Oregon Side of the Lower Middle Snake Subbasin Plan

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Northwest Power and Conservation Council

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1. Executive Summary

In lieu of what could properly be called an Executive Summary, Subbasin Planners in the Oregon Side of the Lower Middle Snake Subbasin (Oregon Side LMS) present the following Summary of Recommendations and Conclusions stemming from the planning process and intended to help guide implementation of the resulting fish, wildlife and habitat plan for the Oregon Side LMS subbasin.

General Recommendations

While the purpose of this process is to mitigate the impacts of the federal hydropower system on fish and wildlife resources, it is the purpose of this plan to achieve a healthy ecosystem with productive and diverse aquatic and terrestrial species, with emphasis on native species, which will support sustainable resource-based activities.

- The Planning Team believes that implementing this plan will provide opportunities for local natural resource-based economies to coexist and participate in recovery of aquatic and terrestrial species and habitats. Critical to the successful implementation of this plan is the increase in local participation and contribution to information, education, problem solving, and subbasin wide conservation efforts. It is important to promote the understanding and appreciation of healthy and properly functioning ecosystems with residents and stakeholders in the subbasin. The team recognizes the importance of respecting and honoring private property rights as well as the current local conditions, values, and priorities of the subbasin.
- The Planning Team also believes a scientific foundation is needed to diagnose ecosystem problems, design, prioritize, monitor and evaluate management to achieve plan objectives. The Oregon side of the Lower Middle Snake Subbasin Plan provides a next step in the process, but the restraints of a short time frame and funding limited the ability of this iteration of subbasin planning to provide a thorough scientific foundation and to integrate that foundation throughout the planning process. This information will provide the scientific basis for the public involvement and education activities also called for in this plan.

Some data and professional judgment exists to give direction on near term implementation projects, but the many data gaps need to be filled before a complete, holistic implementation can occur. The Research, Monitoring and Evaluation chapter of this plan provides an initial outline of information needed before a more comprehensive iteration of an implementation plan can be developed.

- This plan needs to be understood in the context of existing fish and wildlife plans, Agricultural Water Quality Plan (SB 1010 Plan), ESA recovery plans, future TMDL implementation plans and the many other planning efforts and documents affecting the subbasin. All these plans provide the context, and in many cases direction, for implementing the Oregon side of the Lower Middle Snake Subbasin Plan.

Summary and Synthesis of Plan Conclusions

Problem statements were developed with the Aquatic and Terrestrial Technical Teams, and reviewed by the Planning Team, using factors defined as limiting the potential of focal species or habitats in the Assessment . Socioeconomic Problem Statements were developed by the Planning Team to address potential factors limiting successful implementation of this plan. Objectives and associated strategies were then developed to address each problem statement.

Objectives are generally meant to address habitat for fish and wildlife populations and were developed to address problems defined for each focal habitat.

Research, Monitoring, and Evaluation activities are closely related to the vision, objectives and strategies. This section summarizes additional research, monitoring, and evaluation (RM&E) activities needed to aid in resolving management uncertainties. Monitoring and evaluation activities were described as well as the expected short- and long-term outcomes. Adaptive management is emphasized in this plan. To achieve each objective, strategies require a feedback loop for integration of additional information and modification of future activities.

Recommended actions to mitigate and improve conditions for fish and wildlife were developed during prioritization exercises with the Technical Team, and reviewed by the Planning Team. The Technical Team did not wish to prioritize strategies, rather activities should be implemented as they present themselves. Common rules for prioritization are: 1) build from strength by protecting areas in the best condition, 2) restore outwardly from areas of strength, 3) prioritize for multiple species benefits, 4) prioritize according to importance of limiting factors to be addressed, and 5) prioritize for maximum overlap between terrestrial and aquatic benefits. Watershed disturbance, water quality and quantity were most often defined as limiting factors. The Terrestrial Technical Team determined that shrub-steppe habitats and riparian/ wetland/ spring habitats are the most important to protect and restore in the Oregon side of the Lower Middle Snake subbasin. The Terrestrial Technical Team also determined that projects benefiting ESA species or habitats, or those that work to keep critically imperiled species from being listed, should be prioritized over projects that do not.

Social Impact Conclusions

The Planning Team desires to implement this plan in a way which minimizes adverse impacts to stakeholders and maximizes local public support. Maintaining a viable farming and ranching industry is critical to sustaining a local population in the subbasin, which is an important value to the Planning Team.

<u>Livestock:</u> Grazing is an important land use in the Oregon side of the Lower Middle Snake subbasins involving important economic and multigenerational cultural traditions. A number of the terrestrial and aquatic objectives include recommendations that could potentially alter current grazing management practices . Altering current grazing practices involves implementing appropriate Best Management Practices from state and federal technical guides.

How Best Management Practices are implemented is a concern among livestock producers in the subbasins. The timetable for implementing Best Management Practices needs to be realistic and achievable, and should be jointly developed with livestock producers. Livestock producers are not opposed to reasonable grazing Best Management Practices, they are troubled, however, by rapid, unplanned policy shifts that do not allow time to revise operations with a minimum of disruption and economic consequences. The economic and cultural base of the Oregon side of the Lower Middle Snake subbasin relies heavily on livestock production. New practices should be implemented reasonably to allow time for producers to find alternatives without incurring major operational and economic impacts.

<u>Farming:</u> A number of aquatic objectives (i.e. restore flows, reduce temperature, decrease sedimentation, etc.) include recommendations that impact practices related to irrigated agriculture. Goals for Best Management Practices implementation related to these recommendations not only need to be realistic and achievable, but also must be developed in concert with agricultural producers with enough time to allow successful transitions, without major operational and economic impacts. The wide variety of irrigated croplands and

pasturelands produced within the subbasin enhances both local and statewide economies while supporting multigenerational cultural traditions.

Restoring fire regimes to a more historic trend in the Oregon side of the Lower Middle Snake subbasins will benefit a number of stakeholders with no identified negative impacts. Aggressive fire suppression in shrub steppe habitat is a tool for restoring historic fire regimes. Reducing impacts of catastrophic wildfire on forage resources is important to maintaining a stable local agriculture. These fires destroy the forage base and provide an avenue for invasive noxious plant invasion. Fires in shrub-steppe habitats have economic impacts by reducing short-term forage resources and, through weed invasion, reducing long term forage. Altered fire regimes are negatively impacting shrub-steppe habitats and associated species. Addressing these problems now could potentially reduce future economic impacts. Restoring fire regimes will help avoid this problem, benefiting local communities, natural resource users, as well as the species that depend on impacted habitats.

Noxious weeds invade habitats after fire and other disturbances. Their intrusion impacts agriculture, water quality, recreationists, ranchers, and other people, and native terrestrial and aquatic species and habitat. A need exists for more effective management of noxious weed programs in the subbasin, especially financial help. The entire scale of the current invasive noxious plant control efforts needs to grow; a need exists for more funding for projects and programs to address current problems. Implementing the objectives and strategies in this plan addressing invasive noxious plants will benefit all stakeholders without negative impacts.

Recreation: Currently hunting, fishing and other wildlife viewing related recreation is a billion dollar industry in the state of Oregon. Successful implementation of this plan will benefit anglers, hunters and wildlife watchers by helping preserve and/or improve fish and wildlife populations and habitats. This will also benefit the local economies that support such recreational activities.

Development: The Planning Team is concerned about the irreversible adverse effects on habitats and species of converting agricultural, shrub-steppe and timberlands into commercial and residential developments. In the southern portion of the Oregon side of the Lower Middle Snake subbasin the impacts of municipalities have important effects on species and habitats. The impacts of increased growth need to be managed by municipalities and counties in concert with other activities called for in this plan.

Final recommendations

Implementation in the Oregon side of the Lower Middle Snake subbasins needs to integrate the other major subbasins integral to the Snake in this area. Fish and wildlife are not always restricted to subbasin boundaries. Future work needs to integrate the results of multiple subbasin planning and implementation efforts to address these multiple subbasin issues.

The Planning Team is concerned because it is unclear how future comments will be addressed and the plan revised. Review comments and revisions need to be addressed through a process that includes Planning Team involvement and oversight. This will include funding for Planning Team involvement, facilitation and review and update of the plan. The timeline for this process has been too limited. Planning Team members had very little time to review assessment and plan products. Insufficient time existed for this to be a fully integrated planning process that allowed policy makers and public to integrate with the technical committees.

The Planning Team believes this process has provided positive interaction with stakeholders and has resulted in information to direct future implementation activities in the subbasin. This plan provides the rationale for increasing BPA funding to activities in the Oregon side of the Lower Middle Snake subbasins. This plan provides an adequate foundation for prioritization and implementation of activities in the subbasin while pointing towards the need to develop additional information and planning to refine future activities.

The Planning Team intends that this plan will provide a structure for implementation and future research and planning in the Oregon side of the Lower Middle Snake subbasins. This plan will streamline the process for project selection and implementation. The Planning Team also thinks that BPA funds should be more equitably distributed among subbasins in proportion to losses, which would result in more BPA funding for the Oregon side of the Lower Middle Snake subbasins. The Oregon side of the Lower Middle Snake is one of the subbasins that has been the most impacted but the least compensated for impacts of the hydropower system on anadromous aquatic species.

2. Introduction

2.1 Description of Planning Entity

The Baker County Association of Conservation Districts (BCACD) was the lead entity for the development of this Subbasin Plan. BCACD is made up of four Soil and Water Conservation Districts (SWCD) within Baker County, Oregon. The Districts are: Baker Valley SWCD, Burnt River SWCD, Eagle Valley SWCD and Keating SWCD. Districts are made up of officials elected to two-year terms during general elections held in November. The Districts' interests include: improving water quality and quantity, reducing the impact of noxious weeds, providing technical and financial assistance to landowners and continuing to be proactive in land use issues.

The Vision of the BCACD is:
To take available technical financial and educational resources, whatever their source, and focus or coordinate them so that they meet the needs of the local land user.

The Mission of the BCACD is:
To facilitate the activities of member Districts in providing assistance to governmental agencies, private landowners and other interested parties in their respective pursuits of natural resource conservation, all in accordance with applicable laws of the State of Oregon.

Membership in BCACD includes all Directors and Associate Directors of the Baker Valley SWCD, Burnt River SWCD, Eagle Valley SWCD and Keating SWCD. Each group has one vote, with a Chairperson elected to preside over meetings. Decisions are made by majority vote; the chair has the option of resolving ties by voting. The group establishes committees as needed to facilitate the mission. Meetings are open to the public with agencies, organizations and interested citizens encouraged to attend.

BCACD was established as a 501(c)(3) organization in 1995. The group has engaged in conservation efforts through the SWCDs in cooperation with the Natural Resource Conservation Service (NRCS), Oregon Department of Fish and Wildlife (ODFW), Oregon Department of Forestry (ODF), US Fish and Wildlife Service (USFWS), US Forest Service (USFS), Bureau of Land Management (BLM) and Bureau of Reclamation (BOR), along with private landowners.

2.2. List of Participants

Multiple agencies and entities are involved in managing and protecting fish and wildlife populations and their habitats in the Oregon side of the Lower Middle Snake subbasin. Federal, state and local regulation, plans, policies, initiative and guidelines are part of this effort and share co-management authority over the fisheries resource. Federal involvement in this arena stems from ESA responsibilities and management responsibilities for federal lands and habitat and migratory birds. Numerous federal, state, and local land managers are responsible for multipurpose land and water use management, including protecting and restoring fish and wildlife habitat. The contract entities and plan participants involved in the development of the Oregon side of the Lower Middle Snake subbasin plan are outlined below. The Oregon Department of Fish and Wildlife is responsible for managing species that are not federally listed and non-migratory birds.

Northwest Power and Conservation Council

The NPCC has the responsibility to develop and periodically revise the Fish and Wildlife Program for the Columbia Basin. In the 2000 revision, the NPCC proposed that 62 locally developed subbasin plans, as well as plans for the mainstem Columbia and Snake rivers, be adopted into its Fish and Wildlife Program. The NPCC will administer subbasin planning contracts pursuant to requirements in it Master Contract with the BPA (NPCC 2000). The NPCC will be responsible for reviewing and adopting each subbasin plan, ensuring that it is consistent with the vision, biological objectives and strategies adopted at the Columbia Basin and province levels.

Bonneville Power Administration

The BPA is a federal agency established to market power produced by the federal dams in the Columbia River basin. As a result of the Northwest Power Act of 1980, BPA is required to allocate a portion of power revenues to mitigate the damages caused to fish and wildlife populations and habitat from federal hydropower construction and operation.

Project Team

In addition to using its own staff, BCACD hired two contractors to help with the planning process and help write plan documents: Cat Tracks Wildlife Consulting to be the writer/editor and Jennifer Mudd to provide all the GIS maps. Staff from these contractors served on the project team. Staff from BCACD carried out the public involvement and public relation tasks for the subbasin.

Planning Team

The planning team for the Oregon side of the Lower Middle Snake subbasin was composed of representatives from government agencies with jurisdictional authority in the subbasin, fish and wildlife managers, county and industry representatives and private landowners. The planning team's primary responsibilities were to guide the public involvement process, develop the vision statement, review the biological objectives and participate in prioritizing subbasin strategies. Regular communication and input among team members occurred at the inception of and throughout the planning process. The planning team met every other Thursday for the first six months and every Thursday thereafter.

Table 1. Oregon side of the Lower Middle Snake Planning Team

Name	Affiliation
Doni Clair	Project and fiscal manager
M. Cathy Nowak	Contracted writer/editor
Jennifer Mudd	Contracted GIS technician
George Keister	Oregon Dept of Fish and Wildlife
Jeff Zakel	Oregon Dept of Fish and Wildlife
Gary Miller	US Fish and Wildlife
Keith Paul	US Fish and Wildlife
Jerry Franke	Burnt River SWCD
Dave Clemens	Eagle Valley SWCD

Tim A Kerns	Baker Valley SWCD
Jackie Dougan	Bureau of Land Management

Technical Team

The technical team included scientific experts who guided the development of the subbasin assessment and plan. This team has the biological, physical and management expertise to refine, validate and analyze data used to inform the planning process. The technical team also guided and participated in developing the biological objectives, strategies and research, monitoring and evaluation sections of the plan and reviewed all project documents. The technical team met with the planning team and participated in workshops that were one or more days long and focused on input of professional judgment to fill data gaps.

2.3. Stakeholder Involvement Process

As the Oregon side of the Lower Middle Snake Subbasin Management Plan was developed, four methods of outreach and public and government participation were used in the Oregon side of the Lower Middle Snake subbasin:

- Technical team meetings and workshops
- Planning team meetings
- Attendance and presentation at Baker County Natural Resource Committee meetings
- Attendance and presentation at Oregon side of the Lower Middle Snake Basin Watershed Council meetings
- A web-site

Technical Team Participation

The technical team was composed of members that have technical expertise in fish, wildlife and habitat resources in the Oregon side of the Lower Middle Snake subbasin. The meetings were held Thursday mornings at the BCACD office in Baker City and were open to the public. The technical team reviewed and gave input on the technical aspects of the subbasin plan and this input is in large part documented in the subbasin assessment.

Planning Team Participation

The planning team was composed of members that have expertise and knowledge of the management of natural resources and socioeconomic issues in the Oregon side of the Lower Middle Snake subbasin. The meetings were held Thursday mornings in the BCACD office in Baker City and were open to the public. The planning team reviewed and gave input on the management aspects of the subbasin plan and this input is documented in the subbasin management plan.

Public Meeting Outreach

The project manager attended several meetings of the Baker County Natural Resources Advisory Board and the Powder Basin Watershed Council. Both groups supported the drafts as they were presented and had opportunities to get their concerns documented. Members of these groups include representatives from: US Forest Service, Bureau of Land Management, Bureau of Reclamation, US Fish and Wildlife, Oregon Dept. of Forestry, Oregon Dept. of Fish and Wildlife, County government, stakeholders and land owners/managers.

2.4. Overall Approach to the Planning Activity

The Oregon side of the Lower Middle Snake Subbasin Management Plan has been developed as part of the Northwest Power and Conservation Council's (NPCC) Columbia River Basin Fish and Wildlife Program. Subbasin plans will be reviewed and eventually adopted into the Council's Fish and Wildlife Program to help direct Bonneville Power Administration (BPA) funding of projects that protect, mitigate and enhance fish and wildlife habitats adversely impacted by the development and operation of the Columbia River hydropower system. The National Marine Fisheries Service (NMFS, also referred to as NOAA Fisheries) and the U.S. Fish and Wildlife Service (USFWS) intend to use subbasin plans as building blocks in recovery planning to meet some of the requirements of the 2000 Federal Columbia River Power System Biological Opinion (BiOp). Subbasin plans are to be developed in an open public process that includes the participation of a wide range of state, federal and local governments; local managers; landowners; and other stakeholders – a process that NPCC hope will ensure support of the final plan and direct funding to natural resource projects that have a benefit to fish and wildlife.

The Oregon side of the Lower Middle Snake Basin Planning Team and the Baker County Association of Conservation Districts intend the Oregon side of the Lower Middle Snake Subbasin Plan to serve multiple purposes. They intend the plan to meet the Council's call for subbasin plans as part of its Columbia Basin wide program and to provide a resource for federal agencies involved with Endangered Species planning efforts. But equally important, this plan is a locally organized and implemented effort involving the major resource managers and local governments in the subbasin to develop the best possible approach to protecting, enhancing and restoring fish and wildlife in the Oregon side of the Lower Middle Snake Subbasin. This plan is intended to provide resources necessary to develop activities forwarding the vision of the Oregon side of the Lower Middle Snake Basin Planning Team at both subbasin/programmatic scales and to provide the context and information for developing site specific projects. The Oregon side of the Lower Middle Snake Subbasin Plan is comprised of three volumes that are interdependent, but each provides a unique way in understanding the characteristics, management and goals for the future of the Power subbasin. The three volumes generally conform to the guidance set forth in the Council's Technical Guide for Subbasin Planners (2001), which became available during the late-middle part of the project.

Assessment – The assessment develops the scientific and technical foundation for the subbasin plan. The assessment provides an overview, a discussion of focal species and habitats, including environmental conditions and ecological relationships, limiting factors and syntheses and interpretation. The Oregon side of the Lower Middle Snake Subbasin Assessment provides the analysis and background information to support the recommendations made in the Oregon side of the Lower Middle Snake Subbasin Management Plan.

Inventory - The inventory includes information on existing fish and wildlife information, present and future programs, projects and activities. This information provides an overview of the management context, including existing resources for protection and restoration in the subbasin.

Management Plan – The Management Plan includes a vision for the future of the Oregon side of the Lower Middle Snake Subbasin, biological goals and objectives and strategies for achieving them.

This Plan was developed through a process designed to involve the public and natural resource management within the subbasin. A project team was formed to develop and document, under the guidance of the technical teams, the Oregon side of the Lower Middle Snake Subbasin Management Plan. The completed document was submitted by Baker County Association of

Conservation Districts (BCACD). The following sections detail the entities involved in resource management with the Oregon side of the Lower Middle Snake Subbasin and describe the planning, public involvement and review procedures.

2.5. Process and Schedule for Revising/Updating the Plan

An adopted subbasin plan is intended to be a living document that increases analytical, predictive and prescriptive ability to restore fish and wildlife habitats. This Oregon side of the Lower Middle Snake Subbasin Management Plan will be updated as need arises and funds become available to include new information that will guide revision of the biological objectives, strategies and the implementation plan. The NPCC view plan development as an ongoing process of evaluation and refinement of the region's efforts through adaptive management, research and evaluation. More information about subbasin planning can be found at http://www.nwcouncil.org.

3. Subbasin Assessment

3.1. Subbasin Overview

3.1.1. General Description

3.1.1.1 Subbasin Location

The Oregon Side of the Lower Middle Snake subbasin (hereafter, the Oregon Side LMS subbasin) is located within the Lower Middle Snake subbasin. It encompasses the area draining into the mainstem Snake River, excluding major tributaries (Powder and Burnt rivers) from Snake River mile 260 at Copper Creek to Snake River mile 335 at Benson Creek (**Figure 1**). The subbasin includes small portions of larger management units at local, state, and federal levels. Little information specific to the area of interest in this document has been compiled or published. Most information compiled and summarized to date is in the context of the Lower Middle Snake Subbasin in its entirety or for all of Baker County rather than for the portion of each considered here. Therefore, information in this document may be presented for Baker County or for the Lower Middle Snake subbasin with qualifiers where this information is thought not to be representative of the Oregon Side of the LMS subbasin. Much of the general subbasin information and many of the figures were taken from the draft *Lower Middle Snake Subbasin Summary* (Saul et al. 2001).

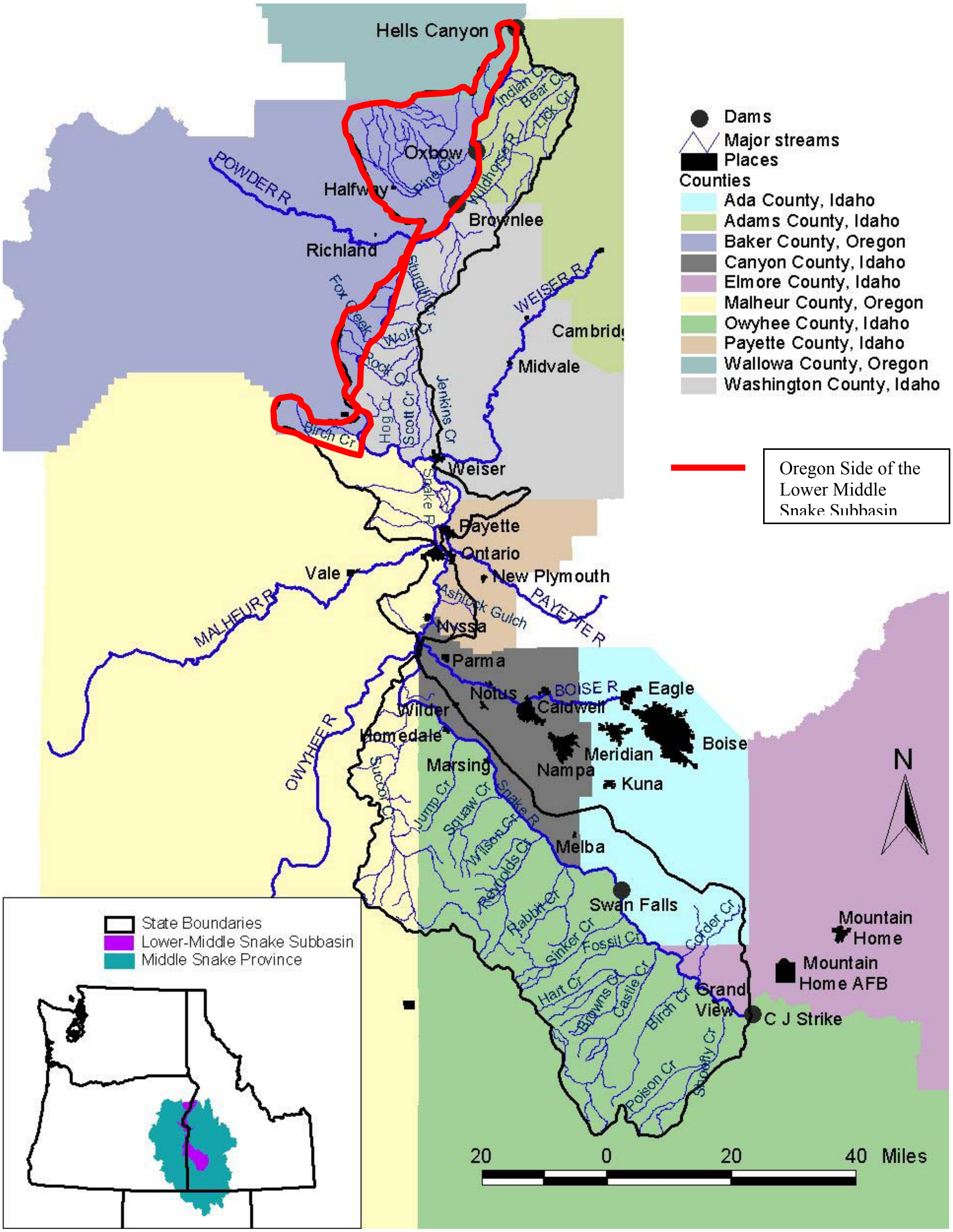


Figure 1. Location of the Lower Middle Snake Subbasin

3.1.1.2 Subbasin Size

The Oregon Side LMS subbasin lies primarily within Baker County but includes small portions of Union, Wallowa and Malheur counties, Oregon.

3.1.1.3 Geology and Topography

The Oregon Side of the Lower Middle Snake subbasin is in the Blue Mountains Province, which joined the continental west coast about 300 million years ago when the Blue Mountain island arc was accreted to the North American continent (Vallier 1998; Orr and Orr 1996; Hubbard 1956). In the Wallowa and Seven Devils mountain ranges, the mountain building of the Northern Rockies uplifted the mountains to their current elevations, causing rivers and streams to rapidly incise the landscape. This led to the formation of canyons and gorges throughout the region (Orr and Orr 1996). About 13 million years ago lava flows dammed the Snake River at the narrows of Hells Canyon (on the Oregon-Idaho border). This backed up the Snake to form Lake Idaho, which grew to be 150 miles long and 50 miles wide (Orr and Orr 1996). Lake Idaho filled an area from the Oregon border to Twin Falls. Sediments deposited within the lake basin (Idaho Group Sediments) persist on the Snake River Plain today (Orr and Orr 1996).

About 1.5 million years ago, Lake Idaho cut through what is now Hells Canyon, connecting the Snake River Plain to the Columbia River Basin. Once this happened, the Snake and its tributaries began to cut their current valleys. About 14,500 years ago, the Bonneville Flood increased the rate of downcutting when the Great Salt Lake drained north through the Snake River Canyon, flushing large amounts of sand and gravel into the subbasin (Orr and Orr 1996). The flood deepened and widened the Snake River Canyon, which in turn, led to further downcutting of the tributary canyons, further steepening canyon slopes, creating terraces and depositing gravels (Vallier 1998). Most recently, stream alluvium has been deposited in river and stream bottoms and lake sediments have been deposited by wind and water into depressions in the basalt flows (Figure 6; DAF 1998).

In Hells Canyon, the basalt is prone to rockslides and forms many colluvium and alluvium deposits throughout the canyon. Many of the canyon walls are steep; the rocks are noncohesive and severely weathered. Relatively large earthquakes (as strong as Richter magnitude 5) appear to have occurred in the past. Landslides and mass wasting contribute significant amounts of gravel and cobbles into the Snake River (Vallier 1998). Overall the subbasin is dominated by
mafic volcanic flow, alluvium and sandstone, cumulatively covering approximately 65% of the subbasin (Figure 7).

The over-steepened side slopes of Hells Canyon caused landslides to occur, forming many colluvial and alluvial fans near the base of the canyon. Wind-blown loess and volcanic ash have been deposited in the area and now mantle the ridges and summits on both sides of the canyon (USDA Forest Service 1981a).

Soils within Hells Canyon influence erosion and sedimentation into the Snake River and its tributaries, influencing water quality and habitat. The primary factor governing soil development is the deep canyon itself, with steep continuous slopes that often continue well over a mile from the river to the crest of the mountain ridges on either side, ascending through several soil climatic regimes. Vegetation and soil development within the canyon are heavily influenced by the east/west facing canyon sides and the north/south slope aspects caused by many ephemeral streams receiving sunlight differently.

Soils in the canyon commonly contain varying amounts of coarse angular gravels, cobbles, silt and ash (USDA Forest Service 1981a). Many rock outcrops interrupt the soil landscape on the along the upper slopes of the east-facing Oregon side of the canyon. The intermittent outcrops and coarse material can inhibit erosion from surface runoff and reduce sediment transport.

The most common sub-type forms in a semi-arid environment and contains a clay-rich subsurface horizon. Alluvium-dominated areas have been developed into agriculture. Few studies of soils and soil erosion have taken place in Hells Canyon and information on the erosion characteristics and processes of soils is therefore limited. Soils identified in the canyon are highly erodible (high K-factors) because of high silt/fine sand texture and high concentrations of volcanic ash. However, surface erosion processes, such as rill and sheet erosion, are not as common in the canyon as in other nearby watersheds due to the undisturbed grassland and shrub-steppe vegetation and forest canopies on many north facing side slopes (Art Kreger, Soil Scientist, USDA Forest Service, personal communication 5/2/01 *cited in Saul et al. 2001*). Within the side slopes of the many draws on the Oregon side of the canyon, some soil creep has taken place because deep current soils overlie horizons of dark organic rich topsoil from past grassland soils (Art Kreger, Soil Scientist, USDA Forest Service, personal communication 5/2/01 *cited in Saul et al. 2001*).

Unlike soil erosion, the hazards associated with geology in the Hells Canyon National Recreation Area have long been studied (Vallier 1994; 1998). Erosion processes taking place in the canyon consist mainly of various forms of mass wasting, with rock and debris flows being the most prevalent. Sustained rainfalls and shaking from the many earthquakes that take place in and around Hells Canyon increase the likelihood of landslides occurring (Vallier 1994). Because of the continuous steep slopes on either side of the canyon, landslides and debris flows can travel down slope great distances and often reach the bottom. The colluvium at the bottom of many steep slopes is often unstable and subject to movement at any time, and is a source of sedimentation into streams. Undercutting by stream erosion or road construction has increased instability and movement of these deposits (Vallier 1994).

Rockslides are an imminent danger to travelers in the Hells Canyon National Recreation Area. Rock falls occur without warning at anytime almost on a daily basis. Rocks falling onto power line roads have been known to leave indentations in the roads (Vallier 1994).

Although the many gravel bars, alluvial fans, river terraces and landslides have occupied the Hells Canyon area for thousands of years, sedimentation from fine material from more recent influences are still a concern.

The Lower Middle Snake subbasin lies in the lower portion of the Snake River Plain and is surrounded by high mountains: The Jarbidge and Owyhee Mountains are to the south, the Blue Mountains to the west, Seven Devils and Wallowa Mountains to the north, and the Sawtooth and Boise Mountains to the northeast. The highest elevation in the subbasin is 9,101 feet, which occurs at the summit of Granite Mountain in the headwaters of Pine Creek. The lowest elevation in the subbasin is 1,496 feet at Hells Canyon Reservoir.

3.1.1.4 Climate and Weather

The Lower Middle Snake subbasin as a whole has a semi-arid climate, with limited areas of moderate to high precipitation in the northernmost portions of the subbasin. Summers in the canyons tend to be hot (mean temperatures of 80° to 90° F, with maximums often > 100° F) and winters milder (mean temperatures > 30° F). At mid-elevations and on the upper plateau temperatures are cooler, with moderately severe winters and warm summers.

Annual precipitation follows the same pattern across the subbasin, although amounts of precipitation increase downstream (Figure 2). Precipitation comes in the form of short, intense summer storms and longer, milder winter storms (IDEQ and ODEQ 2001). Precipitation is strongly seasonal, with the majority of the precipitation falling in the winter. The Hells Canyon area receives an average of 13 inches per year (Figure 2; Daly et al. 1997). The highest precipitation area in the subbasin is in the headwaters of Pine Creek (average of 69 inches annually) in the Wallowa Mountains.

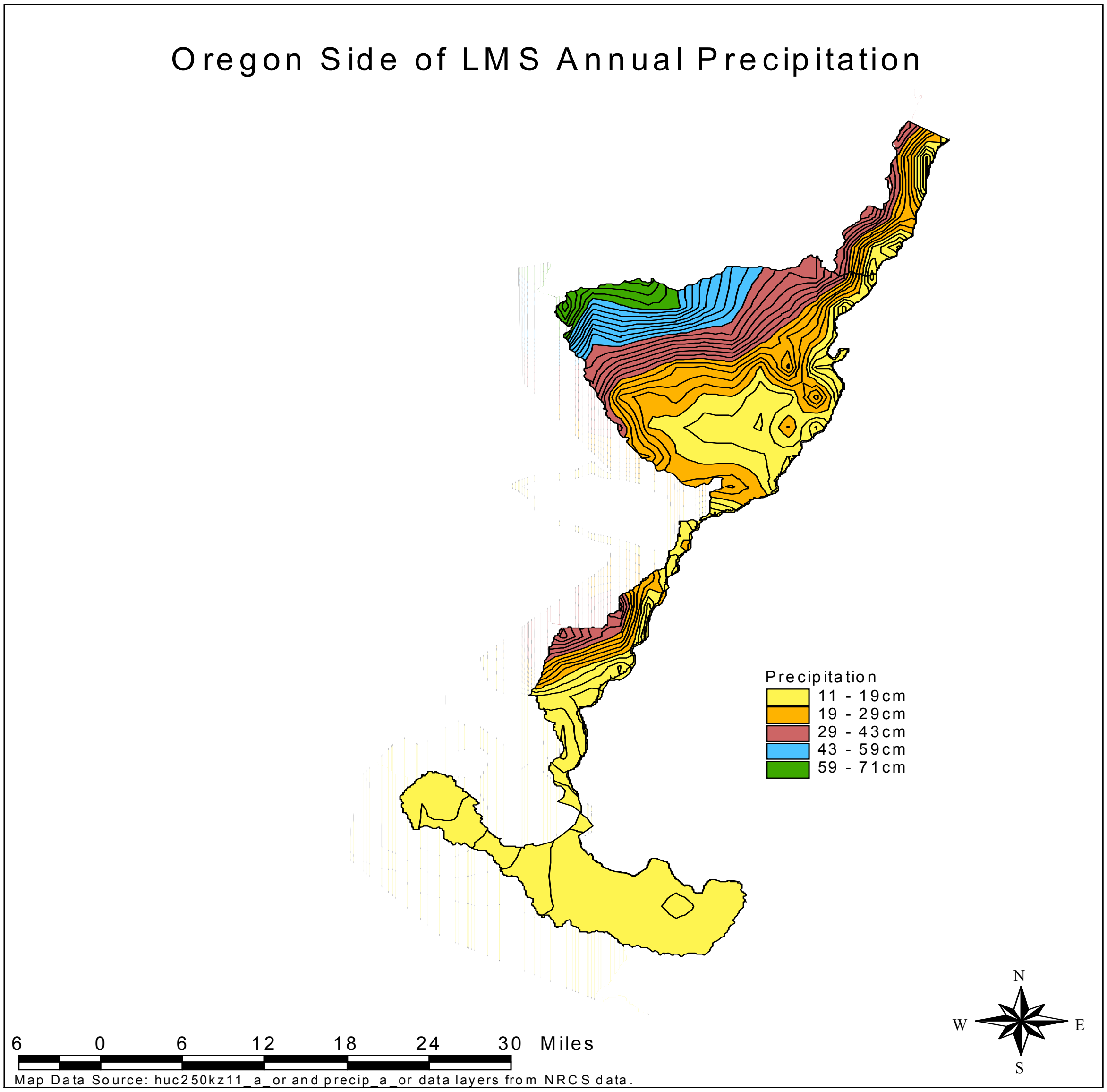


Figure 2. Precipitation patterns in the Oregon Side Lower Middle Snake subbasin.

