DPS.

- Loss of eggs, fry, or spawning habitat is expected to be very rare, and confined to one or few redds and scattered throughout any one watershed. In rare circumstances, treatments may produce excessive sediment into occupied spawning habitat which may smother eggs, or people or animals may inadvertently step on eggs when operating in occupied spawning habitat when redds are present. The duration of this activity would be temporary, and effects would be localized and confined to a small footprint. We do not anticipate any significant reduction in the reproduction from this action.
- Adverse effects are expected to be rare and treatments will not result in a significant direct mortality to the Klamath River DPS. In rare circumstances, treatments may produce excessive sediment into occupied spawning habitat which may smother eggs, potentially resulting in a loss of individuals. On rare

occasions, people or animals could be present in occupied habitat, which may inadvertently step on or result in harassment to a few older individuals. These actions could lead to small localized reductions. However, these small losses are not anticipated to have lasting effect on bull trout numbers.

- We do not anticipate the loss of any local population or a reduction in distribution of the Klamath River DPS. While National Forest land contain some of the best spawning and rearing habitat for bull trout and are important areas to the recovery of this DPS, the majority of occupied habitat occurs off the Pacific Northwest Region U.S. Forest Service land (61 percent), representing greater than half of their range. Treatments that may affect bull trout or their habitat are anticipated to be short term and we do not anticipate that any populations would be significantly affected. Although some limited activities may occur adjacent to occupied habitat of the Klamath River DPS, current invasive plant inventories show only about 250 acres of invasive plants within 300 feet of the water on National Forest land in the entire Oregon Closed Basins watershed, greatly reducing the likelihood of overlap between projects and occupied habitat. We do not anticipate any change in distribution as a result of this action.

Therefore, the U.S. Forest Service Pacific Northwest Region Invasive Plant Program Plan is not anticipated to reduce the reproduction, numbers, or distribution of the Klamath River DPS.

***Bull Trout (Coastal/Puget Sound, Columbia River, and Klamath DPS) Critical Habitat***

The Invasive Plant Program will not destroy or adversely modify critical habitat by, directly or indirectly, appreciably diminishing the value of proposed bull trout critical habitat for Coastal/Puget Sound DPS and designated bull trout critical habitat for the Columbia River DPS and the Klamath River DPS.

- Project activities will have only localized and limited short-term effects on food supply and substrate due to the potential for increased herbicide and sediment to enter the stream channel.
- It is unlikely that potential effects will measurably affect bull trout habitat or food supply within or downstream of the Invasive Plant Program in the long term.
- Although the Invasive Plant Program has the potential to adversely affect bull trout critical habitat, the adverse affects to primary constituent elements 4 and 8 resulting from the Invasive Plant Program will be short-term, will not permanently alter or destroy the quality or function of the habitat or food supply at the local scale, and remain functional to maintain the conservation role of the critical habitat for the Columbia DPS and Klamath DPS, and proposed critical habitat for the Coastal/Puget Sound DPS.

Therefore, the U.S. Forest Service Pacific Northwest Region Invasive Plant Program Plan is not anticipated to adversely affect any of the physical or biological features that were the basis for determining the habitat to be critical and will maintain the conservation role of proposed critical habitat for the Coastal/Puget Sound DPS, and designated critical habitat for the Klamath River DPS, and Columbia River DPS.

## **SUMMARY OF THE CONSERVATION RECOMMENDATIONS**

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

### **Terrestrial Animals**

#### ***Bald Eagle***

Conduct treatments in the vicinity of bald eagle nest sites outside of the breeding season (January through August) where practicable. Avoid treatments within 0.25 miles (0.5 line of sight) of nests during the breeding season, when practicable.

#### ***Spotted Owl***

Schedule treatments involving heavy equipment or other high-noise techniques to avoid the nesting season when within the proximity of know nesting spotted owls or unsurveyed suitable nesting habitat, where practicable.

Conduct surveys in unsurveyed suitable nesting habitat to determine presence of species in treatment areas where extensive heavy machinery or other high-noise techniques are to be used, where practicable. Surveys would only need to include areas within 0.25 miles of the activity and only in nesting quality habitat.

#### ***Marbled Murrelet***

Ensure that treatment areas in or near marbled murrelet habitat are free of trash during and following treatments to avoid attracting predators.

Conduct surveys, as practicable, when activities will result in noise above ambient levels and occur within 35 to 45yards of unsurveyed marbled murrelet habitat

When treating in occupied or unsurveyed suitable murrelet habitat, time treatments to avoid the nesting season (April to September) and feeding times (the 2 hours after sunrise and 2 hours before sunset) where possible.

#### ***Western Snowy Plover***

Where practicable, avoid treatments in or near snowy plover habitat during the nesting season (March through August).

If treatments are conducted during the snowy plover nesting season, have a biologist present on site during treatments in occupied snowy plover habitat to assist in location and avoidance of nests.

### ***Oregon Silverspot Butterfly***

Conduct trials with sethoxydim in unoccupied butterfly habitat to determine the effectiveness in treating invasive grasses with minimal impacts to the early blue violet. If sethoxydim proves successful, consider utilizing this tool to treat invasive grass in occupied butterfly habitat.

Avoid herbicide treatment of a large portion of a single Oregon silverspot butterfly population in a given year, unless sethoxydim (grass-specific herbicide) is proven to not be harmful to the butterfly or its host plant.

Avoid the use of glyphosate in butterfly habitat, due to its potential toxicity to Oregon silverspot butterflies.

### **Plants**

Use non-persistent herbicides in known habitat of listed plants, where possible. This will likely reduce the risk of effects to dormant individuals.

Where practicable, schedule applications to coincide with the most period of dormancy for the species, this would minimize the chances for exposure.

Where downslope movement of persistent herbicide is possible during runoff events, consider the use of an herbicide such as imazapic, which has less potential for soil residual effects. This herbicide is more selective than glyphosate, which has less potential for soil residual effects and greater potential to impact non-target plants. Potential exposure through runoff would be reduced and the native plant community would be less affected.

To minimize potential effects to the primary pollinators for MacFarlane's four o'clock and Spalding's catchfly, consider avoiding the direct spraying of glyphosate in the proximity of these listed plants during the blooming period on plant species used by bumblebees or where pollinators of the listed species are unknown. While the U.S. Forest Service analysis did not find that glyphosate was likely to reach toxic levels for bees, it represents the highest potential of all the herbicides and the U.S. Forest Service did indicate some concern in their discussion of general effects to plants.

***Showy Stickseed***, in addition to the above as applicable

During manual or chemical treatments, limit the number, routes, and locations of people at the site. Direct ingress and egress through unoccupied or rocky areas to limit effects to showy stickseed habitat .

If they are ever found to occupy the same site as showy stickseed, clip the flower heads and pull new seedlings of invasive plants where practicable to limit soil disturbance.

### **Aquatic Animals**

If manual or mechanical treatments require working in the water when listed fish or redds are present, survey the area prior to the activity to identify the location of presence of fish and/or redds. Mark the locations or have the fish biologist on site during the activity to avoid redds and minimize impacts, when possible.

To reduce adverse effects from manual or mechanical treatments within riparian areas that may disturb bull trout, Lost River sucker or shortnose sucker eggs, observe in-water work period as designated by the State for the area in which they occur, where possible.

Choose or modify techniques for treating invasive plants in riparian areas that minimize the potential deliver of herbicides or sediment to the streams or ponds. Consider establishing buffers for treatments with a potential to directly deliver herbicides to streams or ponds with Oregon chub or bull trout populations (e.g. broadcast spray).

***Oregon chub***, in addition to the above

Employ extra care in treatments that may increase sediment and herbicide in areas adjacent to, or that feed into, occupied Oregon chub habitat. These slack-water habitats are more susceptible to sedimentation and chemical effects than running water systems.

Continue to support the ongoing reintroduction programs for the Oregon chub. Increasing the number of stable populations will reduce the risk of loss of the species if individual populations are affected.

### **REINITIATION NOTICE**

This concludes formal consultation on the U.S. Forest Service Pacific Northwest Region Invasive Plant Program Plan. Reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (2) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or (3) a new species is listed or critical habitat designated that may be affected by the action.

## **INCIDENTAL TAKE STATEMENT**

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. Harm is further defined by Service regulations to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering (50 CFR 17.3). Harass is defined by Service regulations as intentional or negligent actions that create the likelihood of injury to listed wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering (50 CFR 17.3). Incidental take is defined as take that is incidental to, and not the purpose of, carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of an Incidental Take Statement.

### **Amount or Extent of Take**

In the preceding document we determined that there is some potential for adverse biological effects that could rise to the level of incidental take for the bald eagle, northern spotted owl, marbled murrelet, western snowy plover (coastal population), Lost River sucker, shortnose sucker, Oregon chub, bull trout (Coastal/Puget Sound, Columbia River, and Klamath distinct population segments) and Oregon silverspot butterfly associated with future invasive plant projects prepared under this plan. However, we are unable to determine, at the plan level, the likelihood or quantity of such effects that may conform to the regulatory definition of take. Therefore, any such incidental take will be addressed through future sub-regional, National Forest level, or project-specific consultations.

## LITERATURE CITED

- Amsberry, K, and R. J. Meinke. 2002. Reproductive ecology of *Fritillaria gentneri*. Unpublished report prepared for the U.S. Fish and Wildlife Service and the Medford Bureau of Land Management, Medford, Oregon. 40 pp.
- Andreasen, J.K. 1975. Systematics and status of the Family Catostomidae in southern Oregon. Ph.D. Thesis, Oregon State University, Corvallis, Oregon. 76 pp.
- Anthony, R.G., E.D. Forsman, A.B. Franklin, D.R. Anderson, K.P. Burnham, G.C. White, C.J. Schwarz, J. Nichols, J.E. Hines, G.S. Olson, S.H. Ackers, S. Andrews, B.L. Biswell, P.C. Carlson, L.V. Diller, K.M. Dugger, K.E. Fehring, T.L. Fleming, R.P. Gerhardt, S.A. Gremel, R.J. Gutiérrez, P.J. Happe, D.R. Herter, J.M. Higley, R.B. Horn, L.L. Irwin, P.J. Loschl, J.A. Reid, and S.G. Sovern. 2004. Status and trends in demography of northern spotted owls, 1985-2003. Final Report to the Interagency Regional Monitoring Program, Portland, Oregon. September 2004. 179pp.
- Anthony, R.G., R.J. Steidl, and K. McGarigal. 1995. Recreation and bald eagles in the Pacific Northwest. pp. 223-241, in R.L. Knight and K. J. Gutzwiller. Wildlife and Recreationists: coexistence through management and research. Island Press, Washington, D.C. 372 pp.
- Barbour, M.G. and J. Major. 1990. Terrestrial vegetation of California. California Native Plant Society. Special Publication Number 9, University of Davis, CA. 1028pp.
- Barnes, J.L. 1996. Reproductive ecology, population genetics, and clonal distribution of the narrow endemic: *Mirabilis macfarlanei* (Nyctaginaceae). Masters thesis, Utah State University, Logan, Utah.
- Barnes, J.L., P.G. Wolf, and V.J. Tepedino. 1994. Genetic diversity and gene flow: implications for the rare plant, *Mirabilis macfarlanei* (Nyctaginaceae). Department of Biology, Utah State University, Logan, Utah.
- Barnes, J.L., P.G. Wolf, and V.J. Tepedino. 1995. Genetic diversity and gene flow, and clonal structure of the Salmon River populations of MacFarlane's Four-o'clock, *Mirabilis macfarlanei* (Nyctaginaceae). Cooperative Challenge Cost Share project, Utah State University, Bureau of Land Management. 63 pp.
- Barnes, M. 2004. Habitat Variation and Experimental Management of Kincaid's Lupine. Bulletin of the Native Plant Society of Oregon 37(9):95//102 - 103.  
Rec #: 6151 3 pp.
- Barrowclough, G.F. and R.J. Gutierrez. 1990. Genetic variation and differentiation in the spotted owl. Auk 107:737-744.

- Batt, P.E. 1996. State of Idaho bull trout conservation plan. Office of the Governor, Boise, ID. 20pp.
- Baxter, C.V., C.A. Frissell, and F.R. Hauer. 1999. Geomorphology, Logging Roads, and the Distribution of Bull Trout Spawning in a Forested River Basin: Implications for Management and Conservation. Transactions of the American Fisheries Society 128:854-867.
- Baxter, J.S., and J.D. McPhail. 1999. The influence of redd site selection, groundwater upwelling, and over-winter incubation temperature on survival of bull trout (*Salvelinus confluentus*) from egg to alevin. Canadian Journal of Zoology 77:1233-1239.
- Begon, M., and M. Mortimer. 1986. Population Ecology: A Unified Study of Animals and Plants. Blackwell Scientific Publications, Cambridge, MA. 220 pgs.
- Beissinger, S.R. 1995. Population trends of the marbled murrelet projected from demographic analyses. pages 385-393. In Ralph, C.J., G.L. Hunt jr., M.G. Raphael, J.F. Piatt, tech. eds. 1995. Ecology and conservation of the marbled murrelet. Gen. Tech. Rep. PSW-GTR-152. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture. 420pp.
- Benner, Barbara. 1993. in litt. Bureau of Land Management, Spokane, Washington. *In Hill and Gray 2004*. Letter to Edna Rey-Vizgirdas (Fish and Wildlife Service) dated 11 April 1995. Administrative record of the Fish and Wildlife Service, Snake River Basin Fish and Wildlife Office, Boise, Idaho. 1 pp
- Benner, Barbara. 2003a. in litt. Bureau of Land Management, Spokane, Washington. *In Hill and Gray 2004*. Letter to Janice Hill (via email dated 13 November, 2003). Notes and "to do" list from the *Silene spaldingii* meeting on October 28, 2003.
- Benner, Barbara. 2003b. in litt. Bureau of Land Management, Spokane, Washington. *In Hill and Gray 2004*. Letter to Janice Hill (via email dated 6 May, 2003). Questionnaire. 7 pp.
- Beschta, R.L., R.E. Bilby, G.W. Brown, L.B. Holtby, and T.D. Hofstra. 1987. Stream temperature and aquatic habitat: fisheries and forestry interactions. Pages 191-232 in E.D. Salo and T.W. Cundy (eds). Streamside Management Forestry and Fisheries Interactions. Institute of Forest Resources, University of Washington, Seattle, Washington, Contribution No. 57. 232 pp.
- Bienz, C.S. and J.S. Ziller. 1987. Status of three lacustrine sucker species (Catostomidae). Report to the U.S. Fish and Wildlife Service, Sacramento, California. 24 pp.