3.1.1.5 Land Cover

Shrub and grassland communities comprise approximately 78% of the Lower Middle Snake subbasin. Other substantial components of the vegetative community include big sagebrush communities (30.7%), xeric grasslands (22.6%), agricultural fields (14.4%), forest communities (13.1%), and salt-desert shrub communities (9.5%). Various other shrub and grassland types individually cover between 0.5% and 2.4% of the subbasin.

Forested areas in the subbasin are predominately mixed conifer forest (6%) and Ponderosa pine (*Pinus ponderosa*; 2.2%), both of which are concentrated in the Hells Canyon portion of the subbasin. Western juniper (*Juniperus* spp.) and mountain mahogany represent small percentages of land cover for the subbasin, 2.6 percent and 0.44 percent respectively, and are concentrated in the high elevation areas of the upper subbasin.

In Wyoming big sagebrush (*Artemisia tridentata wyomingensis*) communities, big sagebrush is the dominant shrub species and a variety of grass species may dominate the understory. These species include Thurber needlegrass (*Stipa thurberiana*), bluebunch wheatgrass (*Agropyron spicatum*), bottlebrush squirreltail (*Sitanion hystrix*), basin wildrye (*Elymus cinereus*), Indian ricegrass (*Oryzopsis hymenoides*), Sandberg bluegrass (*Poa secunda*), and needle and thread grass (*Stipa comata)* USDI 1995). On the Oregon side of Brownlee Reservoir, Wyoming big sagebrush communities on most south aspects have been largely converted by fire to annual grasslands, primarily of cheatgrass and medussa head rye. This has also occurred, although to a lesser extent, adjacent to Oxbow and Hells Canyon Reservoirs; much more bitterbrush, sagebrush, and bunchgrass remains in the communities adjacent to the latter two reservoirs.

Riparian communities along the Snake River and perennial and intermittent creeks are dominated by coyote willow (*Salix exigua*). This species grows in a very narrow band just above the mean water line of the river. Russian olive (*Elaeagnus angustifolia*), an exotic species, often grows along with willow (USDI 1995). The confluences of intermittent and perennial streams with the Snake River often have alluvial areas that support more extensive stands of coyote willow, peachleaf willow (*Salix amygdaloides*) and occasionally black cottonwood (*Populus trichocarpa*). Cottonwoods are found at the mouth of Sinker Creek (USDI 1995). In higher elevation riparian areas, aspen (*Populus tremuloides*), birch (*Betula* spp.), shrubs and other trees occur in groves. Riparian areas in tributaries are often limited in size because of limited canyon wall constriction. Pockets of diversity lie scattered around the desert in the form of wetlands and creeks, hot springs and wet meadows. Several islands in the Snake River are almost entirely covered with coyote willow, Wood's rose (*Rosa woodsii*) and golden currant (*Ribes aureum*).

Vegetation in the subbasin has changed since presettlement times due in part to the introduction of nonnative species, grazing pressure by domestic stock, changes in the fire regime, and changes in hydrology. Grazing pressure, in conjunction with 14 years of below normal precipitation, which culminated in the drought of 1934, resulted in a reduction of native understory grasses and the creation of dense, monotypic stands of big sagebrush (USDI 1995). The reduction in native understory paved the way for the invasion of exotic annuals and noxious weeds (USDI 1995). Noxious weeds have become established in many areas of the subbasin and have caused reductions in plant diversity, habitat quality, habitat quantity and forage for wildlife species. By changing basic regimes, such as the fire regime, exotic plants, especially the grasses, have changed basic ecological patterns that now limit the reintroduction of native vegetation communities and encourage further weed invasion. In many areas, succession towards more complex communities has been stunted or stopped and fish and wildlife populations have been negatively impacted.

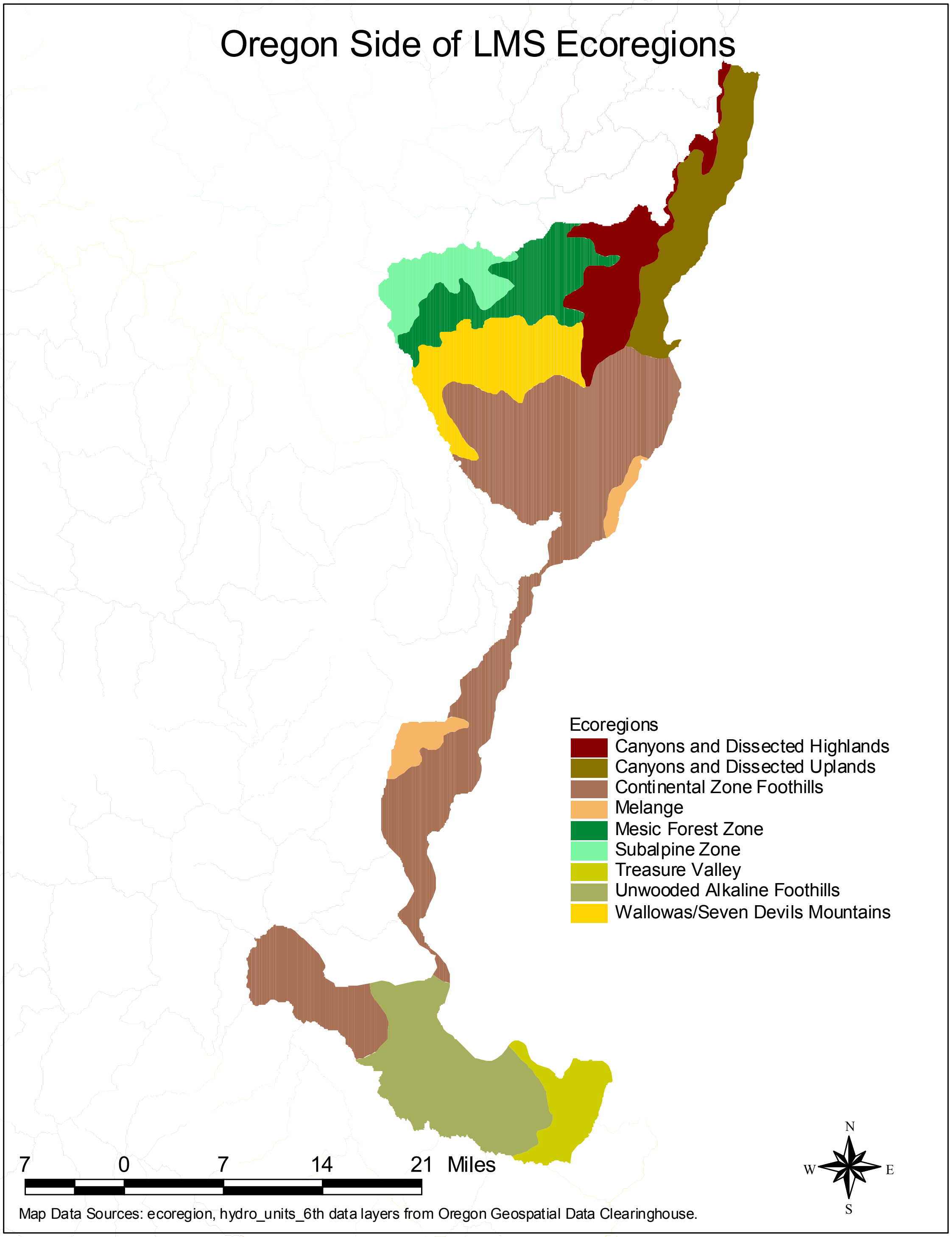


Figure 3. Ecoregions of the Oregon Side LMS subbasin, Oregon.

3.1.1.6 Land Use and Population

Prior to European settlement, the Northern Shoshone, Northern Paiute and Bannock (a Northern Paiute subgroup) Tribes occupied a territory that extended across most of southern

Idaho into western Wyoming and down into Nevada and Utah, a portion of which is today referred to as the Middle and Upper Snake Provinces of the Columbia River Basin.

The Tribes moved with the seasons. The annual subsistence cycle began in the spring, when some bands moved into the mountains to hunt large game and collect roots. Other bands moved to fishing locations on the Snake and Columbia Rivers. During the summer, large groups traveled to Wyoming and Western Montana to hunt bison.

The summer months were a time of inter-tribal gatherings. Tribes met along the Snake River to trade, hunt, fish, and to collect seeds, nuts and berries. Late fall was a time of intensive preparation for winter. Meats and various plant foods were cached for later use and winter residences along the Snake River were readied (Idaho Army National Guard 2000).

The Tribes utilized fish and wildlife resources across the region. Using implements such as spears, harpoons, dip nets, seines, and weirs, they fished for Chinook salmon, steelhead trout (Oncorhynchus mykiss), Pacific lamprey (Entosphenus tridentatus), white sturgeon (Acipenser transmontanus), cutthroat trout (Oncorhynchus clarki), and mountain whitefish (Coregonus williamsoni). They hunted antelope, deer, elk, bighorn sheep, rabbits, bears and certain types of waterfowl (Idaho Army National Guard 2000).

Currently, land use is closely tied to land ownership, with the private lands further developed than public lands. Road density is often used as a surrogate for intensity of land use, since development of land involves building roads. Least developed areas include the Hells Canyon area, along the canyon itself and in parts of Pine Creek.

Agricultural land uses occur on 14% of the Lower Middle Snake subbasin (USGS 1999). Agriculture is concentrated in areas of flat terrain adjacent to the Snake River, with irrigation water coming from the Snake or its tributaries. The upstream and central reaches of the Snake River support the highest concentrations of agricultural land uses. All major tributaries of the Upper Snake also contain agricultural lands, which contribute to the water quality of the mainstem (IDEQ and ODEQ 2001).

Almost the entire subbasin is grazed, often impacting riparian vegetation, water temperatures and sedimentation. The environmental costs of both grazing and farming are severe in some areas of the subbasin, but the economic and social benefits of the two land uses are important locally and regionally. Overall, land use in the subbasin continues to improve its practices, like other areas of the Columbia Basin, and the ecological impacts of land management have been greatly improved over the last few decades in much of the subbasin.

Timber harvest in the Lower Middle Snake subbasin as a whole is not a primary land use due to the paucity of marketable trees. Some timber harvest has occurred in the Pine Creek watershed (USDA 1999).

Mining has occurred throughout the subbasin. A wide variety of products have been extracted, including: gemstones, metals, minerals, geothermal resources, mercury, and earthen materials. Current mining activities (mineral-producing mines) are concentrated in the central portion of the subbasin. Sand and gravel are the primary products. In other areas, mineral-producing mines extract clay, gypsum, pumice, gold, gemstones, sand/gravel and zeolite.

Impacts of mining activity to natural resources are variable and depend on mine size and location, mining methods, products mined, and a number of other factors. Some species (e.g. bats) may benefit from the creation of mines, but most are adversely affected. The most common influences of mining activities on aquatic resources involve production of acidic wastes, toxic metals, and sediment (Nelson et al. 1991). Historic use of mercury in mining operations has resulted in increased mercury concentrations in river systems. Owyhee and Brownlee Reservoirs have experienced elevated mercury levels in fish tissue samples (Walt VanDyke, ODFW, personal communication, October 12, 2001 *cited in Saul et al. 2001*).

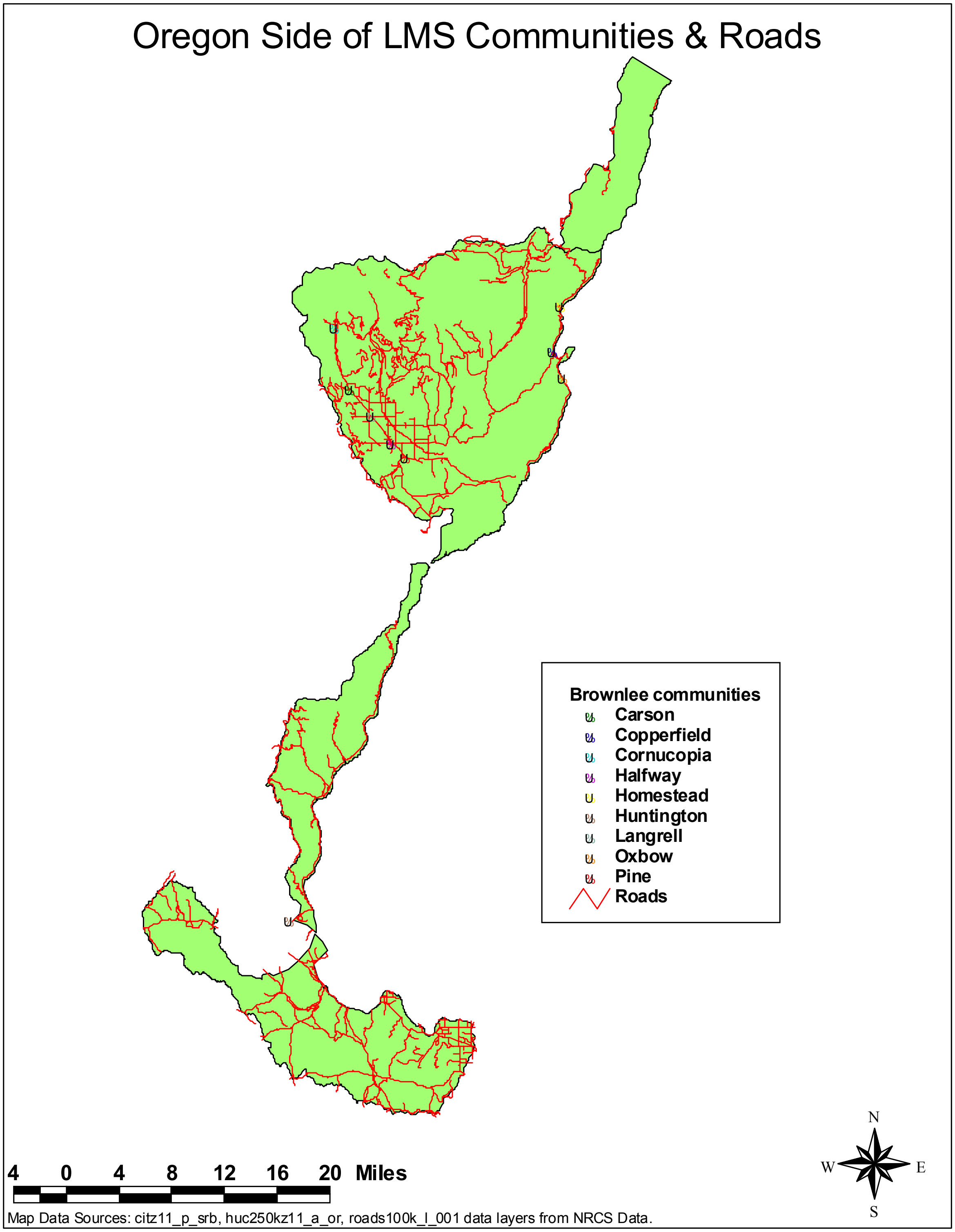


Figure 4. Communities and roads of the Oregon Side LMS subbasin, Oregon.

3.1.1.7 Economy

The major employers for Baker County (Powder, Burnt and Pine subbasins) are agriculture, tourism and government. The median income ranges from $29,000 to $32,000, well below the state average of $37,000. The poverty rate averages 14.6 percent, which is a full 3 percent higher than the state average. The unemployment rate for the county averages 8.5 percent.

Using such factors as unemployment rates, annual income, and population, the State of Oregon determines areas within the state that are "distressed." Distressed areas receive priority assistance from the Economic and Community Development Department. Baker County has been designated as "distressed".

With only 16,700 people spread across the county, large cities and towns are sparse. Baker City is the largest populated area and has a population of 9,840. The remaining populations are located in very small rural communities and are predominantly white, with Hispanics and Native Americans making up the largest minority populations. Without major industries to attract more people, the population will continue at its current rate.

3.1.1.8 Land Ownership

Approximately 68% of the land in the Lower Middle Snake subbasin is publicly owned (Figure 5). The BLM is the largest federal landowner, managing 48% of the landholdings in the subbasin. The Wallowa-Whitman National Forest manages approximately 133,000 acres, including 55,700 acres of the Hells Canyon National Recreation Area that falls within the subbasin. The majority of the privately owned land (810,000 acres) is located at the lower elevations near the Snake River.

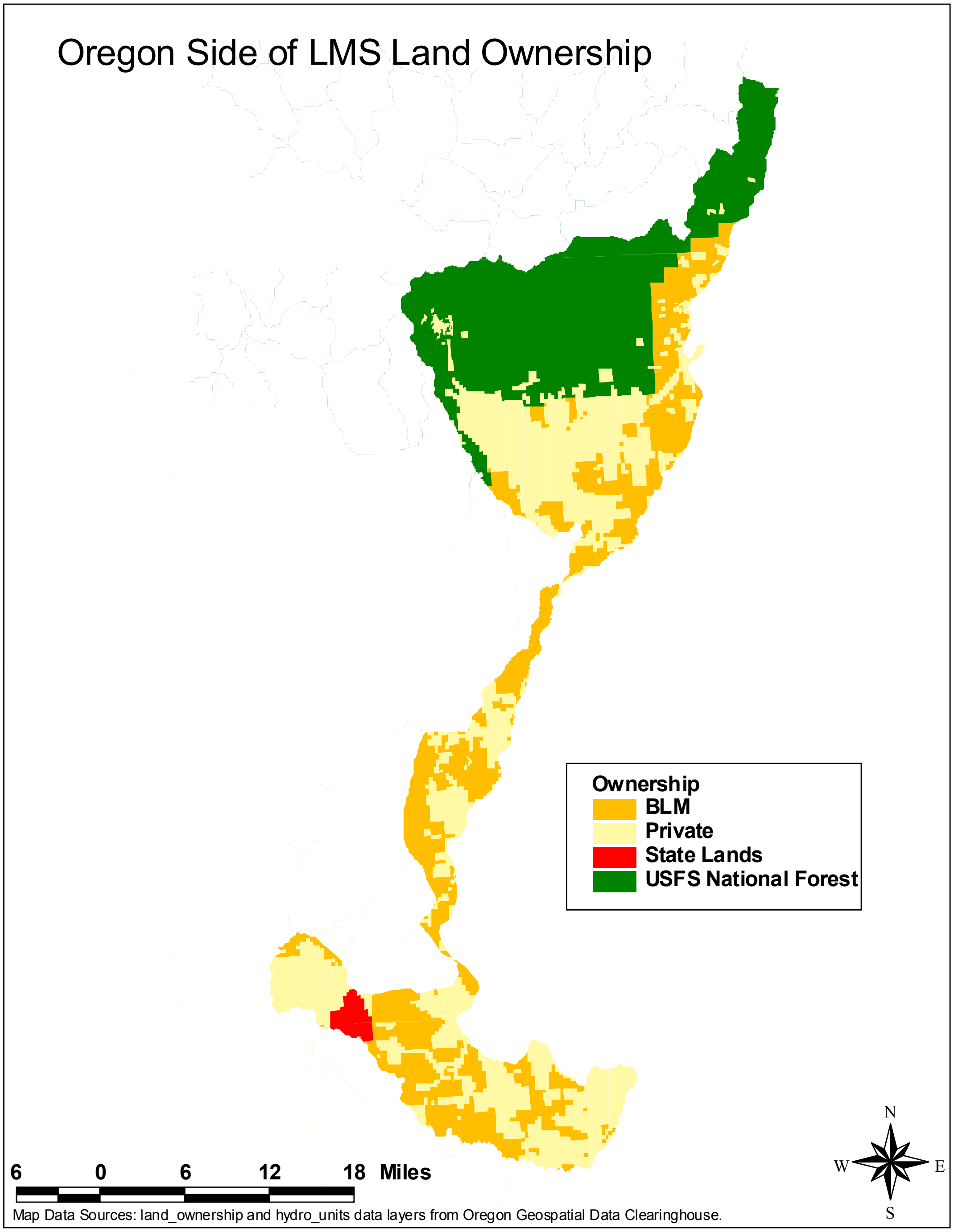


Figure 5. Land Ownership in the Oregon Side Lower Middle Snake Subbasin, Oregon.

3.1.2. Subbasin Existing Water Resources

3.1.2.1 Watershed Hydrography

The Oregon Side of the Lower Middle Snake subbasin is comprised of the Pine Creek drainage and numerous smaller Snake River tributaries that flow directly into it without first joining a larger stream such as the Powder or Burnt rivers.

Pine Creek, the largest Snake River tributary in the Oregon Side LMS subbasin, has its headwaters near Red Mountain in the Eagle Cap Wilderness Area of the Wallowa Mountains at elevations of over 9,000 feet. Pine Creek flows generally southeast and is joined by the East and West forks of Pine Creek and numerous other tributaries before passing near the communities of Carson (RM 25.5) and Langrell (RM 27) and the city of Halfway (RM 20). Below Halfway, it is joined by Clear Creek (RM 15), Deer Creek (RM 15), East Pine Creek (RM 14.5), Fish Creek (RM 8.5) and North Pine Creek (RM 8) before reaching the Snake River in the Hell's Canyon Reservoir near the community of Copperfield (RM 270).

Table 2. Notable Streams in the Oregon Side of the Lower Middle Snake subbasin and their points of confluence with the Snake River or its tributary, Pine Creek.

Main Stream	Tributary (RM)	Tributary (RM)
Snake River		
	Copper Creek (261)	
	Homestead Creek (265)	
	Pine Creek (270)	
		North Pine Creek (8)
		Fish Creek (8.5)
		Fourmile Creek (10)
		East Pine Creek (14.5)
		Deer Creek (15)
		Clear Creek (15)
		East Fork Pine Creek (32)
	Connor Creek (314)	
	Hibbard Creek (317)	
	Morgan Creek (318)	
	Benson Creek (334) Birch Creek	

3.1.2.2 Hydrologic Regime

Streamflow in the Snake is seasonally variable. The majority of in-river flow is from snowmelt and runoff from areas where precipitation falls mostly as snow. The snowmelt-driven flow regimes result in low flows in fall and winter and high flows during spring and early summer (IDEQ and ODEQ 2001). In some areas and seasons, groundwater discharge is a substantial source of flow to the Snake.

Mainstem flow in the Snake is heavily influenced by dams and other water-control structures on both the mainstem and tributaries. Less than 20% of the total inflow into the Snake River reaches the river without passing through a reservoir or other control structure (USBR 1998). This management of flows affects both the magnitude and timing of flow variations within the mainstem Snake River. Generally, high flows are lower and low flows are higher than those recorded prior to the placement of impoundments in the early 1900s. The overall volume may not have changed substantially, but the flows are more evenly distributed over the year (USBR 1998; USGS 1996 cited in IDEQ and ODEQ 2001).

Annual streamflow is also highly variable. Between 1928 and 1996 the annual streamflow of the Snake River at Weiser varied between a high flow of 24.5 million acre-feet and a low flow of 6.4 million acre feet (USBR 1998). Mean high flows generally range from 60,000-80,000 cfs, and mean low flows from 7,000-10,000 cfs. Currently, Hells Canyon Dam discharge is maintained at 10,000 cfs minimum discharge during fall chinook salmon (Oncorhynchus tschawytscha) spawning/incubation periods. Flow into Brownlee Reservoir is the product of Upper Snake River outflow (96.4%) and the Burnt and Powder Rivers (combined at 3.6%; IDEQ and ODEQ 2001). Water levels fluctuate as much as 75 feet for flood control in spring. Annual fluctuation in flows to Brownlee Reservoir from the Snake River is high. Flow at Hells Canyon dam is 97% from Brownlee (Nurnberg and Brown and Caldwell 2001). Flow into Oxbow Reservoir is mostly from Brownlee outflow, with only 1% from Wildhorse Creek. Flow into Hells Canyon Reservoir is mostly from Oxbow Reservoir outflow, with less than 1% from Pine Creek.

Minimum flows in the reach from C.J. Strike Dam to Brownlee Dam have been identified for protecting aquatic resources, wildlife and vegetation (Table 3and Table 4). These flows are often not met during the irrigation season (USBR 1998). In addition to concerns about low flows, episodic high flows are necessary to maintain riparian and wetland vegetation dependant on periodic flooding. Maintaining islands in the Snake River also requires periodic sediment deposition from large episodic events (USBR 1998). Episodic events are needed every 10-15 years to maintain viable cottonwood communities.

Table 3. Minimum flows for aquatic resources from C.J. Strike Reservoir to Brownlee Dam in cfs (from USBR 1998)

<table>
<tr><th>Nov</th><th>Dec</th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th></tr>
<tr><td colspan="5">16000</td><td>15,000</td><td>12,000</td><td>9,000</td><td>-</td><td colspan="2">12,500</td><td>-</td></tr>
</table>

Table 4. Minimum flows for wildlife and vegetation resources from C.J. Strike Reservoir to Brownlee Dam (from USBR 1998)

<table>
<tr><th rowspan="2">Reach</th><th rowspan="2">Gauge</th><th rowspan="2">Parameter Level</th><th colspan="5">Parameter (cfs)</th></tr>
<tr><th>Spring[1]</th><th>Summer[2]</th><th>Fall[3]</th><th>Winter[4]</th><th>Episodic[5]</th></tr>
<tr><td rowspan="4">C.J. Strike Reservoir to Swan Falls Dam</td><td rowspan="4">River below dam near Grand view</td><td>Optimum</td><td colspan="2">11,200</td><td colspan="2">9,700</td><td>41,300</td></tr>
<tr><td>Beneficial</td><td colspan="2">10,300</td><td colspan="2">9,600</td><td>34,400,</td></tr>
<tr><td>Neutral</td><td colspan="2">9,300</td><td colspan="2">9,400</td><td>27,500</td></tr>
<tr><td>Adverse</td><td colspan="2"><9,300 and >11,200</td><td colspan="2"><8,300</td><td>2,670</td></tr>
<tr><td rowspan="12">Swan Falls Dam to Brownlee reservoir</td><td rowspan="4">Near Murphy</td><td>Optimum</td><td colspan="2">13,400</td><td colspan="2">11,800</td><td>No Data</td></tr>
<tr><td>Beneficial</td><td colspan="2">13,000</td><td colspan="2">11,500</td><td>No Data</td></tr>
<tr><td>Neutral</td><td colspan="2">11,100</td><td colspan="2">10,800</td><td>No Data</td></tr>
<tr><td>Adverse</td><td colspan="2"><11,100 and >13,400</td><td colspan="2"><8,500</td><td>No Data</td></tr>
<tr><td rowspan="4">At Nyssa</td><td>Optimum</td><td colspan="2">21,000</td><td colspan="2">14,900</td><td>No Data</td></tr>
<tr><td>Beneficial</td><td colspan="2">19,700</td><td colspan="2">14,100</td><td>No Data</td></tr>
<tr><td>Neutral</td><td colspan="2">15,200</td><td colspan="2">13,000</td><td>No Data</td></tr>
<tr><td>Adverse</td><td colspan="2"><15,200 and >21,000</td><td colspan="2"><10,500</td><td>No Data</td></tr>
<tr><td rowspan="4">At Weiser</td><td>Optimum</td><td colspan="2">28,300</td><td colspan="2">18,600</td><td>No Data</td></tr>
<tr><td>Beneficial</td><td colspan="2">27,600</td><td colspan="2">16,300</td><td>No Data</td></tr>
<tr><td>Neutral</td><td colspan="2">21,000</td><td colspan="2">15,200</td><td>No Data</td></tr>
<tr><td>Adverse</td><td colspan="2"><21,000 and >28,300</td><td colspan="2"><11,500</td><td>No Data</td></tr>
</table>

Brownlee reservoir		Optimum	Maintain at or near 2078.5 feet spring through fall, fluctuate in winter
		Beneficial	Maintain at or near 2077.5 feet spring through fall, fluctuate in winter
		Neutral	Maintain at or near 2077 feet spring through fall, fluctuate in winter
		Adverse	Maintain at or near 1975 feet spring through fall, fluctuate in winter

[1]April, May and March
[2]July and August
[3]September, October and November
[4]December, January, February, March
[5]every 10-15 years

Most small tributaries in the low elevation, arid portions of the subbasin are ephemeral or intermittent, with flow present only seasonally or during high precipitation events. Flow is highly variable in the perennial streams. Many creeks remain perennial in the headwaters, but flow subsurface in lower reaches during drought years (USDI 1997, USDI 1999). Annual flow patterns in the tributaries are highly variable, and typically match the wide fluctuations in snow pack that occur throughout the subbasin. The limited data available regarding tributary runoff patterns and volume do not indicate any long-term trends (USDI 1999).

The Oregon Side LMS subbasin is primarily served by three types of aquifer: pre-Miocene rock aquifers, Miocene basaltic rock aquifers and aquifers in unconsolidated rock.

3.1.2.3 Water Quality

The highly impacted flow regimes that result from the control structures in the Snake River watershed influence pollutant transport within the subbasin. Pollutants such as sediment, mercury and pesticides tend to accumulate behind structures such as dams and diversions (IDEQ and ODEQ 2001). This reduces the overall concentration downstream while localizing the pollutant mass. As a result, downstream habitat may experience better water quality conditions while reservoir water quality suffers.

Control structures impact the transport and processing of nutrients and algae. Reduced flow velocities can lead to conditions where excessive incoming nutrient and organic loads, delivered to an impoundment, result in nuisance algae growth and dissolved oxygen (DO) depletion. Reduced DO, in turn, can degrade aquatic habitat, kill fish and increase nutrient and toxins released at the interface between sediments and water (IDEQ and ODEQ 2001).

§303(d) Listed Segments

Section §303(d) of the Clean Water Act (CWA) requires that water bodies violating State or Tribal water quality standards be identified and placed on a §303(d) list. Water bodies that do not meet water quality standards with implementation of existing management measures are listed as impaired under §303(d) of the CWA. It is the state's responsibility to develop their respective §303(d) list and establish a Total Maximum Daily Load (TMDL) for the parameter(s) causing water body impairment.

Mainstem river segments listed under section §303(d) of the CWA are summarized in Table 5. It should be noted that, in addition to the parameters described in Table 5, USBR (1998) identifies sediment as a problem pollutant for all mainstem Snake River reaches between C.J. Strike Dam and Weiser.

Water quality in the Snake River in the Lower Middle Snake subbasin is subject to the criteria of two states. Idaho and Oregon use different methodologies to determine what constitutes a water quality violation. In the reach between Oregon and Idaho, the river must meet the criteria of both states (IDEQ and ODEQ 2001).

Tributary streams in the Oregon Side LMS subbasin are subject only to Oregon water quality criteria. Those tributary segements listed under section §303(d) of the CWA are shown in Table 6 and Figure 6.

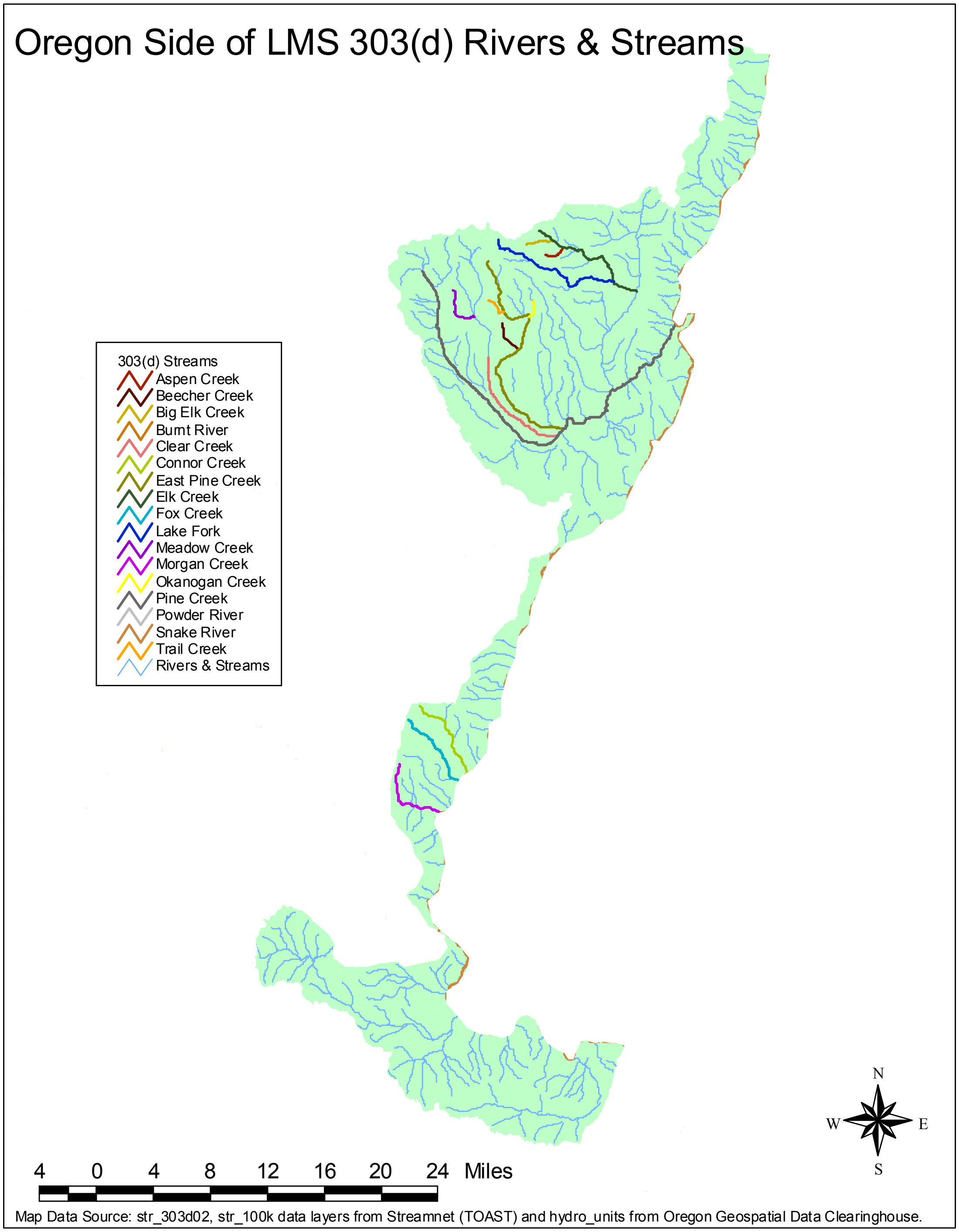


Figure 6. Listed 303(d) stream segements in the Oregon Side LMS subbasin, Oregon.

Table 5. Snake River stream segments in the Oregon Side LMS subbasin listed under §303d of the CWA (IDEQ and ODEQ 2001).

Listing State	Segment	§303d listed parameters	Designated beneficial uses
Idaho	Snake River: RM 347 to 285 (Scott Creek to Brownlee Dam	Dissolved oxygen, mercury, nutrients, pH, sediment	cold water biota, salmonid spawning, primary contact recreation, domestic water supply, special resource water
Idaho	Snake River: RM 285 to 272.5 (Oxbow Reservoir)	Nutrients, sediment, pesticides	cold water biota, salmonid spawning, primary contact recreation, domestic water supply, special resource water
Idaho	Snake River: 272.5 to 247 (Hells Canyon Reservoir)	Not listed	cold water biota, salmonid spawning, primary contact recreation, domestic water supply, special resource water
Oregon	Snake River: RM 335 to 260 (Brownlee Reservoir, Oxbow Reservoir and upper half of Hells Canyon Reservoir	Mercury and temperature	Private/public private domestic water supply, industrial water supply, irrigation water, livestock watering, salmonid rearing and spawning, resident fish and aquatic life, water contact recreation, wildlife and hunting, fishing, boating, aesthetics, hydropower
Oregon	Snake River: RM 260 to 188 (Lower half of Hells Canyon Reservoir and Downstream Snake River)	Mercury and temperature	Private/public private domestic water supply, industrial water supply, irrigation water, livestock watering, salmonid rearing and spawning, resident fish and aquatic life, water contact recreation, wildlife and hunting, fishing, boating, aesthetics, anadromous fish passage, commercial navigation and transport

Table 6. Tributary stream segments in the Oregon Side LMS subbasin listed under §303d of the CWA.

Stream Segment	Parameters of Concern	Designated Beneficial Uses
Aspen Creek – RM 0-1.6	Temperature	Salmonid rearing & spawning
Beecher Creek – RM 0-2.4	Temperature	Salmonid rearing
Big Elk Creek – RM 0-2.1	Temperature	Salmonid rearing & spawning
Clear Creek – RM 0-8.7	Temperature	Salmonid rearing & spawning
Connor Creek RM 0-6.7	Temperature	Salmonid rearing
East Pine Creek RM 0-12.2 & 12.2-18.7	Temperature	Salmonid rearing & spawning
Elk Creek RM 0-9.5	Temperature	Salmonid rearing & spawning
Fox Creek RM 0-6.4	Temperature	Salmonid rearing & spawning
Lake Fork RM 0-10.4	Temperature	Salmonid rearing
Meadow Creek RM 0-3.3	Temperature	Salmonid rearing & spawning
Morgan Creek RM0-6.1	Temperature	Salmonid rearing & spawning
Okanogan Creek RM 0-1.3	Temperature	Salmonid rearing
Pine Creek RM 0 – 32.7	Temperature	Salmonid rearing & spawning
Trail Creek RM 0-1.6	Temperature	Salmonid rearing & spawning

Source: ODEQ www.deq.state.or.us

The presence of mercury in surface waters is a water quality concern, especially when present in readily mobile and easily accumulated forms such as methylated mercury. Various reaches of the Snake River are listed as having water quality concerns related to mercury (Table 5), and elevated mercury levels in fish tissues have been observed in portions of the river (Rinella et al. 1994 and Clark and Maret 1998, both cited in IDEQ and ODEQ 2001). Mercury concentrations from sampled fish tissues are summarized in (Table 7).

Common sources of mercury in the subbasin are legacy mining activities and natural geologic materials. Mercury itself was mined from portions of the subbasin, but more frequently was used to amalgamate mined gold and silver. Mercury is still present in tailing piles associated with those operations (IDEQ and ODEQ 2001).

Table 7. Average concentrations of mercury in sampled fish tissues from Brownlee Reservoir 1970 - 1997 (IDEQ and ODEQ 2001).

Reach	River Miles	# Samples	Year	Avg. Mercury (mg/Kg wet weight)
Brownlee Reservoir	335-285	33	1970	0.45
		130	1994	0.39
		5	1997	0.26

The primary water quality problems in small tributaries to the Snake include high water temperatures, fine sediment deposition, stream-riparian habitat alteration, and fecal coliform bacteria (USDI 1999).

3.1.2.4 Riparian Resources

See Section 3.4, habitat discussions.

3.1.2.5 Wetland Resources

See Section 3.4, habitat discussions.

3.1.3 Hydrologic and Ecologic Trends in the Subbasin

3.1.3.1 Macro-climate and its Influence on Hydrology in the Subbasin

See Section 3.1.2.2 *Hydrologic Regime*

3.1.3.2 Macro-climate and its Influence on Ecology in the Subbasin

The macroclimate of the subbasin, with its varying precipitation patterns (Figure 2), wind exposure and temperature extremes, is a major influence on the ecology of the subbasin. The lower elevation areas of the Snake River are generally warmer and drier than higher elevation areas of the Wallowa Mountains. These differences can be seen in the progression of upland vegetation communities from grassland and shrub-steppe through ponderosa pine to mixed conifer forests. The vegetation communities, in turn, influence use by a variety of wildlife species. Climatic differences also drive wildlife migration patterns as many species move down in elevation to escape winter's snow and cold and to higher elevation to escape summer's heat and find food.

3.1.3.3 Human Use Influence on Hydrology in the Subbasin

Snake River flows in the Lower Middle Snake subbasin originate from C.J. Strike Dam, well above the area of interest in the Oregon Side Lower Middle Snake subbasin, and end with the regulated flows of Hells Canyon Dam at the northern end of the subbasin. Most major tributaries above the Oregon Side subbasin are regulated, with dams and/or major irrigation works on the Owyhee, Boise, Malheur, and Payette Rivers. The reservoirs upstream from

Brownlee Dam have the cumulative capacity to store 75% of the average annual runoff (Columbia River Basin System Operation Review 1991).

Surface diversions greatly impact the flow through the Lower Middle Snake subbasin. The Hells Canyon complex provides irrigation storage for more than 3.5 million acres of land, with a total estimated annual consumptive use of 6-8 million acre-feet (IDEQ and ODEQ 2001). Of the 3 million acres of irrigated land in the Snake River basin above Hells Canyon Dam, about 2 million acres are supplied by surface water, mostly by gravity diversions (USBR 1998). About 16.5 million acre-feet of surface water are diverted annually and conveyed by more than 3,000 miles of canals and laterals to irrigate agricultural fields (USBR 1998). Out of the 20 million acre-feet of total combined surface water and groundwater used for irrigation, most returns to a stream or aquifer, with about 6 million acre-feet lost to consumptive use (USBR 1998). In low-water years, pumping and diversions can remove more water from the Snake River than is contributed by its inflowing tributaries. Irrigation recharge during periods of low tributary input represents a significant source of in-river flow (as much as 52%; IDEQ and ODEQ 2001).

Impoundments and Hydroelectric Facilities

Hells Canyon Project

The Hells Canyon project is made up of three dams: Brownlee, Oxbow and Hells Canyon. Located on the Snake River between Idaho and Oregon, these three dams comprise two-thirds of Idaho Power Company's total hydroelectric generating capacity (IPC 2001). The Federal Power Commission (now the FERC) authorized the project in 1955. The Hells Canyon Project provides power, flood control, and recreational opportunities to the region.

Brownlee Dam/Reservoir

Brownlee Dam was completed in 1959 and is the most upstream (RM 285) of the three dams in the Hells Canyon Complex. The dam formed a reservoir 58 miles long (with 190 miles of shoreline)—the longest on the Snake River. The reservoir is 2,077 feet above sea level and has a total storage capacity of 975,000 acre-feet (total reservoir volume is 1,420,000 acre-feet). Full pool surface area covers 14,000 acres (IDEQ and ODEQ 2001). Average residence time (reservoir volume/avg. daily inflow volume) is 35 days based on data from 1961-2000, with a range of 15-70 days (Nurnberg and Brown and Caldwell 2001). The rock-filled dam has a generating capacity of 585 megawatts (IPC 2001).

Brownlee Reservoir was constructed for power production, but the Army Corps of Engineers (ACE) also operates it for flood control. NMFS provides consultation for anadromous fish production and passage (Nurnberg and Brown and Caldwell 2001). Idaho Power prefers keeping Brownlee at or near full pool because it provides the best conditions for power generation. However, withdrawals, seasonal weather fluctuations, and the need for flood control affect the ability to constantly keep the reservoir at maximum pool. The lowest reservoir elevation is typically in late April, with near-full status reached by late May. In most years, that level has been maintained from Memorial Day weekend through July Fourth weekend, which coincides with the majority of the crappie and bass spawning season (water level fluctuations during spawning season may negatively impact spawning success).

From early July through mid-August Idaho Power releases water to help anadromous fish, present in the Snake River system below Hell's Canyon Dam, migrate downstream. Brownlee then partially refills, but soon after Labor Day another salmon-related drawdown begins and typically lasts through mid-October. This creates room in Brownlee to store excess inflows between mid-October and mid-December while outflows from Hells Canyon Dam are held stable to protect spawning fall chinook downstream.

These operations originally were characterized as voluntary participation, but have become mandatory with the creation of federal endangered species laws. Protecting recreational access has become more difficult as a result, since many boat ramps are dewatered during drawdown conditions.

Oxbow Dam/Reservoir

Oxbow takes its name from a three-mile bend in the Snake River at river mile 273 that early settlers said resembled the U-shaped collar around an ox's neck. Oxbow Dam was the second dam of the Hells Canyon Project, completed in 1961. Today, the three-dam project supplies power, provides flood control, and provides recreation opportunities to the region (IPC 2001).

The rock fill dam contains a powerhouse with 4 generating units, having a total nameplate generating capacity of 190 megawatts (IPC 2001). Operating strategies and restrictions throughout the Hells Canyon Complex, including Oxbow Dam, are generally similar to those described above for Brownlee Dam.

Hells Canyon Dam/Reservoir

At river mile 247.6, Hells Canyon Dam, the third and last of the Hells Canyon complex, began generating electricity in 1967. Hells Canyon is the deepest canyon on the North American Continent. Today, the three-dam project supplies power, provides flood control, and provides recreation opportunities to the region.

The concrete gravity dam contains a powerhouse with 3 generating units, having a total nameplate generating capacity of 391 megawatts (IPC 2001). Operating strategies and restrictions throughout the Hells Canyon Complex, including Hells Canyon Dam, are generally similar to those described above for Brownlee Dam.

Other Impoundments

In addition to the Hell Canyon Complex of Dams on the Snake River, the Oregon Side LMS subbasin contains numerous other dams and impoundments. The Oregon Water Resources Department lists fifteen impoundments with storage capacities of 10 acre-feet or more (Table 8).

Table 8. Oregon Side LMS subbasin, Oregon impoundments with storage capacity of 10 acre-feet or more.

Name	Stream	Dam Height (ft)	Storage (Ac-ft)
Clear Creek Reservoir	West Fork Clear Creek	16	257
Crow, FM Reservoir	Deer Gulch	15	140
East Lakes Creek Res.	East Fork Pine Creek	15	132
Fish Creek Reservoir	Lake Fork Creek	22	825
Kivett 1	Unnamed	18	30
Kivett 2	Unnamed	17	23
Kivett 3	Birch Creek	26	39
Laird Reservoir	Sag Creek	20	69
McBride Reservoir	Birch Creek	22	40
Melhorn & Bassett Res.	Clear Creek	20	216
Mosley, RK Reservoir	Pine Creek	20	180
Sugarloaf Reservoir	Elk Creek	27	260
Thompson Reservoir	Unnamed Trib. to Pine Cr.	15	30
Twin Lake - Lower	West Fork Pine Creek	22	75
Twin Lake - Upper	West Fork Pine Creek	10	150

3.1.3.4 Human Use Influence on Ecology in the Subbasin

Human development and activities have changed the ecology of the subbasin in many ways including alterations to the vegetation communities, changes in vegetation structure, manipulation of surface and ground water resources, soil movement, relocation of streams and changes to the composition of fish and wildlife communities. The major activities that have resulting in those changes include: logging, fire suppression, grazing, cultivation and other agricultural development, draining of wetlands, ditching and diking of streams, water withdrawal and the introduction, both intentional and unintentional, of exotic plant and animal species.

3.1.4. Regional Context

3.1.4.1 Relation to the Columbia Basin

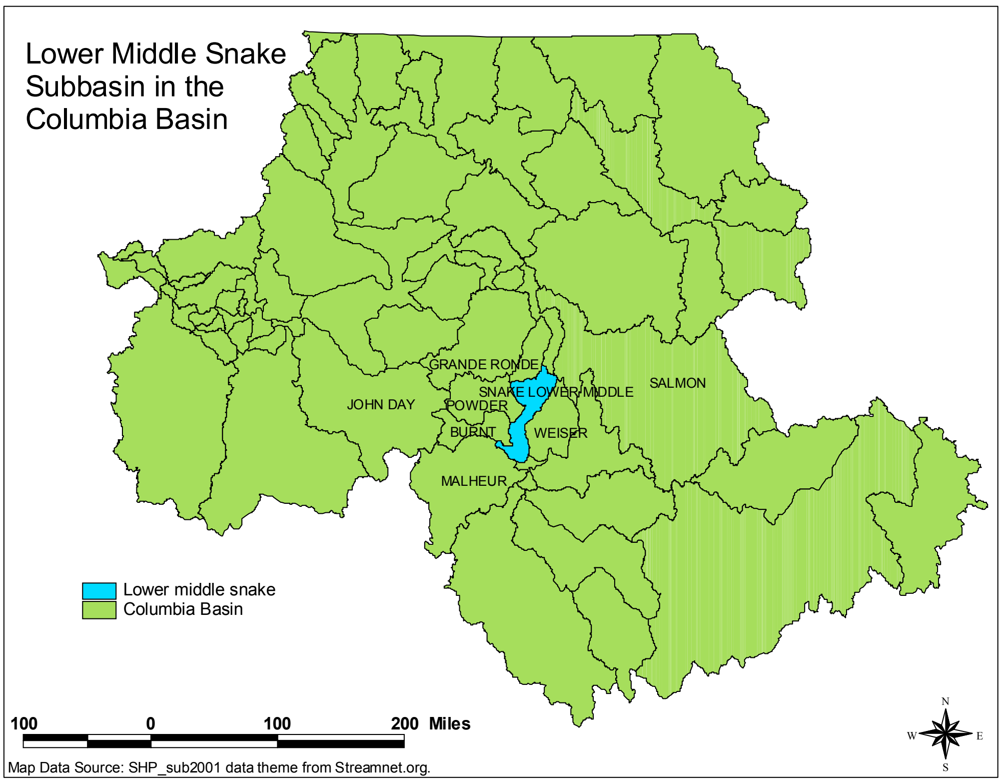


Figure 7. The Oregon Side LMS subbasin within the Columbia River Basin.

3.1.4.2 Relation to the Ecological Province

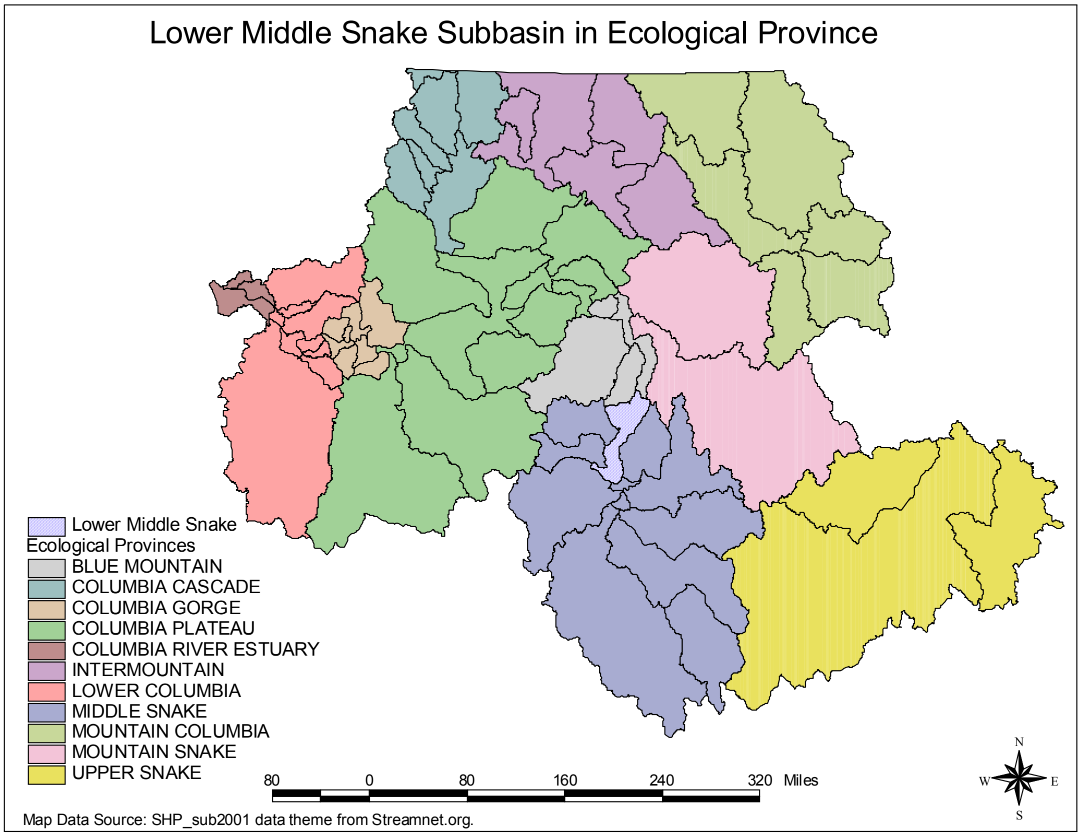


Figure 8. The Oregon Side LMS subbasin within the Middle Snake Ecological Province.

3.1.4.5 NOAA Fisheries Evolutionary Significant Units

Anadromous fish have been extirpated from the subbasin. If they were reintroduced, they would be considered part of the Snake River ESUs.

3.1.4.6 USFWS Designated Bull Trout Planning Units

The Oregon Side LMS subbasin is included in the Hell's Canyon Complex Bull Trout Recovery Unit.

3.2. Focal Species Characterization and Status

3.2.1 Native/Non-native Wildlife, Plant and Resident/Anadromous Fish of Ecological Importance

Fish

Prior to construction of hydropower dams, the Snake River from Shoshone Falls downstream, supported a diverse and rich aquatic community (Lance et al. 2001). Steelhead trout, Chinook salmon, white sturgeon, redband or rainbow trout, Pacific lamprey, bull trout (*Salvelinus confluentus*) and a host of other aquatic species, inhabited the river and could freely range throughout the Snake and Columbia river systems.

Construction of hydroelectric projects on the Snake River eliminated anadromous species such as Chinook salmon, steelhead trout, and Pacific lamprey above the Hells Canyon Complex of dams (Northwest Power Planning Council 1986) and contributed significantly to the reduction of native redband trout, bull trout and white sturgeon (Lukens 1981, Cochnauer 1983, Quigley and Arbelbide 1997). Resident fish populations including bull trout, sturgeon and redband trout populations have been segmented into isolated habitat areas with no ability to interact with other populations.

Construction of Brownlee (1959), Oxbow (1961), and Hells Canyon (1967) dams progressively eliminated anadromous species from the Lower Middle Snake River subbasin (Northwest Power Planning Council 1986). Numerous other dams and diversions had already blocked passage in the main tributaries and many of the smaller tributaries. The loss of anadromous fish impacted the basic biomass in the system, reducing overall nutrients, prey base and wildlife resources throughout the subbasin and associated tributaries.

The Lower Middle Snake subbasin is currently inhabited by at least 39 species of fish, 19 of which are native to the region (Appendix Table 1). Generally, habitat conditions in the subbasin are poor for native fish; the few exceptions are limited to small habitat patches. Poor quality habitat, reduced quantity of habitat, and isolation of populations in fragmented habitat reduces the viability of many species.

Currently, the dominant salmonid species throughout the subbasin include rainbow trout and mountain whitefish (IDEQ and ODEQ 2001). Reservoir rainbow trout populations are primarily comprised of hatchery-reared trout. Native redband rainbow trout are found in a limited number of tributary streams throughout the subbasin. Bull trout are found only in limited tributary systems between Hells Canyon Reservoir and Hells Canyon Dam, and in Hells Canyon Reservoir itself (IDEQ and ODEQ 2001). Prevalent non-salmonid game species throughout the reservoirs in this subbasin include largemouth and smallmouth bass, crappie, catfish and bullheads, and white sturgeon (IDEQ and ODEQ 2001). Yellow perch (*Perca flavescens*) are also common throughout much of the subbasin (Lance et al. 2001). Non-game species common throughout the river and reservoir systems include largescale sucker (*Catostomus macrocheilus*), northern pikeminnow (*Ptychocheilus oregonensis*), peamouth (*Mylocheilus caurinus*), and carp (*Cyprinus carpio*) (Lance et al. 2001).

The Hells Canyon Complex Recovery Unit (HCCRU) is comprised of the Snake River mainstem and tributaries in Oregon and Washington that drain to the Snake River within the Hells Canyon Hydroelectric Project (Hells Canyon, Oxbow, and Brownlee Dams and associated reservoirs). Two core areas were identified in the HCCRU, the Pine/Indian/Wildhorse Core Area consisting of the Pine Creek subbasin in Oregon and Indian and Wildhorse subbasins in Idaho. Chapter 1 of the Draft Bull Trout Recovery Plan (In Press) defines core areas as follows: The combination of core habitat (i.e., habitat that could supply all elements for the long-term security of bull trout) and a core population (i.e., bull trout inhabiting core habitat) of bull trout.

There are currently at least 7 local bull trout populations identified in this core area. The Powder Core Area encompasses the streams draining the Powder River and contains 10 or more local bull trout populations.

Wildlife

The complex topography, varied soil conditions, and diverse vegetative communities of the Lower Middle Snake subbasin make it an ideal home for a large number of wildlife species. The majority of the Lower Middle Snake subbasin has been identified as a Center for Biodiversity and/or a Center for Endemism and Rarity (Quigley and Arbelbide 1997).

3.2.1.1 Species Designated as Threatened or Endangered

In addition to the Federal Endangered Species Act (ESA), Oregon employs Endangered and Threatened Species listings at the state level. The Oregon Side LMS subbasin is, or may be, host to one fish and four wildlife species listed as Threatened or Endangered or are Candidates for listing at the federal level (Table 9, Table 10).

Table 9. State and Federally listed threatened fish species in the Oregon Side LMS subbasin.

Common Name	*Scientific Name*	Federal Status	Oregon Status
Bull trout	*Salvelinus confluentus*	Threatened	Sensitive - Critical

Table 10. State and Federally listed endangered, threatened and candidate wildlife species potentially in the Oregon Side LMS subbasin. A * denotes species extirpated from the area or whose population status is unknown.

Common Name	*Scientific Name*	Federal Status	Oregon Status
Columbia spotted frog	*Rana luteiventris*	Candidate	Sensitive-Unclear Status
Bald eagle	*Haliaeetus leucocephalus*	Threatened	Threatened
gray wolf*	*Canis lupus*	Threatened	Endangered
Canada lynx*	*Lynx canadensis*	Threatened	None

3.2.1.2 Species Recognized as Rare or Significant to the Local Area

In the Oregon Side LMS subbasin, one fish and 23 wildlife species are designated Species of Concern by the USFWS and NOAA Fisheries (Table 11, Table 12).

Table 11. Federally Designated Fish Species of Concern in the Oregon Side LMS subbasin.

Common Name	*Scientific Name*	Federal Status	Oregon Status
Interior redband trout	*Oncorhynchus mykiss*	SOC	Sensitive - Vulnerable

Table 12. Federally designated Wildlife Species of Concern potentially in the Oregon Side LMS subbasin. A * denotes species extirpated from the area or whose population status is unknown.

Common Name	*Scientific Name*	Federal Status	Oregon Status
tailed frog	*Ascaphus truei*	Species of Concern	Sensitive - Vulnerable
northern sagebrush lizard	*Sceloporus graciosus*	Species of Concern	Sensitive - Vulnerable
northern goshawk	*Accipiter gentilis*	Species of Concern	Sensitive Critical
western burrowing owl	*Athene cunicularia*	Species of Concern	Sensitive Critical
ferruginous hawk	*Buteo regalis*	Species of Concern	Sensitive Critical
western greater sage-grouse*	*Centrocercus urophasianus*	Species of Concern	Sensitive - Vulnerable
yellow-billed cuckoo	*Coccyzus americanus*	Species of Concern	Sensitive Critical
eastern Oregon willow flycatcher	*Empidonax trailii*	Species of Concern	Sensitive – Unclear Status
Lewis's woodpecker	*Melanerpes lewis*	Species of Concern	Sensitive Critical
mountain quail	*Oreortyx pictus*	Species of Concern	Sensitive – Unclear Status
white-headed	*Picoides albolarvatus*	Species of Concern	Sensitive Critical

Common Name	***Scientific Name***	**Federal Status**	**Oregon Status**
woodpecker			
pale western big-eared bat	*Corynorhinus townsendii*	Species of Concern	Sensitive Critical
California wolverine*	*Gulo gulo*	Species of Concern	Listed Threatened
silver-haired bat	*Lasionycteris noctivagans*	Species of Concern	Sensitive – Unclear Status
Pacific fisher*	*Martes pennanti*	Species of Concern	Sensitive Critical
western small-footed myotis	*Myotis ciliolabrum*	Species of Concern	Sensitive – Unclear Status
long-eared myotis	*Myotis evotis*	Species of Concern	Sensitive – Unclear Status
fringed myotis	*Myotis thysanodes*	Species of Concern	Sensitive – Vulnerable
long-legged myotis	*Myotis volans*	Species of Concern	Sensitive – Unclear Status
Yuma myotis	*Myotis yumanensis*	Species of Concern	None
Preble's shrew	*Sorex preblei*	Species of Concern	None

Table 13 . State and Federal Special Status Plant Species in the Oregon Side LMS Subbasin including Designated State and Federal Status, Natural Heritage Rank, and Documented Locations in the Subbasin.

Common Name	Scientific Name	Federal Status[1]	State Status[2]	Natural Heritage Rank[3]	Documented Locations (drainages)
Hells Canyon Rockcress	*Arabis hastatula*	SOC	None	G2, S2	Hells Canyon
upward-lobed moonwort	*Botrychium ascendens*	SOC	C	G2G3, S2	Powder
crenulate moonwort	*Botrychium crenulatum*	SOC	C	G3, S2	
skinny moonwort	*Botrychium lineare*	SOC	None	G1, S1	
twin-spike moonwort	*Botrychium paradoxum*	SOC	C	G2, S1	Powder
stalked moonwort	*Botrychium pedunculosum*	SOC	C	G2G3, S1	
Clustered lady's-slipper	*Cypripedium fasciculatum*	SOC	C	G3G4, S2	
Cronquist's stickseed	*Hackelia cronquistii*	SOC	LT	G3, S3	Brownlee Reservoir
Davis' peppergrass	*Lepidium davisii*	SOC	LT	G3, S1	
Slick spot peppergrass	*Lepidium papilliferum*	C	None	Rank G2, S2 (Idaho)	
Red-fruited lomatium	*Lomatium erythrcarpum*	SOC	LE	G1, S1	Powder
Cusick's lupine	*Lupinus cusickii*	SOC	LE	G2, S2	
Washington monkeyflower	*Mimulus patulus*	SOC	LT	G3, S3	Lick Creek
Oregon semaphoregrass	*Pleuropogon oregonus*	SOC	LT	G1, S1	Powder
Snake River goldenweed	*Pyrrocoma radiata*	SOC	LE	G3, S3	Sturgil Creek Rock Creek
Bartonberry	*Rubus bartonianus*	SOC	C	G2, S2	Hells Canyon; Brownlee

					Reservoir
Douglas clover	*Trifolium douglasii*	SOC	None	G2, S1	Brownlee Reservoir

3.2.1.3 Species with Special Ecological Importance to the Subbasin

Many species in the subbasin, although they have no special legal status, are ecologically important due to functional specialization, critical functional links, habitat specialization or other characteristics that make them unique. Critical functional link species (also called functional keystone species) are those whose removal would most alter the structure, composition or function of the community (IBIS 2003;Table 14). Functional Specialists are those species that serve only one or very few key ecological functions. Functional specialists could be highly vulnerable to changes in their environment (IBIS 2003; Table 15). Several target species have been selected for use in Habitat Evaluation Procedures (HEP) through the loss assessment and mitigation crediting process (Sather-Blair et al. 1991; Table 16). These target species and their habitats are considered for habitat mitigation throughout the Columbia Basin, including the Oregon Side LMS subbasin.

Table 14. Critically Functionally Linked Species in the Middle Snake Ecological Province (NHI 2003)

Species Common Name	Species Scientific Name
Long-toed Salamander	*Ambystoma macrodactylum*
Black-chinned Hummingbird	*Archilochus alexandri*
Great Blue Heron	*Ardea herodias*
Redhead	*Aythya americana*
Greater Scaup	*Aythya marila*
Canada Goose	*Branta canadensis*
Great horned owl	*Bubo virginianus*
House Finch	*Carpodacus mexicanus*
American Beaver	*Castor canadensis*
Rocky Mountain Elk	*Cervus elaphus nelsoni*
Black Tern	*Chlidonias niger*
American Crow	*Corvus brachyrhynchos*
Big Brown Bat	*Eptesicus fuscus*
Horned lark	*Eremophila alpestris*
Common porcupine	*Erithizon dorsatum*
Sagebrush vole	*Lagurus curtatus*
Mew Gull	*Larus canus*
Snowshoe Hare	*Lepus americanus*
Montane Vole	*Microtus montanus*
Brown-headed Cowbird	*Molothrus ater*
Mink	*Mustela vison*
Bushy-tailed Woodrat	*Neotoma cinerea*
Deer Mouse	*Peromyscus maniculatus*
Double-crested cormorant	*Phalacrocorax auritus*
Spotted towhee	*Pipilo maculatus*
Raccoon	*Procyon lotor*
Mountain lion	*Puma concolor*
Rufous Hummingbird	*Selasphorus rufus*
Great Basin spadefoot	*Spea intermontana*
Golden-mantled Ground Squirrel	*Spermophilus lateralis*
Williamson's sapsucker	*Sphyrapicus thyroideus*

Nuttall's (mountain) cottontail	*Sylvilagus nuttalli*
Red Squirrel	*Tamiasciurus hudsonicus*
Northern Pocket Gopher	*Thomomys talpoides*
Black Bear	*Ursus americanus*

Table 15. Functional Specialist species in the Middle Snake Ecological Province and the number of Key Environmental Functions (KEFs) performed by each (NHI-IBIS 2003). A * denotes species extirpated from the area or whose population status is unknown.