- Blakesley, J.A., Franklin, A.B., and R.J. Gutierrez. 1992. Spotted owl roost and nest site selection in northwestern California. 1992. *Journal of Wildlife Management*, 56(2): 388-392.
- Boag, T.D. 1987. Food habits of bull char, *Salvelinus confluentus*, and rainbow trout, *Salmo gairdneri*, coexisting in a foothills stream in northern Alberta. *Canadian Field-Naturalist* 101: 56-62.
- Bond, C.E. 1992. Notes on the nomenclature and distribution of the bull trout and the effects of human activity on the species. Pages 1-4 in P.J. Howell, and D.V. Buchanan (eds). *Proceedings of the Gearhart Mountain Bull Trout Workshop*, Oregon Chapter of the American Fisheries Society, Corvallis, Oregon. 4 pp.
- Boulanger, J. G., K. Martin, G. Kaiser, and A. E. Derocher. 1996. Evaluating uncertainty in estimating population trends of marbled murrelets. Pages 53-63 in A. W. Diamond and A. W. Nettleship, editors: *Biology and conservation of forest birds*. Society of Canadian Ornithologists, Fredericton, New Brunswick, Canada.
- Brewin, P.A., M.K. Brewin, and M. Monita. 1997. Distribution maps for bull trout in Alberta. Pages 206-216 in W.C. Mackay, M.K. Brewin, and M. Monita (eds). *Friends of the Bull Trout Conference Proceedings*. Bull Trout Task Force (Alberta), c/o Trout Unlimited Calgary, Alberta, Canada. 216 pp.
- Brock 1987. The ecology of *Lomatium cookii*, an endangered species of the Rogue Valley, Oregon. The Nature Conservancy, Oregon Field Office, Portland, Oregon. 19 pp. Cited in USFWS 2002. *Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for Lomatium cookii (Cook's Lomatium) and Limnanthes floccosa ssp. grandiflora (Large-Flowered Woolly Meadowfoam) From Southern Oregon*. Final Rule. November 7, 2002. 67 FR 68003.
- Brock, Richard and R. Callagan. 2000. Site review of *Fritillaria gentneri* on BLM lands. 2000 report. 22 pp.
- Brock, Richard and R. Callagan. 2001. Site review of *Fritillaria gentneri* on BLM lands, 2001 Report. Siskiyou Biosurvey LLC. Ashland, Oregon. 34 pp.
- Brown, L.G. 1992. On the zoogeography and life history of Washington native char Dolly Varden (*Salvelinus malma*) and bull trout (*Salvelinus confluentus*). Washington Department of Wildlife, Fisheries Management Division Report, Olympia, Washington. 104 pp.
- Buchanan, D.M., and S.V. Gregory. 1997. Development of water temperature standards to protect and restore habitat for bull trout and other cold water species in Oregon. Pages 1-8 in W.C. Mackay, M.K. Brewin and M. Monita (eds). *Friends of the Bull Trout Conference Proceedings*. Bull Trout Task Force(Alberta), c/o Trout Unlimited Calgary, Alberta, Canada.

- Buchanan, D.V., M.L. Hanson, and R.M. Hooton. 1997. Status of Oregon's bull trout. Oregon Department of Fish and Wildlife, Portland, Oregon. 168 pp.
- Buehler, D. A. 2000. Bald Eagle (*Haliaeetus leucocephalus*). In The Birds of North America, No. 506 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA. 40 pp.
- Buettner, M. 1997. Upper Klamath Lake fish die-off, 3rd consecutive year - 1997. Report to Bureau of Reclamation, Klamath Falls, Oregon, 29 September 1997. 7 pp.
- Buettner, M. and G. Scopettone. 1990. Life history and status of catostomids in Upper Klamath Lake, Oregon. U.S. Fish and Wildlife Service Completion Report. 108pp.
- Buettner, M. and G. Scopettone. 1991. Distribution and information on the taxonomic status of the shortnose sucker *Chasmistes brevirostris* and Lost River sucker *Deltistes luxatus* in the Klamath River Basin, California. U.S. Fish and Wildlife Service, Seattle National Research Center-Reno Substation. 101 pp.
- Bureau of Land Management. 1995a. Coos Bay Shorelands, Final Management Plan. 25pp. plus map.
- Bureau of Land Management. 1995b. The New River Area of Critical Concern Management Plan. 149pp.
- Bureau of Reclamation. 1996. Biological assessment of PacifiCorp and The New Earth Company operations associated with the Klamath Project. Klamath Falls, Oregon. 52 pp.
- Bureau of Reclamation. 2000a. Radio telemetry studies of adult Shortnose and Lost River suckers in Upper Klamath Lake and tributaries, Oregon. Unpublished report. U.S. Bureau of Reclamation, Klamath Basin Area Office, Klamath Falls, Oregon. 4 pp.
- Bureau of Reclamation. 2000b. Analysis of Tule Lake water quality and sucker telemetry, 1992-1995. Unpublished report. U.S. Bureau of Reclamation, Klamath Basin Area Office, Klamath Falls, Oregon. 58 pp.
- Burger, A. E. 2002. Conservation assessment of marbled murrelets in British Columbia, a review of biology, populations, habitat associations and conservation. Pacific and Yukon Region, Canadian Wildlife Service. 168 pages.
- Burkey, T.V. 1989. Extinction in nature reserves: the effect of fragmentation and the importance of migration between reserve fragments. *Oikos* 55:75-81.

- Burkey, T.V. 1995. Extinction rates in archipelagoes: Implications for populations in fragmented habitats. *Conservation Biology* 9: 527-541.
- Caffrey, C. 2003. Determining impacts of West Nile Virus on crows and other birds. *American Birds* (103rd Count) 57:14-21.
- California Department of Fish and Game. 1993. Lost River and shortnose sucker life history and population dynamics in Clear and Tule Lakes, California. Progress Rept. 1. Contract Number FG1610. 5 pp.
- Caplow, F. 2001. Annual report for Spalding's Catchfly (*Silene spaldingii*) on Fairchild AFB, Washington. Washington State Department of Natural Resources, Natural Heritage Program, Olympia, Washington. 11 pp., with appendix.
- Caplow, F. 2004. May Field Report for *Hackelia venusta*. Washington Department of Natural Resources. 4 pp.
- Castelein, K.A., D.J. Lauten, L.N. Renan, S.R. Pixley, and M.A. Stern. 2001. The distribution and reproductive success of the western snowy plover along the Oregon coast - 2001. The Oregon Natural Heritage Program. Portland, Oregon. Unpublished report. 52pp.
- Castelein, K.A., D.J. Lauten, S.R. Pixley, L.N. Renan, M.A. Stern, and C. Grinnell. 2002. The distribution and reproductive success of the western snowy plover along the Oregon coast - 2002. The Oregon Natural Heritage Program. Portland, Oregon. Unpublished report. 54pp.
- Cavender, T.M. 1978. Taxonomy and distribution of the bull trout, *Salvelinus confluentus* (Suckley), from the American northwest. *California Fish and Game* 64:139-174.
- Chamberlain, T. W., R. D. Harr, and F. H. Everest. 1991. Timber harvesting, silviculture and watershed processes. Pages 181-205 in W. R. Meehan (ed). Influences of forest and rangeland management on salmonid fishes and their habitats. American Fisheries Society Special Publication 19.
- Clark, D., P. Hammond, D. Johnson, T. Kaye, B. Kelpsas, F. Pfund, M. Vomocil, and M. Wilson. 2003. Final Report: Control of *Brachypodium sylvaticum* and restoration of rare native upland prairie habitat at Butterfly Meadows, Benton County. ODA-1342-GR. Unpub. report submitted to Oregon Dept. of Agriculture, Salem, OR. 25 pp.
- Cole, G.F. 1972. Preservation and management of grizzly bears in Yellowstone National Park. Pp. 274-288 in S. Herrero, ed. Bears – their biology and management. IUCN Publ. New Series 23.

- Coombs, C.I., C.E. Bond, and S.F. Drohan. 1979. Spawning and early life history of the Warner sucker (*Catostomus warnerensis*). Unpublished report to the U.S. Fish and Wildlife Service. 52pp.
- Cooperman, M.S. in litt., 2002. Clarification of the role of submergent macrophytes to larval shortnose and Lost River suckers in the Williamson River and Upper Klamath Lake. Comments sent to the National Research Council, Committee on Endangered and Threatened Fishes in the Klamath Basin, March 7, 2002. 3 pp.
- Cooperman, M. and D.F. Markle. 2000. Ecology of Upper Klamath Lake Shortnose and Lost River suckers. 2. Larval Ecology of Shortnose and Lost River suckers in the Lower Williamson River and Upper Klamath Lake. Oregon State University, Department of Fisheries and Wildlife, Corvallis, Oregon. 26 pp.
- Courtney, S.P., J.A. Blakesley, R.E. Bigley, M.L. Cody, J.P. Dumbacher, R.C. Fleischer, A.B. Franklin, J.F. Franklin, R.J. Gutiérrez, J.M. Marzluff, L. Sztukowski. 2004. Scientific evaluation of the status of the northern spotted owl. Sustainable Ecosystems Institute. Portland, Oregon. September 2004.
- Craig, D.P., M.A. Stern, K.A. Mingo, D.M. Crain, and G.A. Rosenberg. 1992. Reproductive ecology of the western snowy plover on the south coast of Oregon. Submitted to Oregon Department of Fish and Wildlife, Roseburg, OR, and Coos Bay District, Bureau of Land Management, North Bend, OR. 13 pp plus tables and maps.
- Craig, S.D., and R.C. Wissmar. 1993. Habitat conditions influencing a remnant bull trout spawning population, Gold Creek, Washington (draft report). Fisheries Research Institute, University of Washington. Seattle, Washington. 44 pp.
- Crawford, R., in litt. 2003 Washington Natural Heritage Program, Olympia, Washington. Letter to Janice Hill (via email from Florence Caplow, dated 23 July 2003) edits on draft conservation strategy report.
- Cunningham, M.E., R. Shively and E. Janney. 2002. Monitoring of Lost River and shortnose suckers in the lower Williamson River, Oregon: Annual report 2001. In Monitoring of adult Lost River and shortnose suckers in the Upper Klamath Basin, 2001. Draft annual report (February 2002) of research to the U.S. Bureau of Reclamation, Mid-Pacific Region, Klamath Area Office. 134 pgs. Contract #00AA200049.
- D'Antonio, C.M., and P.M. Vitousek. 1992. Biological invasions by exotic grasses, the grass/fire cycle, and global change. *Annu. Rev. Ecol. Syst.* 23:63-87.
- Dambacher, J.M., M.W. Buktenica, and G.L. Larson. 1992. Distribution, abundance, and habitat utilization of bull trout and brook trout in Sun Creek, Crater Lake National Park, Oregon. p. 30-36 *In*: P.J. Howell and D.V. Buchanan, editors.

Proceedings of the Gearhart Mountain bull trout workshop. Oregon Chapter of the American Fisheries Society, Corvallis.

- Daubenmire, R. 1968. Forest vegetation of eastern Washington and northern Idaho. Washington State University, Washington Agricultural Experiment Station, College of Agriculture, Pullman, Washington. 104 pp.
- Daubenmire, R. 1970. Steppe vegetation of Washington. Technical Bulletin 62. Washington State University, Washington Agricultural Experiment Station, College of Agriculture, Pullman, Washington. 131 pp.
- Davis, B. and R. Miller. 1967. Brain patterns in minnows of the genus *Hybopsis* in relation to feeding habits and habitats. *Copeia* 1967:1-39.
- DeLoach, C.J. 1991. Past successes and current prospects in biological control of weeds in the United States and Canada. *Natural Areas Journal* 11(3): 1829-34
- Desjardins, M. and D.F. Markle. 2000. Distribution and biology of suckers in Lower Klamath Reservoirs. 1999 Final report submitted to PacifiCorp, Portland, Oregon. 69 pp.
- Divoky, G.J. and M. Horton. 1995. Breeding and natal dispersal, nest habitat loss and implications for marbled murrelet populations. Pages 83-87 in C.J. Ralph, G.L. Hunt, M.G. Raphael, and J.F. Piatt (eds.). *Ecology and conservation of the marbled murrelet*. General Technical Report. PSW-GTW-152. Pacific Southwest Experimental Station, USDA Forest Service, Albany, California. 420 pp.
- Donald, D.B., and D.J. Alger. 1993. Geographic distribution, species displacement, and niche overlap for lake trout and bull trout in mountain lakes. *Canadian Journal of Zoology* 71:238-247.
- Dunbar, D. L., B. P. Booth, E. D. Forsman, A. E. Hetherington, and D. J. Wilson. 1991. Status of the spotted owl, *Strix occidentalis*, and barred owl, *Strix varia*, in southwestern British Columbia. *Canadian Field Naturalist* 105:464-468.
- Dunham, J.B., and B.E. Rieman. 1999. Metapopulation structure of bull trout: Influences of physical, biotic, and geometrical landscape characteristics. *Ecological Applications* 9:642-655.
- Dunsmoor, L. 1993. Laboratory studies of fathead minnow predation on Catostomid larvae. Klamath Tribes research report KT-93-01. 16 pp.
- Dunsmoor, L., and C. Bienz. in litt.,. 1997. Comments on the proposed rule to list bull trout in the Klamath River and Columbia River from Klamath Tribe to Robert Ruesink, Fish and Wildlife Service, Boise, Idaho. 6p.

- Dunsmoor, L., L. Basdekas, B. Wood, and B. Peck. 2000. Quantity, composition, and distribution of emergent vegetation along the Lower River and Upper Klamath Lake shorelines of the Williamson River Delta, Oregon. Completion report. Klamath Tribes, Chiloquin, Oregon and U.S. Bureau of Reclamation, Klamath Basin Area Office, Klamath Falls, Oregon. 27 pp.
- Evans, H.F. 1960. A preliminary investigation of caribou in the northwestern United States. M.S. Thesis, Montana State Univ., Missoula. 145pp.
- Fertig, Walter. 2000. Status Review of the Ute Ladies' Tresses (*Spiranthes diluvialis*) in Wyoming. Wyoming Natural Diversity Database, University of Wyoming, Laramie, WY 17 pp.
- Folmar, L.C., Sanders, H.O., and Julin, A.M. 1979. Toxicity of the herbicide glyphosate and several of its formulations to fish and aquatic invertebrates. Arch. Environ. Contam. Toxicol. 8(3): p.269-78.
- Forsman, E.D., Meslow, E.C., Wight, H.M. 1984. Distribution and biology of the spotted owl in Oregon. Wildlife Monographs, 87:1-64.
- Fraley, J.J., and B.B. Shepard. 1989. Life history, ecology and population status of migratory bull trout (*Salvelinus confluentus*) in the Flathead Lake and river system, Montana. Northwest Science 63:133-143.
- Franklin, A. B., K. P. Burnham, G. C. White, R. J. Anthony, E. D. Forsman, C. Schwarz, J. D. Nichols, and J. Hines. 1999. Range-wide status and trends in northern spotted owl populations. U.S. Geological Survey, Colorado and Oregon Cooperative Fish and Wildlife Research Units, Fort Collins, CO and Corvallis, OR. 71 pp.
- Franklin, A.B., Anderson, D.R., Gutiérrez, R.J., and K.P. Burnham. 2000. Climate, habitat quality, and fitness in northern spotted owl populations in northwestern California. Ecological Monographs, 70(4): 539-590.
- Franklin, I.R. 1980. Evolutionary change in small populations. *in*. Conservation Biology: an evolutionary-ecological perspective, M.E. Soule and B.A. Wilcox, eds., pp 135-149. Sinauer Assoc., Sunderland, MA.
- Franson, J.C., L. Sileo, N.J. Thomas. 1995. Causes of eagle deaths. *in* LaRoe, E.T., G.S. Farris, C.E. Puckett, P.D. Doran and M.J. Mac, eds. Our living resources: a report to the nation on distribution, abundance and health of U.S. plants, animals and ecosystems. U.S. Department of the Interior, National Biological Service, Washington D.C. 530 pp.