Species Common Name	Species Scientific Name	# of KEFs
White-throated swift	*Aeronautes saxatalis*	2
Turkey vulture	*Cathartes aura*	1
Canyon wren	*Catherpes mexicanus*	2
Brown creeper	*Certhia americana*	2
Vaux's swift	*Chaetura vauxi*	2
Common nighthawk	*Chordeiles minor*	5
Olive-sided flycatcher	*Contopus cooperi*	2
Western wood-pewee	*Contopus sordidulus*	2
Black swift	*Cypseloides niger*	5
Ringneck snake	*Diadophis punctatus*	6
Northern pygmy owl	*Glaucidium gnoma*	6
Canada lynx*	*Lynx canadensis*	6
Long-eared myotis	*Myotis evotis*	2
Osprey	*Pandion haliaetus*	2
Common poorwill	*Phalaenoptilus nuttallii*	1
Western pipistrelle	*Pipistrellus hesperus*	2
Rock wren	*Salpinctes obsoletus*	2
Preble's shrew	*Sorex preblei*	2
Winter wren	*Troglodytes troglodytes*	2

Table 16. Target Species Selected for the Lower Snake River Project HEP (Sather-Blair et al. 1991).

Species Common Name	Species Scientific Name	Habitat Association
Downy woodpecker	*Picoides pubescens*	Riparian forest
Yellow warbler	*Dendroica petechia*	Scrub-shrub wetlands
Marsh wren	*Cistothorus palustris*	Emergent wetlands
Song sparrow	*Melospiza melodia*	Mesic shrubland and riparian forest shrub understory
Western meadowlark	*Stumella neglecta*	Grass / shrub-steppe
River otter	*Lutra canadensis*	Riverine and riparian
Mule deer	*Odocoileus hemionus*	Upland and riparian
California quail	*Callipepla californica*	Upland habitats
Ring-necked pheasant	*Phasianus colchicus*	Upland and agricultural
Chukar	*Alectoris chukar*	Grassland & shrub-steppe
Mallard	*Anas platyrhynchos*	Habitat associated with backwater / ponded areas
Canada goose	*Branta canadensis*	River and reservoir systems

3.2.1.4 Species Recognized by Tribes

All living things are valued by the Tribes of the Columbia Plateau. In general, tribal religious beliefs are that the Creator created and gave foods and medicines in the form of plants and animals to the Natityat (i.e., Indian people) to survive. In return the Natityat made a promise to the Creator to always protect these gifts. As such, each species is believed to fulfill important roles in the ecosystem. Some examples of these roles in tribal tradition and culture are shown inTable 17.

Table 17. Some examples of the importance of plants and animals in the cultural and spiritual lives of the Natityat.

Traditional or Cultural Role	Examples of Animals Involved
regalia	eagle feathers and otter, deer, and elk pelts
instruments/drums	eagle whistle, deer hide drum, dew claw rattles
housing	tule, lodgepole
subsistence	salmon, whitefish, mule deer, elk, grouse, chokecherry, lamprey, fresh water mussel, huckleberry, various root food plants, mushrooms
medicinal	various plants
burial/religious ceremonies	tule
stories/oral histories	coyote, owl
tools	elk/deer antler tools, fish bones, willow, mock orange, oceanspray, dogbane hemp

3.2.1.5 Locally Introduced and Extirpated Species

Several native fish and wildlife species are or were extirpated from Oregon including the Lower Middle Snake subbasin (Iten et al. 2001). A variety of factors contributed to the decline and disappearance of these species. Some were aggressively hunted and killed for bounty because of the threat they posed to humans and their livestock (e.g., wolf, grizzly bear). Some species were hunted for meat and hides while others were persecuted as agricultural pests. Still other species existed in naturally small populations or in restricted habitats and were vulnerable to disturbances or habitat loss. Loss of habitat was a major factor in the decline of most of these species (Iten et al. 2001). Several species once extirpated from the subbasin have been reintroduced with varying levels of success. Table 18 and Table 19 list fish and wildlife species extirpated from the subbasin as well as the approximate time period of extirpation and whether they have been reintroduced.

Table 18. Aquatic species extirpated from the Oregon Side of the LMS subbasin

Common Name	*Scientific Name*
Coho salmon	*Oncorhynchus kisutch*
Sockeye salmon	*Oncorhynchus nerka*
Chinook Salmon	*Oncorhynchus tshawytscha*
Steelhead	*Oncorhynchus mykiss*

Table 19. Terrestrial wildlife species extirpated from the Oregon Side LMS subbasin, the approximate time of extirpation and whether the species has been reintroduced (O'Neil et al. 2001, ODFW 2003).

Common Name	*Scientific Name*	Time of Extirpation	Reintroduced/ Status
Bighorn sheep	*Ovis canadensis*	Mid-1940's	Yes / Successful
Bison	*Bos bison*	Early to mid-1800's	No
Yellow-billed cuckoo	*Coccyzus americanus*	By 1945	No
Gray wolf	*Canis lupus*	1940's	No

Grizzly bear	*Ursus arctos*	1931	No
Sharp-tailed grouse	*Tympanuchus phasianellus*	Late 1960's	No
Rocky Mountain goat	*Oreamnos americana*	Late 19th century	Yes / Successful

Just as human activities contributed, directly or indirectly, to the extirpation of these species, their reintroduction and recovery will require active management by humans.

In addition to the native species present in the Oregon Side LMS subbasin, many non-native species have been introduced, either intentionally or unintentionally (Witmer and Lewis 2001). Accidental introductions occur when animals escape captivity (e.g., red fox) when they arrive as stowaways on ships, trains, trucks or other vehicles (e.g., house mouse) and when habitat alteration allows a species to expand into regions not historically occupied (e.g., opossum).

Intentional introductions have occurred for a variety of reasons including a person's desire to have present species from the country or region of their heritage, in other words aesthetic reasons (e.g., European starling and eastern fox squirrel). Many game species have been introduced to provide recreational opportunities, often combined with aesthetic reasons (e.g., chukar and wild turkey). Some species, kept in captivity, were released because the owners no longer wished or were able to care for the animals (e.g., bullfrog). Table 20 and Table 21 list introduced fish and wildlife species.

Table 20. Introduced fish of the Oregon Side LMS subbasin.

Common Name	*Scientific Name*	Common Name	*Scientific Name*
Brook trout	*Salvelinus fontinalis*	Bluegill	*Lepomis macrochirus*
Lake trout	*Salvelinus namaycush*	Pumpkinseed	*Lepomis gibbosus*
Westslope cutthroat trout	*Oncorhynchus clarki lewisi*	Warmouth	*Lepomis gulosis*
Carp	*Cyprinus carpio*	Yellow perch	*Perca flavescens*
Black crappie	*Poxomis nigromaculatus*	Channel catfish	*Ictalurus punctatus*
White crappie	*Poxomis annularis*	Flathead catfish	*Pylodictis olivaris*
Largemouth bass	*Micropterus salmoides*	Brown bullhead	*A,eiurus nebulosus*
Smallmouth bass	*Micropterus dolomieui*	Golden trout	*Oncorhynchus aguabonita*

Table 21. Introduced wildlife of the Oregon Side LMS subbasin.

Common Name	*Scientific Name*	Common Name	*Scientific Name*
Chukar	*Alectoric chukar*	House sparrow	*Passer domesticus*
Gray partridge	*Perdix perdix*	Red fox	*Vulpes vulpes*
Ring-necked pheasant	*Phasianus colchicus*	House cat	*Felis catus*
Wild turkey	*Meleagris gallopavo*	Domestic dog	*Canis familiaris*
California quail	*Calipepla californica*	Fox squirrel	*Sciurus niger*
Rock dove	*Columba livia*	House mouse	*Mus musculus*
European starling	*Sturnus vulgaris*	Bullfrog	*Rana catesbiana*

Introduced species have the potential for a variety of adverse ecological consequences including impacts to native species through competition for forage, nest sites and other resources; hybridization; disease transmission; predation; herbivory; damage to plants by trampling; prevention of plant regeneration and soil erosion (Witmer and Lewis 2001). Some introduced species may have positive consequences for certain native species even as they negatively affect others. For example, introduced upland game birds may compete with native upland birds for resources while providing an increased prey base for native avian and mammalian predators (Witmer and Lewis 2001).). It is possible that some introduced species may fill an unoccupied niche in a given habitat or area and therefore have no or minimal negative impact on native species.

Introduced species may also have adverse impacts on human health and activities through disease transmission to humans, pets and/or livestock; structural damage to buildings and roads; reductions in water quality and quantity; contamination of food; competition for livestock forage and predation on livestock (Witmer and Lewis 2001).

Noxious Weeds:

The spread of noxious weeds has been described as a “biological emergency” (ODA 2001). Alien species in general are second only to habitat loss and degradation among threats to biodiverstiy (Wilcove et al. 2000). In Oregon, noxious weeds pose a serious economic and environmental threat. Oregon loses $83 million annually to 21 of the 99 state-listed noxious weeds (ODA 2001). These invasive, mostly non-native, plants choke out crops, destroy range and pasture lands, clog waterways, affect human and animal health and threaten native plant communities.

During the last 10 years, the number of state-listed noxious weeds in Oregon has increased by 40 percent. The recent detection of two aggressive invasive weeds, kudzu and smooth cordgrass, in Oregon has sounded a serious alarm about new invasions. The increasing spread of established weeds is equally alarming; infestations of some invasives have expanded up to 42 fold in Oregon since 1989 (ODA 2001).

A total of 14 noxious weeds have been documented in the Oregon Side LMS subbasin (Table 22). Some of these species present an ever-increasing threat to crop and wildlands in northeast Oregon (Mark Porter, Wallowa Resources, personal communication, 2001).

Table 22. Noxious weeds documented to occur in the Lower Middle Snake subbasin (USDA 1999; USDI 1999; 2001a; 2001b; 2001c).

Common Name	Species
Canada thistle	*Cirsium arvense*
Dalmatian toadflax	*Linaria dalmatica*
Diffuse knapweed	*Centaurea diffusia*
Field bindweed	*Convolvulus arvensis*
Leafy spurge	*Euphorbia esula*
Perennial pepperweed	*Lepidium latifolium*
Poison hemlock	*Conium maculatum*
Puncture vine	*Tribulus terrestris*
Purple loosestrife	*Lythrum salicaria*
Rush skeletonweed	*Chondrilla juncea*
Russian knapweed	*Centaurea repens*
Scotch thistle	*Onopordon acanthium*
White-top	*Cardaria draba*
Yellow starthistle	*Centaurea solstitialis*

In addition to those species listed as noxious weeds, numerous other introduced plants occur in the Oregon Side LMS subbasin (Table 23). Given that most residential landscaping consists of introduced species, it would be impossible to list all of the introduced species present in the subbasin. However, many species have been introduced into previously natural habitats (e.g., Russian olive) or have escaped the urban/suburban environment and become established "in the wild." Further, some species have been introduced and become established through livestock feed (e.g., cheat grass). As with animals, introduced plants may be beneficial under certain circumstances. For example, some introduced, annual grasses may green up in late winter or spring before native, perennial grasses providing early forage for wildlife. Nevertheless, introduced plants are generally detrimental to the habitats in which they live. Introduced plants outcompete the native plant community, thus creating a monoculture that can increase erosion by wind and water; decrease the capture, storage and proper release of precipitation and alter nutrient cycling. Further, monocultures of introduced plants reduce biological diversity by displacing macro- and microfauna that depend on native plants for food and cover (Sheley and Petroff 1999).). The Pacific Northwest Exotic Pest Plant Council (PNW-EPPC) has compiled a list of "Exotic Pest Plants of Greatest Ecological Concern in Oregon and Washington" (PNW-EPPC 1997; Table 23). The PNW-EPPC defines an exotic pest plant as "a non-native plant that disrupts, or has the potential to disrupt or alter the natural ecosystem function, composition and diversity of the site it occupies" (PNW-EPPC 1997). Different species of exotic plants have different potential for invasiveness and require different management responses in natural areas and wildlands. Additionally, climate and soils may naturally limit the invasive potential of a given species in some areas. This seems to be the case with Russian olive in Baker County where it has been introduced but shows little tendency to become invasive (G. Keister, ODFW personal communication 4/1/2004).

Table 23. Introduced plants, known to be present in the subbasin, not listed as noxious weeds by county weed boards but which may be invasive and have an impact on habitat (PNW-EPPC 1997; D. Clemens USFS, personal communication, 2/28/2004).

Common Name	*Scientific Name*	Common Name	*Scientific Name*
Bull thistle	*Cirsium vulgare*	Reed Canarygrass*	*Phalaris arundinacea*
Yellow nutsedge	*Cyperus esculenta*	Venice mallow	*Hibiscus trionum*
Quack grass	*Agropyron repens*	Hoary cress	*Cardaria draba*
Redstem filaree	*Erodium cicutarium*	Prickly lettuce	*Lactuca serriola*
Russian olive	*Elaegnus angustifolia*	Ox-eye daisy	*Leucanthumum vulgare*
Cheatgrass	*Bromus tectorum*	Pineapple weed	*Matricaria matricarioides*
Tamarisk	*Tamarix pentandra*	Black locust	*Robinia pseudoacacia*
Himalayan blackberry	*Rubus discolor*	Red sorrel	*Rumex acetosella*
Tumble mustard	*Sisymbrium altissimum*	Meadow salsify	*Tragopogan pratensis*
Tree of heaven	*Ailanthus altissima*	Longspine sandbur	*Cenchrus longispinus*
Blue mustard	*Chorispora tenella*	Yellowflag iris	*Iris pseudacorus*
Sulfur cinquefoil	*Potentilla recta*	Western salsify	*Tragopogon dubius*
Common burdock	*Arctium minus*	Absinth wormwood	*Artemisia absinthium*
Field bindweed	*Convolvulus arvense*	Houndstongue	*Cynoglossum officinale*
Flixweed	*Descurania sophia*	Birdsfoot trefoil	*Lotus corniculatus*
White sweetclover	*Melilotus alba*	Yellow sweetclover	*Melilotus officinalis*

Timothy	*Phleum pratense*	Curly dock	*Rumex crispus*
Puncture-vine	*Tribulus terrestris*	Spiny cocklebur	*Xanthium spinosum*

* Reed Canarygrass is a native species but some varieties have been introduced; those introduced varieties may have contributed to the invasiveness of this species (Angela Sondenaa, Nez Perce Tribe, personal communication, 2/12/04).

3.2.2 Focal Species Selection

3.2.2.1 List of Species Selected

Aquatic Wildlife:

- Redband Trout (*Oncorhychus mykiss*)
- Bull Tout (*Salvelinus confluentus*)
- Snake River Steelhead (*Oncorhychus mykiss*)
- Snake River Spring/Summer Chinook Salmon (*Oncorhynchus tshawytscha*)

Terrestrial Wildlife:

- High-elevation Conifer Forest:
  - American marten (*Martes americana*)
  - Olive-sided flycatcher (*Contopus cooperi*)
- Eastside Mixed Conifer Forest:
  - Blue grouse (*Dendragopus obscurus*)
- Ponderosa Pine Forest And Woodlands:
  - White-headed woodpecker (*Picoides albolarvatus*)
- Alpine and Subalpine Habitats:
  - Black rosy-finch (*Leucosticte atrata*)
- Eastside Canyon Shrublands:
  - Canyon wren (*Catherpes mexicanus*)
- Eastside Grasslands:
  - Western meadowlark (*Sturnella neglecta*)
- Shrub-steppe:
  - Sage grouse (*Centrocercus urophasianus*)
  - Mule deer (*Odocoileus hemionus*)
- Open Water – Lakes, Rivers, Streams:
  - Bald eagle (*Haliaeetus leucocephalus*)
- Wetlands:
  - Columbia spotted frog (*Rana luteiventris*)
  - Great blue heron (*Ardea herodias*)
  - Yellow-breasted chat (*Icteria virens*)
  - Ruffed grouse (*Bonasa umbellus)*
  - American beaver (*Castor canadensis*)

Plants:

- Rare or Unique Habitats:
  - Quaking Aspen (*Populus tremuloides)*
  - Curlleaf Mountain Mahogany (*Cercocarpus ledifolius*)

3.2.2.2 Methodology for Selection

Fish focal species in the subbasin were selected based on federal status. Given that anadromous fish are currently absent from the subbasin, bull trout are the only federally listed fish present and redband trout are the only species of concern. Snake River steelhead and spring/summer Chinook salmon were present in the subbasin historically and it is thought that the habitat still exists to sustain these species if the passage barriers presented by the Hell's Canyon Complex of dams were addressed and anadromous fish returned to the Snake River above those dams. Therefore, these two species were also selected as focal in this subbasin.

Wildlife species in the subbasin were evaluated for focal species selection by first selecting those species with state or federal legal status (ESA species), then selecting species critically functionally linked (CFL) to their communities and those which are functional specialists (FS) within the subbasin. Among the species that fit one or more of those criteria (State listed, Federally listed, CFL, FS), it was noted whether they were also Partners in Flight (PIF) species, HEP species and/or managed (game) species as well as the number of subbasin habitats the species was closely associated with and whether any of those habitats were thought to be in decline or at risk. The resulting matrix was qualitatively evaluated by the subbasin terrestrial technical team to select Focal Species that: a) carried legal protection under a state or federal ESA, b) best represented habitats in decline or at risk, c) served a critical ecological function within their community or in the subbasin as a whole, d) were culturally, socially or economically important species within the subbasin, or e) any combination of the above.

Focal plant species were selected because of their critical importance to the habitats they occupy. Aspen and mountain mahogany habitats in the subbasin are generally small inclusions within other habitats. These two plant species define those habitats.

3.2.3. Aquatic Focal Species Population Delineation and Characterization

3.2.3 – A Redband Trout

3.2.3.1-A Redband Trout Population Data and Status

3.2.3.1.1 Abundance

No specific data are available regarding population numbers of Oregon Side LMS redband trout. However, surveys done in the Powder River and Eagle Creek drainages (including Pine Creek) in 1991 indicated that redband trout were widespread and abundant (Kostow 1995). Population density varies locally throughout the subbasin.

3.2.3.1.2 Productivity

The productivity of trout in the Oregon Side LMS can be measured by the trend of the population growth rate (USFWS 2002). The estimate of the number of redband trout in the subbasin is difficult to attain since population surveys have not been conducted on the subbasin scale. Therefore population trends cannot be determined due to the limitation of data.

3.2.3.1.3 Life History Diversity

The *O. m. gairdneri* populations in the Oregon Side LMS subbasin are resident only. The steelhead life history was extirpated from the subbasin with construction of the Hell's Canyon Complex of dams. In areas where there are no barriers to such movements, there remain segments of the population that exhibit fluvial and adfluvial characteristics.

3.2.3.1.4 Carrying Capacity

No information exists as to the carrying capacity of the Oregon Side LMS system for redband trout.

3.2.3.1.5 Population Trend and Risk Assessment

An estimate of the number of redband trout in the Oregon Side LMS Subbasin is difficult to attain since limited population studies have been conducted on the entire basin. Therefore it is hard to determine if the population is increasing, decreasing, or remaining the same. Though connectivity has been disrupted by passage barriers and water management, risk assessments cannot be determined at this time due to the limited population data on redband trout.

3.2.3.1.6 Unique Population Units

The Oregon Side LMS subbasin holds two populations of redband trout in Pine Creek and McGraw Creek. ODFW is in the process of a review of native trout populations as part of their Native Fish Conservation Policy update process. The most recent information is available from the 1997 Status Report.

3.2.3.1.6.1 Life History Characteristics

Resident redband trout tolerate water temperatures from 56° F to 70° F. Redband trout mature between 1 and 5 years of age with most maturing at age 3. They spawn mainly in the spring although studies of other inland populations as well as field investigations indicate that redband trout spawn throughout the year where water conditions allow (ODFW 1993a). This is most likely to occur in spring-fed systems where water temperature is essentially constant.

Redband trout are omnivorous and opportunistic; they consume primarily invertebrates but will also eat vegetation and, occasionally, other fish.

Redband trout in the Oregon Side LMS subasin exhibit resident, fluvial and adfluvial life histories in various locations in the subbasin depending, in part, on the presence of passage barriers.

3.2.3.1.6.2 Genetic Integrity

Significant allozyme differences exist between these populations and other Snake River redband populations (Kostow 1995). Currens (1997) recommended that future management actions be undertaken in a manner which retains the genetic identity of these individual populations.

3.2.3.1.6.3 Spatial Diversity

Redband trout are widely distributed within the Pine Creek drainage of the subbasin. Though the data are limited, current and historical distribution of redband trout is relatively static. Though management and land use activities have affected the seasonal use of habitat within some reaches of the subbasin, redband trout continue to utilize a good percentage of habitats historically available to the species (Figure 9, Table 24)

3.2.3.2-A Redband Trout Distribution

3.2.3.2.1 Current Distribution

Distribution of redband trout is widespread throughout the Pine Creek drainage of the Oregon Side LMS subbasin (Figure 9, Table 24).

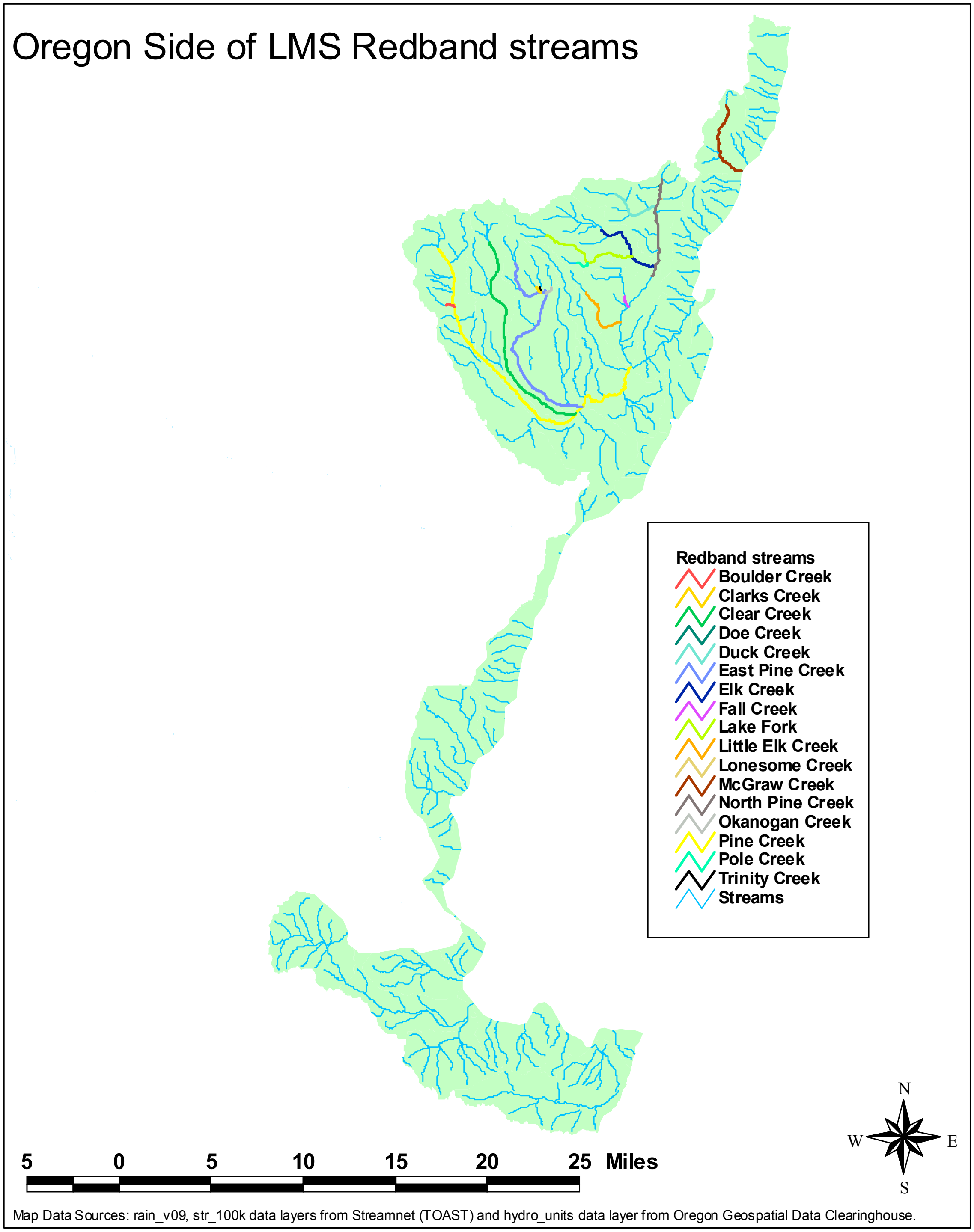


Figure 9. Redband trout distribution in the Oregon Side LMS subbasin.

Table 24. Redband trout habitat range in the Oregon Side LMS subbasin. A weight (0-2) was assigned to each attribute relative to the reach's importance to the life stage.

	0-100%	Current Range (0-2)					0-100%	Reference Range (0-2)				
Reach Name	Percent reach untilization	Spawn and incubation	Summer rearing	Winter rearing	Migration	Confidence	Percent Reach utilization	Spawn and incubation	Summer rearing	Winter rearing	Migration	Confidence
Pine Cr-1	15%	0.0	0.0	1.0	1.0	1	25%	0.0	0.0	1.0	1.0	1
Pine Cr NF-1	50%	1.0	1.0	0.5	1.0	1	70%	1.5	1.0	0.5	1.0	1
Lake Fork Cr	40%	1.5	1.5	0.5	1.0	1	50%	1.5	1.5	0.5	1.0	1
Pine Cr NF-2	50%	1.0	1.5	0.5	1.0	1	50%	1.0	1.5	0.5	1.0	1
Pine Cr-2	25%	0.5	0.2	1.0	1.0	1	40%	1.0	1.0	1.5	1.0	1
Fish Creek	25%	1.5	0.5	0.5	1.0	1	30%	1.5	1.0	0.5	1.0	1
Long Branch/Four Mile	2%	0.5	0.0	0.0	0.3	1	5%	0.5	0.1	0.0	0.3	1
Pine Cr E-1	30%	1.0	0.5	1.0	1.0	1	60%	1.5	1.5	1.0	1.0	1
Pine Cr E-2	30%	1.0	1.0	0.5	1.0	1	40%	1.5	1.5	0.5	1.0	1
Pine Cr-3	10%	1.0	0.1	1.0	1.0	1	40%	1.0	1.5	1.5	1.0	1
Clear Cr-1	20%	1.0	0.5	0.5	1.0	1	50%	1.5	1.5	0.5	1.0	1
Clear Cr-2	10%	1.5	1.5	0.5	1.0	1	30%	1.0	1.5	0.5	1.0	1
Pine Cr-4	25%	1.0	0.5	1.0	1.0	1	60%	1.5	1.0	1.5	1.0	1
Pine Cr-5	20%	1.5	1.5	0.5	1.0	1	50%	1.5	1.5	0.5	1.0	1
Sag Cr-1	0%	0.0	0.0	0.0	0.0	1	5%	0.5	0.1	0.0	1.0	1
Sag Cr-2	0%	0.0	0.0	0.0	0.0	2	5%	0.2	0.1	0.0	0.3	1

3.2.3.2.2 Historic Distribution

Except where anthropogenic barriers prevent movement of fish into historic areas, the historic distribution of redband trout was likely similar to the current distribution. However, seasonal use and movements have likely changed due to changes in water quality and/or water quantity. The historic distribution of *O. mykiss* may have been different because the anadromous form formerly present had the capability to utilize a wider range of habitats.

3.2.3.2.3 Identification of Differences in Distribution due to Human Disturbance

See above.

3.2.3.3-A Description of Aquatic Introductions, Artificial Production and Captive Breeding Programs – Redband Trout

3.2.3.3.1 Introduction: Current

See Section 3.2.3.3.3 below.

3.2.3.3.2 Introduction: Historic

See Section 3.2.3.3.4 below.

3.2.3.3.3 Artificial Production: Current

Hatchery rainbow trout released in the subbasin originate from coastal stock and releases are done primarily in standing bodies of water (lakes, ponds, reservoirs). Present stocking consists of releases in Main Pine Creek and North Pine Creek as well as in several lakes. Rainbow trout released in the Oregon Side LMS Subbasin are reared outside the basin, primarily at the Oak Springs hatchery near Maupin, Oregon and the Fall River Hatchery in the Deschutes basin.

3.2.3.3.4 Artificial Production: Historic

Hatchery rainbow trout have been used to enhance fishery opportunities and harvest in the subbasin since the 1940's. This stocking effort supported popular trout fisheries on subbasin streams and reservoirs. Historically, releases have consisted of fry, fingerling, and legal-size (6-10 in.) fish.

In an effort to enhance angling opportunities, non-native salmonids were introduced to the Powder River subbasin. Eastern brook trout were released into a few streams of the Oregon Side LMS subbasin in the 1920's and 30's and again in the 1960's.

3.2.3.3.5 Artificial Production and Introduction: Ecological Consequences

Hatchery and native rainbow/redband trout have the potential to interbreed which may influence fitness for the Pine Creek environment by introducing genetic characters evolved in other areas. This potential is limited to local systems influenced by ongoing stocking programs.

3.2.3.3.6 Relationship between Naturally- and Artificially-produced Populations

Although some interaction undoubtedly takes places between hatchery rainbow trout and wild redband trout in the areas where they overlap, the nature of the interaction is unknown. However, sampling within Pine Creek, revealed no hybridization or introgression with non-native rainbow trout (Currens 1996).

3.2.3 – B Bull Trout

3.2.3.1-B Bull Trout Population Data and Status

3.2.3.1.1 Abundance

Bull trout population estimates for the Pine Creek system in 1994 yielded a minimum population estimate of 435 and maximum population estimate of 1305 (Buchanan et al. 1997). Efforts were also made by the Recovery Unit Team (RUT) to estimate population levels by expanding distribution/density and spawning ground samples into unsampled but suspected habitat. In the eight streams where survey sites exist, the actual number of redds observed ranged from 0 to 43 per site during 1998 through 2000, which is equivalent to 0 to 37.3 redds per kilometer (0 to 60.0 redds per mile) of stream length (USFWS 2000).

3.2.3.1.2 Productivity

Given the lack of specific population data, productivity is difficult to estimate with any confidence. The productivity of these populations is unknown.

3.2.3.1.3 Life History Diversity

Bull trout populations in the Oregon Side LMS subbasin all exhibit a resident life history strategy.

3.2.3.1.4 Carrying Capacity

The carrying capacity of the subbasin for bull trout is unknown although loss and degradation of habitat in addition to the loss of anadromous fish have undoubtedly resulted in a decrease in that capacity.

3.2.3.1.5 Population Trend and Risk Assessment

Buchanan et al (1997) reported that the Elk Creek and Meadow Creek populations remained at moderate risk but the East Pine Creek and Upper Pine Creek populations had been downgraded from "of special concern" to "moderate risk."

3.2.3.1.6 Unique Population Units

The Oregon Side LMS subbasin includes 4 bull trout population units. These are: Upper Pine Creek, Clear Creek, East Pine Creek and Elk Creek.

3.2.3.1.6.1 Life History Characteristics

Bull trout are a top level predator in many areas of their distribution. Juvenile bull trout feed on aquatic insects until large enough to eat fish. They remain primarily piscivorous throughout their adult life. Resident bull trout exhibit slower growth rates than migratory forms (Kostow 1995).

Bull trout spawn between August and October, generally in cold headwaters or spring-fed streams. Adults may spawn annually or in alternate years.

3.2.3.1.6.2 Genetic Integrity

Bull trout of the Oregon Side LMS subbasin are considered, by ODFW, part of the Malheur Gene Conservation Group although the Pine Creek populations are currently isolated from other populations in the group. Genetic samples were collected in 1995 from bull trout in Elk Creek and from the East Fork Pine Creek. Results suggest that bull trout populations from the John Day Basin and northeastern Oregon (including the Pine Creek Basin) comprise a major genetic lineage (Spruell and Allendorf 1997).

3.2.3.1.6.3 Spatial Diversity

Bull trout currently inhabit much of the Pine Creek drainage.

3.2.3.2-B Bull Trout Distribution

3.2.3.2.1 Current Distribution

Bull trout currently inhabit much of the Pine Creek drainage including Main Pine, East Fork Pine, East Pine, and North Fork Pine Creeks, Elk Creek, Fish Creek and Clear Creek (Figure 10, Table 25).

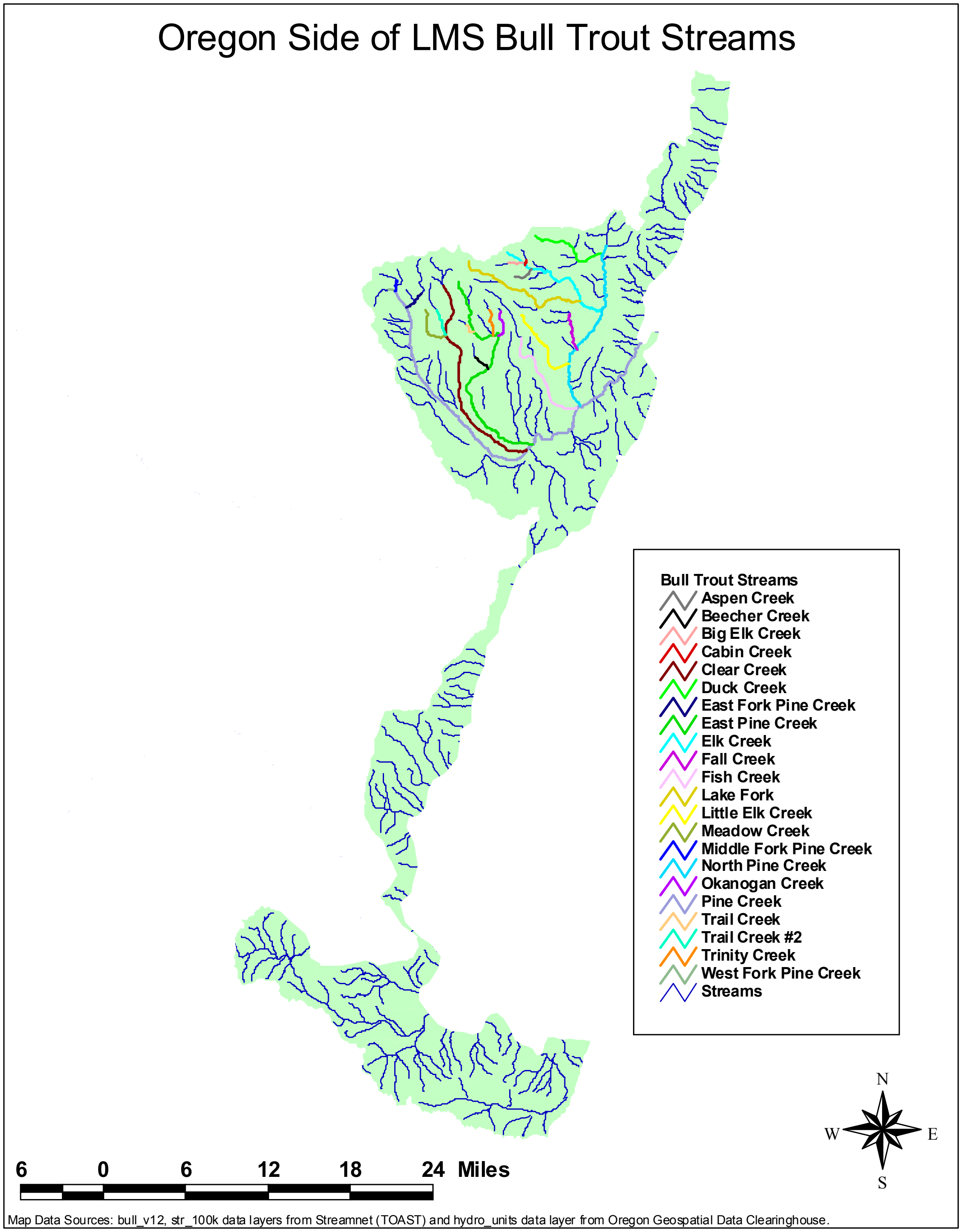


Figure 10. Bull trout distribution in the Oregon Side LMS subbasin, Oregon.

Table 25. Bull trout habitat range in the Oregon Side LMS subbasin. A weight (0-2) was assigned to each attribute relative to the reach's importance to the life stage.

	0-100%	Current Range (0-2)					0-100%	Reference Range (0-2)				
Reach Name	Percent reach untilization	Spawn and incubation	Summer rearing	Winter rearing	Migration	Confidence	Percent Reach utilization	Spawn and incubation	Summer rearing	Winter rearing	Migration	Confidence
Pine Cr-1	10%	0.0	0.0	0.0	1.0	1	25%	0.5	0.5	1.0	2.0	1
Pine Cr NF-1	10%	0.2	0.5	1.0	2.0	1.2	25%	1.0	1.0	1.0	2.0	1
Lake Fork Cr	25%	1.0	1.5	1.0	1.5	1	75%	2.0	2.0	1.0	2.0	1
Pine Cr NF-2	5%	0.2	1.5	1.5	1.0	1	10%	1.0	1.5	1.5	1.0	1
Pine Cr-2	5%	0.5	0.1	1.0	0.5	1	50%	1.5	1.0	1.5	2.0	1
Fish Creek	20%	0.5	0.5	1.0	1.0	1	100%	1.5	1.0	1.5	1.5	1
Long Branch/Four Mile	20%	0.5	0.5	1.0	1.0	1	100%	1.5	1.0	1.5	1.5	1
Pine Cr E-1	20%	0.5	0.5	1.0	1.0	1	100%	1.5	1.0	1.5	1.5	1
Pine Cr E-2	75%	2.0	1.5	1.5	1.0	1.5	75%	2.0	1.5	1.5	1.0	1.5
Pine Cr-3	20%	0.5	0.5	1.0	1.0	1	90%	2.0	1.5	1.5	2.0	1.5
Clear Cr-1	0%	0.0	0.0	0.0	0.0	1	10%	0.0	0.0	0.5	0.5	
Clear Cr-2	0%						0%					
Pine Cr-4	90%	2.0	2.0	1.5	1.5	1.5	90%	2.0	2.0	1.5	2.0	1.5
Pine Cr-5	100%	0.5	0.5	0.5	1.0	1	100%	1.5	1.5	1.5	1.0	1
Sag Cr-1	100%						100%					
Sag Cr-2	100%						100%					

3.2.3.2.2 Historic Distribution

There is no known historic documentation of bull trout in the Oregon Side LMS subbasin prior to the 1960s; historic distribution of bull trout in Pine Creek is unknown although it is suspected they are native throughout the basin. The completion of Hell's Canyon Dam in 1968 closed access to the basin for salmon and steelhead. Hell's Canyon Dam and Oxbow Dam (completed in 1961) limit movement of Pine Creek bull trout in the Snake River to the Hell's Canyon pool and tributaries entering from the Idaho side of the river (e.g., Indian Creek).

3.2.3.2.3 Identification of Differences in Distribution due to Human Disturbance

See above.

3.2.3.3-B Description of Aquatic Introductions, Artificial Production and Captive Breeding Programs – Bull Trout

3.2.3.3.1 Introduction: Current

There is no current stocking of bull trout in the subbasin.

3.2.3.3.2 Introduction: Historic

In an effort to enhance angling opportunities, non-native salmonids were introduced to the Powder River subbasin. Stocking of the high lakes with brook trout dates to the early 1930s the late 1800s according to oral histories collected by Gildemeister (1989 and 1992). Brook trout has been observed in association with bull trout in Clear Creek.

3.2.3.3.3 Artificial Production: Current

See above.

3.2.3.3.4 Artificial Production: Historic

See above.

3.2.3.3.5 Artificial Production and Introduction: Ecological Consequences

There are no artificially produced bull trout in the subbasin. However, introductions of other native and non-native salmonids have taken place as described above. Bull trout have naturally coexisted and coevolved with rainbow trout, Chinook salmon and many other native, aquatic species. However, the introduction of non-native salmonids to native bull trout habitat can be a limiting factor for some populations (Buchanan et al. 1997). Markle (1992) studied bull trout, brook trout and resulting bull trout/brook trout hybrids in Oregon and found that some small populations of bull trout are seriously threatened by the presence of introduced brook trout. Bull trout x brook trout hybrids have been observed in Clear Creek.

3.2.3.3.6 Relationship between Naturally- and Artificially-produced Populations

See above.

3.2.3 – C Snake River Steelhead

Snake River steelhead were extirpated from the subbasin with the completion of Hell's Canyon Dam. Their historic range and reach utilization are shown in Table 26. They are included as focal species for planning purposes because it is felt the habitat exists to sustain the species if passage is developed, allowing for the reintroduction of steelhead to these historic habitats.

Table 26. Steelhead habitat range in the Oregon Side LMS subbasin. A weight (0-2) was assigned to each attribute relative to the reach's importance to the life stage. Only the historic range is shown; steelhead have been extirpated from the subbasin.

	0-100%	Current Range (0-2)					0-100%	Reference Range (0-2)				
Reach Name	Percent reach untilization	Spawn and incubation	Summer rearing	Winter rearing	Migration	Confidence	Percent Reach utilization	Spawn and incubation	Summer rearing	Winter rearing	Migration	Confidence
Pine Cr-1	0%	0.0	0.0	0.0	0.0	2	25%	0.0	0.0	1.0	2.0	1
Pine Cr NF-1	0%	0.0	0.0	0.0	0.0	2	40%	1.5	1.0	0.5	2.0	1
Lake Fork Cr	0%	0.0	0.0	0.0	0.0	2	50%	1.5	1.5	0.5	1.5	1
Pine Cr NF-2	0%	0.0	0.0	0.0	0.0	2	20%	1.0	1.0	0.5	1.0	1
Pine Cr-2	0%	0.0	0.0	0.0	0.0	2	35%	1.0	1.0	1.5	2.0	1
Fish Creek	0%	0.0	0.0	0.0	0.0	2	15%	1.0	1.0	0.5	1.0	1
Long Branch/Four Mile	0%	0.0	0.0	0.0	0.0	2	5%	0.5	0.1	0.0	0.3	1
Pine Cr E-1	0%	0.0	0.0	0.0	0.0	2	60%	1.5	1.5	1.0	2.0	1
Pine Cr E-2	0%	0.0	0.0	0.0	0.0	2	40%	1.5	1.5	0.5	1.0	1
Pine Cr-3	0%	0.0	0.0	0.0	0.0	2	40%	1.0	1.5	1.5	2.0	1
Clear Cr-1	0%	0.0	0.0	0.0	0.0	2	50%	1.5	1.5	0.5	2.0	1
Clear Cr-2	0%	0.0	0.0	0.0	0.0	2	30%	1.0	1.5	0.5	1.0	1
Pine Cr-4	0%	0.0	0.0	0.0	0.0	2	60%	1.0	1.0	1.5	2.0	1
Pine Cr-5	0%	0.0	0.0	0.0	0.0	2	50%	1.5	1.5	0.5	1.0	1
Sag Cr-1	0%	0.0	0.0	0.0	0.0	2	0%	0.0	0.0	0.0	0.0	1
Sag Cr-2	0%	0.0	0.0	0.0	0.0	2	0%	0.0	0.0	0.0	0.0	1

3.2.3 – D Snake River Spring Chinook Salmon

Snake River Chinook salmon were extirpated from the subbasin with the completion of Hell's Canyon Dam. Their historic range and reach utilization are shown in Table 27 They are included as focal species for planning purposes because it is felt the habitat exists to sustain the species if passage is developed allowing for the reintroduction of salmon to these historic habitats.

Table 27. Chinook salmon habitat range in the Oregon Side LMS subbasin. A weight (0-2) was assigned to each attribute relative to the reach's importance to the life stage. Only the historic range is shown; salmon have been extirpated from the subbasin.

	0-100%	Current Range (0-2)					0-100%	Reference Range (0-2)				
Reach Name	Percent reach untilization	Spawn and incubation	Summer rearing	Winter rearing	Migration	Confidence	Percent Reach utilization	Spawn and incubation	Summer rearing	Winter rearing	Migration	Confidence
Pine Cr-1	0%	0.0	0.0	0.0	0.0	2	25%	0.0	0.0	1.0	2.0	1
Pine Cr NF-1	0%	0.0	0.0	0.0	0.0	2	35%	1.0	1.0	0.5	2.0	1
Lake Fork Cr	0%	0.0	0.0	0.0	0.0	2	45%	1.5	1.5	0.5	1.5	1
Pine Cr NF-2	0%	0.0	0.0	0.0	0.0	2	10%	0.5	1.0	0.5	1.0	1
Pine Cr-2	0%	0.0	0.0	0.0	0.0	2	35%	1.0	1.0	1.5	2.0	1
Fish Creek	0%	0.0	0.0	0.0	0.0	2	5%	0.0	0.0	0.5	0.0	1
Long Branch/Four Mile	0%	0.0	0.0	0.0	0.0	2	0%	0.0	0.0	0.0	0.0	1
Pine Cr E-1	0%	0.0	0.0	0.0	0.0	2	60%	1.5	1.5	1.0	2.0	1
Pine Cr E-2	0%	0.0	0.0	0.0	0.0	2	35%	1.0	1.5	0.5	1.0	1
Pine Cr-3	0%	0.0	0.0	0.0	0.0	2	80%	2.0	1.5	1.5	2.0	1
Clear Cr-1	0%	0.0	0.0	0.0	0.0	2	40%	1.5	1.5	0.5	2.0	1
Clear Cr-2	0%	0.0	0.0	0.0	0.0	2	25%	1.0	1.5	0.5	1.0	1
Pine Cr-4	0%	0.0	0.0	0.0	0.0	2	40%	1.5	1.0	1.5	2.0	1
Pine Cr-5	0%	0.0	0.0	0.0	0.0	2	40%	1.0	1.5	0.5	1.0	1
Sag Cr-1	0%	0.0	0.0	0.0	0.0	2	0%	0.0	0.0	0.0	0.0	1
Sag Cr-2	0%	0.0	0.0	0.0	0.0	2	0%	0.0	0.0	0.0	0.0	1

3.2.3.4 Harvest in the Subbasin

3.2.3.4.1 Current In-basin Harvest Levels – Direct/Indirect

Bull trout are federally listed as Threatened; harvest is prohibited.

Redband trout are harvested recreationally along with supplemental rainbow trout. Harvest is governed by daily catch and possession limits but no data are collected regarding angler success or numerical take. Occasional, random creel reports are held in ODFW district files but they are of limited usefulness.

3.2.3.4.2 Historic In-basin Harvest Levels

Virtually no data exist regarding historic harvest of redband and bull trout in the Oregon Side LMS subbasin. Harvest of bull trout is prohibited due to their federal status and harvest records were not kept prior to listing the species.

There are limited data regarding historic harvest of steelhead and Chinook salmon in the subbasin.

3.2.3.5 Environmental conditions for Aquatic Focal Species

The version of QHA used for this assessment was the Oregon TOAST version 1.01, dated 10/24/2003. The overview of the methodology presented here is taken from the "QHA User's Guide for Subbasin Planning in Oregon, October 21, 2003" (McConnaha et al., 2003).

The QHA provides a structured, "qualitative" approach to analyzing the relationship between a given fish species and its habitat. It does this through a systematic assessment of the condition of several aquatic habitat attributes (sediment, water temperature, etc.) that are thought to be key to biological production and sustainability. Attributes are assessed for each of several stream reaches within the subbasin. Habitat attribute conditions are then considered in terms of their influence on a given species and life stage. QHA relies on the expert knowledge of natural resource professionals with experience in a given local area to bring together all available information to describe physical conditions in each reach, and to create an hypothesis about how the habitat would be used by a given fish species. The hypothesis is the "lens" through which physical conditions in the stream are viewed. The hypothesis consists of weights that are assigned to life stages and habitat attributes, as well as a description of how reaches are used by different life stages. These result in a composite weight that is applied to a physical habitat score in each reach. This score is the difference between a rating of physical habitat in a reach under the current condition and a theoretical "reference" condition. The final result is an indication of the relative restoration and protection value for each reach and habitat attribute.

QHA should not be viewed as a sophisticated analytical model. QHA simply supplies a framework for reporting information and analyzing the relationships between a species and its environment. It is up to knowledgeable scientists, managers, and planners to interpret results and make actual decisions regarding these relationships and the actions that might be taken to protect or strengthen these relationships.

To develop reaches for use in QHA, the subbasin was divided into 6th field HUCs. These were modified as necessary by the subbasin Technical Team to reflect habitat conditions, significant passage barriers or use by focal species. Sixteen reaches were delineated but one of those, Sag Creek 2, was not rated. Therefore, 15 reaches were considered in the QHA analysis for the Oregon Side LMS subbasin.

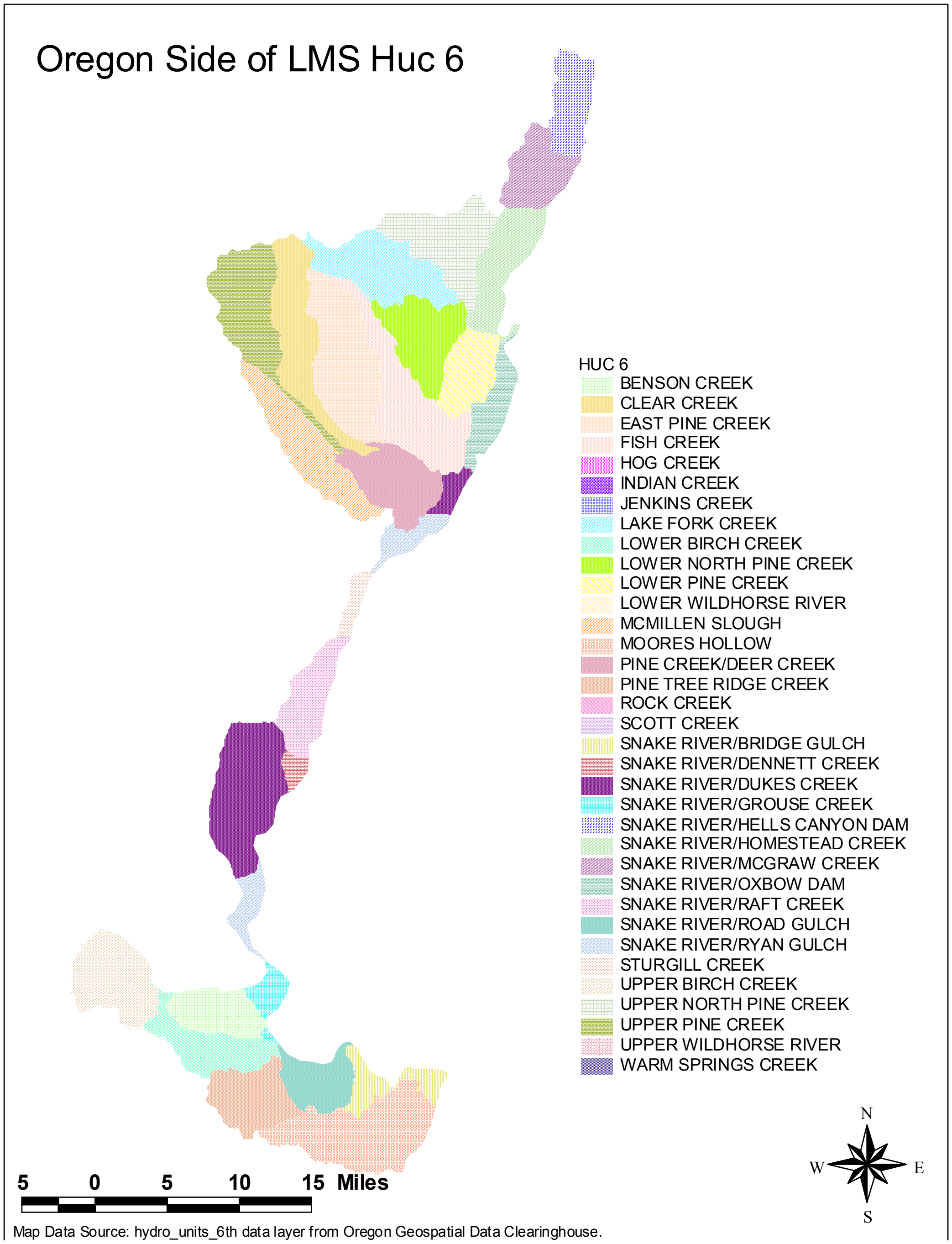


Figure 11. Level 6 HUCs used to delineate stream reaches in the Oregon Side LMS subbasin, Oregon.

Within each reach the aquatic technical team characterized current and historical habitat conditions for each of eleven habitat attributes. These rating tables were the heart of the assessment, and the most time-consuming part of the assessment.

For the purposes of this assessment "current" conditions were defined as the condition of the aquatic environment as it exists today. "Reference" conditions were defined as conditions that were likely in place prior to European settlement. It is critical to note that reference conditions were not considered to be static, or "one size fits all", nor were they always considered to be optimum. To the extent practicable the aquatic assessment team considered how conditions would vary among the reference reaches due to natural environmental conditions and processes. The eleven habitat attributes considered are listed in Table 28. These are the habitat characteristics that are generally thought to be the main "drivers" of fish production and sustainability.

Table 28. QHA habitat attributes and their definitions.

Habitat Attribute	Definition
Riparian Condition	Condition of the stream-side vegetation, land form and subsurface water flow.
Channel Stability	The condition of the channel in regard to bed scour and artificial confinement. Measures how the channel can move laterally and vertically and to form a "normal" sequence of stream unit types.
Habitat diversity	Diversity and complexity of the channel including amount of large woody debris (LWD) and multiple channels
Key Habitat	The complex of habitat types formed by geomorphic processes (including LWD) within the stream (e.g. pools, riffles, glides etc.).
Sediment Load	Amount of fine sediment within the stream, especially in spawning riffles
High Flow	Frequency and amount of high flow events.
Low Flow	Frequency and amount of low flow events.
Oxygen	Dissolved oxygen in water column and stream substrate
High Temperature	Duration and amount of high summer water temperature or low winter temperatures that can be limiting to fish survival
Pollutants	Introduction of toxic (acute and chronic) substances into the stream

The reference and current condition ratings describe the relative value of the physical environment to the focal species that use the reach. Each of the eleven habitat attributes (**Error! Reference source not found.**) is rated for each of the 15 reaches according to the following rating scheme:

0 = 0% of optimum **2 = 50% of optimum** **4 = 100% of optimum**
1 = 25% of optimum **3 = 75% of optimum**

Optimum was defined as being ideal for survival and productivity. Given that some reaches of the Oregon Side LMS subbasin may never have been ideal for fish, these reaches were given a reference rating of <4 for some attributes (e.g., high temperature). This reflects natural environmental conditions that likely made some reaches undesirable for fish in some seasons.

Also included, as part of the reach rating, was an explicit estimation of the level of confidence the assessment team had in their current habitat ratings using a rating scale that ranged from 0 (speculative) to 1 (expert opinion) to 2 (well documented). This rating identified the teams overall knowledge of individual reaches. These individual confidence ratings provide a sense of where understanding of conditions and processes within the subbasin is strong, and where additional understanding is needed.

The QHA process requires the aquatic technical team to develop species-specific hypotheses regarding the relative importance of each life stage to overall fish productivity and sustainability. Life stages are first rated as to their overall importance in the subbasin. Four life stages are considered in this analysis – spawning, summer rearing, winter rearing and migration. For each focal species the technical team rated life stages on a 4 to 1 scale; with 4 being most important. This process defines the life stage(s) that are used to evaluate the importance of the various habitat factors. The life stage rank hypotheses for the Oregon Side LMS subbasin focal species are given in the first rows of Table 29, Table 30, Table 31 and Table 32. These overall life stage rank values indicate that for redband and bull trout the aquatic technical team believes that spawning and incubation is the most important life stage, and migration the least likely to be limiting. However, for steelhead, migration is nearly as important as spawning and incubation and for Chinook it is of equal importance to survival of the species.

In addition to the overall life stage ranking the aquatic technical team also ranked each habitat characteristic for each life stage. The ranking scale ranged from 0 to 2, with 0 indicating that the habitat attribute has no effect on the life stage, and value of 1 indicating some effect, and a value of 2 indicating a critical effect.

Table 29. Species habitat hypothesis - Focal Species: Redband Trout in the Powder River subbasin.

	Spawning/ Incubation	**Summer Rearing**	**Winter Rearing**	**Migration**
Life Stage Rank (1-4)	4.0	3.5	2.5	2.0
Weight assigned to each attribute relative to its importance to the life stage (value range: 0-2)				
Riparian Condition	1.5	2.0	1.5	0.5
Channel stability	1.5	2.0	2.0	1.0
Habitat Diversity	1.5	2.0	2.0	1.0
Fine sediment	2.0	1.0	2.0	0.0
High Flow	1.5	0.5	2.0	2.0
Low Flow	1.0	2.0	0.5	1.5
Oxygen	2.0	2.0	2.0	2.0
Low Temp	2.0	0.0	1.0	0.0
High Temp	1.0	2.0	0.0	0.0
Pollutants	2.0	2.0	2.0	2.0
Obstructions	0.0	0.0	0.0	2.0

Table 30. Species habitat hypothesis – Focal Species: Bull Trout in the Powder River subbasin.

	Spawning/ Incubation	**Summer Rearing**	**Winter Rearing**	**Migration**
Life Stage Rank (1-4)	4.0	3.5	2.5	2.0
Weight assigned to each attribute relative to its importance to the life stage (value range: 0-2)				
Riparian Condition	2.0	2.0	1.5	0.5
Channel stability	1.5	2.0	2.0	1.0
Habitat Diversity	1.0	2.0	2.0	1.0
Fine sediment	2.0	1.0	1.0	0.0

High Flow	2.0	0.5	2.0	2.0
Low Flow	1.0	2.0	0.5	2.0
Oxygen	2.0	2.0	2.0	2.0
Low Temp	2.0	0.0	2.0	0.0
High Temp	1.0	2.0	0.0	1.0
Pollutants	2.0	2.0	2.0	2.0
Obstructions	0.0	0.0	0.0	2.0

Table 31. Species habitat hypothesis – Focal Species: Steelhead in the Oregon Side LMS Subbasin.

	Spawning/ Incubation	Summer Rearing	Winter Rearing	Migration
Life Stage Rank (1-4)	4.0	3.5	2.5	3.5
Weight assigned to each attribute relative to its importance to the life stage (value range: 0-2)				
Riparian Condition	1.5	2.0	1.5	0.5
Channel stability	1.5	2.0	2.0	1.0
Habitat Diversity	1.5	2.0	2.0	1.0
Fine sediment	2.0	1.0	2.0	0.0
High Flow	1.5	0.5	2.0	2.0
Low Flow	1.0	2.0	0.5	1.5
Oxygen	2.0	2.0	2.0	2.0
Low Temp	2.0	0.0	1.0	0.0
High Temp	1.0	2.0	0.0	0.0
Pollutants	2.0	2.0	2.0	2.0
Obstructions	0.0	0.0	0.0	2.0

Table 32. Species habitat hypothesis – Focal Species: Chinook salmon in the Oregon Side LMS subbasin.

	Spawning/ Incubation	Summer Rearing	Winter Rearing	Migration
Life Stage Rank (1-4)	4.0	3.5	2.5	4.0
Weight assigned to each attribute relative to its importance to the life stage (value range: 0-2)				
Riparian Condition	2.0	2.0	1.5	0.5
Channel stability	1.5	2.0	2.0	1.0
Habitat Diversity	1.5	2.0	2.0	0.0
Fine sediment	2.0	1.0	1.0	0.0
High Flow	1.0	0.5	2.0	2.0
Low Flow	2.0	2.0	0.5	2.0
Oxygen	2.0	2.0	2.0	2.0
Low Temp	2.0	0.0	2.0	0.0
High Temp	1.0	2.0	0.0	0.0

Pollutants	2.0	2.0	2.0	2.0
Obstructions	0.0	0.0	0.0	2.0

The combined rating for both life stage and habitat characteristics establishes a simple hypothesis about how each focal species interacts with its environment in the subbasin. The QHA applies these hypotheses for the focal species to the attribute ratings described in section 3.3 above. The result is several output products (described in detail in following sections) that identify:

1) Within-reach ranking of which habitat attribute is most limiting,
2) Among-reach ranking of which reach would most benefit the focal species of concern were that reach restored to reference condition, and
3) Among-reach ranking of which reach is most important to protect in order to benefit the focal species of concern.

3.2.3.5.1 Characterization of Historic

In general, aquatic habitats in the Oregon Side LMS subbasin were rated at or near optimum for most attributes in the reference condition. However, some attributes were likely less than optimum and therefore influenced fish distribution even before European settlement of the area. The effects were thought to be minor with virtually all reaches rated at 75% of optimum or better.

3.2.3.5.2 Characterization of Current

A few reaches of the Oregon Side LMS subbasin are moderately to severely impaired in a few of the habitat attributes considered in the QHA analysis (Table 33). The greatest habitat degradation occurs in lower gradient streams that tend to be at lower elevations in the subbasin. See Appendix 4, Table 37 and Table 38 for reach attribute ratings.

Table 33. Number and percent of Oregon Side LMS subbasin reaches rated at ≤ 50% of optimum for each habitat attribute.

Habitat Attribute	# Reaches at ≤ 50% Optimum	% Reaches at ≤ 50% Optimum
Riparian Condition	1	7%
Channel Stability	3	20%
Habitat Diversity	2	13%
Fine Sediment	8	53%
High Flow	2	13%
Low Flow	4	27%
Oxygen	0	0%
Low Temperature	0	0 %
High Temperature	4	27%
Pollutants	0	0%
Obstructions	1	7%

<u>Channel Stability</u>

For the purposes of QHA channel stability is defined as the condition of the channel in regard to bed scour and artificial confinement. Channel stability in this context is a measure of how the channel can move laterally and vertically and to form a "normal" sequence of stream unit types.

Current channel stability is significantly impaired or modified in the lower reaches of Pine Creek, North Fork Pine Creek, East Fork Pine Creek, Clear Creek and Sag Creek as well as Pine Creek 3 & 4. Channel stability has been compromised in these areas due to confinement by roads and railroads as well as diking and straightening associated primarily with agricultural activities.

Riparian Condition

For the purposes of QHA, Riparian Condition is defined as the condition of the stream-side vegetation, land form and subsurface water flow. The subbasin Technical Team utilized data from the USFS and BLM to assist in assessing riparian condition. Reaches with the poorest riparian condition include North Fork Pine Creek 1, East Pine Creek 1 and Clear Creek 1. In general, the areas with the best riparian condition are those at higher elevations and with higher gradient.

Habitat Diversity

For the purposes of QHA habitat diversity is defined as the diversity and complexity of the channel, including amount of large woody debris (LWD) and multiple channels. It includes the complex of habitat types formed by geomorphic processes within the stream (e.g. pools, riffles, glides etc.). In the reference condition habitat diversity would have varied due to the overriding valley geomorphology, as well as the biological limitations of adjacent riparian areas (with respect to LWD inputs). As such, habitat diversity is closely related to the previous two environmental attributes.

Habitat diversity is lacking in a number of reaches including North Fork Pine Creek 1, Pine Creek 2, East Pine Creek 1, Clear Creek 1, Clear Creek 2, Pine Creek 4 and Sag Creek. As with riparian condition and channel stability (and most other attributes), condition generally improves with increased elevation and stream gradient. Loss of habitat diversity is due to a number of factors including confinement by roads and railroads, diking, straightening and the loss of riparian trees associated with agricultural activities.

Fine Sediment

Fine sediment is defined as the amount of fine sediment within the stream, especially in spawning riffles. In the reference condition fine sediment inputs would vary around the basin due to the underlying geology of the upstream contributing area, variations in watershed and riparian vegetation, and variability in the timing and distribution of disturbance (most notably fire and floods). Fine sediment deposition would be driven by the overriding valley geomorphology, which would result in higher deposition within the low gradient, unconfined reaches, and higher rates of deposition in steeper more confined channels. Reference sediment levels would also be driven by natural rates of bank erosion (driven in part by the reference riparian vegetation conditions), upland vegetation and disturbance, and flow regime.

Eight (53%) reaches were rated at 50% of optimum or less. Those rated best for sediment include Lake Fork Creek, Pine Creek 5 and Sag Creek.

High Flow

High flow is defined within QHA as the frequency and amount of high flow events. The subbasin Technical Team rated reaches for high flow based on the ability of the channel and associated floodplain to handle high flow events without significant damage or destruction to the channel or surrounding area. Volumes of runoff within the entire Powder River subbasin are greatest during the spring months, occurring primarily from runoff associated with snowmelt. Peak flows occur typically in the winter months and can be generated by either rainstorms or rain-on-snow events, particularly in the western portion of the subbasin. Frozen ground contributes to the winter flooding events. Spring peak flows associated with both rain and snowmelt also occur in portions of the subbasin. Summer rainstorms also generate peak flows in this area, although infrequently.

Twelve (80%) reaches were rated at 75% of optimum or better for this attribute. The exceptions were Pine Creek 1, North Fork Pine Creek 1 and North Fork Pine Creek 2 which were rated between 50% and 75%.

Low Flow

Low Flow is defined within QHA as the frequency and amount of low flow events. Natural volumes of runoff are lowest in both tributary and mainstem reaches during the late summer and early fall.

While some areas of the subbasin most likely experienced moderately low flows in the reference condition, water withdrawals for agricultural use have exacerbated the situation significantly. Low flows are a major problem in some reaches within the subbasin, generally in areas affected by irrigation withdrawals. The worst low flow conditions were in East Pine Creek 1, Pine Creek 3, Clear Creek 1 and Pine Creek 4.

Oxygen

Oxygen is defined as the levels of dissolved oxygen (D.O.) in water column and stream substrate. Only 3 of the reaches were rated as 75% of optimum, the rest were optimum.

Low Temperature

Low temperature is defined as the duration and amount of low winter temperatures that can be limiting to fish survival. Low wintertime temperatures can negatively impact fish when anchor ice forms. Low temperature was not found to be a limiting factor in the subbasin; all reaches were rated as optimum.

High Temperature

High temperature is defined as the duration and amount of high summer water temperatures that can be limiting to fish survival. Reference conditions for high summertime water temperatures would be expected to be inversely proportional to elevation and riparian cover, and would be influenced by streamside microclimate.