- Fraser, J.D., L.D. Frenzel and J.E. Mathisen. 1985. The impact of human activities on breeding bald eagles in north-central Minnesota. *Journal of Wildlife Management* 49:585-592.
- Frissell, C.A. 1997. A spatial approach to species viability: Conservation of fishes in the Columbia River Basin. Biological Station Open File Report Number 101-97. Flathead Lake Biological Station, University of Montana, Polson, MT. 23 pp.
- Furniss, M.J., T.D. Roelofs, and C.S. Yee. 1991. Road construction and maintenance. *American Fisheries Society Special Publication* 19:297-323.
- Gamon, J. 1991. Report on the status of *Silene spaldingii* Wats. in Washington. Prepared for Washington State Department of Natural Resources. Unpublished report prepared by the Natural Heritage Program, Olympia, Washington. 53 pp.
- Gamon, J.G. 1997. Report on the status of *Hackelia venusta* (Piper) St. John. Washington 38 pp.
- Garmendia, A.E., Van Kruiningen, H.J., French, R.A., Anderson, J.F., Andreadis, T.G., Kumar, A. and A.B. West. 2000. Recovery and identification of West Nile virus from a hawk in winter. *Journal of Clinical Microbiology* 38:3110-3111.
- Gilbert, C.H. 1898. The fishes of the Klamath Basin. *Bull. U.S. Fish Comm.* 17(1897):I-13.
- Gilpin, M., in litt. 1997. Bull trout connectivity on the Clark Fork River, letter to Shelly Spalding, Montana Department of Fish, Wildlife and Parks, Helena, Montana. 5 pp.
- Goetz, F. 1989. Biology of the bull trout, *Salvelinus confluentus*, literature review. U.S. Department of Agriculture, U.S. Forest Service, Willamette National Forest, Eugene, Oregon. 54 pp.
- Golden, M.P. 1969. The Lost River sucker. *Oregon Game Comm. Admin. Report* No. 1-69.
- Gray, K. 2001. Early historical accounts of Canyon Grasslands and fire. *Sage Notes* 23:13-17.
- Grubb, T.G. and R.M. King. 1991. Assessing human disturbance of breeding bald eagles with classification tree models. *Journal of Wildlife Management* 55:500-511.
- Grubb, T.G., W.W. Bowerman, J.P. Giesy and G.A. Dawson. 1992. Responses of breeding bald eagles, *Haliaeetus leucocephalus*, to human activities in northcentral Michigan. *Canadian Field Naturalist* 106:443-453.

- Gutermuth, B., C. Watson, and J. Kelly. 2000b. Link River hydroelectric project (Eastside and westside powerhouses) Final entrainment study report. Cell Tech, Klamath Falls, Oregon and PacifiCorp Environmental Services, Portland, Oregon. 127 pp.
- Gutermuth, B., C. Watson, and R. Weider. 1999. Link River hydroelectric project - Eastside and westside powerhouses annual entrainment study report (March 1997 - July 1998). New Earth Corp., Klamath Falls, Oregon. 89 pp.
- Gutermuth, B., E. Pinkston, and D. Vogel. 2000. A-canal fish entrainment during 1997 and 1998 with emphasis on endangered suckers. Completion report. New Earth/Cell Tech, Klamath Falls, Oregon and Natural Resource Scientists, Inc., Red Bluff, California. 51 pp.
- Gutierrez, R. J., A. B. Franklin, and W. S. LaHaye. 1995. Spotted owl (*Strix occidentalis*). in: A. Poole and F. Gill, editors. The birds of North America, No. 179. The Academy of Natural Sciences and The American Ornithologists' Union, Washington, D.C. 28 pp.
- Hamer, J.D. 1974. Distribution, abundance, and management implications of the grizzly bear and mountain caribou in the Mountain Creek watershed of Glacier National Park, British Columbia. M.S. Thesis. Univ. of Calgary, Alberta. 164 pp.
- Hamer, T.E. and S.K. Nelson. 1995. Nesting chronology of the marbled murrelet. In Ralph, C.J., G.L. Hunt jr., M.G. Raphael, J.F. Piatt, tech. eds. 1995. Ecology and conservation of the marbled murrelet. Gen. Tech. Rep. PSW-GTR-152. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture. 420 pp.
- Hamer, J.D., S. Herrero, and R.T. Ogilvie. 1977. Ecological studies of the Banff National Park grizzly bear. Proj. Report 1978. 239 pp. as cited in US Fish and Wildlife Service 1993a
- Hamer, T.E., S.G. Seim, and K.R. Dixon. 1989. Northern spotted owl and northern barred owl habitat use and home range size in Washington: preliminary report. Washington Department of Wildlife, Olympia, Washington.
- Hamer, T. E., D.L. Hays, S.M. Senger, and E.D. Forsman. 2001. Diets of northern barred owls and northern spotted owls in an area of sympatry. *J. Raptor Res.* 35(3): 221-227.
- Hammond, P.C. 1998. Habitat management plan for the Oregon silverspot butterfly (*Speyeria zerene hippolyta*) at Camp Rilea, Clatsop County, Oregon. Oregon State Military Department, Oregon Army National Guard. 73 pp.

- Hammond, P.C. 2000. 2000 report of Oregon silverspot butterfly use of habitat management areas at Rock Creek-Big Creek on the Siuslaw National Forest. U.S. Department of Agriculture, Forest Service, Siuslaw National Forest. 14 pp.
- Hammond, P.C. and D.V. McCorkle. 1984. Ecological investigations of *Viola adunca*. U.S. Department of Agriculture, Forest Service, Siuslaw National Forest. 84 pp.
- Hammond, P.C., and D.V. McCorkle. 1991. 1991 Introduction of the Oregon silverspot butterfly (*Speyeria zerene hippolyta*) on Fairview Mountain. U.S. Department of Agriculture, Forest Service, Siuslaw National Forest. 14 pp.
- Hanski, I.A. and M.E. Gilpin. 1997. *Metapopulation Biology: ecology, genetics, and evolution*. Academic Press, San Diego, California. 512 pp.
- Hard, J. 1995. A quantitative genetic perspective on the conservation of intraspecific diversity. *American fisheries Society Symposium* 17:304-326.
- Hatch, D. 1997. Draft snowy plover management plan for Ocean Beach, Golden Gate National Recreation Area. 58pp. plus tables and appendices.
- Hayes, B.S. and R. Shively. 2001. Monitoring of Lost River and shortnose suckers at shoreline spawning areas in Upper Klamath Lake, Oregon. U.S. Geological Survey, BRD. Annual Report 2000. 40 pp.
- Hayes, B.S. and R. Shively. 2002. Monitoring of Lost River and shortnose suckers at shoreline spawning areas in Upper Klamath Lake, Oregon: Annual report 2001. *In: Monitoring of adult Lost River and shortnose suckers in the Upper Klamath Basin, 2001. Draft annual report (February 2002) of research to the U.S. Bureau of Reclamation, Mid-Pacific Region, Klamath Area Office.* 134 pp. Contract #00AA200049.
- Healy, M.C. and A. Prince. 1995. Scales of variation in life history tactics of Pacific salmon and the conservation of phenotype and genotype. *American Fisheries Society Symposium* 17:176-184.
- Henjum, M.G., J.R. Karr, D.L. Bottom, D.A. Perry, J.C. Bednarz, S.G. Wright, S.A. Beckwitt, and E. Beckwitt. 1994. Interim protection for late-successional forests, fisheries, and watersheds. National forests east of the Cascade Crest, Oregon, and Washington. A report to the Congress and President of the United States Eastside Forests Scientific Society Panel. American Fisheries Society, American Ornithologists Union Incorporated, The Ecological Society of America, Society for Conservation Biology, The Wildlife Society. *The Wildlife Society Technical Review* 94-2. 104 pp.

- Herter, D.R., and L.L. Hicks. 2000. Barred owl and spotted owl populations and habitat in the central Cascade Range of Washington. *Journal of Raptor Research* 34(4): 279-286.
- Hicks, L.A., D.M. Mauser, J. Beckstrand, and D. Thomson. 2000. Ecology of Shortnose and Lost River suckers in Tule Lake National Wildlife Refuge, California, Progress report, April - November 1999. Klamath Basin National Wildlife Refuges, Tulelake, California. 39 pp.
- Hill, J.L., and K.L. Gray. 2000. Conservation of Spalding's catchfly (*Silene spaldingii*) in the Lower Corral Creek Study Area, Garden Creek Ranch, Craig Mountain, Idaho - 1999 Field Season. Unpublished report on file at: The Nature Conservancy of Idaho Field Office, Sun Valley, Idaho. 18 pp., plus appendices.
- Hill, J.L. and K.L. Gray. 2004. Conservation Strategy for Spalding's catchfly (*Silene spaldingii* Wats.). Conservation Data Center, Idaho Department of Fish and Game, Boise, Idaho. 153 pp. plus appendices.
- Hitchcock, C.L., A. Cronquist, M. Ownbey, and J.W. Thompson. 1964. Vascular plants of the Pacific Northwest, Part 2: Salicaceae to Saxifragaceae. University of Washington Press, Seattle, Washington. 597 pp.
- Hjort, R., P. Hulett, L. LaBolle, and H. Li. 1984. Fish and invertebrates of revetments and other habitats in the Willamette River, Oregon. U.S. Army Eng. Waterways Exp. Sta. EWQOS Tech. Rep. E-84-9. 83 pp.
- Hoelscher, B., and T.C. Bjornn. 1989. Habitat, density and potential production of trout and char in Pend Oreille Lake tributaries. Project F-71-R-10, Subproject III, Job No. 8. Idaho Department of Fish and Game, Boise, Idaho. 60 pp.
- Holt, R. 1997. Upper Klamath Lake fish disease exam report. Oregon Department of Fish and Wildlife, Corvallis, Oregon. 10 pp.
- Hothem, R. L. and A. N. Powell. 2000. Contaminants in eggs of western snowy plovers and California least terns: Is there a link to population decline? *Bull. Environ. Toxicol.* (2000) 65:42-50.
- Howell and Buchanan. 1992. Proceedings of the Gearhart Mountain Bull Trout Workshop. Oregon Chapter of the American Fisheries Society, Corvallis, Oregon. 65 pp.
- Huff, M., P. Jodice, J. Baldwin, S. Miller, R. Young, K. Ostrom, C.J. Ralph, M. Raphael, C. Strong, C. Thompson, and G. Falxa. 2003. Marbled murrelet effectiveness monitoring northwest forest plan 2002 annual summary report. 27pp.
- Hill, J., in litt. 2003. *In* Hill and Gray 2004. Private ecological consultant. Deary, Idaho. Questionnaire.

- Jakober, M. 1995. Autumn and winter movement and habitat use of resident bull trout and west slope cutthroat trout in Montana. M.S. Thesis, Montana State University, Bozeman, Montana. 110 pp.
- Johnson, C.G., Jr. 1998. Vegetation response after wildfires in national forests of northeastern Oregon. R6-NR-ECOL-TP-06-98. U.S. Department of Agriculture, U.S. Forest Service, Pacific Northwest Region. 128 pp., plus appendices.
- Johnston, A. 2002. Northern spotted owl survey and monitor report. U.S. Department of Interior, National Park Service, Crater Lake National Park, Crater Lake, Oregon.
- Kagan, J. 1986. A new species of *Lomatium* (Apiaceae) from southwestern Oregon. *Madroño* 33(1): 71-75.
- Kagan, J. 1989. Draft species management guide for *Silene spaldingii*. Oregon Natural Heritage Data Base, Portland, Oregon. 10 pp., plus appendix.
- Kann, J. and W.W. Walker. 1999. Nutrient and hydrologic loading to Upper Klamath Lake, Oregon, 1991-1998. Report submitted to Klamath Tribes, Chiloquin, Oregon and the U.S. Bureau of Reclamation, Klamath Falls, Oregon. 48 pp.
- Kaye, T.N. 1992. Status report update for *Mirabilis macfarlanei*. Oregon Department of Agriculture, Conservation Biology program. 40 pp. plus maps.
- Kaye, T.N. 2000a. *Lomatium cookii*: Population Monitoring in the Illinois Valley, Josephine County, Oregon. Unpublished progress report prepared for the USDI Bureau of Land Management, Medford District, and the Institute for Applied Ecology.
- Kaye, T.N. 2000b. Effect of population monitoring on Cook's desert parsley (*Lomatium cookii*). Unpublished report funded jointly by the U.S. Fish and Wildlife Service and the Oregon Department of Agriculture, Plant Conservation Biology Program.
- Kaye, T.N. 2002. Population Monitoring for Proposed Experimental Habitat Manipulation of Willamette daisy, Oxbow west site, West Eugene. Institute for Applied Ecology, Corvallis, Oregon and Eugene District, BLM, Eugene, Oregon. 22 pp.
- Kaye, T.N. and R. Meinke. 1992. Long-term monitoring for *Mirabilis macfarlanei* in Hell's Canyon, Wallowa-Whitman National Forest. Prepared by the Conservation Biology Program, Oregon Department of Agriculture. Report submitted to the Wallowa-Whitman National Forest, U.S. Department of Agriculture, ODA/USFS Challenge cost-share project.