Although many reaches in the subasin undoubtedly experienced summer high water temperatures that influenced fish distribution in the reference condition, low flows and loss of riparian vegetation have significantly increased the severity and extent of the problem. Further, loss of habitat diversity (i.e., large wood, pools, etc) has resulted in the loss of cool water refugia to which fish can escape during periods of high temperature. Likewise, passage barriers restrict movement from areas of high water temperature to cooler locations. Four reaches (27%) in the subbasin were rated at 50% of optimum or less. High temperature is a problem to some degree in nearly every reach of the subbasin.

Pollutants

Pollutants are defined as toxic (acute and chronic) substances introduced into the stream. In the reference condition it is unlikely that any significant sources of pollutants existed within the subbasin. Pollutants were not a significant issue anywhere in the subbasin although some reaches have minor effects.

Obstructions

Obstructions are defined as physical barriers to the movement of fish throughout the reach. All reaches were thought to have been at or near optimum historically. In the current condition, many reaches in the subbasin have significant obstructions to fish movement including several that were rated zero for obstructions meaning they were impassable. One reach, Sag

Creek 1, was rated at 25% of optimum while obstructions were less of a problem in the rest of the subbasin. A few reaches, generally in the upper portion of streams, were rated as essentially obstruction-free.

3.2.4 Terrestrial Focal Species Population Delineation and Characterization

Terrestrial focal species accounts were prepared as a collaborative effort among several subbasins. For each species, a general region- or basin-wide account was prepared by the author noted at the beginning of each account, and then subbasin-specific information, if available, was added by each subbasin's technical team and writer/editor. The following focal species accounts are brief, edited versions of the comprehensive accounts found in Appendix 3.

3.2.4.1 Columbia Spotted Frog (Rana lueiventris) Keith Paul, USFWS

3.2.4.1.1 Life History

The Columbia spotted frog (CSF) is olive green to brown in color, with irregular black spots. They may have white, yellow, or salmon coloration on the underside of the belly and legs (Engle 2004). CSFs are about one inch in body length at metamorphosis (Engle 2004). Females may grow to approximately 100 mm (4 inches) snout-to-vent length, while males may reach approximately 75 mm (3 inches) snout-vent length (Nussbaum et al. 1983; Stebbins 1985; Leonard et al. 1993).

The CSF eats a variety of food including arthropods (e.g., spiders, insects), earthworms and other invertebrate prey (Whitaker et al. 1982). Adult CSFs are opportunistic feeders and feed primarily on invertebrates (Nussbaum et al. 1983). Larval frogs feed on aquatic algae and vascular plants, and scavenged plant and animal materials (Morris and Tanner 1969).

The timing of breeding varies widely across the species range owing to differences in weather and climate, but the first visible activity begins in late winter or spring shortly after areas of ice-free water appear at breeding sites (Licht 1975; Turner 1958; Leonard et al 1996). Breeding typically occurs in late March or April, but at higher elevations, breeding may not occur until late May or early June (Amphibia Web 2004). Great Basin population CSFs emerge from wintering sites soon after breeding sites thaw (Engle 2001).

David Pilliod observed movements of approximately 2,000 m (6,562 ft) linear distance within a basin in montane habitats (Reaser and Pilliod, in press). Pilliod et al. 1996 (in Koch et al. 1997) reported that individual high mountain lake populations of *R. luteiventris* in Idaho are actually interdependent and are part of a larger contiguous metapopulation that includes all the lakes in the basin. In Nevada, Reaser (1996; in Koch et al. 1997) determined that one individual of R. luteiventris traveled over 5 km (3.11 mi) in a year (NatureServe 2003).

Though movements exceeding 1 km (0.62 mi) and up 5 km (3.11 mi) have been recorded, these frogs generally stay in wetlands and along streams within 0.6 km (0.37 mi) of their breeding pond (Turner 1960, Hollenbeck 1974, Bull and Hayes 2001). Frogs in isolated ponds may not leave those sites (Bull and Hayes 2001; NatureServe 2003).

Based on recapture rates in the Owyhee Mountains, some individuals live for at least five years. Skeletochronological analysis in 1998 revealed a 9-year old female (Engle and Munger 2000). Mortality of eggs, tadpoles, and newly metamorphosed frogs is high, with approximately 5% surviving the first winter (David Pilliod, personal communication, cited in Amphibia Web 2004).

3.2.4.1.2 Habitat

This species is relatively aquatic and is rarely found far from water. It occupies a variety of still water habitats and can also be found in streams and creeks (Hallock and McAllister 2002). CSF's are found closely associated with clear, slow-moving or ponded surface waters, with little shade (Reaser 1997). CSF's are found in aquatic sites with a variety of vegetation types, from grasslands to forests (Csuti 1997). A deep silt or muck substrate may be required for hibernation and torpor (Morris and Tanner 1969). In colder portions of their range, CSF's will use areas where water does not freeze, such as spring heads and undercut streambanks with overhanging vegetation (IDFG et al. 1995). CSF's may disperse into forest, grassland, and brushland during wet weather (NatureServe 2003). They will use stream-side small mammal burrows as shelter. Overwintering sites in the Great Basin include undercut banks and spring heads (Blomquist and Tull 2002).

Reproducing populations have been found in habitats characterized by springs, floating vegetation, and larger bodies of pooled water (e.g., oxbows, lakes, stock ponds, beaver-created ponds, seeps in wet meadows, backwaters; IDFG et al. 1995; Reaser 1997). Breeding habitat is the temporarily flooded margins of wetlands, ponds, and lakes (Hallock and McAllister 2002). Breeding habitats include a variety of relatively exposed, shallow-water (<60 cm), emergent wetlands such as sedge fens, riverine over-bank pools, beaver ponds, and the wetland fringes of ponds and small lakes. Vegetation in the breeding pools generally is dominated by herbaceous species such as grasses, sedges (*Carex* spp.) and rushes (*Juncus* spp.) (Amphibia Web 2004).

3.2.4.1.3 Present Distribution

Populations of the CSF are found from Alaska and British Columbia to Washington east of the Cascades, eastern Oregon, Idaho, the Bighorn Mountains of Wyoming, the Mary's, Reese, and Owyhee River systems of Nevada, the Wasatch Mountains, and the western desert of Utah (Figure 12; Green et al. 1997). Genetic evidence (Green et al. 1996) indicates that Columbia spotted frogs may be a single species with three subspecies, or may be several weakly-differentiated species.

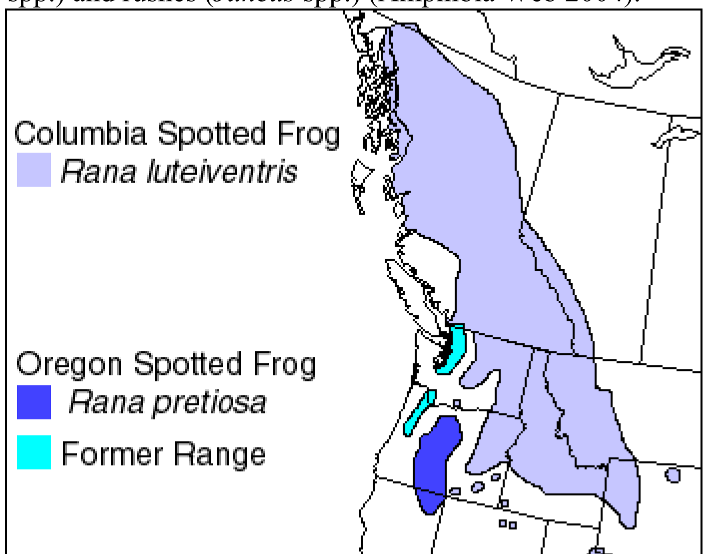


Figure 12. Current distribution of Columbia Spotted Frog (*Rana luteiventris*; USGS, Northern Prairie Wildlife Research Center; range acquired from Green et al. 1997).

The FWS recognizes four distinct population segments (DPS) based on disjunct distribution: the Wasatch Front DPS (Utah), West Desert DPS (White Pine County, NV and Toole County Utah), Great Basin DPS (southeast Oregon, southwest Idaho, and northcentral/northeast Nevada), and the Northern DPS (includes northeastern Oregon, eastern Washington, central and northern parts of Idaho, western Montana, northwestern Wyoming, British Columbia and Alaska) (C. Mellison, J. Engle, pers. comm., 2004).

There is still some uncertainty about whether the northeast Oregon frogs are part of the Great Basin or Northern population. This group of frogs (Blue and Wallowa Mountains) is isolated from the Great Basin population based on geography, and the habitat in the Anthony Lakes area is more like that of the Northern population (montane) than the Great Basin (high desert). It has been considered to make the Snake River a boundary between the Northern and Great Basin populations, but further genetics work will need to be done to clarify the issue (J. Engle, pers. comm., 2004).

Two populations of CSFs are found within the Columbia River Basin: Northern DPS and Great Basin DPS. The Great Basin DPS is further divided into five subpopulations: southeastern Oregon, Owyhee, Jarbidge-Independence, Ruby Mountains, and Toiyabe (J. Engle, C. Mellison, pers. comm., 2004). Of the five subpopulations, only the southeastern Oregon, Owyhee, and the Jarbidge-Independence occur in the Columbia River Basin.

Currently, Columbia spotted frogs appear to be widely distributed throughout southwestern Idaho (mainly in Owyhee County) and eastern Oregon, but local populations within this general area appear to be isolated from each other by either natural or human induced habitat disruptions. The largest local population of spotted frogs in Idaho occurs in Owyhee County in the Rock Creek drainage. The largest local population of spotted frogs in Oregon occurs in Malheur County in the Dry Creek Drainage (USFWS 2002c).

3.2.4.1.4 Current Population Data and Status

Extensive surveys since 1996 throughout southern Idaho and eastern Oregon, have led to increases in the number of known spotted frog sites. Although efforts to survey for spotted frogs have increased the available information regarding known species locations, most of these data suggest the sites support small numbers of frogs. Of the 49 known local populations in southern Idaho, 61 percent had 10 or fewer adult frogs and 37 percent had 100 or fewer adult frogs [Engle 2000; Idaho Conservation Data Center (IDCDC) 2000]. The largest known local population of spotted frogs occurs in the Rock Creek drainage of Owyhee County and supports under 250 adult frogs (Engle 2000). Extensive monitoring at 10 of the 46 occupied sites since 1997 indicates a general decline in the number of adult spotted frogs encountered (Engle 2000; Engle and Munger 2000; Engle 2002). All known local populations in southern Idaho appear to be functionally isolated (Engle 2000; Engle and Munger 2000; USFWS 2002c).

Of the16 sites that are known to support Columbia spotted frogs in eastern Oregon, 81 percent of these sites appear to support fewer than 10 adult spotted frogs. In southeastern Oregon, surveys conducted in 1997 found a single population of spotted frogs in the Dry Creek drainage of Malheur County. Population estimates for this site are under 300 adult frogs (Munger et al. 1996). Monitoring (since 1998) of spotted frogs in northeastern Oregon in Wallowa County indicates relatively stable, small local populations (less than five adults encountered) (Pearl 2000). All of the known local populations of spotted frogs in eastern Oregon appear to be functionally isolated (USFWS 2002c).

3.2.4.1.5 Historic Habitat Distribution

Historic range of the Northern population is most likely similar to that of the current range. Moving south into the southern populations (Great Basin, Wasatch Front, and West Desert) the range was most likely larger in size. Due to habitat loss and alteration, fragmentation, water diversion, dams, and loss of beaver the current distribution and abundance of CSF and suitable habitat has dramatically decreased.

3.2.4.1.6 Current Habitat Distribution

3.2.4.1.7 Limiting Factors

Habitat Loss and Degradation:

Spotted frog habitat degradation and fragmentation is probably a combined result of past and current influences of heavy livestock grazing, spring development, agricultural development, urbanization, and mining activities. These activities eliminate vegetation necessary to protect frogs from predators and UV-B radiation; reduce soil moisture; create undesirable changes in water temperature, chemistry and water availability; and can cause restructuring of habitat zones through trampling, rechanneling, or degradation which in turn can negatively affect the available invertebrate food source (IDFG et al. 1995; Munger et al. 1997; Reaser 1997; Engle and Munger 2000; Engle 2002). Spotted frog habitat occurs in the same areas where these activities are likely to take place or where these activities occurred in the past and resulting habitat degradation has not improved over time. Natural fluctuations in environmental conditions tend to magnify the detrimental effects of these activities, just as the activities may also magnify the detrimental effects of natural environmental events (USFWS 2002c)].

Springs provide a stable, permanent source of water for frog breeding, feeding, and winter refugia (IDFG et al. 1995). Springs provide deep, protected areas which serve as hibernacula for spotted frogs in cold climates. Springs also provide protection from predation through underground openings (IDFG et al. 1995; Patla and Peterson 1996). Most spring developments result in the installation of a pipe or box to fully capture the water source and direct water to another location such as a livestock watering trough. Loss of this permanent source of water in desert ecosystems can also lead to the loss of associated riparian habitats and wetlands used by spotted frogs. Developed spring pools could be functioning as attractive nuisances for frogs, concentrating them into isolated groups, increasing the risk of disease and predation (Engle 2001). Many of the springs in southern Idaho, eastern Oregon, and Nevada have been developed (USFWS 2002c).

The reduction of beaver populations has been noted as an important feature in the reduction of suitable habitat for spotted frogs. Beaver are important in the creation of small pools with slow-moving water that function as habitat for frog reproduction and create wet meadows that provide foraging habitat and protective vegetation cover, especially in the dry interior western United States (St. John 1994). In some areas, beavers are removed because of a perceived threat to water for agriculture or horticultural plantings. As indicated above, permanent ponded waters are important in maintaining spotted frog habitats during severe drought or winter periods. Removal of a beaver dam in Stoneman Creek in Idaho is believed to be directly related to the decline of a spotted frog subpopulation there. Intensive surveying of the historical site where frogs were known to have occurred has documented only one adult spotted frog (Engle 2000; USFWS 2002c).

Fragmentation of habitat may be one of the most significant barriers to spotted frog recovery and population persistence. Recent studies in Idaho indicate that spotted frogs exhibit breeding site fidelity (Patla and Peterson 1996; Engle 2000; Munger and Engle 2000; J. Engle, IDFG, pers. comm., 2001). Movement of frogs from hibernation ponds to breeding ponds may be impeded by zones of unsuitable habitat. As movement corridors become more fragmented due to loss of flows within riparian or meadow habitats, local populations will become more isolated (Engle 2000; Engle 2001). Vegetation and surface water along movement corridors provide relief from high temperatures and arid environmental conditions, as well as protection from predators. Loss of vegetation and/or lowering of the water table as a result of the above mentioned activities can pose a significant threat to frogs moving from one area to another. Likewise, fragmentation and loss of habitat can prevent frogs from colonizing suitable sites elsewhere (USFWS 2002c).

Though direct correlation between spotted frog declines and livestock grazing has not been studied, the effects of heavy grazing on riparian areas are well documented (Kauffman et al. 1982; Kauffman and Kreuger 1984; Skovlin 1984; Kauffman et al. 1985; Schulz and Leininger 1990). Heavy grazing in riparian areas on state and private lands is a chronic problem throughout the Great Basin (USFWS 2002c).

The effects of mining on Great Basin Columbia spotted frogs, specifically, have not been studied, but the adverse effects of mining activities on water quality and quantity, other wildlife species, and amphibians in particular have been addressed in professional scientific forums (Chang et al. 1974; Birge et al. 1975; Greenhouse 1976; Khangarot et al. 1985; USFWS 2002c).

Disease and Predation:

Predation by fishes is likely an important threat to spotted frogs. The introduction of nonnative salmonid and bass species for recreational fishing may have negatively affected frog species throughout the United States. The negative effects of predation of this kind are difficult to document, particularly in stream systems. However, significant negative effects of predation on frog populations in lacustrine systems have been documented (Hayes and Jennings 1986;

Pilliod et al. 1996, Knapp and Matthews 2000). One historic site in southern Idaho no longer supports spotted frog although suitable habitat is available. This may be related to the presence of introduced bass in the Owyhee River (IDCDC 2000). The stocking of nonnative fishes is common throughout waters of the Great Basin.

The bull frog (*Rana catesbeiana*), a nonnative ranid species, occurs within the range of the spotted frog in the Great Basin. Bullfrogs are known to prey on other frogs (Hayes and Jennings 1986). They are rarely found to co-occur with spotted frogs, but whether this is an artifact of competitive exclusion is unknown at this time (USFWS 2002c).

Although a diversity of microbial species is naturally associated with amphibians, it is generally accepted that they are rarely pathogenic to amphibians except under stressful environmental conditions. Chytridiomycosis (chytrid) is an emerging panzootic fungal disease in the United States (Fellers et al. 2001). Clinical signs of amphibian chytrid include abnormal posture, lethargy, and loss of righting reflex. Gross lesions, which are usually not apparent, consist of abnormal epidermal sloughing and ulceration; hemorrhages in the skin, muscle, or eye; hyperemia of digital and ventrum skin, and congestion of viscera. Diagnosis is by identification of characteristic intracellular flask-shaped sporangia and septate thalli within the epidermis. Chytrid can be identified in some species of frogs by examining the oral discs of tadpoles which may be abnormally formed or lacking pigment (Fellers et al. 2001) (USFWS 2002c).

Existing Regulatory Mechanisms:

Spotted frog occurrence sites and potential habitats occur on both public and private lands. This species is included on the Forest Service sensitive species list; as such, its management must be considered during forest planning processes. However, little habitat restoration, monitoring or surveying has occurred on Forest Service lands (USFWS 2002c)].

BLM policies direct management to consider candidate species on public lands under their jurisdiction. To date, BLM efforts to conserve spotted frogs and their habitat in Idaho, Oregon, and Nevada have not been adequate to address threats (USFWS 2002c).

Columbia spotted frogs are not on the sensitive species list for the State of Oregon. Protection of wetland habitat from loss of water to irrigation or spring development is difficult because most water in the Great Basin has been allocated to water rights applicants based on historical use and spring development has already occurred within much of the known habitat of spotted frogs. Federal lands may have water rights that are approved for wildlife use, but these rights are often superceded by historic rights upstream or downstream that do not provide for minimum flows. Also, most public lands are managed for multiple use and are subject to livestock grazing, silvicultural activities, and recreation uses that may be incompatible with spotted frog conservation without adequate mitigation measures (USFWS 2002c).

Other Natural or Anthropogenic Factors:

Multiple consecutive years of less than average precipitation may result in a reduction in the number of suitable sites available to spotted frogs. Local extirpations eliminate source populations from habitats that in normal years are available as frog habitat (Lande and Barrowclough 1987; Schaffer 1987; Gotelli 1995). These climate events are likely to exacerbate the effects of other threats, thus increasing the possibility of stochastic extinction of subpopulations by reducing their size and connectedness to other subpopulations. As movement corridors become more fragmented due to loss of flows within riparian or meadow habitats, local populations will become more isolated (Engle 2000). Increased fragmentation of the habitat can lead to greater loss of populations due to demographic and/or environmental stochasticity (USFWS 2002c).

3.2.4.2 Great Blue Heron (Ardea herodias) Paul Ashley and Stacey Stovall, WDFW

3.2.4.2.1 Life History

Fish are preferred food items of the great blue heron in both inland and coastal waters (Kirkpatrick 1940; Palmer 1962; Kelsall and Simpson 1980), although a large variety of dietary items has been recorded. Frogs and toads, tadpoles and newts, snakes, lizards, crocodilians, rodents and other mammals, birds, aquatic and land insects, crabs, crayfish, snails, freshwater and marine fish, and carrion have all been reported as dietary items for the great blue heron (Bent 1926; Roberts 1936; Martin et al. 1951; Krebs 1974; Kushlan1978).

Great blue herons feed alone or occasionally in flocks. Solitary feeders may actively defend a much larger feeding territory than do feeders in a flock (Meyerriecks 1962; Kushlan 1978). Flock feeding may increase the likelihood of successful foraging (Krebs 1974; Kushlan 1978) and usually occurs in areas of high prey density where food resources cannot effectively be defended.

In the Oregon Side LMS subbasin, great blue herons are often seen hunting along rivers and streams as well as in wet meadows and marshes. At times, especially during winter and spring, great blue herons can be seen hunting in agricultural fields and pastures.

3.2.4.2.2 Habitat

Minimum habitat area for the great blue heron includes wooded areas suitable for colonial nesting and wetlands within a specified distance of the heronry where foraging can occur. A heronry frequently consists of a relatively small area of suitable habitat. For example, heronries in the Chippewa National Forest, Minnesota, ranged from 0.4 t o 4.8 ha in size and averaged 1.2 ha (Mathisen and Richards 1978). Twelve heronries in western Oregon ranged from 0.12 t o 1.2 ha in size and averaged 0.4 ha (Werschkul et al. 1977).

Short and Cooper (1985) provide criteria for suitable great blue heron foraging habitat. Suitable great blue heron foraging habitats are within 1.0 km of heronries or potential heronries. The suitability of herbaceous wetland, scrub-shrub wetland, forested wetland, riverine, lacustrine or estuarine habitats as foraging areas for the great blue heron is ideal if these potential foraging habitats have shallow, clear water with a firm substrate and a huntable population of small fish.

A smaller energy expenditure by adult herons is required to support fledglings if an abundant source of food is close to the nest site than if the source of food is distant. Nest sites frequently are located near suitable foraging habitats. Social feeding is strongly correlated with colonial nesting (Krebs 1978), and a potential feeding site is valuable only if it is within "commuting" distance of an active heronry. For example, 24 of 31 heronries along the Willamette River in Oregon were located within 100m of known feeding areas (English 1978). Most heronries along the North Carolina coast were located near inlets, which have large concentrations of fish (Parnell and Soots 1978). The maximum observed flight distance from an active heronry to a foraging area was 29 km in Ohio (Parris and Grau 1979).

Great blue herons feed anywhere they can locate prey (Burleigh 1958). This includes the terrestrial surface but primarily involves catching fish in shallow water (Bent 1926; Meyerriecks 1960; Bayer 1978).

Cover for concealment does not seem to be a limiting factor for the great blue heron. Heron nests often are conspicuous, although heronries frequently are isolated. Herons often feed in marshes and areas of open water, where there is no concealing cover.

Short and Cooper (1985) describe suitable great blue heron nesting habitat as a grove of trees at least 0.4 ha in area located over water or within 250m of water. These potential nest sites may be on an island with a river or lake, within a woodland dominated swamp, or in vegetation near a river or lake. Trees used as nest sites are at least 5m high and have many branches at least 2.5 cm in diameter that are capable of supporting nests. Trees may be alive or dead but must have an "open canopy" that allows an easy access to the nest.

A wide variety of nesting habitats is used by the great blue heron throughout its range in North America. Trees are preferred heronry sites, with nests commonly placed from 5 to 15 m above ground (Burleigh 1958; Cottrille and Cottrille 1958; Vermeer 1969; McAloney 1973). Smaller trees, shrubs, reeds (*Phragmites communis*), the ground surface, rock ledges along coastal cliffs, and artificial structures may be utilized in the absence of large trees, particularly on islands (Lahrman 1957; Behle 1958; Vermeer 1969; Soots and Landin 1978; Wiese 1978).

Heron nest colony sites vary, but are usually near water. These areas often are flooded (Sprunt 1954; Burleigh 1958; English 1978). Islands are common nest colony sites in most of the great blue heron's range (Vermeer 1969; English 1978; Markham and Brechtel 1979). Many colony sites are isolated from human habitation and disturbance (Mosely 1936; Burleigh 1958). Mathisen and Richards (1978) recorded all existing heronries in Minnesota as at least 3.3 km from human dwellings, with an average distance of 1.3 km to the nearest surfaced road. Nesting great blue herons may become habituated to noise (Grubb 1979), traffic (Anderson 1978), and other human activity (Kelsall and Simpson 1980). Colony sites usually remain active until the site is disrupted by land use changes.

A few colony sites have been abandoned because the birds depleted the available nest building material and possibly because their excrement altered the chemical composition of the soil and the water. Heron exretia can have an adverse effect on nest trees (Kerns and Howe 19667; Wiese 1978).

3.2.4.2.3 Present Distribution

The great blue heron breeds throughout the U.S. and winters as far north as New England and southern Alaska (Figure 13; Bull and Farrand 1977). The nationwide population is estimated at 83,000 individuals (NACWCP 2001).

In the Oregon Side LMS subbasin, great blue herons are often seen hunting along rivers and streams as well as in wet meadows and marshes. At times, especially during winter and spring, great blue herons can be seen hunting in agricultural fields and pastures.

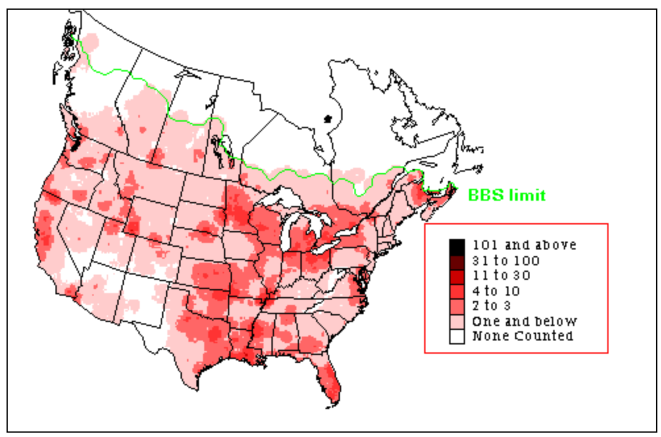


Figure 13. . Great blue heron summer distribution from Breeding Bird Survey (BBS) data (Sauer *et al.* 2003).

3.2.4.2.4 Current Population Data and Status

In the past, herons and egrets were shot for their feathers, which were used as cooking utensils and to adorn hats and garments, and they also provided large, accessible targets. The slaughter of these birds went relatively unchecked until 1900 when the federal government passed the Lacey Act, which prohibits the foreign and interstate commercial trade of feathers.

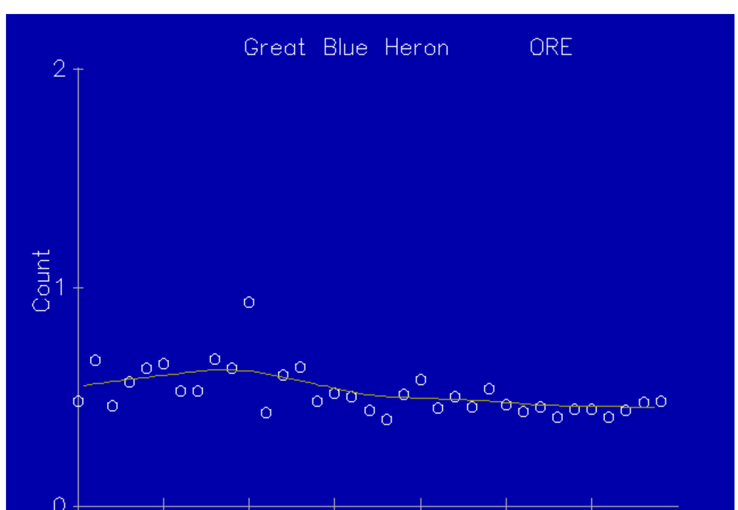


Figure 14. Great blue heron Breeding Bird Survey (BBS) Oregon trend results: 1966-2002 (Sauer *et al.* 2003).

Greater protection was afforded in 1918 with the Migratory Bird Treaty Act, which empowered the federal government to set seasons and bag limits on the hunting of waterfowl and waterbirds. With this protection, herons and other birds have made dramatic comebacks.

Breeding bird survey trend data show a stable to slightly declining trend in populations throughout Oregon (Figure 14). Surveys of blue heron populations are not conducted in the Oregon Side LMS subbasin. However, populations appear to be stable.

3.2.4.2.5 Historic Habitat Distribution

3.2.4.2.6 Current Habitat Distribution

3.2.4.2.7 Limiting Factors

Habitat destruction and the resulting loss of nesting and foraging sites, and human disturbance probably have been the most important factors contributing to declines in some great blue heron populations in recent years (Thompson 1979a; Kelsall and Simpson 1980; McCrimmon 1981).

Natural generation of new nesting islands, created when old islands and headlands erode, has decreased due to artificial hardening of shorelines with bulkheads. Loss of nesting habitat in certain coastal sites may be partially mitigated by the creation of dredge spoil islands (Soots and Landin 1978). Several species of wading birds, including the great blue heron, use coastal spoil islands (Buckley and McCaffrey 1978; Parnell and Soots 1978; Soots and Landin 1978). The amount of usage may depend on the stage of plant succession (Soots and Parnell 1975; Parnell and Soots 1978), although great blue herons have been observed nesting in shrubs (Wiese 1978), herbaceous vegetation (Soots and Landin 1978), and on the ground on spoil islands.

Poor water quality reduces the amount of large fish and invertebrate species available in wetland areas. Toxic chemicals from runoff and industrial discharges pose yet another threat. Although great blue herons currently appear to tolerate low levels of pollutants, these chemicals can move through the food chain, accumulate in the tissues of prey and may eventually cause reproductive failure in the herons.

Several authors have observed eggshell thinning in great blue heron eggs, presumably as a result of the ingestion of prey containing high levels of organochlorines (Graber et al. 1978; Ohlendorf et al. 1980). Konermann et al. (1978) blamed high levels of dieldrin and DDE use for reproductive failure, followed by colony abandonment in Iowa. Vermeer and Reynolds (1970) recorded high levels of DDE in great blue herons in the prairie provinces of Canada, but felt that reproductive success was not diminished as a result. Thompson (1979a) believed that it was too early to tell if organochlorine residues were contributing to heron population declines in the Great Lakes region.

Heronries often are abandoned as a result of human disturbance (Markham and Brechtel 1979). Werschkul et al. (1976) reported more active nests in undisturbed areas than in areas that were being logged. Tree cutting and draining resulted in the abandonment of a mixed-species heronry in Illinois (Bjorkland 1975). Housing and industrial development (Simpson and Kelsall 1979) and water recreation and highway construction (Ryder et al. 1980) also have resulted in the abandonment of heronries. Grubb (1979) felt that airport noise levels could potentially disturb a heronry during the breeding season.

3.2.4.3 Bald Eagle (Haliaeetus leucocephalus) Keith Paul, USFWS

3.2.4.3.1 Life History

As our national symbol, the bald eagle is widely recognized. Its distinctive white head and tail do not appear until the bird is four to five years old. These large powerful raptors can live for 30 or more years in the wild and even longer in captivity (USFWS 2003).

Bald eagles consume a variety of prey that varies by location and season. Prey are taken alive, scavenged, and pirated (Frenzel 1985, Watson et al. 1991). Fish were the most frequent prey among 84 species identified at nest sites in south-central Oregon, and a tendency was observed for some individuals or pairs to specialize in certain species (Frenzel 1985). Wintering and migrant eagles in eastern Oregon fed on large mammal carrion, especially road-killed mule deer, domestic cattle that died of natural causes, and stillborn calves, as well as cow afterbirth, waterfowl, ground squirrels, other medium-sized and small rodents, and fish. Proportions varied by month and location. Food habits are unknown for nesting eagles over much of the state (Isaacs and Anthony 2003a).

Bald eagles are most abundant in Oregon in late winter and early spring, because resident breeders (engaged in early nesting activities), winter residents, and spring transients are all present. Nest building and repair occur any time of year, but most often observed from February to June (Isaacs and Anthony unpublished data). Bald eagles are territorial when breeding but gregarious when not (Stalmaster 1987). They exhibit strong nest-site fidelity (Jenkins and Jackman 1993). Both sexes build the nest, incubate eggs, and brood and feed young (Stalmaster 1987). Egg laying occurs mid-February to late April; hatching late March to late May; and fledging late June to mid-Aug (Isaacs and Anthony unpublished data; Isaacs and Anthony 2003a).

During the nest building, egg laying and incubating periods, eagles are extremely sensitive and will abandon a nesting attempt if there are excessive disturbances in the area during this time. The eaglets are able to fly in about three months and then, after a month, they are on their own.

Bald eagles can be resident year-round where food is available; otherwise they will migrate or wander to find food. When not breeding, they may congregate where food is abundant, even away from water (Stalmaster 1987). Migrants passing through Glacier National Park generally followed north-south flyways similar to those of waterfowl (McClelland et al. 1994). In contrast, juveniles and subadults form California traveled north to Oregon, Washington, and British Columbia in late summer and fall (D. K. Garcelon p.c.; R. E. Jackman p.c.; Isaacs and Anthony 2003a)].

Reviews of published literature (Harmata et al. 1999., Jenkins et al. 1999) suggested that survival varies by location and age; hatch-year survival was usually >60%, and survivorship increased with age to adulthood. However, recent work by Harmata et al. (1999) showed survival lowest among 3- and 4-year old birds (Isaacs and Anthony 2003a).

The major factor leading to the decline and subsequent listing of the bald eagle was disrupted reproduction resulting from contamination by organochlorine pesticides. Other causes of death in bald eagles have included shooting, electrocution, impact injuries, and lead poisoning (USFWS 2003).

3.2.4.3.2 Habitat

Bald eagles are generally associated with large bodies of water, but can occur in any habitat with available prey (Isaacs and Anthony 2003a).

Bald eagles nest in forested areas near the ocean, along rivers, and at estuaries, lakes, and reservoirs (Isaacs and Anthony 2001). Consequently, shoreline is an important component of nesting habitat; 84% of Oregon nests were within 1 mi (1.6 km) of water (Anthony and Isaacs 1989). All nests observed in Oregon have been in trees, primarily Sitka spruce and Douglas-fir west of the Cascades and ponderosa pine, Douglas-fir, and sugar pine in eastern Oregon (Anthony and Isaacs 1989). Use of black cottonwood for nesting has increased recently as Columbia and Willamette River populations have increased. Bald eagles also nest in white fir, red fir, grand fir, incense-cedar, Oregon white oak, quaking aspen, and willow (Isaacs and Anthony unpublished data). Live trees are usually used for nest trees, although nests will continue to be used if the tree dies.

Wintering eagles in the Pacific Northwest perch on a variety of substrates; proximity to a food source is probably the most important factor influencing perch selection by bald eagles (Steenhof et al. 1980). Most tree perches selected by eagles provide a good view of the surrounding area (Servheen 1975, Stalmaster 1976), and eagles tend to use the highest perch sites available (Stalmaster 1976) (USFWS 1986)].

Eagles use a variety of tree species as perch sites, depending on regional forest types and stand structures. Dead trees are used by eagles in some areas because they provide unobstructed view and are often taller than surrounding vegetation (Stalmaster 1976). Artificial perches may be important to wintering bald eagles in situations where natural perches are lacking. Along the Columbia River in Washington, where perch trees are not available, eagles regularly use artificial perches, including both crossarm perches and a tripod perch (Fielder, p.c.;USFWS 1986)].

Habitat requirements for communal night roosting are different form those for diurnal perching. Communal roosts are invariably near a rich food resource and in forest stands that are uneven-aged and have at least a remnant of the old-growth forest component (Anthony et al. 1982). Roost tree species and stand characteristics vary considerably throughout the Pacific Northwest (Anthony et al 1982) (USFWS 1986).

Isolation is an important feature of bald eagle wintering habitat. In Washington, 98% of wintering bald eagles tolerated human activities at a distance of 300 m (328 yards) (Stalmaster and Newman 1978). However, only 50% of eagles tolerated disturbances of 150 m (164 yards) (USFWS 1986).

3.2.4.3.3 Present Distribution

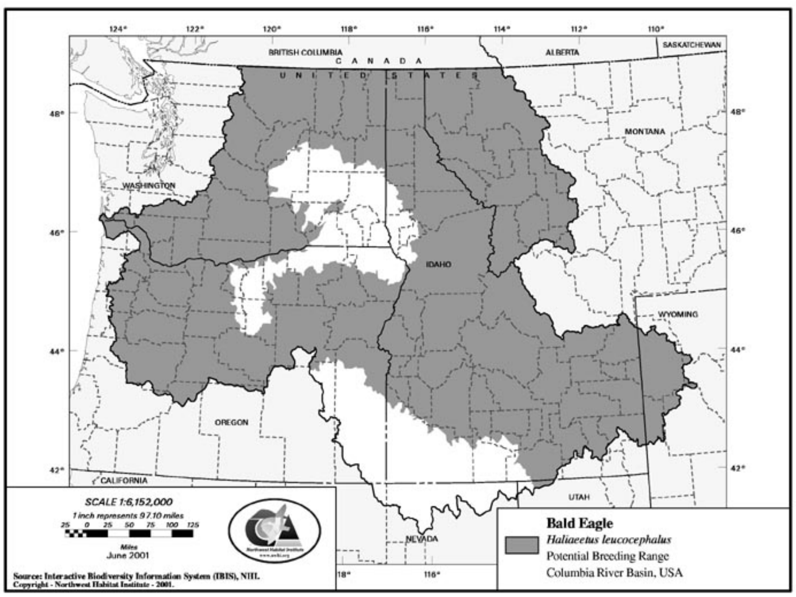


Figure 15. Breeding Distribution of the bald eagle (*Haliaeetus leucocephalus*) in the Columbia River Basin (IBIS 2003).

In Oregon, the bald eagle nested in 32 of 36 counties. Those counties where breeding did not occur include Sherman, Gilliam, Morrow, and Malheur counties (Isaacs and Anthony 2001). However, an active bald eagle nest was reported in Malheur County in 2003 (G. Miller, USFWS, personal communication, 4/13/2004). Bald eagles can be found throughout the state during non-breeding. Local variation in number of eagles and timing of peak abundance is due to weather and food supply. Eagles are common in winter and early spring at Hells Canyon, Oxbow, and Brownlee reservoirs, and along the Wallowa and Grande Ronde Rivers (Isaacs et al. 1992). There is one known, active bald eagle nest in the Oregon Side LMS subbasin.

An understanding of population structure, abundance, and distribution is complicated by multiple age classes, breeding status, nesting chronology, origin and movements of individuals, local and regional distribution and abundance of prey, local and regional weather, and season. For example, native and non-native juveniles (<1 yr old), subadults (1-4 yr old), and nonbreeding adults, and breeding adults can all occur in the same area (e.g., Klamath Basin) in winter and early spring (Isaacs and Anthony 2003a).

3.2.4.3.4 Current Population Data and Status

By 1940, the bald eagle had "become rather an uncommon bird" except along the coast and Columbia River, and in Klamath Co. (Gabrielson and Jewett 1940). The population may have reached its historical low by the early 1970's. By then, nesting pairs were extirpated in northeastern Oregon (Isaacs and Anthony 2001).

The bald eagle was declared threatened in Oregon, Washington, Michigan, Minnesota, Wisconsin, and Florida, and endangered in the other 43 contiguous states in 1978 under the federal Endangered Species Act (ESA) because of declining number of nesting pairs and reproductive problems caused by environmental contaminants (USDI 1978).

Habitat protection and management, the ban on use of DDT (Greier 1982) and reduced direct persecution due to education were followed by a recent population increase. Improved nesting success and a population increase led to a 1999 proposal to delist federally (USDI 1999). Oregon also may propose to delist the species (Isaacs and Anthony 2003a).

The upward population trend could reverse if the species is delisted without maintaining habitat-protection measures implemented under the ESA (e.g., USFS and BLM special habitat management for bald eagles, Oregon Forest Practices Rules protecting bald eagle sites on nonfederal forest land, and local zoning laws that protect wildlife habitat). Habitat degradation and a population decline could go undetected if monitoring of nesting and wintering populations is not continued.

As summarized in Steenhof et al. (2002), mid-winter population trends from 1986-2000 for the Pacific Northwest are: Oregon (+1.4%), Washington (+4.6%), Idaho (+1.9). Isaacs and Anthony (2003b) compiled information on bald eagle nest locations and history of use in the Washington and Oregon portions of the Columbia River Recovery Zone 1971 through 2003. Nesting success was 64% in OR and 52% in WA, resulting in 5-year nesting success of 64% in OR and 58% in WA. Young/successful site was 1.65 in OR and 1.71 in WA. Three nestlings were observed at 7 sites in OR and 1 site in WA. Nesting success for Recovery Zones with at least 5 occupied sites was highest in Recovery Zone 9 (Blue Mountains) with 1.62 young per occupied site. Net increase in the OR population was 3.7% for 2003. Annual increase averaged 7.4% from 1980-2001; the increase in 2002 was 2.0%. Reasons for the relatively low increase the past 2 years are unknown.

3.2.4.3.5 Historic Habitat Distribution

3.2.4.3.6 Current Habitat Distribution

3.2.4.3.7 Limiting Factors

Currently, loss of habitat and human disturbance are still potential threats. Habitat loss results from the physical alteration of habitat as well as from human disturbance associated with development or recreation (i.e., hiking, camping, boating, and ORV use). Activities that can and have negatively impacted bald eagles include logging, mining, recreation, overgrazing (particularly in riparian habitats), road construction, wetland filling, and industrial development. These activities, as well as suburban and vacation home developments are particularly damaging when they occur in shoreline habitats. Activities that produce increased siltation and industrial pollution can cause dissolved oxygen reductions in aquatic habitats, reduction s in bald eagle fish prey populations followed by reductions in the number of eagles. Not all developments in floodplain habitats are detrimental to bald eagles, as some reservoirs and dams have created new habitat with dependable food supplies (USFWS 2003).

Although habitat loss and residual contamination remain a threat to the bald eagle's full recovery, breeding populations in most areas of the country are making encouraging progress. The following continue to be important conservation measures (USFWS 2003):

1. Avoid disturbance to nests during the nesting season: January – August.
2. Avoid disturbance to roosts during the wintering season: November – March.
3. Protect riparian areas from logging, cutting, or tree clearing.
4. Protect fish and waterfowl habitat in bald eagle foraging areas.
5. Development of site-specific management plans to provide for the long-term availability of habitat.

3.2.4.4 White-headed Woodpecker (Picoides albolarvatus) Paul Ashley and Stacey Stovall, WDFW.

3.2.4.4.1 Life History

The white-headed woodpecker (*Picoides albolarvatus*) is a year round resident in the Ponderosa pine (*Pinus ponderosa*) forests found at lower elevations (generally below 950m). They are particularly vulnerable due to their highly specialized winter diet of ponderosa pine seeds and the lack of alternate, large cone producing, pine species.

White-headed woodpeckers feed primarily on the seeds of large Ponderosa pines. This is makes the white-headed woodpecker quite different from other species of woodpeckers who feed primarily on wood boring insects (Blood 1997; Cannings 1987 and 1995). The existence of only one suitable large pine (ponderosa pine) is likely the key limiting factor to the white-headed woodpecker's distribution and abundance.

Other food sources include insects (on the ground as well as hawking), mullein seeds and suet feeders (Blood 1997; Joe et al. 1995). These secondary food sources are used throughout the spring and summer. By late summer, white-headed woodpeckers shift to their exclusive winter diet of ponderosa pine seeds.

White-headed woodpeckers are monogamous and may remain associated with their mate throughout the year. They build their nests in old trees, snags or fallen logs but always in dead wood. Every year the pair bond constructs a new nest. This may take three to four weeks. The nests are, on average 3m off the ground. The old nests are used for overnight roosting by the birds.

Generally large ponderosa pine snags consisting of hard outer wood with soft heartwood are preferred by nesting white-headed woodpeckers. In British Columbia 80 percent of reported nests have been in ponderosa pine snags, while the remaining 20 percent have been recorded in Douglas-fir snags. Excavation activities have also been recorded in Quaking Aspen, live Ponderosa pine trees and fence posts (Cannings et al. 1987).

3.2.4.4.2 Habitat

White-headed woodpeckers live in montane, coniferous forests from British Columbia to California and seem to prefer a forest with a relatively open canopy (50-70 percent cover) and an availability of snags (a partially collapsed, dead tree) and stumps for nesting. The birds prefer to build nests in trees with large diameters with preference increasing with diameter. The understory vegetation is usually very sparse within the preferred habitat and local populations are abundant in burned or cut forest where residual large diameter live and dead trees are present.

Highest abundances of white-headed woodpeckers occur in old-growth stands, particularly ones with a mix of two or more pine species. They are uncommon or absent in monospecific ponderosa pine forests and stands dominated by small-coned or closed-cone conifers (e.g., lodgepole pine or knobcone pine).

Where food availability is at a maximum such as in the Sierra Nevadas, breeding territories may be as small as 10 ha (Milne and Hejl 1989). Breeding territories in Oregon are 104 ha in continuous forest and 321 ha in fragmented forests (Dixon 1995b). In general, open Ponderosa pine stands with canopy closures from 30 to 50 percent are preferred. The openness however, is not as important as the presence of mature or veteran cone producing pines within a stand (Milne and Hejl 1989). In the South Okanagan, British Columbia, Ponderosa pine stands in age classes 8 -9 are considered optimal for white-headed woodpeckers (Haney 1997). Milne and Hejl (1989) found 68 percent of nest trees to be on southern aspects, this may be true in the South Okanagan as well, especially, towards the upper elevational limits of Ponderosa pine (800 - 1000m).

3.2.4.4.3 Present Distribution

These woodpeckers live in montane, coniferous forests from southern British Columbia in Canada, to eastern Washington, southern California and Nevada and Northern Idaho in the United States (Figure 16). The exact population of the white-headed woodpecker is unknown but there are thought to be less than 100 of the birds in British Columbia.

3.2.4.4.4 Current Population Data and Status

Although populations appear to be stable at present, this species is of moderate conservation importance because of its relatively small and patchy year-round range and its dependence on mature, montane coniferous forests in the West. Knowledge of this woodpecker's tolerance of forest fragmentation and silvicultural practices will be important in conserving future populations.

3.2.4.4.5 Historic Habitat Distribution

3.2.4.4.6 Current Habitat Distribution

3.2.4.4.7 Limiting Factors

Nesting and foraging requirements are the two critical habitat attributes limiting the population growth of this species of woodpecker. Both of these limiting factors are very closely linked to the habitat attributes contained within mature open stands of Ponderosa pine. Past land use practices, including logging and fire suppression, have resulted in significant changes to the forest structure within the Ponderosa pine ecosystem.

Fire suppression has altered the stand structure in many of the forests in the Oregon Side LMS subbasin. Lack of fire has allowed dense stands of immature ponderosa pine as well as the more shade tolerant Douglas-fir to establish. This has led to increased fuel loads resulting in more severe stand replacing fires where both the mature cone producing trees and the large suitable snags are destroyed. These dense stands of immature trees has also led to increased competition for nutrients as well as a slow change from a Ponderosa pine climax forest to a Douglas-fir dominated climax forest.

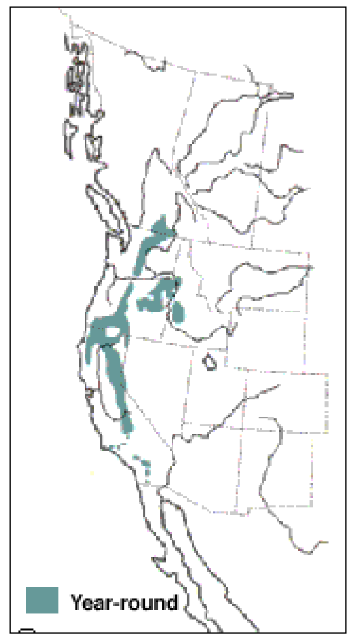


Figure 16. White-headed woodpecker breeding distribution (from BBS data) (Sauer et al. 2003).

3.2.4.5 Olive-sided Flycatcher (Contopus cooperi) Keith Paul, USFWS

3.2.4.5.1 Life History

The olive-sided flycatcher (OSF) is one of the most recognizable breeding birds of Oregon's coniferous forests with its resounding, three-syllable, whistled song *quick, three beers*. OSFs prey almost exclusively on flying insects including flying ants, beetles, moths, and dragonflies, but with a particular preference for bees and wasps (Bent 1942, cited in Altman 2003).

OSFs forage mostly from high, prominent perches at the top of snags or the dead tip or uppermost branch of a live tree. They forage by "sallying" or "hawking" out to snatch a flying insect, and then often returning to the same perch ("yo-yo" flight) or another prominent perch.

Nest building is most evident during the first and second week of June, but completed nests have been reported as early as May 27 (Altman 2000). The nest area is aggressively defended by both members of the pair. OSFs are monogamous. They produce 3-4 eggs per clutch and one clutch per pair.

The spring migration of OSFs is well documented because of the loud, distinctive song. Spring migration peaks in late May, earlier in southwest and coastal Oregon, and later in eastern Oregon. Timing of fall migration is less known, but peaks in late August and into the first week of September (Altman 2003).

3.2.4.5.2 Habitat

The OSF breeds only in coniferous forests of North America and is associated with forest openings and forest edge. During migration OSFs have been observed in a great diversity of habitats compared to that of the breeding season, including lowland riparian, mixed or deciduous riparian at higher elevations and urban woodlots and forest patches. Olive-sided flycatchers have been observed moving north through sagebrush flats in Malheur and Harney Counties, OR (M. Denny, pers. comm.; Altman 2003). They winter in tropical forests of Central and South America.

3.2.4.5.3 Present Distribution

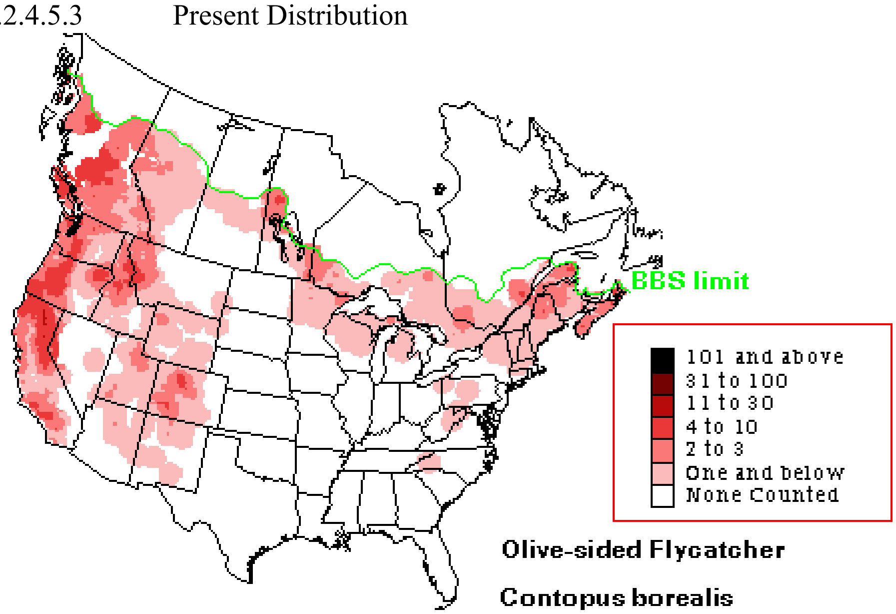


Figure 17. Breeding range of Olive-sided flycatcher (*Contopus borealis*) in North America (Sauer et al. 1997).

The olive-sided flycatcher breeds only in coniferous forests of North America; from Alaska's boreal forest south to Baja California, in central North American south to northern Wisconsin, and in eastern North America south to northeast Ohio and southwest Pennsylvania, including all of New England, and locally in the Appalachians south to western North Carolina (Figure 17; Altman 2003).

In Oregon, it breeds in low densities throughout conifer forests from near sea level along the coast to timberline in the Cascades and Blue Mountains. The olive-sided flycatcher is most abundant throughout the Cascades (Sauer et al. 1997). In migration, may occur in any forested habitat including forest patches in desert oases of southeast Oregon, urban forest, and deciduous or mixed deciduous/coniferous riparian forest (Altman 2003).

3.2.4.5.4 Current Population Data and Status

Population trends for OSF based on Breeding Bird Surveys (BBS) data show highly significant declines for all continental (N. America), national (U.S. and Canada), and regional (e. and w. N. America) analyses, and for most state and physiographic region analyses (Sauer et al. 1997). In Oregon, there has been a highly significant ($p < 0.01$) statewide decline of 5.1% per year from 1966-96 (Altman 2003).

3.2.4.5.5 Historic Habitat Distribution

3.2.4.5.6 Current Habitat Distribution

3.2.4.5.7 Limiting Factors

Causes of population decline have focused on habitat alteration and loss on the wintering grounds, because declines are relatively consistent throughout the breeding range of the species (Altman and Sallabanks 2000). Other factors potentially contributing to declines on the breeding grounds include habitat loss through logging, alteration of habitat from forest management practices (e.g., clearcutting, fire suppression), lack of food resources, and reproductive impacts from nest predation or parasitism (Altman 2003). It has also been speculated that the olive-sided flycatcher may depend on early post-fire habitat, and has likely been negatively affected by fire-control policies of the past 50-100 years (Hutto 1995a).

3.2.4.6 Black Rosy-finch

3.2.4.6.1 Life History

During the breeding season, black rosy-finches take what insects that they can find, often ones frozen and exposed by melting snow (Csuti et al. 1997). They use mainly open ground and snowfields for feeding (French 1954, Johnson 1989b, Contreras). Some insects are caught in flight. Seeds and green parts of alpine plants are an important part of the diet, especially after the breeding season (Csuti et al. 1997).

For black rosy-finches breeding at higher elevations, breeding can be postponed until June. A nest cup of moss or grass is placed on a rock ledge or concealed in a crevice. The usual clutch is 4 or 5 (range 2-6) eggs, which are incubated for two weeks by the female. The young are fed by the parents for about five weeks and remain with the family group until fall (Csuti et al. 1997). In addition to crops, rosy-finches possess special paired sacs beneath the floor of the mouth, found only in one other North American genus (*Pinicola*), which allow parents to carry extra food with each trip to the young (Johnson 2002).

3.2.4.6.2 Habitat

The black rosy-finch has one of the most barren and specialized breeding habitats in Oregon (Contreras 2003). They use bare rock outcroppings, cliffs, and talus for breeding and mainly open ground and snowfields for feeding (French 1954, Johnson 1989b, Contreras, cited in Contreras 2003). In winter, black rosy-finches typically roost in large communal roosts in caves, mine shafts, on rafters of barns, and in clusters of old cliff swallow (*Petrochelidon pyrrhonota*) nests (Johnson 2002).

3.2.4.6.3 Present Distribution

In Oregon, black rosy-finches typically breed on Steens Mountain (Scott 1966, cited in Contreras 2003). They may breed occasionally in the Wallowa Mountains (Gabrielson and Jewett 1940, Johnson 1975, Evanich 1992a, cited in Contreras 2003), but not proven and birds are not always found when sought. They are rarely found in central Wallowa County (Evanich 1990, cited in Contreras 2003).

3.2.4.6.4 Current Population Data and Status

The black rosy-finch is considered a Sensitive Species by Oregon Department of Fish and Wildlife because of its very small, geographically isolated population. Its breeding habitat is unlikely to be affected by humans because of its inaccessibility. There is no data available that allows comparison of population size for Oregon (Contreras 2003), so no short- or long-term trends can be determined.

3.2.4.6.5 Historic Habitat Distribution

3.2.4.6.6 Current Habitat Distribution

3.2.4.6.7 Limiting Factors

Black rosy-finches are most vulnerable during the winter, when concentrated at feeders, roosts, and along highways. Within the Oregon Side LMS subbasin, the dominant limiting factor for this species is the limited extent of appropriate habitat. Preferred alpine and subalpine habitats are restricted to a very small portion of the subbasin in the Eagle Cap Wilderness Area.

3.2.4.7 Canyon Wren

3.2.4.7.1 Life History

The canyon wren feeds entirely on spiders and insects. They catch their prey by gleaning from rocky surfaces, often in concealed situations (Grinnell and Miller 1944, Bent 1948, Jones and Dieni 1995).

Canyon wrens are monogamous, possibly mating for life (Tramontano 1964, Mirsky 1976, Jones and Dieni 1995). Nest building peaks in early May to early June (Jones and Dieni 1995).

Canyon wrens typically nest in rock caverns, crevices, cliffs, or banks; some nests attached by a stick and twig base to rock faces in caves or crevices (Bent 1948, Tramontano 1964, Jones and Dieni 1995).

3.2.4.7.2 Habitat

The canyon wren occupies cracks, crevices, and interstices found in steep rocky canyon walls, cliff faces, rimrock, and boulder piles in open arid country (Gilligan et al. 1994, Jones and Dieni 1995, Miller 2003). Cool, shaded, stream-carrying canyons with exposed, steep-walled rock outcrops and a vertical component are a typical setting (Verner and Boss 1980, Jones and Dieni 1995). These microhabitats provide protective shade and cool temperatures during seasons of intense heat and exposure (Miller and Stebbins 1964).

3.2.4.7.3 Present Distribution

In Oregon, the canyon wren is fairly common but a local breeder east of the Cascade summit; restricted to rocky cliffs or outcrops (Miller 2003). They are often found more dispersed after the breeding season (Miller 2003). There is no documentation of changes from the historic to the current distribution.

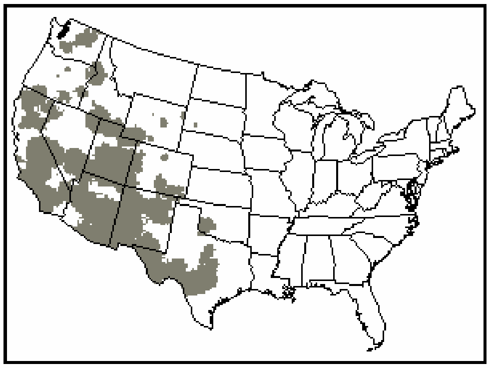


Figure 18. Current distribution of canyon wren in the U.S. Shaw Creek Bird Supply ©

3.2.4.7.4 Current Population Data and Status

There are no current population estimates available. Breeding Bird Survey (BBS) data are of limited value because the habitat of this species is inadequately surveyed throughout its range (Jones and Dieni 1995). BBS trend data 1996-1994 (B. Peterjohn and J. Sauer, unpublished data) indicates declines throughout the coverage area, but few trends have statistical significance (Jones and Dieni 1995). There is no information available regarding population trends in Oregon.

3.2.4.7.5 Historic Habitat Distribution

3.2.4.7.6 Current Habitat Distribution

3.2.4.7.7 Limiting Factors

The only potential threat to canyon wrens is recreational rock climbing which may disturb nesting locally (Jones and Dieni 1995).

3.2.4.8 Yellow-breasted Chat

3.2.4.8.1 Life History

The yellow-breasted chat (YBC) is the largest of the wood-warblers. The YBC has a diet mostly composed of insects, which are gleaned from vegetation (Csuti et al. 1997) in dense shrubs and thickets (Eckerle and Thompson 2001). Insects include ants, bees, and wasps; beetles and weevils; caterpillars, moths, grasshoppers, mayflies, true bugs, and spiders (Bent 1953, Marten et al. 1951, Csuti et al. 1997). Fruit and berries may comprise a small portion of their diet in the summer, and a larger portion in the fall and winter (Csuti et al. 1997, Vroman 2003).

YBC arrive in eastern Oregon (east of the Cascades) from early to mid-May (Vroman 1997). They are recorded nesting in Oregon as early as May 6th (Csuti et al. 1997). They tend to sing as soon as reaching nesting grounds (Vroman 2003). The chats song is long and complex, including a series of cackles, rattles, whistles, mews, and squeals.

During the breeding season, male chats maintain and defend individual territories (Dennis 1958, Thompson and Nolan 1973).

3.2.4.8.2 Habitat

YBCs occupy edges of large, dense thickets in valley riparian areas and swales, floodplain areas adjacent to streams and river, and in unmanaged dense leafy vegetation fringing ponds and swamps (Gabrielson and Jewett 1940, Bent 1953, Vroman 2003). Open-canopy overstory trees are generally present, except in desert riparian situations (Vroman 2003). In eastern Oregon, chats have occupied riparian willow and dogwood on the Malheur National Wildlife Refuge (Littlefield 1990). Riparian areas occupied along the Malheur and Owyhee rivers, upper Willow Cr., Succor Cr. and in the Oregon Canyon Mountains consist of brushy mature willow and mountain alder (Contreras and Kindschy 1996, Vroman 2003).

3.2.4.8.3 Present Distribution

As cited in Vroman (2003), the chat is a locally uncommon summer resident in northeast Oregon valleys (Grande Ronde Bird Club 1988, Umatilla NF 1991, ODFW undated checklist); Snake River Canyon, Imnaha River, Little Sheep Creek (OBBA); Grande Ronde, Powder, and Burnt River systems (OBBA); Walla Walla River and tributaries, Umatilla River; Butter, Willow, and Rhea Creek in Morrow County (OBBA). Chats are rare in forested regions of the Blue Mountains (Thomas 1979, OBBA). They are locally common in southeast and northeast Oregon where habitat is excellent (Figure 19).

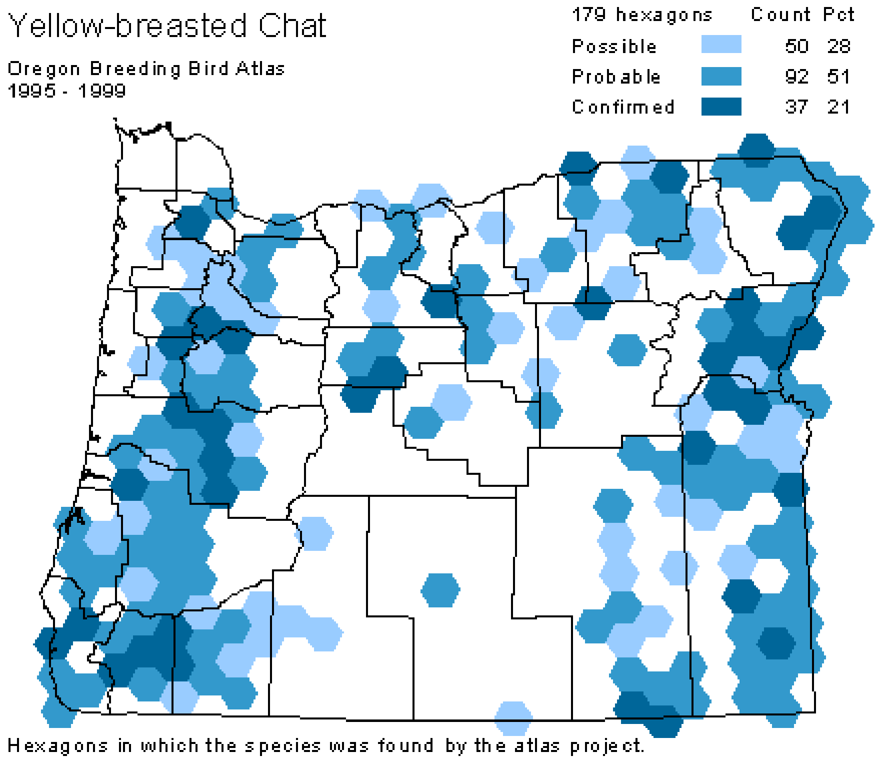


Figure 19. Oregon Breeding Bird Atlas project detections of yellow-breasted chat in Oregon 1995-1999 (Adamus et al. 2001).

3.2.4.8.4 Current Population Data and Status

In a 1980 breeding season survey, Rogers (1980) detected YBCs at a rate of 8-9 birds/mi (5.5 birds/km) between Joseph and Imnaha (a 20 mi [32.2 km] length of road) (Vroman 2003). Statewide BBS data 1980-98 show an increasing (but statistically non-significant) breeding season trend (2.0%/year) (Vroman 2003).

3.2.4.8.5 Historic Habitat Distribution

3.2.4.8.6 Current Habitat Distribution

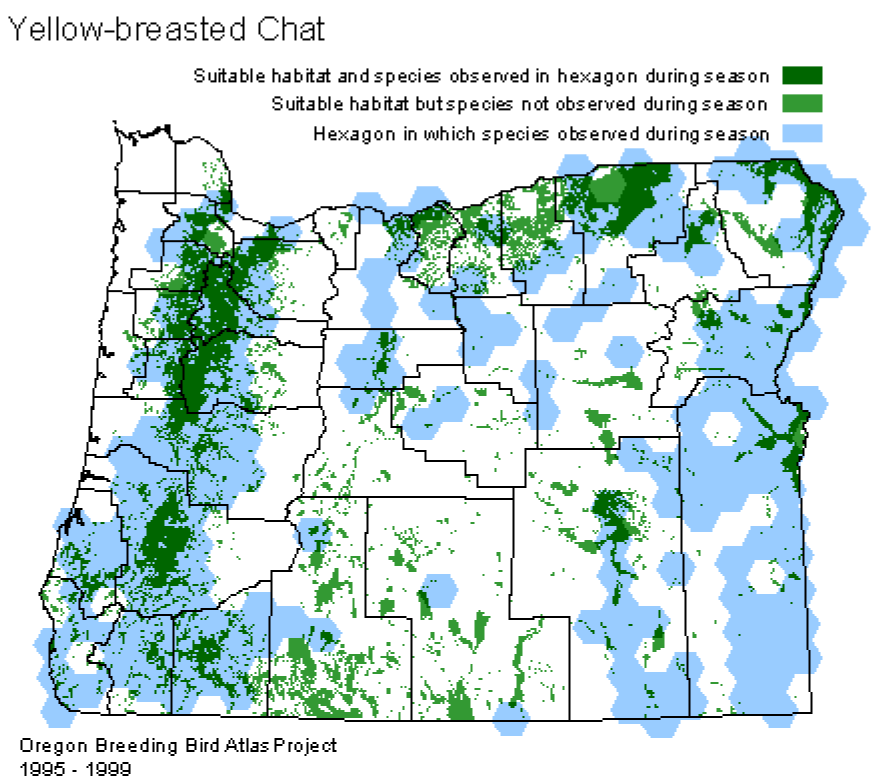


Figure 20. Oregon Breeding Bird Atlas Project yellow-breasted chat habitat areas in Oregon (Adamus et al. 2001).

3.2.4.8.7 Limiting Factors

The greatest threat to the YBC population is loss or modification (e.g., undergrowth removal, reduced width) of river riparian and floodplain habitat, particularly, east of the Cascades (Vroman 2003).

3.2.4.9 Western Meadowlark (Sturnella neglecta) Keith Paul, USFWS

3.2.4.9.1 Life History

The western meadowlark (WM) is one of the most familiar and endearing avian images of grass- or sagebrush-dominated habitats throughout Oregon. WMs take mostly insects in late spring and summer, seeds in the fall, and where available, grain in winter and early spring (Altman 2003). They eat beetles, crickets, grasshoppers, caterpillars, craneflies, sow bugs, spiders, snails, a few bird eggs, and some carrion (Csuti et al. 1997).

Most nesting begins in late April, with the peak of nesting activity throughout May, although there is an early egg date of April 3 (Gabrielson and Jewett 1940). In eastern Oregon, migrants first arrive in late February and most are on territories by April (Gilligan et al. 1994). At Malheur National Wildlife Refuge (NWR), the earliest spring arrival has been February 6, with the average arrival February 27, peak of passage March 10-25, and earliest nesting April 23 (Littlefield 1990a) (Altman 2003).