- Kaye, T.N., W. Messinger, and S. Massey. 1990. Populations monitoring plan, habitat analysis and breeding system for *Mirabilis macfarlanei*. Report submitted to the Wallowa-Whitman National Forest, U.S. Department of Agriculture, ODA/USFS Challenge Cost Share project. 22 pp.
- Keister G.P., R.G. Anthony, E.J. O'Neill. 1987. Use of communal roosts and foraging areas by bald eagles wintering in the Klamath Basin. *Journal of Wildlife Management* 51: 415-420.
- Klamath Tribes. 1995. Upper Klamath and Agency Lakes water quality assessment and inflow nutrient budget and endangered species restoration program support. Progress report. Natural Resources Department, Chiloquin, Oregon. 19 pp.
- Klamath Tribes 1996. A synopsis of the early life history and ecology of catostomids, with a focus on the Williamson River Delta. Unpublished manuscript. Natural Resources Department, Chiloquin, Oregon.
- Koch, D.L. and G.P. Contreras 1973. Preliminary survey of the fishes of the Lost River system including Lower Klamath Lake and Klamath Strait drain with special reference to the Shortnose (*Chasmistes brevirostris*) and Lost River suckers (*Catostomus luxatus*). Center for Water Resources Research, Desert Research Institute, University of Nevada, Reno, Nevada. 45 pp.
- Koehler, GM. 1990. Population and habitat characteristics of lynx and snowshoe hares in north central Washington. *Canadian J. of Zool.* 68:845-851.
- Komar, N., N.A. Panella, J.E. Burns, S.W. Dusza, T.M. Mascarenhas, and T.O. Talbot. 2001. Serologic evidence for West Nile virus infection in birds in the New York City vicinity during an outbreak in 1999. *Emerging Infectious Diseases* 7(4):621-5.
- Kuykendall, K. and T.N. Kaye. 1993a. *Lupinus sulphureus* ssp. *kincaidii* survey and reproduction studies. Oregon Department of Agriculture, Salem, Oregon, and Roseburg District BLM, Roseburg, Oregon.
- Kuykendall, K. and T.N. Kaye. 1993b. Status Report for *Lupinus sulphureus* ssp. *kincaidii*. Draft report to Oregon Department of Agriculture, Corvallis, OR. 71 pp.
- LaHaye, W.S., and R.J. Gutierrez. 1999. Nest sites and nesting habitat of the northern spotted owl in northwestern California. *Condor* 101: 324-330.
- Lank, D. B., N. Parker, E. A. Krebs, and L. M. Tranquilla. 2003. Geographic distribution, habitat selection, and population dynamics with respect to nesting habitat characteristics, of marbled murrelets. Centre for Wildlife Ecology, Simon Fraser University, Burnaby, Canada. 66 pages.

- Lauten, D.J., K.A. Castelein, B.V. Smithers, K.C. Jandér, E. Elliott-Smith, and E.P. Gaines. 2003. The distribution and reproductive success of the western snowy plover along the Oregon coast - 2003. The Oregon Natural Heritage Program. Portland, Oregon. Unpublished report. 52pp.
- Leary, R.F., F.W. Allendorf, and S.H. Forbes. 1993. Conservation genetics of Bull trout in the Columbia and Klamath River drainages. *Conservation Biology* 7:856-865.
- Leathe, S.A., and P. Graham. 1982. Flathead Lake fish food habits study. Environmental Protection Agency, through Steering Committee for the Flathead River Basin Environmental Impact Study. Contract R008224-01-4 to Montana Department of Fish, Wildlife and Parks. 137 pp plus appendices.
- Lesica, P. 1988. Monitoring *Silene spaldingii* on Wild Horse Island: 1988 Progress Report. Unpublished paper prepared for The Nature Conservancy, Montana/Wyoming Office, Helena, Montana. 3 pp.
- Lesica, P. 1997. Demography of the endangered plant, *Silene spaldingii* (Caryophyllaceae) in northwest Montana. *Madroño* 44:347-358.
- Lesica, P. 1999. Effects of fire on the demography of the endangered, geophytic herb *Silene spaldingii* (Caryophyllaceae). *American Journal of Botany* 86:996-1002.
- Leskiw, T., and R.J. Gutiérrez. 1998. Possible predation of a Spotted Owl by a Barred Owl. *Western Birds* 29:225-226.
- Li, H., C. Schreck, C. Bond, E. Rexstad. 1987. Factors influencing changes in fish assemblages of Pacific Northwest streams. Pages 193-202 in W.J. Mathews and D.C. Heinz, editors. *Community and evolutionary ecology of North American stream fishes*. University of Oklahoma Press, Norman, OK.
- Light, J., L. Herger, and M. Robinson. 1996. Upper Klamath basin bull trout conservation strategy, a conceptual framework for recovery. Part one. The Klamath Basin Bull Trout Working Group. 77 pp.
- Loftus, M.E. 2001. Assessment of potential water quality stress to fish. Supplement to effects of water quality and lake level on the biology and habitat of selected fish species in Upper Klamath Lake. Prepared for Bureau of Indian Affairs by R2 Resource Consultants. 37 pp.
- Manley, I. A. 1999. Behavior and habitat selection of marbled murrelets nesting on the Sunshine Coast. Masters of Science Thesis. Department of Biological Sciences, Simon Fraser University, Burnaby, Canada. 163 pages.

- Markle, D.F. and M. Cooperman. 2002. Relationship between Lost River and shortnose sucker biology and management of Upper Klamath Lake. In: Water Allocation in the Klamath Reclamation Project, 2001: An Assessment of Natural Resource, Economic, Social and Institutional Issues in the Upper Klamath Basin. W.S. Braunworth, Jr., T. Welch and R. Hathaway (eds.). Oregon Sate University Extension Service, Corvallis, Oregon. in review. 26 pp.
- Markle, D.F. and D.C. Simon. 1993. Preliminary studies of systematics and juvenile ecology of Upper Klamath Lake suckers. Annual report. Oregon State University. Department of Fisheries and Wildlife, Corvallis, Oregon. 129 pp.
- Markle, D.F. and D.C. Simon. 1994. Larval and juvenile ecology of Upper Klamath Lake suckers. Annual report. Oregon State University. Department of Fisheries and Wildlife, Corvallis, Oregon. 70 pp.
- Markle, D.F., M. Cunningham, and D.C. Simon. 2000. Ecology of Upper Klamath Lake Shortnose and Lost River suckers—1. Adult and larval sampling in the Lower Williamson River, April-August 1999. Annual report: 1999. Oregon State University, Department of Fisheries and Wildlife, Corvallis, Oregon. 47 pp.
- Markle, D.F., T.N. Pearsons, and D.T. Bills. 1989. Taxonomic status and distributional survey of the Oregon chub, *Oregonichthys crameri*. Final report (unpublished) to ODFW (Contract No. OSU 30-262-9714). 29 pp.
- Markle, D.F., T.N. Pearsons, and D.T. Bills. 1991. Natural history of *Oregonichthys* (Pisces: Cyprinidae), with a description of a new species from the Umpqua River of Oregon. *Copeia* 1991(2):277-293.
- Marra, P.P., S. Griffing, C. Caffrey, A.M. Kilpatrick, R. McLean, C. Brand, E. Saito, A.P. Dupuis, L. Kramer, and R. Novak. 2004. West Nile Virus and wildlife. *BioScience* 54(5):393-402.
- Marshall, D.B. 1988. Status of the Marbled Murrelet in North America: with special emphasis on populations in California, Oregon, and Washington. Audubon Society of Portland.
- Martinka, C.J. 1972. Habitat relationships of grizzly bears in Glacier National Park. National Park Serv. Prog. Rep. 19 pp.
- Marzluff, J.M., M.G. Raphael, and R. Sallabanks. 2000. Understanding the effects of forest management on avian species. *Wildlife Society Bulletin* 28:1132-1143.
- McCorkle, D.V. and P.C. Hammond. 1988. Observations on the biology of *Speyeria zerene hippolyta* (Nymphalidae) in a marine modified environment. *J. Lepid. Soc.* 42: 184-195.

- McCorkle, D.V., P.C. Hammond, and G. Pennington. 1980. Ecological investigation report: Oregon silverspot butterfly (*Speyeria zerene hippolyta*). U.S. Department of Agriculture, Forest Service, Siuslaw National Forest. 117 pp.
- McGarigal, K. R.G. Anthony and F.B. Isaacs. 1991. Interactions of humans and bald eagles on the Columbia River estuary. *Wildlife Monographs* 115.
- McIntosh, B.A., J.R. Sedell, J.E. Smith, R.C. Wissmar, S.E. Clarke, G.H. Reeves, and L.A. Brown. 1994. Management history of eastside ecosystems: Changes in fish habitat over 50 years, 1935 to 1992. U.S. Forest Service, Pacific Northwest Research Station, General Technical Report. PNW-GTR 321. 55 pp.
- McKelvey, K.S., K.B. Aubry, and Y.K. Ortega. 2000a. History and distribution of lynx in the contiguous United States. Chapter 8 in L.F. Ruggiero, K.B. Aubry, S.W. Buskirk, *et al.*, tech. eds. *Ecology and Conservation of Lynx in the United States*. General Technical Report RMRS-GTR-30WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. As Published by University Press of Colorado, Boulder. 480 pp.
- McLean, R.G., S.R. Ubico, S.E. Docherty, W.R. Hansen, L. Sileo, and T.S. McNamara. 2001. West Nile Virus and transmission and ecology in birds. *Annals of the New York Academy of Sciences* 951:54-57.
- McPhail, J.D., and J.S. Baxter. 1996. A review of bull trout (*Salvelinus confluentus*) life-history and habitat use in relation to compensation and improvement opportunities. Department of Zoology, University of British Columbia. Fisheries Management Report No. 104. Vancouver, British Columbia, Canada. 31 pp.
- McShane, C., T. Hamer, H. Carter, G. Swartzman, V. Friesen, D. Ainley, R. Tressler, K. Nelson, A. Burger, L. Spear, T. Mohagen, R. Martin, L. Henkel, K. Prindle, C. Strong, and J. Keany. 2004. Evaluation report for the 5-year status review of the marbled murrelet in Washington, Oregon, and California. Unpublished report. EDAW, Inc. Seattle, Washington. Prepared for the U.S. Fish and Wildlife Service, Region 1. Portland, Oregon.
- Meehan, W.R. 1991. Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. *American Fisheries Society Special Publication* 19. 733 pp.
- Meffe, G.K., and C.R. Carroll. 1994. Principles of conservation biology. Sinauer Associate, Inc. Sunderland, Massachusetts. Pages 187-190.
- Menke, C. 2003. Relationships of exotic species and wildfire to the threatened plant *Silene spaldingii*. M.S. Thesis. Department of Botany and Plant Pathology, Oregon State University, Corvallis, Oregon. 73 pp.

- Meyer, J.S., Irwin, L.L., and M.S. Boyce. 1998. Influence of habitat abundance and fragmentation on northern spotted owls in western Oregon. *Wildlife Monographs*
- Meyers, J.H., Risley, C. and End, R. 1989. The ability of plants to compensate for insect attack, why biological control of weeds and insects is so difficult. *Proceedings for the VII International Symposium on Biological Control of Weeds*. Rome, Italy.
- Montana Bull Trout Scientific Group. 1995a. Upper Clark Fork River drainage bull trout status report (including Rock Creek). Prepared for Montana Bull Trout Restoration Team. Helena, Montana. 40 pp.
- Montana Bull Trout Scientific Group. 1995b. Bitterroot River drainage bull trout status report. Prepared for Montana Bull Trout Restoration Team. Helena, Montana. 31 pp.
- Montana Bull Trout Scientific Group. 1995c. Blackfoot River drainage bull trout status report. Prepared for Montana Bull Trout Restoration Team. Helena, Montana. 37 pp.
- Montana Bull Trout Scientific Group. 1995d. Flathead River drainage bull trout status report (including Flathead Lake, the North and Middle forks of the Flathead River and the Stillwater and Whitefish River). Prepared for Montana Bull Trout Restoration Team. Helena, Montana. 46 pp.
- Montana Bull Trout Scientific Group. 1995e. South Fork Flathead River drainage bull trout status report (upstream of Hungry Horse Dam). Prepared for Montana Bull Trout Restoration Team. Helena, Montana. 33 pp.
- Montana Bull Trout Scientific Group. 1996a. Swan River drainage bull trout status report (including Swan Lake). Prepared for Montana Bull Trout Restoration Team. Helena, Montana. 42 pp.
- Montana Bull Trout Scientific Group. 1996b. Lower Clark Fork River drainage bull trout status report (Cabinet Gorge Dam to Thompson Falls). Prepared for Montana Bull Trout Restoration Team. Helena, Montana. 34 pp.
- Montana Bull Trout Scientific Group. 1996c. Middle Clark Fork River drainage bull trout status report (from Thompson Falls to Milltown, including the lower Flathead River to Kerr Dam). Prepared for Montana Bull Trout Restoration Team. Helena, Montana. 37 pp.
- Montana Bull Trout Scientific Group. 1996d. Lower Kootenai River drainage bull trout status report (below Kootenai Falls). Prepared for Montana Bull Trout Restoration Team. Helena, Montana. 32 pp.

- Montana Bull Trout Scientific Group. 1996e. Middle Kootenai River drainage bull trout status report (between Kootenai Falls and Libby Dam). Prepared for Montana Bull Trout Restoration Team. Helena, Montana. 36 pp.
- Montana Bull Trout Scientific Group. 1996f. Upper Kootenai River drainage bull trout status report (including Lake Koocanusa, upstream of Libby Dam). Prepared for Montana Bull Trout Restoration Team. Helena, Montana. 30 pp.
- Montana Bull Trout Scientific Group. 1998. The relationship between land management activities and habitat requirements of bull trout. Prepared for Montana Bull Trout Restoration Team. Helena, Montana. 78 pp.
- Mowat, G., K.G. Poole, and M. O'Donoghue. 2000. Ecology of lynx in northern Canada and Alaska. Chapter 9 in L.F. Ruggiero, K.B. Aubrey, S.W. Buskirk, *et al.*, tech. eds. Ecology and Conservation of Lynx in the United States. General Technical Report RMRS-GTR-30WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. As Published by University Press of Colorado, Boulder. 480 pp.
- Murie, A. 1944. The wolves of Mount McKinley. U.S. Government Printing Office. Washington, D.C. 238 pp.
- Murray, M. 2001. Habitat prediction mapping for three rare plants on the Willowa-Whitman National Forest: *Mirabilis macfarlanei*, *Silene spaldingi*, and *Spiranthes diluvialis*. Oregon Natural Heritage Program, Portland Oregon. 11 pp.
- Nehlsen, W., J. Williams, and J. Lichatowich. 1991. Pacific salmon at the crossroads: stocks at risk from California, Oregon, Idaho, and Washington. Fisheries 16(02):4-21.
- Nelson, S.K., and T.E. Hamer. 1995. Nesting biology and behavior of the marbled murrelet. Pages 57-68 in C.J. Ralph, G.L. Hunt, M.G. Raphael, and J.F. Piatt (eds.). Ecology and conservation of the marbled murrelet. General Technical Report. PSW-GTW-152. Pacific Southwest Experimental Station, USDA Forest Service, Albany, California. 420 pp.
- Nelson, S. K., and A. K. Wilson. 2002. Marbled murrelet habitat characteristics on state lands in western Oregon. Corvallis, OR: Oregon Cooperative Fish and Wildlife Research Unit, OSU, Department of Fisheries and Wildlife. 151 pages.
- Newton, J.A., and S. Pribyl. 1994. Bull trout population summary: Lower Deschutes River subbasin. Oregon Department of Fish and Wildlife, The Dalles, Oregon. Oregon administrative rules, proposed amendments to OAR 340-41-685 and OAR 340-41-026. January 11, 1996. 16 pp.

- Oregon Chapter of American Fisheries Society. 1993. Petition to the Fish and Wildlife Service to list bull trout in the upper Klamath basin under the Endangered Species Act. Corvallis, Oregon. 24 pp.
- Oregon Coastal Conservation and Development Commission. 1974. Fish and wildlife resources: Oregon coastal zone. Prepared by Ken Thomas and Dale Snow. Portland, Oregon.
- Oregon Department of Transportation. 2003. Final draft biological assessment for state-wide maintenance activities requiring a section 404 fill permit or section 10 permit. November 13, 2003.
- Oregon Natural Heritage Program. 1997. Agate Desert vernal pool habitat: Preliminary mapping and assessment. Prepared for the Oregon DSL, contract 10738-369. The Nature Conservancy, Portland, Oregon. 23 pp. plus tables, as cited in Oregon Department of Transportation. 2003. Final draft biological assessment for state-wide maintenance activities requiring a section 404 fill permit or section 10 permit. November 13, 2003.
- Oregon Parks and Recreation Department. 2005. Ocean Shore Management Plan 194 pp.
- Page, G.W. 1988. Nesting success of snowy plovers in central coastal California in 1988. Report of the Point Reyes Bird Observatory, Stinson Beach, CA. 7 pp.
- Page, G.W. and L.E. Stenzel. 1981. The breeding status of the snowy plover in California. *Western Birds* 12(1): 1-40.
- Page G.W., F.C. Bidstrup, R.J. Ramer, and L.E. Stenzel. 1986. Distribution of wintering snowy plovers in California and adjacent states. *Western Birds* 17(4): 145-170.
- Page, G.W., L.E. Stenzel, W.D. Shuford, and C.R. Bruce. 1991. Distribution and abundance of the snowy plover on its western North American breeding grounds. *Journal of Field Ornithology* 62(2): 245-255.
- Page, G.W., J. S. Warriner, J. C. Warriner, and P.W. C. Paton. 1995. Snowy plover (*Charadrius alexandrinus*). In *Birds of North America*, No. 154 (A. Poole and F. Gill, eds). The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D.C. 24 pp.
- Page, G.W., J.S. Warriner, J.C. Warriner, and R.M. Halbeisen. 1977. Status of the snowy plover on the northern California coast. Part I: Reproductive timing and success. California Department of Fish and Game Nongame Wildlife Investigations. Sacramento, California. 10pp.

- Palacios, E.P., L. Alfaro, and G.W. Page. 1994. Distribution and abundance of breeding snowy plovers on the Pacific coast of Baja California. *Journal of Field Ornithology* 65(4):490-497.
- Pearson, A.M. 1975. The northern interior grizzly bear (*Ursus arctos*). *Can. Wildl. Serv. Rep. Series*. 34. 86 pp.
- Pearson, R.R., and K.B. Livezey. 2003. Distribution, numbers, and site characteristics of spotted owls and barred owls in the Cascade Mountains of Washington. *J. Raptor Res.*, 37(4): 265-276.
- Pearsons, T.N. 1989. Ecology and decline of a rare western minnow: the Oregon chub (*Oregonichthys crameri*). Master of Science Thesis. Oregon State University, Corvallis, Oregon. 86 pp.
- Perkins, D. G. G.G. Scoppettone, and M. Buettner. 2000a. Reproductive biology and demographics of endangered suckers in Upper Klamath Lake, Oregon. 39 pp.
- Perkins, D.L. 1996. Lost River and Shortnose suckers of Upper Klamath Lake. Report 96-1. California Science Center, Reno Field Station. 16 pp.
- Perkins, D.L. and G.G. Scoppettone. 1996. Spawning and migration of Lost River suckers (*Deltistes luxatus*) and Shortnose suckers (*Chasmistes brevirostris*) in the Clear Lake drainage, Modoc County, California. National Biological Service, California Science Center, Reno Field Station, Reno, Nevada. 51 pp.
- Perkins, D.L., J. Kann, and G.G. Scoppettone. 2000a. The role of poor water quality and fish kills in the decline of endangered Lost River and Shortnose suckers in Upper Klamath Lake. Final report. U.S. Geological Survey, Biological Resources Division, Western Fisheries Research Center, Reno Field Station, Reno, Nevada. 39 pp.
- Pickering, D. 1998. Population dynamics of the Oregon silverspot butterfly, *Speyeria zerene hippolyta* (Lepidoptera, Nymphalidae) at four central coast sites. Report to U.S. Department of Agriculture, Forest Service, Siuslaw National Forest. The Nature Conservancy, Portland, Oregon. 23 pp.
- Pickering, D. 2000. Population dynamics of the Oregon silverspot butterfly, *Speyeria zerene hippolyta* (Lepidoptera, Nymphalidae) at four central coast sites. Report to U.S. Department of Agriculture, Forest Service, Siuslaw National Forest. The Nature Conservancy, Portland, Oregon. 26 pp.
- Pickering, D. 2005. Population dynamics of the Oregon silverspot butterfly, *Speyeria zerene hippolyta* (Lepidoptera, Nymphalidae) at four central coast sites. Report to U.S. Department of Agriculture, Forest Service, Siuslaw National Forest. The Nature Conservancy, Portland, Oregon.

- Pickering, D., P. Bierzychudek, D. Salzer, and N. Rudd. 2001. Oregon silverspot butterfly dispersal patterns and habitat management. The Nature Conservancy, Portland, Oregon. 74 pp.
- Pratt, K.L. 1992. A review of bull trout life history. Pages 5-9 in P.J. Howell, and D.V. Buchanan, eds. Proceedings of the Gearhart Mountain Bull Trout Workshop. Oregon Chapter of the American Fisheries Society, Corvallis, Oregon. 9 pp.
- Pratt, K.L., and J.E. Huston. 1993. Status of bull trout (*Salvelinus confluentus*) in Lake Pend Oreille and the lower Clark Fork River. Draft report. Prepared for the Washington Water Power Company, Spokane, Washington. 108 pp.
- Quigley, T.M. and S.J. Arbelbide, tech. editors. 1997. An assessment of ecosystem components in the interior Columbia basin and portions of the Klamath and Great basins: volume III. General Technical Report PNW-GTR-4-5. U.S. Department of Agriculture, Forest Service, and U.S. Department of Interior, Bureau of Land Management. Pages 1174-1185.
- Ralph, C.J., and S.L. Miller. 1995. Offshore population estimates of marbled murrelets in California. In Ralph, C.J., G.L. Hunt jr., M.G. Raphael, J.F. Piatt, tech. eds. 1995. Ecology and conservation of the marbled murrelet. Gen. Tech. Rep. PSW-GTR-152. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture. 420 pp.
- Ralph, C.J., G.L. Hunt jr., M.G. Raphael, J.F. Piatt, tech. eds. 1995. Ecology and conservation of the marbled murrelet. Gen. Tech. Rep. PSW-GTR-152. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture. 420 pp.
- Raphael, M.G., D. Evans Mack, J.M. Marzluff, and J. Luginbuhl. 2002. Effects of forest fragmentation on populations of the marbled murrelet. Studies in Avian Biology 25:221-235.
- Ratliff, D.E., and P.J. Howell. 1992. The status of bull trout populations in Oregon. Pages 10-17 in: P.J. Howell and D.V. Buchanan (eds). Proceedings of the Gearhart Mountain bull trout workshop. Oregon Chapter of the American Fisheries Society, Corvallis.
- Rees, J. and P. Lee. 1990. Management of bald eagles, *Haliaeetus leucocephalus*, and their habitats on National Forests of the Pacific Northwest. USDA Forest Service, Portland, OR. 61 pp. + appendices.
- Reiser, D.W., M. Loftus, D. Chapman, E. Jeanes, and K. Oliver. 2001. Effects of water quality and lake level on the biology and habitat of selected fish species in Upper Klamath Lake. Prepared for Bureau of Indian Affairs by R2 Resource Consultants. 135 pp.

- Rich, C.F., Jr. 1996. Influence of abiotic and biotic factors on occurrence of resident bull trout in fragmented habitats, western Montana. M.S. Thesis, Montana State University, Bozeman, Montana. 53 pp.
- Rieman, B.E., and F.W. Allendorf. 2001. Effective population size and genetic conservation criteria for bull trout. *North American Journal of Fisheries Management* 21:756-764.
- Rieman, B.E., and J.B. Dunham. 2000. Metapopulations and salmonids: a synthesis of life history patterns and empirical observations. *Ecology of Freshwater Fish* 9:1-2.
- Rieman, B.E., and J.D. McIntyre. 1993. Demographic and habitat requirements for conservation of bull trout. General Technical Report INT-302. U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Ogden, Utah. 40 pp.
- Rieman, B.E., and J.D. McIntyre. 1995. Occurrence of bull trout in naturally fragmented habitat patches of varied size. *Transactions of the American Fisheries Society* 124(3):285-296.
- Rieman, B.E., and J.D. McIntyre. 1996. Spatial and temporal variability in bull trout redd counts. *North American Journal of Fisheries Management* 16:132-141.
- Rieman, B.E., D.C. Lee, and R.F. Thurow. 1997. Distribution, status, and likely future trends of bull trout within the Columbia River and Klamath River basins. *North American Journal of Fisheries Management*. 17:1111-1125.
- Roe, A.N., K.G. Poole, and D.L. May. 1999. A review of lynx behavior and ecology and its relation to ski area planning and management. Unpubl. Report, IRIS Environmental Systems. Calgary, Alberta, Canada. 67pp.
- Ruediger, B., J. Claar, S. Gniadek, B. Holt, L. Lewis, S. Mighton, B. Naney, G. Patton, T. Rinaldi, J. Trick, A. Vandehey, F. Wahl, N. Warren, D. Wenger, and A. Williamson. 2000. Canada lynx conservation assessment and strategy. USDA Forest Service, USDI Fish and Wildlife Service, USDI Bureau of Land Management, and USDI National Park Service. Missoula, MT. 122 pp.
- Rush, T., and J. Gamon. 1999. Management plan for Spalding's catchfly (*Silene spaldingii*) on Fairchild Air Force Base, Washington. Unpublished report by the Washington Natural Heritage Program, Olympia, Washington. 15 pp., plus appendices.
- Saunders, D.A., R.J. Hobbs, and C.R. Margules. 1991. Biological consequences of ecosystem fragmentation: A review. *Conservation Biology* 5:18-32.

- Scheerer, P., and G.D. Apke. 1998. Oregon Chub Research. Middle Fork Willamette and Santiam River Drainages. Annual Progress Report. E96970022. 53 pp.
- Scheerer, P., and K. Jones. 1997. Oregon Department of Fish and Wildlife Annual Progress Report on Oregon chub. EF-96 VII-1. 78 pp.
- Scheerer, P.D. and P.J. McDonald. 2000. Oregon chub research: Middle Fork Willamette and Santiam River Drainages. Unpublished. Oregon Department of Fish and Wildlife, Fish Research Project October 1999-September 2000. Annual Progress Report, Portland. 90 pp.
- Scheerer, P., T.J. Cornwell, and K. Jones. 1998. Oregon Department of Fish and Wildlife Annual Progress Report on Oregon chub. Project Number E-2. 71 pp.
- Scheerer, P.D., P.S. Kavanagh, and K.K. Jones. 2002. Oregon chub investigations. Oregon Department of Fish and Wildlife, Fish Research Project E-2-32. Annual Progress Report. Oregon Department of Fish and Wildlife, Corvallis, Oregon. 73 pp.
- Scheerer, P.D., P.S. Kavanagh, and S.E. Jacobs. 2004. Oregon chub investigations. Oregon Department of Fish and Wildlife, Fish Research Project E-2-35 and E-2-36. Annual Progress Report. Oregon Department of Fish and Wildlife, Corvallis, Oregon. 23 pp plus appendix.
- Scheerer, P.D., P.S. Kavanagh, and K.K. Jones. 2003. Oregon Chub Investigations. Annual Progress Report, Fish Research Project, 1 July 2002 – 30 June 2003. Project Number E-2-33. 77 pp.
- Scheerer, P., S. Loerts, and K. Jones. 1995. Oregon Department of Fish and Wildlife Annual Progress Report on Oregon chub. EF-94 VII-1. 54pp.
- Scheerer, P.D., C.S. Mease, P.S. Kavanagh, and K.K. Jones. 2001. Oregon chub investigations. Unpublished. Oregon Department of Fish and Wildlife, fish Research Project May 2000-April 2001. E-2. Annual Progress Report, Portland. 78 pp.
- Scheerer, P., C. Shafer, and K. Jones. 1992. Oregon Chub Investigations. Oregon Department of Fish and Wildlife, Fish Research Project EF-91 VII-1. 31 pp.
- Schill, D.J. 1992. River and stream investigations. Job Performance Report, Project F-73-R-13. Idaho Department of Fish and Game, Boise, Idaho. 58 pp.
- Schmitt, C.J. and C.M. Bunck. 1995. Persistent environmental contaminants in fish and wildlife. Pp. 413-417 *In* LaRoe, E.T., G.S. Farris, C.E. Puckett, P.D. Doran and M.J. Mac, eds. Our living resources: a report to the nation on distribution,

abundance and health of U.S. plants, animals and ecosystems. U.S. Department of the Interior, National Biological Service, Washington D.C. 530 pp.

- Scoppettone, G. 1986. Upper Klamath Lake, Oregon, catostomid research. U.S. Fish and Wildlife Service Report, Reno, Nevada. 14 pp.
- Scoppettone, G.G. 1988. Growth and longevity of the cui-ui and longevity of other Catostomids and Cyprinids in Western Transactions of the American Fisheries Society 117:301-307.
- Scoppettone, G.G., and G.L. Vinyard. 1991. Life history and management of four endangered lacustrine suckers. Pages 359-377 in W.L. Minckley and J.E. Deacon, eds. Battle against extinction: Native fish management in the American West. University of Arizona Press, Tucson.
- Seabloom, E.W. and A.M. Wiedemann. 1994. Distribution and effects of *Ammophila breviligulata* Fern. (American beachgrass on the foredunes of the Washington coast. Journal of Coastal Research 10(2):178-188.
- Sedell, J.R., and F.H. Everest. 1991. Historic changes in pool habitat for Columbia River Basin salmon under study for TES listing. Draft U.S. Department of Agriculture Report, Pacific Northwest Research Station, Corvallis, Oregon 6 pp.
- Sedell, J. R. and J. L. Froggatt. 1984. Importance of streamside forests to large rivers: The isolation of the Willamette River, Oregon, U.S.A., from its floodplain by snagging and streamside forest removal. Verh. Internat. Verein. Limnol. 22:1828-1834.
- Sedell, J., F. Reeves, F. Hauer, J. Stanford, and C. Hawkins. 1990. Role of refugia in recovery from disturbances: Modern fragmented and disconnected river systems. Environ. Mgmt. 14(5)711-724.
- SERA (Syracuse Environmental Research Associates, Inc.). 1997a. Effects of surfactants on the toxicity of glyphosate, with specific reference to Rodeo. SERA TR 97-206-1b February 6, 1997.
- SERA (Syracuse Environmental Research Associates, Inc.). 1997b. Use and assessment of marker dyes used with herbicides. SERA TR 96-21-07-03b. December 21, 1997.
- SERA (Syracuse Environmental Research Associates, Inc.). 1999. Clopyralid (Transline)- Final Report. SERA TR 99-21-11/12-01c. February 27, 1999.
- SERA (Syracuse Environmental Research Associates, Inc.). 1999. Imazapyr - Human Health and Ecological Risk Assessment Preliminary Draft - Program Description. SERA TR 98-21-14-01b. May 6, 1999.

- SERA (Syracuse Environmental Research Associates, Inc.). 2001. Glyphosate - WordPerfect Worksheets for Human Health and Ecological Risk Assessments. SERA WPWS 01-43-07-03a. November 23, 2003.
- SERA (Syracuse Environmental Research Associates, Inc.). 2001. Imazapic [Plateau and Plateau DG] - Human Health and Ecological Risk Assessment Final Report. SERA TR 00-21-28-01e. January 28, 2001.
- SERA (Syracuse Environmental Research Associates, Inc.). 2001. Sethoxydim [Poast] - Human Health and Ecological Risk Assessment Final Report. SERA TR 01-43-01-01c. October 31, 2001.
- SERA (Syracuse Environmental Research Associates, Inc.). 2003. Chlorsulfuron - Human Health and Ecological Risk Assessment Preliminary Draft - Introduction and Program Description. SERA TR 02-43-18-01a. April 10, 2003.
- SERA (Syracuse Environmental Research Associates, Inc.). 2003. Metsulfuron methyl - Human Health and Ecological Risk Assessment Preliminary Draft - Introduction and Program Description. SERA TR 02-43-17-01a. April 14, 2003.
- SERA (Syracuse Environmental Research Associates, Inc.). 2003. Picloram - Revised Human Health and Ecological Risk Assessment Final Report. SERA TR 03-43-26-01b. June 30, 2003.
- SERA (Syracuse Environmental Research Associates, Inc.). 2003. Sulfometuron methyl - Human Health and Ecological Risk Assessment Preliminary Draft - Introduction and Program Description. SERA TR 02-43-17-02a. October 16, 2003.
- SERA (Syracuse Environmental Research Associates, Inc.). 2003. Triclopyr - Revised Human Health and Ecological Risk Assessments Final Report. SERA TR 02-43-13-03b. March 15, 2003.
- Sexauer, H.M., and P.W. James. 1997. Microhabitat use by juvenile trout in four streams located in the eastern Cascades, Washington. Pages 361-370 in W.C. Mackay, M.K. Brewin and M. Monita (eds). Friends of the Bull Trout Conference Proceedings. Bull Trout Task Force (Alberta), c/o Trout Unlimited Calgary, Alberta, Canada.
- Shively, R.S. 2002. Size distribution of suckers collected in Clear Lake and Gerber Reservoir, in 2000. U.S. Geological Survey. Unpublished data. 5 pp.
- Shively, R.S., M.F. Bautista, and A.E. Kohler. 2000. Monitoring of Lost River and shortnose suckers at shoreline spawning areas in Upper Klamath Lake, 1999. Completion report. U.S. Geological Survey, Biological Resources Division, Klamath Falls Duty Station, Klamath Falls, Oregon. 26 pp.

- Simon, D.C. 2002. Preliminary data analysis: Annual survey of abundance and distribution of age 0 shortnose and Lost River suckers in Upper Klamath Lake. Annual report: 2002. Oregon Cooperative Research Unit, Department of Fisheries and Wildlife, Corvallis. 5 pp.
- Simon, D.C. and D.F. Markle. 2001. Ecology of Upper Klamath Lake shortnose and Lost River suckers. Annual survey of abundance and distribution of age 0 shortnose and Lost River suckers in Upper Klamath Lake. Annual report: 2000. Oregon Cooperative Research Unit. Department of Fisheries and Wildlife. Corvallis. 59 pp.
- Simon, D.C., G.R. Hoff, D.J. Logan, and D.F. Markle. 1996. Larval and juvenile ecology of Upper Klamath Lake suckers. Annual report: 1995. Oregon State University, Department of Fisheries and Wildlife, Corvallis. 60 pp.
- Simon, D.C., G.R. Hoff, and D.F. Markle. 1995. Larval and juvenile ecology of Upper Klamath Lake suckers. Annual report. Oregon State University, Department of Fisheries and Wildlife, Corvallis. 49 pp.
- Simon, D.C., M. Terwilliger, and D.F. Markle. 2000b Ecology of Upper Klamath Lake shortnose and Lost River suckers—3. Annual survey of abundance and distribution of age 0 shortnose and Lost River suckers in Upper Klamath Lake. Annual report: 1999. Oregon. 41 pp.
- Simon, D.C., M.R. Terwilliger, P. Murtaugh, and D.F. Markle. 2000a. Larval and juvenile ecology of Upper Klamath Lake suckers: 1995-1998. Final report. Oregon State University. Department of Fisheries and Wildlife, Corvallis. 109 pp.
- Singer, F.J. 1978. Seasonal concentrations of grizzly bears, North Fork of the Flathead River, Montana. *Can. Field Nat.* 92:283-286.
- Singer, S. W., D. L. Suddjian, and S. A. Singer. 1995. Fledging behavior, flight patterns, and forest characteristics at marbled murrelet tree nests in California. *Northwestern Naturalist* 76:54-62.
- USDA Forest Service. 2001. Biological assessment for Baker Beach Dunes restoration project. Mapleton Ranger District. Siuslaw National Forest.
- Slobodchikoff, C.N. and J.T. Doyen. 1977. Effects of *Ammophilla arenaria* on sand dune arthropod communities. *Ecology* 58:1171-1175.
- Snyder, J.O. 1908. Relationships of the fish fauna of the lakes of southeastern Oregon. *Bull. Bureau Fisheries* 27(1907):69-102.

- Speich, S.M., and Wahl. 1995. Marbled murrelet populations of Washington – Marine habitat preferences and variability of occurrence. Pates 313-326 in C.J. Ralph, G.L. Hunt, M. Raphael, and J.F. Piatt (Tech. eds.). Ecology and conservation of the marbled murrelet. Gen. Tech. Rept. PSW-GTR-152. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Dept. of Agriculture. 420 pp.
- Spruell, P., and F. Allendorf. 1997. Nuclear DNA analysis of Oregon bull trout. Final report to the Oregon Department of Fish and Wildlife. Division of Biological Sciences, University of Montana. 28 pp.
- Spruell, P., A.R. Hemmingsen, P.J. Howell, N. Kanda, and F.W. Allendorf. 2003. Conservation genetics of bull trout: Geographic distribution of variation at microsatellite loci. *Conservation Genetics* 4:17-29.
- Spruell, P., B.E. Rieman, K.L. Knudsen, F.M. Utter, and F.W. Allendorf. 1999. Genetic population structure within streams: microsatellite analysis of bull trout populations. *Ecology of Freshwater Fish* 8:114-121.
- Stalmaster, M.V. 1987. *The Bald Eagle*. Universe Books. New York. 227 pp.
- Stalmaster, M.V. and J.L. Kaiser. 1998. Effects of recreational activity on wintering bald eagles. *Wildlife Monograph* 137. 46 pp.
- Stalmaster, M.V. and J.R. Newman. 1978. Behavioral responses of wintering bald eagles to human activity. *Journal of Wildlife Management* 42:506-513.
- Staples, W.R. 1995. Lynx and coyote diet and habitat relationships during a low hare population on the Kenai Peninsula, Alaska. M.S. Thesis. University of Alaska, Fairbanks.
- State of Oregon. 1996. Oregon administrative rules, proposed amendments to OAR 340-41-685 and OAR 340-41-026. January 11, 1996. 61 pp.
- State of Oregon. 1997. Coastal Salmon Restoration Initiative. The Oregon Plan. State of Oregon. 27 pp.
- Steidl, R. J. and R. G. Anthony. 1996. Responses of bald eagles to human activity during the summer in interior Alaska. *Ecological Applications* 6:482-491.
- Stenzel, L.E., J.C. Warriner, J.S. Warriner, K.S. Wilson, F.C. Bidstrup, and G.W. Page. 1994. Long-distance breeding dispersal of snowy plovers in western North America. *J. Animal Ecology* 63:887-902.
- Stenzel, L.E., S.C. Peaslee, and G.W. Page. 1981. II. Mainland Coast. Pages 6-16 in Page, G.W. and L.E. Stenzel, (eds). *The breeding status of the snowy plover in California*. *Western Birds* 12(1):1-40.

- Stern, M.A., J.S. McIver, and G.A. Rosenberg. 1991. Nesting and reproductive success of snowy plovers along the south Oregon coast, 1991. Report to Oregon Department of Fish and Wildlife-Nongame, Roseburg, OR and Coos Bay District, Bureau of Land Management, North Bend, OR. 18 pp.
- Stinson, D. W., J. W. Watson, and K. R. McAllister. 2001. Washington state status report for the bald eagle. Washington Department of Fish and Wildlife, Olympia, WA.
- Strong, C. S. 2003a. Marbled murrelet abundance and reproductive indices in Oregon during 2002. Oregon Department of Fish and Wildlife, Wildlife Diversity Program. 14 pages.
- Strong, C. S. 2003b. Status of marbled murrelets at sea in conservation zone 5: Mendocino, Sonoma, and Marin counties. Crescent Coastal Research, Astoria, Oregon. 22 pages.
- Strong, C.S., and T.M. Carten. 2000. Marbled murrelets at sea in Oregon: status of abundance and reproduction during 1999. Draft final report to the Oregon Department of Fish and Wildlife. Portland, Oregon. 17pp.
- Swanberg, T. R. 1997. Movements of and habitat use by fluvial bull trout in the Blackfoot River, Montana. Transactions of the American Fisheries Society 126:735-746.
- Tait, C.K., and E.J. Mulkey. 1993a. Assessment of biological and physical factors limiting distribution of stream-resident Warner suckers (*Catostomus warnerensis*). 34 pp.
- Tait, C.K., and E.J. Mulkey. 1993b. Estimation of stream-resident Warner sucker abundance and total habitat area in two basins using a statistically valid sampling design. Unpublished report to Bureau of Land Management and Oregon Department of Fish and Wildlife. 40 pp.
- Taylor, B.E., S. Pollard, and D. Louie. 1999. Mitochondrial DNA variation in bull trout (*Salvelinus confluentus*) from northwestern North America: implications for zoogeography and conservation. Molecular Ecology 8:1155-1170.
- Teske, M.E., S.L. Bird, D.M. Esterly, S.L. Ray, and S.G. Perry. 2001. A user's guide for AgDRIFT 2.0: a tiered approach for assessment of spray drift. Continuum Dynamics, Inc. Public Use Version, C.D.I. Report No. 01-01.
- The Nature Conservancy (TNC). 2000. Unpublished report. Cause of nest failures of snowy plovers on the Oregon coast 1990-2000.

- Thomas, G. 1992. Status of bull trout in Montana. Report prepared for Montana Department of Fish, Wildlife and Parks, Helena, Montana. 66 pp.
- Thomas, J.W., E.D. Forsman, J. B. Lint, E. C. Meslow, B. R. Noon, and J. Verner. 1990. A conservation strategy for the northern spotted owl. Report of the Interagency Scientific Committee to address the conservation of the northern spotted owl. Unpublished interagency document. 458 pp.
- Tisdale, E.W. 1983. Grasslands of western North America: The Pacific Northwest Bunchgrass. Pages 223-245 *In*: Grassland ecology and classification symposium proceedings, A.C. Nicholson, A. McLean, and T.E. Baker, eds. Ministry of Forest, Province of British Columbia, Victoria, British Columbia, Canada. 353 pp.
- Tisdale, E.W. 1986. Canyon grasslands and associated shrublands of west-central Idaho and adjacent areas. Bulletin No. 40. Forest, Wildlife and Range Experiment Station, University of Idaho, Moscow, Idaho. 42 pp.
- Turaski, M. and W. Watkins, 2001. Summary Analysis of Nutrient Loading to Upper Klamath Lake from the Wood River Wetland. Unpublished report. U.S. Bureau of Land Management, Klamath Falls Resource Area, Oregon. 1 p.
- U.S. Army Corps of Engineers. 2000. Biological Assessment of the effects of the Willamette River Basin flood control project on species listed under the Endangered Species Act. Final; April 2000. USACE Portland District. 800 p.
- U.S. Department of Agriculture. 1983. Soil Survey of Morrow County Area, Oregon. Soil Conservation Service, Oregon Agricultural Experiment Station, Corvallis, Oregon. 223 pp. plus maps.
- U.S. Department of Agriculture and U.S. Department of the Interior. 1993. Forest Ecosystem Management: An Ecological, Economic, and Social Assessment. Report of the Forest Ecosystem Management Assessment Team (FEMAT). July 1993. Portland, OR: USDA Forest Service and the USDI Bureau of Land Management.
- U.S. Department of Agriculture and U.S. Department of the Interior. 1994. Record of decision for amendments to Forest Service and Bureau of Land Management planning documents within the range of the northern spotted owl. U.S. Forest Service, Bureau of Land Management, Portland, OR. 2 vols. and appendices
- U.S. Department of Agriculture and U.S. Department of the Interior. 1995a. Decision Notice/Decision Record Finding of No Significant Impact, Environmental Assessment for the Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon, and Washington, Idaho, and portions of California (PACFISH). 72 pp. plus appendices

- U.S. Department of Agriculture and U.S. Department of the Interior. 1995b. (Department of Agriculture and Department of Interior. 1995a. Decision Notice, Environmental Assessment, and Finding of No Significant Impact for the Interim Strategies for Managing Anadromous Fish-producing Watersheds in eastern Oregon and Washington, Idaho, western Montana, and portions of Nevada. (INFISH) 17 pp. plus attachments.
- U.S. Department of Agriculture and U.S. Department of the Interior. 1996. Status of the Interior Columbia Basin, Summary of Scientific Findings. 113 pp.
- U.S. Department of the Interior and U.S. Department of Commerce. 1996. Policy: regarding the recognition of distinct vertebrate population segments under the endangered species act. Federal Register 61:4722-4725.
- U.S. Environmental Protection Agency. 1998. Consumer fact sheet on: picloram. EPA 811-F-95-003-T (4605) ed. Volume 1998. Office of Water. National Primary Drinking Water Regulations.
- U.S. Environmental Protection Agency. 2004. Overview of the Ecological Risk Assessment process in the Office of Pesticide Programs, U.S. Environmental Protection Agency. Office of Prevention, Pesticides and Toxic Substances, Office of Pesticide Programs. Washington, D.C. January 23, 2004. 92 pp.
- U.S. Fish and Wildlife Service. 1975. Endangered and Threatened Wildlife and Plants; Amendment listing the grizzly bear of the 48 conterminous states as a threatened species. 40(145): 31734-31736.
- U.S. Fish and Wildlife Service. 1978. Final rule to list *Arabis mcdonaldiana* as endangered. Federal Register 43: 44810-44812.
- U.S. Fish and Wildlife Service. 1979. Final rule to list MacFarlane's four-o'clock as endangered. Federal Register 44: 61912-61913]
- U.S. Fish and Wildlife Service. 1980. Final rule: threatened status and critical habitat for invertebrate *Speyeria zerene hippolyta* (Oregon silverspot butterfly). Federal Register 66:44935-44939.
- U.S. Fish and Wildlife Service. 1982. Oregon silverspot butterfly (*Speyeria zerene hippolyta*) recovery plan. U.S. Fish and Wildlife Service, Portland, Oregon. 33pp.
- U.S. Fish and Wildlife Service. 1984. Endangered and threatened wildlife and plants; Determination of endangered status for the population of woodland caribou found in Washington, Idaho, and southern British Columbia. 50 CFR Part 17, Federal Register 49(41):7390-7394.

- U.S. Fish and Wildlife Service. 1985a. Final rule: threatened status for *Catostomus warnerensis*. Federal Register 50:39117-39123.
- U.S. Fish and Wildlife Service. 1985b. Recovery plan for the MacFarlane's four-o'clock. U.S. Fish and Wildlife Service, Portland, OR
- U.S. Fish and Wildlife Service. 1986. Recovery plan for the Pacific Bald Eagle. U.S. Fish and Wildlife Service, Portland, Oregon. 160pp.
- U.S. Fish and Wildlife Service. 1987. The northern spotted owl status review. U.S. Fish and Wildlife Service, Portland, OR.
- U.S. Fish and Wildlife Service. 1988. Final rule: endangered status for fish *Deltistes luxatus* and *Chasmistes brevirostris*. Federal Register 53:27130-27134.
- U.S. Fish and Wildlife Service. 1989. The northern spotted owl; a status review supplement. U.S. Fish and Wildlife Service, Portland, OR.
- U.S. Fish and Wildlife Service. 1990a. Recovery Plan for the *Arabis mcdonaldiana* (McDonald's rock-cress). U.S. Fish and Wildlife Service, Portland, Oregon. 40pp.
- U.S. Fish and Wildlife Service. 1990b. 1990 status review: northern spotted owl; *Strix occidentalis caurina*. Report to the Fish and Wildlife Service, Portland, OR. 95 pp.
- U.S. Fish and Wildlife Service. 1990c. Final rule listing: listing of threatened status for northern spotted owl (*Strix occidentalis caurina*). Federal Register 55:26114-26194.
- U.S. Fish and Wildlife Service. 1992d. Endangered and threatened wildlife and plants; determination of threatened status for the Washington, Oregon, and California population of the marbled murrelet, final rule. Fish and Wildlife Service, Federal Register 50 CFR 17: 45328-45337.
- U.S. Fish and Wildlife Service. 1992a. Final Rule to list *Spiranthes diluvialis* (Ute Ladies Tresses) as threatened. Federal Register. 57(12):2048-2054.
- U.S. Fish and Wildlife Service. 1992ba. Final rule: designate critical habitat for northern spotted owl (*Strix occidentalis caurina*). Federal Register 57:1796-1838.
- U.S. Fish and Wildlife Service. 1992c. Recovery plan for the northern spotted owl. Final draft. U.S. Fish and Wildlife Service. Portland, Oregon. 2 Volumes. 662 pp.

- U.S. Fish and Wildlife Service. 1993a. Grizzly bear recovery plan. Missoula, MT 181pp.
- U.S. Fish and Wildlife Service. 1993b. Endangered and threatened wildlife and plants; determination of threatened status for the Pacific coast population of the western snowy plover; final rule. 50 DFR Part 17, Federal Register 57(9), March 5, 1993. Pages 12864-12874.
- U.S. Fish and Wildlife Service. 1993c. Recovery Plan for the Lost River (*Deltistes luxatus*) and Shortnose (*Chasmistes brevirostris*) Suckers. U.S. Fish and Wildlife Service, Portland, Oregon. 108pp.
- U.S. Fish and Wildlife Service. 1993d. Final rule: endangered status for fish *Oregonichthys crameri*. Federal Register 58:53800-53804.
- U.S. Fish and Wildlife Service. 1994a. Recovery plan for the woodland caribou in the Selkirk Mountains. Portland, OR. 71pp.
- U.S. Fish and Wildlife Service. 1994b Proposed rule: critical habitat for the Lost River (*Deltistes luxatus*) and shortnose (*Chasmistes brevirostris*) suckers. Federal Register 59:61744-61757.
- U.S. Fish and Wildlife Service. 1994c. Biological opinion on effects of Long-Term Operation of the Klamath Project, with special emphasis on Clear Lake Operations. Portland, Oregon. 15 pp.
- U.S. Fish and Wildlife Service. 1995a. Agency Review Draft Recovery Plan for Ute ladies tresses (*Spiranthes diluvialis*). U.S. Fish and Wildlife Service, Denver, Colorado. 46pp.
- U.S. Fish and Wildlife Service. 1995b. Endangered and threatened wildlife and plants: Final rule to reclassify the bald eagle from endangered to threatened in all of the lower 48 states. Federal Register 60:35999-36010.
- U.S. Fish and Wildlife Service. 1996c. Final rule to reclassify the MacFarlane's four-o'clock from endangered to threatened. Federal Register 61: 10693-10697.
- U.S. Fish and Wildlife Service. 1995d. Endangered and threatened wildlife and plants; proposed designation of critical habitat for the Pacific coast population of the western snowy plover; proposed rule. Federal Register 60(41):11768-11809.
- U.S. Fish and Wildlife Service. 1996a. Endangered and threatened wildlife and plants; determination of critical habitat for the marbled murrelet; final rule. Fish and Wildlife Service, Federal Register, 50 CFR 17: 26256-26320.

- U.S. Fish and Wildlife Service. 1996b. Piping Plover (*Charadrius melodus*), Atlantic Coast Population, Revised Recovery Plan. Hadley, Massachusetts. 258 pp.
- U.S. Fish and Wildlife Service. 1997. Recovery plan for the threatened marbled murrelet (*Brachyramphus marmoratus*) in Washington, Oregon, and California. Fish and Wildlife Service, Portland, Oregon. 203 pp.
- U.S. Fish and Wildlife Service. 1998a. Recovery Plan for the Native Fishes of the Warner Basin and Alkali Subbasin. Portland, Oregon. 86pp.
- U.S. Fish and Wildlife Service. 1998b. Recovery Plan for the Oregon Chub (*Oregonichthys crameri*). U.S. Fish and Wildlife Service, Portland, Oregon. 69+pp.
- U.S. Fish and Wildlife Service. 1998c. Final rule: threatened status for fish *Salvelinus confluentus* (bull trout) for the Columbia River and Klamath River populations. Federal Register 63:31647-31674.
- U.S. Fish and Wildlife Service. 1999a. Endangered and Threatened Wildlife and Plants; 12-month finding on petitions to change the status of grizzly bear populations in the Selkirk Area in Idaho and Washington and the Cabinet-Yaak area of Montana and Idaho from threatened to endangered. Fed. Reg. 64 (94): 26725-26733.
- U.S. Fish and Wildlife Service. 1999b. Final rule to list *Sidalcea oregana* var. *calva* as endangered. Federal Register 64:71680-71687.
- U.S. Fish and Wildlife Service. 1999c. Final rule to list *Fritillaria gentneri* as endangered. Federal Register 64:69195-69203.
- U.S. Fish and Wildlife Service. 1999d. Proposed rule: delist bald eagle *Haliaeetus leucocephalus* in the lower 48 states. Federal Register 64:36453-36464.
- U.S. Fish and Wildlife Service. 1999e. Endangered and threatened wildlife and plants; designation of critical habitat for the Pacific coast population of the western snowy plover; final rule. 50 CFR Part 17, Federal Register 64(234), December 7, 1999. Pages 68508-68544.
- U.S. Fish and Wildlife Service. 1999f. Final rule: threatened status for fish *Salvelinus confluentus* (bull trout) for the coterminous United States. Federal Register 64:58910-58933.
- U.S. Fish and Wildlife Service. 1999g. Final rule: threatened status for fish *Salvelinus confluentus* (bull trout) for Jarbidge River population. Federal Register 64:17110-17125.

- U.S. Fish and Wildlife Service. 2000a. Endangered and threatened wildlife and plants; determination of threatened status for the contiguous U.S. distinct population segment of the Canada lynx and related rule; final rule. Fed. Regis.65(58):16052-16086.
- U.S. Fish and Wildlife Service. 2000b. Determination of endangered status for *Erigeron decumbens* var. *decumbens* (Willamette daisy) and *Fender's* blue butterfly (*Icaricia icarioides fenderi*), and Threatened status for *Lupinus sulphureus* ssp. *kincaidii* (Kincaid's lupine). Federal Register Volume 65: 3875-3890
- U.S. Fish and Wildlife Service. 2000c. Revised Recovery Plan for MacFarlane's Four-o'clock (*Mirabilis macfarlanei*). Region 1, U.S. Fish and Wildlife Service, Portland, Oregon. 46 pp.
- U.S. Fish and Wildlife Service. 2001a. Final rule to list critical habitat for plant *Sidalcea oregana* var. *calva*. Federal Register 66:46536-46548.
- U.S. Fish and Wildlife Service. 2001b. Western Snowy Plover (*Charadrius alexandrinus nivosus*) Pacific Coast Population Draft Recovery Plan. Portland, Oregon. 630 pp.
- U.S. Fish and Wildlife Service. 2001c. Oregon silverspot butterfly (*Speyeria zerene hippolyta*) revised recovery plan. U.S. Fish and Wildlife Service, Portland, Oregon. 113pp.
- U.S. Fish and Wildlife Service. 2001d. Final rule to list *Silene spaldingii* (Spalding's catchfly) as endangered. Federal Register 66:51598-51606.
- U.S. Fish and Wildlife Service. 2002a. Final rule to list *Lomatium cookii* and *Limnanthes floccose* ssp. *Grandiflora* as endangered. Federal Register 67:68003-68015.
- U.S. Fish and Wildlife Service. 2002b. Determination of Endangered Status for the Washington Plant, *Hackelia venusta* (Showy Stickseed). Federal Register Volume 67:5515-5525.
- U.S. Fish and Wildlife Service. 2002c. Biological opinion on the 10-year Operation Plan for the Klamath Project. Klamath Falls, OR. 201 pp.
- U.S. Fish and Wildlife Service. 2002d. 25 Chapters. *In*: Bull trout (*Salvelinus confluentus*) draft recovery plan. U.S. Fish and Wildlife Service, Portland, Oregon.
- U.S. Fish and Wildlife Service. 2002e. Proposed rule: critical habitat for fish *Salvelinus confluentus* (bull trout) for Klamath River and Columbia River DPSs. Federal Register 67:71235-71438.

- U.S. Fish and Wildlife Service. 2003a. Endangered and threatened wildlife and plants; Final rule to reclassify the gray wolf from the list of endangered and threatened wildlife in portions of the conterminous United States; Establishment of two special regulations for threatened gray wolves. Fed. Register 68(62):15803-15875.
- U.S. Fish and Wildlife Service. 2003b. Biological opinion on seed collection of McDonald's rock-cress (*Arabis mcdonaldiana*) (Log #1-15-03-F-0518). U.S. Fish and Wildlife Service, Roseburg Field Office, Roseburg, Oregon. 16pp.
- U.S. Fish and Wildlife Service. 2003c. Final Recovery Plan for *Fritillaria gentneri* (Gentner's fritillary). U.S. Fish and Wildlife Service, Portland, OR. 70 pp. plus appendices
- U.S. Fish and Wildlife Service. 2004a. Recovery plan for *Sidalcea oregana* var. *calva* (Wenatchee Mountains checker-mallow). U.S. Fish and Wildlife Service, Portland, Oregon. 55pp.
- U.S. Fish and Wildlife Service. 2004b. Five-Year Review of the listing status of the northern spotted owl. Region 1, U.S. Fish and Wildlife Service, Portland, Oregon.
- U.S. Fish and Wildlife Service. 2004c. Western snowy plover nesting success improves in 2004 – Again! U.S. Fish and Wildlife Service, Pacific Region, News Release. November 16, 2004.
- U.S. Fish and Wildlife Service. 2004d. Endangered and threatened wildlife and plants; proposed designation of critical habitat for the Pacific coast population of the western snowy plover; proposed rule. 50 CFR Part 17, Federal Register 69(242):75608-75771.
- U.S. Fish and Wildlife Service. 2004e. Notice of revised 90-day finding and initiation of 5-year review for fish *Deltistes luxatus* and *Chasmistes brevirostris*. Federal Register 69:43554-43558.
- U.S. Fish and Wildlife Service. 2004f. Volume I and II. Draft recovery plan for the Coastal-Puget Sound distinct population segment of bull trout (*Salvelinus confluentus*). 389 pp.
- U.S. Fish and Wildlife Service. 2004g. Notice of initiation of a 5-year review for bull trout (*Salvelinus confluentus*). Federal Register 69:19449-19450.
- U.S. Fish and Wildlife Service. 2004h. Proposed rule: critical habitat for fish *Salvelinus confluentus* (bull trout) for Coastal-Puget Sound DPS. Federal Register 69:35768-35856.

- U.S. Fish and Wildlife Service. 2004i. Final rule: critical habitat for fish *Salvelinus confluentus* (bull trout) for Klamath River and Columbia River DPSs. Federal Register 69:59996-60075.
- U.S. Fish and Wildlife Service and National Oceanic and Atmospheric Administration. 1996. Policy regarding the distinct vertebrate population. Federal Register 61:4721-4725.
- U.S. Forest Service and Bureau of Land Management 2003. Biological Opinion – Proposed Forest Management Actions FY 2004 – FY 2008 For Medford District BLM, Rogue River and Siskiyou National Forests.
- U.S. Forest Service, Pacific Northwest Region. 1994. Management Plan for the Oregon Dunes National Recreation Area, Siuslaw National Forest. 157 pp.
- U.S. Forest Service. 2001. Biological assessment for Baker Beach Dunes restoration project. Mapleton Ranger District. Siuslaw National Forest. 8 pp.
- U.S. Forest Service. 2003. Biological Assessment for Endangered, Threatened and Candidate Species, Hells Canyon National Recreation Area Final Environmental Impact Statement Comprehensive Management Plan.
- U.S. Forest Service. 2005. Biological Assessment for the USDA Forest Service Pacific Northwest Region Invasive Plant Program. Pacific Northwest Region, US Forest Service. 453 pp. plus appendices.
- U.S. Geological Survey. 2000. Unpublished water quality data analysis. Water Resources Division, Oregon District, Portland, Oregon. 41 pp.
- VanBuskirk, R. 1993. Oregon silverspot butterfly *Speyeria zerene hippolyta* (Lepidoptera, Nymphalidae): Clatsop Plains and Central Oregon Coast Research. University of California. The Nature Conservancy, Portland, Oregon. 36 pp.
- VanBuskirk, R. 1998. Survey for the presence of the Oregon Silverspot Butterfly, *Speyeria zerene hippolyta* (Lepidoptera, Nymphalidae) on the Clatsop Plains in 1998. University of California. The Nature Conservancy, Portland, Oregon. 13 pp.
- VanBuskirk, R. and D.L. Pickering. 1999. Dispersal of the Oregon Silverspot Butterfly in Lane County, Oregon. Report to the U.S. Fish and Wildlife Service, Oregon Coastal Field Office, Newport, Oregon.
- VanderKooi, S.P. 2002. Near-shore habitat use by endangered juvenile suckers in Upper Klamath lake, Oregon in regards to vegetation and water. Presentation at 38<sup>th</sup>

Annual Meeting Oregon Chapter American Fisheries Soc., 27 February-1 March 2002, Sunriver, Oregon. 15 pp.

- Vorobik, Linda A. 2003. The *Arabis macdonaldiana* group (Brassicaceae: *A. blepharophylla*, *A. oregana*, *A. aculeolata*, and *A. macdonaldiana*) from southwestern Oregon and northwestern California. MS publication, in press.
- Walker, W.W. 2001. Development of a phosphorus TMDL for Upper Klamath Lake, Oregon. Prepared for Oregon Department of Environmental Quality. 32 pp. plus appendices.
- Ward, J.W. Jr., Gutierrez, R.J., and B.R. Noon. 1998. Habitat selection by northern spotted owls: the consequences of prey selection and distribution. *Condor* 100: 79-92.
- Warriner, J.S., J.C. Warriner, G.W. Page, and L.E. Stenzel. 1986. Mating system and reproductive success of a small population of polygamous snowy plovers. *Wilson Bulletin* 98(1): 15-37.
- Washington Department of Fish and Wildlife. 1997. Grandy Creek trout hatchery biological assessment. FishPro Inc., and Beak Consultants. 61 pp.
- Washington Department of Fish and Wildlife. 2003. Summary of Washington bald eagle nesting data.
- Watson, G., and T. W. Hillman. 1997. Factors affecting the distribution and abundance of bull trout: An investigation at hierarchical scales. *North American Journal of Fisheries Management* 17:237-252.
- Watson, J.W. 2004. Responses of nesting bald eagles to experimental pedestrian activity. *Journal of Raptor Research* 38:295-303.
- Watson, J.W. and D. J. Pierce. 1998a. Ecology of bald eagles in western Washington with an emphasis on the effects of human activity. Washington Department of Fish and Wildlife, Olympia, WA.
- Weddell, B. 2001. Fire in steppe vegetation of the northern intermountain region. Technical Bulletin Number 01-14. Bureau of Land Management, Cottonwood District, Cottonwood, Idaho. 24 pp.
- White, J.D., and S.G. Allen. In prep. Draft western snowy plover management plan, Point Reyes National Seashore, Point Reyes, CA.
- White, R.K., T.L. Ramsey, M.S. Stern, and A.V. Munhall. 1991. Salvage operations and investigations of the range and stream habitat characteristics of the Warner sucker, *Catostomus warnerensis*, during spring and summer 1991. Unpublished

- report to the Bureau of Land management and Oregon Department of Fish and Wildlife. 44pp.
- Whiteley, A. R., P. Spruell, and F.W. Allendorf. 2003. Population genetics of Boise Basin bull trout (*Salvelinus confluentus*). Final report to Rocky Mountain Research Station, Contract:RMRS # 00-JV-1122014-561. 37 pp.
- Wiedemann, A.M. 1987. The ecology of European beachgrass (*ammophila arenaria* (L.) Link). A review of the literature. Oregon Department of Fish and Wildlife Nongame Wildlife Program Technical Report #87-1-01. 18pp.
- Williams, R. N., R. P. Evans, and D. J. Shiozawa. 1997. Mitochondrial DNA diversity in bull trout from the Columbia River basin. Pages 283-297 in W.C. Mackay, M.K. Brewin, and M. Monita (eds). Friends of the Bull Trout Conference Proceedings. Bull Trout Task Force (Alberta), c/o Trout Unlimited Calgary, Alberta, Canada.
- Wilson , M.V. and D.L. Clark. 1997. Effects of Fire, Mowing, and Mowing with Herbicide on Native Prairie of Baskett Butte, Baskett Slough NWR. Prepared for U.S. Fish and Wildlife Service, western Oregon refuges. 9 pp.
- Wilson , M.V. and D.L. Clark. 1998. Recommendations for Control of Tall Oatgrass, Poison Oak, and Rose in Willamette Valley Upland Prairies. Unpublished report to ONHP and USFWS. 13 pp.
- Wilson , M.V. and D.L. Clark. 2001. Controlling Invasive *Arrhenatherum elatius* and Promoting Native Prairie Grasses through Mowing. Applied Vegetation Science 4:129-138.
- Wilson, M.V., D.L. Clark and C.B. Schultz (in preparation). Effects of fire and mowing on native prairie and a rare butterfly in western Oregon.
- Wilson, R.A. 1980. Snowy plover nesting ecology on the Oregon coast. MS Thesis, Oregon State University, Corvallis. 41pp.
- Wilson-Jacobs, R., and E.C. Meslow. 1984. Distribution, abundance, and nesting characteristics of snowy plovers on the Oregon coast. Northwest Science 58(1):40-48.
- Wissmar, R. C., J. E. Smith, B. A. McIntosh, H. W. Li, G. H. Reeves, and J. R. Sedell. 1994. A history of resource use and disturbance in riverine basins of eastern Oregon and Washington (early 1800s-1990s). Northwest Science 68:1-35.
- Wolf, P.G., J. Barnes, and V.J. Tepedino. 1994. Population genetics of the Salmon River populations of MacFarlane's Four-o'clock (*Mirabilis macfarlanei*). Proposal for research submitted to Challenge Cost Share program, USDI Bureau

of Land Management, Coeur d'Alene District. Utah State University, Logan, Utah. 8 pp.

Ziller, J. S. 1992. Distribution and relative abundance of bull trout in the Sprague River subbasin, Oregon. Pages 18-29 *in* P.J. Howell, and D.V. Buchanan, eds. Proceedings of the Gearhart Mountain Bull Trout Workshop. Oregon Chapter of the American Fisheries Society, Corvallis, Oregon. 29 pp.

Ziller, J.S. in litt., 1985. Summary of sucker studies in Williamson and Sprague Rivers. Letter to Craig Bienz, The Klamath Tribes. October 10, 1985. 3 pp.

## **PERSONAL COMMUNICATIONS**

Shawna Bautista, wildlife biologist, Pacific Northwest Region, US Forest Service, Portland, Oregon, pers. comm., 2005.

Paul Bridges, biologist, Roseburg Field Office, USFWS, Roseburg, Oregon, pers. comm., 2005.

Florence Caplow, botanist, Washington Department of Natural Resources, Olympia, Washington, pers. observation. 2004.

Florence Caplow, botanist, Washington Department of Natural Resources, Olympia, Washington, pers. comm., 2005.

Martha Jensen, biologist, Western Washington Office, USFWS, Lacey, Washington, pers. comm., pers. comm., 2005.

Liz Kelly, biologist, Newport Field Office, USFWS, Portland, Oregon, pers. comm., 2005.

Ron Larson, biologist, Klamath Falls Fish and Wildlife Office, USFWS, Klamath Falls, Oregon, pers. comm., 2005.

Jennifer Lord, biologist, Oregon Fish and Wildlife Office, USFWS, Portland, Oregon, pers. comm., 2005.

John Sanchez, fish biologist, Siuslaw National Forest, Corvallis, Oregon, pers. comm. 2005.

Paul Scheerer, biologist, Oregon Department of Fish and Wildlife, Corvallis, Oregon, pers. comm., 2000.

## APPENDIX A

To provide some level of general information on the distribution of potential future treatments under the Invasive Plant Program, we utilized the acres of treatment on National Forests from 1999 to 2002 and the estimate of total treatments from the EIS to calculate both an average annual treatment level by National Forest and a potential single year high level of treatment.

For all treatments except aerial herbicide, we started by determining the percentage of a treatment type that occurred on an individual forest. For example, the Umatilla National Forest conducted 3,711 acres of manual treatments, which represents 43.1 percent of all manual treatments in the Pacific Northwest Region. We then used this percentage to partition the projections in table 4-33 of the Invasive Plant Program EIS into the individual forests. For the Umatilla, 43.1 percent of the 6,393 acres projected in the EIS would equal 2,755 acres. These calculations assume that the funding and distribution of the activity on the National Forests remains static. These values are displayed in Table 1. They represent the average annual level of activity we would expect under this plan. These values may vary slightly from EIS table 4-33 due to rounding errors.

For aerial herbicide use, we could not use past levels as this method has not been available to the U.S. Forest Service in many years. Aerial herbicide potential annual treatment levels was based on information from Shawna Bautista (pers comm. U.S. Forest Service, 2005)<sup>2</sup>. Only four National Forests projected aerial application in response to an information request, and one response was specific to treatments of invasive plant following the large Biscuit fire.

We know that due to funding differences, the time needed to complete planning and review, and the need to design effective treatments, the actual acreage to be treated in any one year will vary from the average over the decade. Therefore, to predict the total amount of treatment, and therefore the potential amount of effect to listed species, we used a variable formula. Because lumping of area over years is more likely where the forest will only have a small amount of activity, all acreages under 100 were multiplied by 4 (assuming efforts could be aggregated into a larger project. For values over 100 acres, the values were doubled. In the case of aerial herbicide application on the Rogue River National Forest, we assumed that half of the projected treatment could occur in any one year. This treatment is specific to the Biscuit fire. We therefore anticipated that treatment of a fire area would occur over a shorter time (1-2 years) than general operational treatments.

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<sup>2</sup> Four National Forests responded to the query on the use of aerial herbicides, indicating they would consider using this technique (Hells Canyon National Recreation Area, Rogue/Siskiyou National Forest, Malheur National Forest, and Umatilla National Forest). Based on their responses, the Forest Service estimated an average annual level of aerial herbicide treatment of 3,196 .

Table 1. Projected average annual acres of treatments based on distribution of treatments from 1999-2002 and assuming funding remains stable. Aerial herbicide treatment is based on information from Shawna Bautista (pers comm. 2005), as there have been no aerial applications in recent years to use in calculating future activity. Numbers vary slightly from EIS table 4-33 due to rounding error.

National Forest	E/W	Projected average annual acres of treatment under preferred alternative holding funding constant							
		Herbicide – ground	Herbicide - aerial	Manual	Mechanical	Biological	Cultural	Prescribed Fire	Total
Deschutes	E	139	0	401	0	0	0	0	540
Fremont	E	434	0	61	0	0	0	0	495
Gifford Pinchot	W	62	0	197	21	5	0	0	285
Malheur	E	25	21	116	0	5	0	0	167
Mt Baker Snoqualmie	W	46	0	38	0	0	0	0	84
Mt Hood	W	259	0	182	53	37	0	0	531
Ochoco	E	259	0	75	0	3	0	0	337
Okanogan	E	2594	0	728	173	422	140	279	4336
Olympic	W	42	0	13	0	0	0	0	55
Rogue	W	345	1536	61	0	9	0	0	1951
Siskiyou	W	3	0	242	55	9	0	0	309
Siuslaw	W	129	0	70	432	35	0	0	666
Umatilla	E	4531	103	2755	0	354	0	0	7743
Umpqua	W	0	0	134	7	30	0	0	171
Wallowa Whitman	E	2954	1536	285	13	587	0	0	5375
Wenatchee	E	366	0	194	147	0	144	288	1139
Willamette	W	317	0	433	298	87	7	14	1156
Winema	E	149	0	396	19	17	0	0	581
Columbia R Gorge	B	2646	0	3	0	66	0	0	2715
Crooked R Grasslands	E	92	0	3	235	75	0	0	405
TOTAL		15,392	3196	6387	1453	1741	291	581	29,041

Table 2. Projected potential annual acres of treatments based on distribution of treatments from 1999-2002, assuming funding remains relatively stable. Aerial herbicide treatment is based on information from Shawna Bautista (pers. comm. 2005), as there have been no aerial applications in recent years to use in calculating future activity. This represents an estimation of the total number of acres treated in a single year. For values over 100 acres, numbers were doubled from the average annual. For values under 100, values were multiplied by 4 (assuming efforts could be aggregated into a larger project). Exceptions are marked.

National Forest	E/W	Projected average annual acres of treatment under preferred alternative holding funding constant							
		Herbicide – ground	Herbicide - aerial	Manual	Mechanical	Biological	Cultural	Prescribed Fire	Total
Deschutes	E	278	0	802	0	0	0	0	1080
Fremont	E	868	0	244	0	0	0	0	1112
Gifford Pinchot	W	244	0	394	84	20	0	0	742
Malheur	E	100	84	232	0	20	0	0	436
Mt Baker Snoqualmie	W	184	0	152	0	0	0	0	336
Mt Hood	W	518	0	364	212	148	0	0	1242
Ochoco	E	518	0	300	0	12	0	0	830
Okanogan	E	5188	0	1456	346	844	280	578	8692
Olympic	W	168	0	52	0	0	0	0	220
Rogue	W	690	7500*	244	0	36	0	0	8470
Siskiyou	W	12	0	484	220	36	0	0	752
Siuslaw	W	258	0	280	864	152	0	0	1554
Umatilla	E	9062	206	5510	0	708	0	0	15486
Umpqua	W	0	0	268	28	120	0	0	416
Wallowa Whitman	E	5908	3072	570	52	1174	0	0	10776
Wenatchee	E	732	0	288	294	0	288	576	2178
Willamette	W	634	0	866	596	348	28	56	2528
Winema	E	298	0	792	76	68	0	0	1234
Columbia R Gorge	B	5292	0	123	0	264	0	0	5679
Crooked R Grasslands	E	398	0	12	470	300	0	0	1180
TOTAL		31350	10862	13433	3242	4250	596	1210	64943

\* as this use is slated for the Biscuit Fire, we used half the amount proposed as a potential treatment in one year. We would anticipate that treatment of a fire area would occur over a shorter time (1-2 years) than general operational treatments so more activity might occur in a single year.