Fall migrants along the coast begin to appear in dunes and farm fields in late August and early September (M. Patterson p.c.). In western valleys, flocks increase in size from August through October, probably due to arrival of northern migrants. At Malheur NWR, autumn migrants arrive in early August and the peak of migration is August 20 through September 20 (Littlefield 1990a).

3.2.4.9.2 Habitat

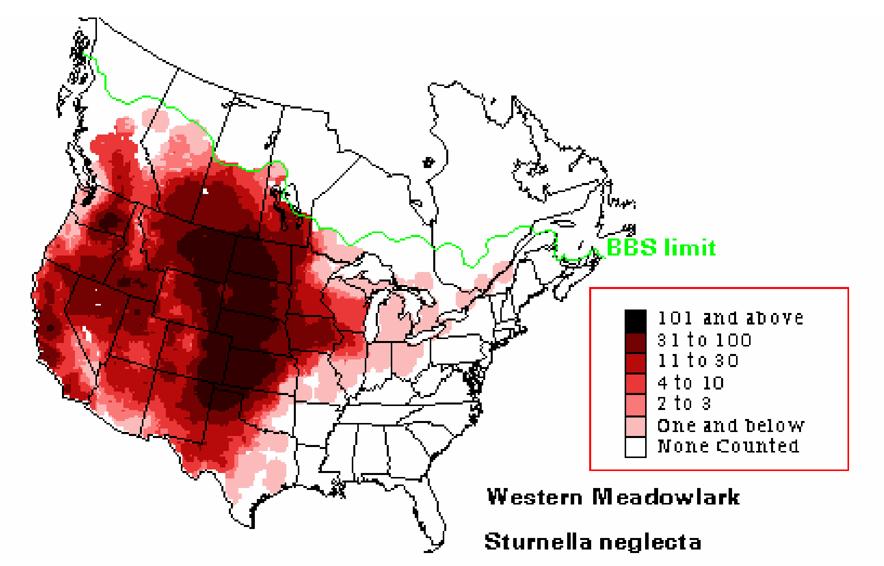
WMs use a variety of habitats including grasslands, savanna, shrub-steppe, cultivated fields, and pastures (Subtropical and Temperate zones) (AOU 1998). They prefer high forb and grass cover, low to moderate litter cover, and little or no woody cover (Sample 1989, Kimmel et al. 1992, Anstey et al. 1995, Hull et al. 1996, Madden 1996). In shrub-steppe and desert grasslands, WMs prefer mesic areas; low shrub cover and density; patchiness in vegetative structure and in heights of forbs and shrubs; and high coverage of grass, forb, and litter (Lanyon 1962, Rotenberry and Wiens 1980, Wiens and Rotenberry 1981, Wiens et al. 1987, McAdoo et al. 1989, Knick and Rotenberry 1995). In general, WMs prefer open, treeless areas (Salt and Salt 1976, Sample 1989, Johnson 1997), although a few shrubs may be used as song perches (Knick and Rotenberry 1995; NatureServe 2003).

3.2.4.9.3 Present Distribution

The WM breeds in grassland and shrub-grassland habitats south from c. British Columbia, east to w. Ontario and n. Minnesota, Michigan, and Wisconsin, south through the eastern edge of the Great Plains to westcentral Texas, and west through northwest Sonora, Mexico to northwest Baja California (Lanyon 1994). In eastern Oregon, WMs enjoy a ubiquitous breeding distribution throughout unforested habitat up to 6,000 ft (1,830 m; Gilligan et al. 1994), and they are one of the most common breeding species in all habitat types in shrub-steppe country (Altman 2003).

3.2.4.9.4 Current Population Data and Status

This is a relatively high-density species in eastern Oregon. Population trends throughout Oregon, based on BBS data, indicate relatively stable long-term (1966-96) trends (1%/year decline), but non-significant ($p<0.01$) short-term (1980-96) declining trends (2.9%/year) (Sauer et al. 1997). Populations in the Columbia Plateau BBS Region (includes all non-forest in e. Oregon, e. Washington, and s. Idaho) mirror the Oregon state trend; relatively stable long-term trends (non-significant decline of 0.6%/year), and highly significant declining short-term trends (2.6%/year) (Sauer et al. 1997). Population trends based on Christmas Bird Count (CBC) data also indicate declining populations (Altman 2003).



3.2.4.9.5 Historic Habitat Distribution

3.2.4.9.6 Current Habitat Distribution

3.2.4.9.7 Limiting Factors

Factors suspected to contribute to declines in other areas include conversion of native grasslands and shrub-steppe to non-suitable agriculture (e.g., rowcrops); habitat degradation from grazing; mortality at nest from trampling by livestock and agricultural practices such as mowing; a high degree of sensitivity to human disturbance near nest sites; and potential reproductive failures from use of pesticides or other contaminants (Lanyon 1994). The WM has been identified as a species of high concern under all proposed management options for the Interior Columbia Basin (also includes e. Oregon, Idaho, and parts of Montana and Nevada; Saab and Rich 1997) (Altman 2003).

3.2.4.10 Ruffed Grouse (Bonasa umbellus)

3.2.4.10.1 Life History

Ruffed grouse are omnivorous. Their diet in spring consists primarily of leaves, buds, and flowers of grasses and forbs (Pelren 2003, Csuti et al. 1997, Rusch et al. 2000). Microarthropods increase in the diet during summer, and berries and other fruits such as salal, hawthorn, and blackberry become common in the diet as they ripen (Durbin 1979, Pelren 2003). During the winter RG mainly consume buds, seeds, twigs and catkins of deciduous trees (Pelren 2003, Csuti et al. 1997, Rusch et al. 2000). Aspen is a major winter food in Oregon, but where aspen is limited Ruffed grouse may also feed on alder, willow, birch, dogwood, hawthorn, and others (Pelren 2003).

In Oregon, breeding at lower elevations can begin in April, and young are fledged by late August (Csuti et al. 1997). Males exhibit territorial behavior throughout the year, but typically in early March territoriality increases and peaks in late March or April, then declines in May (Johnsgard 1983). During this period, male RG select a log, which is used for visual strutting displays and drumming (Pelren 2003).

On average, male Ruffed grouse defend a territory of 10-30 acres in the breeding season (Csuti et al. 1997). Available literature shows that home range of both female and male RG vary significantly by region and by habitat type.

3.2.4.10.2 Habitat

Ruffed grouse are closely associated with dense deciduous or deciduous/evergreen forest, represented primarily by alder-dominated stands in western Oregon and stands containing alders, quaking aspens, hawthorns, and other small trees and shrubs in eastern Oregon (Durbin 1979, Pelren 2003). In the relatively dry habitat of the Blue and Wallowa Mountains, RG frequently congregate along stream corridors and drainages that afford dense vegetation and a diversity of berries, catkins and other food sources (Pelren 2003).

3.2.4.10.3 Present Distribution

In Oregon, Ruffed grouse are a common resident throughout most forested regions of the state (Durbin 1979). Bonasa umbellus affinis occupies most forests at low to moderate elevations east of the Cascade crest (Browning 2002, Pelren 2003), primarily the east slope of the Cascades and the Blue Mountains, but also forested extensions into the lowlands (Pelren 2003).

3.2.4.10.4 Current Population Data and Status

The population status in Oregon appears favorable (Pelren 2003) and the range remains consistent with that noted by Gabrielson and Jewett (1940). Population density data is unavailable for Oregon. Oregon Department of Fish and Wildlife (ODFW) hunter surveys indicated harvest from 1979-1996 range from an estimated 23,983 in 1985 to 74,290 in 1992 (Pelren 2003). Intensive hunter harvest data in Wallowa County suggest relatively stable populations (Pelren 2003).

3.2.4.10.5 Historic Habitat Distribution

3.2.4.10.6 Current Habitat Distribution

3.2.4.10.7 Limiting Factors

In the relatively dry Blue and Wallowa Mountains, streamside buffer zones facilitate dense stands of hawthorn and other food-producing shrubs ideals for the species (Pelren 2003).

3.2.4.11 Blue Grouse (Dendragopus obscurus)

3.2.4.11.1 Life History

During the summer, blue grouse eat the leaves and flowers of herbs; leaves, flowers, and berries of shrubs; conifer needles and invertebrates (Zwickel 1992, Csuti 1997, Pelren 2003). Arthropods compose virtually 100% of the diet of the precocial chicks, but the young birds also begin to eat vegetation in late summer and fall (Pelren 2003). In early fall in eastern Oregon, blue grouse diet increasingly includes conifer seeds, western larch needles and the berries of deciduous shrubs (Pelren 2003).

Blue grouse typically begin breeding in April, and young are fledged by September (Csuti et al. 1997). In eastern Oregon, male breeding behavior usually increases in March and peaks in April (Pelren 2003). Blue grouse are polygamous and males will usually mate with several females. After copulation, females move to isolated locations to nest (Pelren 2003).

3.2.4.11.2 Habitat

Blue grouse may occur in shrub/steppe and grassland communities out to 1.2+ mi (2+ km) from the forest edge; in or along edge of virtually all montane forest communities with relatively open tree canopies; and in alpine/subalpine ecotones (Zwickel 1992). They also use regenerating clearcuts and riparian habitats with dense deciduous cover (Pelren 2003). From south to north, they may occupy some of the hottest and most xeric to some of the coldest (but dry) montane habitats in North America (Zwickel 1992).

Winter range includes conifer forests from sea level to subalpine elevations (Pelren 2003). In eastern Oregon this species occurs principally in association with forests dominated by ponderosa pines (Pelren 1996, 2003). Commonly uses subalpine fir and witches brooms in dwarf-mistletoe-infested Douglas-firs for thermal protection while roosting in winter (Pelren 1996, 2003).

3.2.4.11.3 Present Distribution

In Oregon, *Dendragapus obscurus fuliginosus* is a fairly common resident in coniferous forests from the Cascade crest to the coast, with broad areas of absence around low-elevation urban and unforested valley areas (Pelren 2003). *D. o. sierrae* is limited primarily to the east slope of the Cascades (Pelren 2003). D. o. pallidus occupies coniferous forests of the Blue and Wallowa Mountains (Johnsgard 1983b, Pelren 2003).

3.2.4.11.4 Current Population Data and Status

According to Zwickel (1992), densities of adult male blue grouse in eastern Oregon and other interior populations have ranged from 5-50/mi² (2-19/km²). Oregon Department of Fish and Wildlife (ODFW) has been performing telemetry studies since the 1980's to better understand BG populations and habitat needs (Pelren 2003). In eastern Oregon, harvest data from the late 1970's to the mid-1990's, indicate that the approximate number of hunters declined from 10,000 to 5,000, while the number of blue grouse harvested declined from 25,000 to under 15,000 (Pelren 2003). Despite intensive study of this species over the last 40 years, ability to predict population levels and trends remains poor (Zwickel 1992).

3.2.4.11.5 Historic Habitat Distribution

3.2.4.11.6 Current Habitat Distribution

3.2.4.11.7 Limiting Factors

Local extirpations have occurred in areas taken over by agriculture and cities. Rugged mountainous habitat has helped to protect BG, so the long-term outlook for many populations is good. However, logging, grazing of domestic livestock and urbanization remain threats (Zwickel 1992).

3.2.4.12 Sage Grouse (Centrocercus urophasianus) Keith Paul, USFWS

3.2.4.9.1 Life History

The sage grouse is North America's largest grouse, a characteristic feature of habitats dominated by big sagebrush (*Artemisia tridentate)* in Western North America (Schroeder et al. 1999). Sage grouse feed exclusively on sagebrush during the winter and will also forage on insects and herbs in the summer. Insects are an important dietary component for young chicks (Storch 2000). Compared to other grouse species, sage grouse typically have high survival rates and low productivity. Sage grouse perform breeding behavior displays on traditional grounds, or leks, which are open but adjacent to sagebrush habitats.

3.2.4.9.2 Habitat

Sage grouse populations are sympatric with sagebrush (*Artemisia* spp.) habitats (Connelly et al. 2000). Breeding grounds are centered on and within the vicinity of leks. The same lek sites are used from year to year. They are established in open areas surrounded by sagebrush, which is used for escape and protection from predators (Gill 1965, Patterson 1952, BLM et al. 2000). Optimum sage grouse nesting habitat consists of the following: sagebrush stands containing plants 16 to 32 inches (40 to 80 cm) tall with a canopy cover ranging from 15 to 25 percent and an herbaceous understory of at least 15 percent grass canopy cover and 10 percent forb canopy cover that is at least 7 inches (18 cm) tall (BLM et al. 2000).

Sage grouse winter habitats are relatively similar throughout most of their ranges. Because their winter diet consists almost exclusively of sagebrush, winter habitats must provide adequate amounts of sagebrush (BLM et al. 2000).

3.2.4.9.3 Present Distribution

Currently, in states and provinces that still have sage grouse, their range has been reduced (Figure 21). Declines in distribution have been noted throughout the twentieth century (Hornaday 1916, Locke 1932, McClanahan 1940, Aldrich and Duvall 1955, Connelly and Braun 1997, Schroeder et al. 1999).

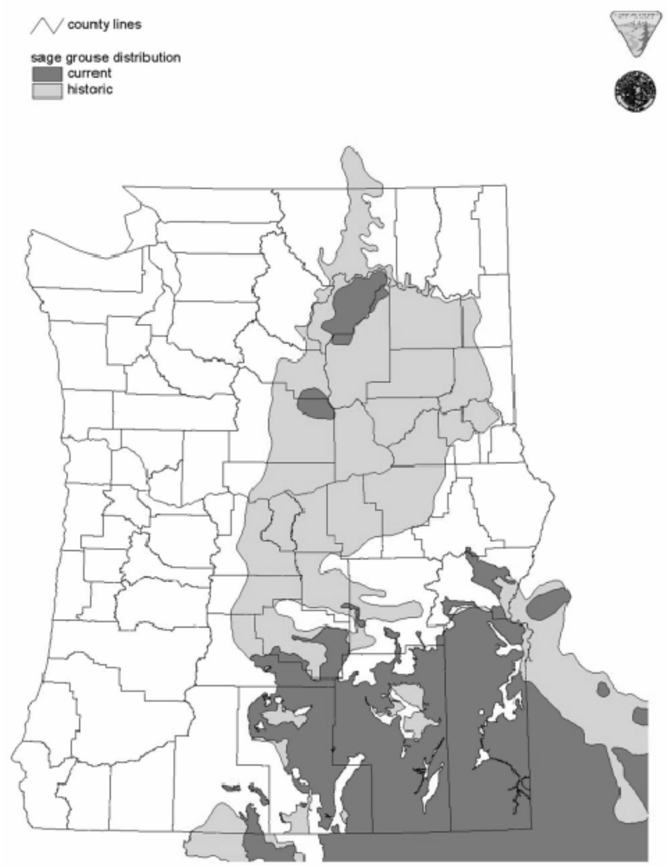


Figure 21. A comparison of current and historic distribution of sage grouse in Oregon and Washington.

3.2.4.9.4 Current Population Data and Status

Sage grouse numbers have been declining throughout the 20th century. Between 1985 and 1994, populations declined by an average of 33% (Storch 2000). Annual harvests during the late 1970's were reported at approximately 280,000 birds, and by 1998, the rangewide breeding population was estimated at 140,000 birds.

Currently, sage grouse are managed as a game species and are not afforded federal protection under the ESA, but seven petitions have been submitted to the U.S. Fish and Wildlife Service requesting listing of distinct populations and the entire species, collectively (NDOW 2003). The most recent petition (March 19, 2003) requested the listing of western and eastern subspecies of the Greater Sage Grouse (*Centrocercus urophasianus*) as endangered under the ESA. As of April 16, 2003, no determination had yet been made by the USFWS. Great Basin populations of sage grouse are included in the Birds of Conservation Concern 2002 (USFWS 2002) as a species that should receive priority for conservation actions.

In Oregon, Oregon Department of Fish and Wildlife (ODFW) made a minimum estimate of sage grouse in 1992 of between 27,505 and 68,012 adults (Table 34).

County	Known Leks	Mean Number of Males/Lek	Total Number of Males	Total Adult Estimate*
Malheur	112	24.3	2,722	6,805
Harney	119	31.0	3,689	9,223
Lake	108	24.3	2,624	6,560
Hart Refuge	22	28.8	634	1,585

Klamath	8	14.2	114	285
Deschutes	22	14.1	310	775
Crook	28	14.7	412	1,030
Baker	33	14.2	469	1,172
Union	2	14.2	28	70
Total	461		11,002	27,505
*Assumes a 60:40 female:male sex ratio to calculate totals.				

Table 34. Minimum population estimate of adult sage grouse in Oregon, 1992 (ODFW 1993).

3.2.4.9.5 Historic Habitat Distribution

Within the Interior Columbia River Basin, sagebrush habitat has been reduced from about 40 million acres (16 million ha) to 26 million acres (11 million ha), representing a loss of about 35% since the early 1900's (Hann et al. 1997, BLM et al. 2000). Most remaining sagebrush-steppe ecosystems in Oregon are on public lands managed by the Bureau of Land Management (BLM) (BLM et al. 2000).

3.2.4.9.6 Current Habitat Distribution

3.2.4.9.7 Limiting Factors

Principle threats to sage grouse include small population size, lack of genetic diversity, habitat degradation, habitat loss, weather, pesticides and herbicides (Connelly et al. 2000, Storch 2000). Permanent conversion of sagebrush to agricultural lands is the single greatest cause of decline in sagebrush-steppe habitat in the interior Columbia Basin (Quigley and Arbelbide 1997, BLM et al. 2000). In the northern half of eastern Oregon, large areas of sagebrush-steppe habitat have been converted to agricultural lands (Wisdom et al. 2000).

3.2.4.13 American Beaver (Castor canadensis) Keith Paul, USFWS and M. Cathy Nowak, CTWC.

3.2.4.13.1 Life History

An adult Castor canadensis is 90-117 cm long, and weighs between 13 and 35 kg. Beavers have a dark brown coat with long glossy guard hairs overlying a very dense, insulating undercoat. They are most easily recognized by their prominent, ever-growing incisors which are fortified on their leading edge by orange iron compounds. Beavers are extremely well adapted to live in water year-round. In addition to their thick, waterproof coat, they have a paddle-shaped tail which acts as a rudder, webbed feet, and valvular ears and nostrils which can be sealed when the beaver is submerged. The beaver's diving reflex helps to conserve heat and oxygen by slowing the heart, thereby reducing blood circulation to the extremities.

Beavers are herbivorous. In summer, a variety of green herbaceous vegetation, especially aquatic species, is eaten (Jenkins and Busher 1979; Svendsen 1980, cited in Verts and Carraway 1998). In autumn and winter as green herbaceous vegetation disappears, beavers shift their diet to stems, leaves, twigs, and bark of many of the woody species that grow near the water (Verts and Carraway 1998).

Beavers, because of their ability to fell trees, dam streams (and irrigation ditches & culverts), dig canals, and tunnel into banks, and because of their taste for certain crops, doubtlessly have the greatest potential of any wild mammal in the state to affect the environment. Their economic value, both positive and negative, can be enormous, depending largely upon the point of view of those affected. However, the more subtle contributions such as to flood control, to maintenance of water flows, to fisheries management, and to soil conservation resulting from their activities, in the long term, may have the greatest economic value (Verts and Carraway 1998).

3.2.4.13.2 Habitat

The beaver almost always is associated with riparian or lacustrine habitats bordered by a zone of trees, especially cottonwood and aspen (Populus), willow (Salix), alder (Alnus), and maple (Acer) (Verts and Carraway 1998). Small streams with a constant flow of water that meander through relatively flat terrain in fertile valleys and are subject to being dammed seem especially productive of beavers (Hill 1982, cited in Verts and Carraway 1998).

3.2.4.13.3 Present Distribution

Beavers are found throughout all of North America except for the northern regions of Canada, the deserts of the southern United States, Mexico, and Florida. (Figure 22; Frazier, 1996). In Oregon, the American beaver can be found in suitable habitats throughout the state (Verts and Carraway 1998).

3.2.4.13.4 Current Population Data and Status

Little is known of the actual population numbers of beaver in Oregon or in the Oregon Side LMS subbasin. However, beavers are furbearers harvested for their pelts; harvest records may serve as indicators of population trend although some fluctuations in harvest level may be the result of differences in trapping pressure, related to pelt prices, and/or skill rather than changes in population. In Oregon, beaver harvest decreased from 5,573 in 1997 to 3,037 in 1998. This was well below the harvest level of 10,000 to 11,000 in the 1980's with the decline likely due to low average pelt prices. Current harvest levels are thought to be below potential levels sustainable by the population (ODFW 2000). Based on increasing complaints of damage by beavers, the population in the Oregon Side LMS subbasin appears to be increasing somewhat (G. Keister, ODFW, personal communication, 4/1/2004).

Figure 22. North American range of beaver (*Castor canadensis*).

3.2.4.13.5 Historic Habitat Distribution

3.2.4.13.6 Current Habitat Distribution

3.2.4.13.7 Limiting Factors

Loss of woody, streamside vegetation for consumption and dam building. Potential for overharvest, especially in response to damage complaints, due mainly to plugging of culverts and irrigation ditches.

3.2.4.14 American Marten (Martes Americana) Charles Gobar, USFS

3.2.4.14.1 Life History

The American marten is a small carnivorous mammal about the size of a small house cat. Although males are larger than females, the sexes otherwise look alike. Martens consume a variety of foods including bird eggs and nestlings, insects, fish, mammals, fruits and berries (Buskirk and Ruggiero 1994). Martens tend to be shy and have been called "wilderness animals" (Thompson-Seton 1925 cited in Buskirk and Ruggiero 1994). They are flexible in their activity patterns and may be active at various times of the day or night (Hauptman 1979).

3.2.4.14.2 Habitat

The marten is a forest species capable of tolerating a variety of habitat types if food and cover are adequate (Strickland and Douglas 1987, cited in Verts and Carraway 1998). The threat of predation is thought to be strong in shaping habitat selection behavior by martens (Buskirk and

Powell 1994). Martens associate closely with late-successional stands of mesic conifers, especially those with complex physical structure near the ground (Buskirk and Powell 1994).

There is no known published quantitative information regarding habitats used by martens in Oregon (Verts and Carraway 1998).

3.2.4.14.3 Present Distribution

In eastern Oregon, martens can be found in the Blue and Wallowa mountains (Verts and Carraway 1998).

3.2.4.14.4 Current Population Data and Status

There are no estimates of density of martens for Oregon (Verts and Carraway 1998). Oregon Department of Fish and Wildlife has harvest data on marten.

3.2.4.14.5 Historic Habitat Distribution

3.2.4.14.6 Current Habitat Distribution

3.2.4.14.7 Limiting Factors

Extensive logging and forest fires reduce the value of areas to martens, sometimes for many years (Strickland and Douglas 1987, cited in Verts and Carraway 1998). In addition to these areas supporting fewer individuals, martens in these areas have shorter life spans, are less productive, and suffer higher natural and trapping mortality than those in undisturbed forest (Thompson 1994, cited in Verts and Carraway 1998). In addition, martens captured significantly less mass of food per kilometer of foraging travel in logged forests (Thompson and Colgan, 1994, cited in Verts and Carraway 1998).

3.2.4.15 Mule Deer (Odocoileus hemionus hemionus) George Keister, ODFW

3.2.4.9.1 Life History

Mule deer fawns are born from late May through mid June following a gestation of approximately 203 days, with does commonly having twins.

Mule deer diets are as varied as the landscapes they inhabit. Grass is preferred only when green and succulent, during spring and fall greenup. Forbs are very desirable as long as available, usually during spring and early summer. Shrubs are extremely important during the winter when snow covers other low-growing vegetation.

3.2.4.9.2 Habitat

Mule deer occupy a variety of summer habitats in the Lower-Middle Snake Subbasin. Consequently, habitat use varies with vegetative and landscape components contained within each herd range. Forested habitats provide mule deer with forage as well as thermal and escape cover. Mule deer occupying mountain-foothill habitats live within a broad range of elevations, climates, and topography which includes a wide range of vegetation. Some mule deer summer in the deep canyon complexes along the Snake River and its tributaries; these areas are dominated by shrub-steppe, mountain shrub, native bunch grass, and annual grass vegetation.

3.2.4.9.3 Present Distribution

The Lower-Middle Snake Subbasin is both summer and winter range for mule deer. The Snake River, from McGraw Creek to Fairwell Bend in Oregon is an important winter range for ~6,000 mule deer that come from five Big Game Management Units to winter in the lower elevation habitats. A similar number of deer winter on the Idaho side of the Snake River.

3.2.4.9.4 Current Population Data and Status

Deer populations and fawn:doe ratios have fluctuated annually but have been in general decline since the early 1980s due to several hard winters, periodic drought, and increasing predation rates. As populations have declined so have buck:doe ratios.

A recent study done by Idaho Power found a high mortality rate for mule deer wintering in the Lower-Middle Snake area. There was a 24% annual mortality rate for adult does, whereas 7 – 15% is expected. The major cause of mortality for adult does was predation by cougars. For fawns, the major cause of mortality was coyote predation. The high adult mortality rate is believed to be a recent development and is too high for the population to sustain itself over the long term.

3.2.4.9.5 Historic Habitat Distribution

3.2.4.9.6 Current Habitat Distribution

3.2.4.9.7 Limiting Factors

Mule deer in the Lower-Middle Snake Subbasin have been negatively impacted by habitat conversion, dam construction, road and highway construction, drought, fire, extreme winters, and increasing predator populations.

3.2.5 Plant Focal Species

3.2.5.1 Quaking Aspen (Populus tremuloides)

Aspens reach 40-70 feet (12-21 m) in height, with a smooth, white trunk 1-2 feet (30-60 cm) in diameter. Aspens are deciduous with bright green, rounded leaves that turn yellow in the fall. Aspens flower early in the spring, producing small cones that split to release tiny, cottony seeds to be dispersed by the wind. Importantly, however, in the western U.S., reproduction is almost entirely vegetative. Suckers sprout from existing root systems; the aspen is a clone and it tends to grow in pure stands because of this reproductive strategy. In some areas, aspen is considered a “nurse crop” because of its tendency to shelter conifers and other broadleaf species which can, eventually take over the stand.

Distribution:

The aspen is the most widely distributed tree in North America (Johnson 1999; Figure 23). In the western U.S., distribution is disjunct based on suitable habitat, fire regime, and historic climatic variation (Johnson 1999).

Habitat Requirements:

Quaking aspen prefers sheltered sites (Farrar 1995). They prefer cool, relatively dry summers with ample sun, and winters with abundant snow to recharge soil moisture for growth during spring and early summer (Johnson 1999). Growth takes place at temperatures between 40° and 90° F (Johnson 1999). Quaking aspen occurs on a variety of soils although it seems to do best in moist, fertile loams with abundant calcium and a water table at 3 to 6 feet in depth (Mueggler 1984). Aspen stands often occur as islands or inclusions within other habitat types including mixed conifer, grassland and shrub-steppe types.

Figure 23. North American Distribution of Quaking Aspen (*Populus tremuloides*; Johnson 1999).

Limiting Factors:

Where aspen are present, nitrogen is, apparently, the most important factor limiting growth (Chen et al. 1998). Fire has historically been the disturbance factor that enabled aspen to out-compete taller, more shade-tolerant tree species. In post-fire habitats, aspen has the advantage over other tree species with its clonal reproduction; the root mass immediately puts energy into sprouting suckers which grow quickly in the open sun and nutrient rich soil (Johnson 1999). Fire suppression and the resultant increase in fire return interval has effectively eliminated this competitive advantage in some areas and allowed invasion of aspen stands by conifers.

When aspen sprouts occur, either by clonal or sexual reproduction, browsing by both native and non-native species slows or prevents recruitment to larger structural stages (Johnson 1999, M. Penninger, personal communication, 2/23/2004). As large trees grow older, decay and fall, young trees are unable to attain a height to escape browsing by ungulates and replace them. Conifers, less preferred by browsers and uncontrolled by fire, can then invade the stand and, eventually, shade out the sun-loving aspens.

In the Oregon Side LMS subbasin, the most common factors limiting aspen stands are: overgrazing, primarily by cattle; conifer invasion; and lower water tables. The latter 2 factors are exacerbated by overgrazing (Oregon Side LMS Subbasin Technical Team, personal communication, 4/1/2004).

3.2.5.2 Curlleaf Mountain Mahogany (Cercocarpus ledifolius)

Curlleaf mountain mahogany occurs as a shrub to small or medium-sized tree usually 3 to 20 feet (1- 7 m) high, but occasionally up to 45 feet (15 m) tall. The species is evergreen; it provides both cover and forage throughout the year. Trees may be extremely long-lived in the absence of external sources of mortality and are often by far the oldest members of the communities in which they occur (Ross 1999).

Distribution:

Curlleaf mountain mahogany is widely distributed in western North America. It occurs from Montana to Baja California and from southwest Oregon to the Bighorn Mountains in Wyoming. Mountain mahogany is found at elevations from 2,013 to 4,528 feet (610-1372 m) in the northern portion of its range including northeast Oregon.

Habitat Requirements:

Curlleaf mountain mahogany occurs on a variety of soils (Davis and Brotherson 1991). It is found on warm, dry, rocky slopes, ridges and outcrops; often in areas with little or no apparent soil development (Ross 1999). This species occurs in a variety of plant associations including sagebrush, pinyon/juniper, aspen, ponderosa pine, lodgepole pine and spruce/fir (Martin 1950, Ross 1999). Curlleaf mountain mahogany often occurs in isolated, pure patches that may become very dense (Marshall and McMurray 1995). In the Oregon Side LMS subbasin, it often occurs at the sagebrush-forest or grassland-forest ecotone.

Limiting Factors:

Curlleaf mountain mahogany reproduces by seed. Seed production is episodic but may be very high at times. In central Oregon, observations of 2 stands for 12 years showed 3 years of high seed production. Seed predation by insects may be nearly complete at times (Dealy 1975). Germination is sporadic, occurring usually on bare mineral soil and is very uncommon in established plant communities. The increase in cheatgrass and other annuals in much of its range have apparently reduced reproduction in many areas (Ross 1999). In the Oregon Side LMS subbasin, the primary limiting factors for mountain mahogany are: grazing by both cattle and wildlife and invasion by conifers (juniper and ponderosa pine).

First year seedling survival may be very low. In north-central Idaho, overall first-year survival was 25 % although survival increased to 45 % when seedlings were protected from browsing by big game and rabbits (Scheldt and Tisdale 1970). Curlleaf mountain mahogany is browsed by a variety of wildlife as well as domestic livestock. It is one of a few species that meet or exceed the protein requirements for wintering big game animals (Davis 1990). When germination does take place, browsing by both native and non-native species slows or prevents recruitment to larger structural stages (M.Penninger, personal communication 2/23/2004). As large trees grow older, decay and fall, young trees are unable to attain a height to escape browsing by ungulates and replace them.

Curlleaf mountain mahogany may depend on fire to reduce conifer competition and prepare the soil for seedling establishment (Bradley et al. 1992). However, individual plants are invariably killed by fire regardless of intensity and never resprout in spite of being considered a weak resprouter after fire. Even very light burns that do not appear to damage mature trees result in complete mortality within 1 year (Ross 2004).

The episodic nature of curlleaf mountain mahogany reproduction, episodic mortality due to fire and girdling by sapsuckers (Ross 2004) and heavy browsing of young trees by wildlife and domestic livestock may create even-age stands with little diversity of size or age class.

3.3. Out-of-Subbasin Effects

3.3.1 Aquatic

The Oregon Side LMS subbasin populations of anadromous fish have been extirpated as discussed elsewhere in this document. Thus, while many out-of-subbasin influences currently have no effect within the subbasin, their effect on potential future restored/recovered populations is unknown but would likely be similar to those observed in nearby subbasins such as the Grande Ronde.

3.3.1.1 Estuary

Unknown

3.3.1.2 Nearshore

Unknown

3.3.1.3 Marine

Unknown

3.3.1.4 Mainstem Habitat

Unknown

3.3.1.5 Hydropower

The hydropower dams of the Hell's Canyon Complex (Hell's Canyon, Oxbow and Brownlee) resulted in the extirpation of anadromous fish, including steelhead and Chinook salmon, from the Pine Creek system and Snake River tributaries in the subbasin.

The dams of the Hell's Canyon Complex block migration by bull trout resulting in a more sedentary, resident population. Further, the lack of anadromous fish may have poorly understood effects on bull trout, redband trout and the suite of aquatic species through the loss of competition for resources, changes in risk of predation and the loss of marine-derived nutrients in the system.

Salmon provide enrichment to natal streams and the adjacent terrestrial environment through both direct consumption of carcasses and through decomposition. Salmon carcasses may be essential to the health of both aquatic and terrestrial systems. Salmon transport marine nutrients to natal streams, and deposit those nutrients as carcasses when they die. Salmon carcasses have been shown to increase production at several trophic levels in streams, including: periphyton production (Foggin and McClelland 1983; Kline et al. 1993; Schuldt and Hershey 1995), invertebrate production (Schuldt and Hershey 1995; Wipfli et al. 1998), and fish production (Bilby et al 1996; and Bilby et al. 1998). Nutrients from salmon are available through direct consumption by invertebrates, juvenile salmonids, and terrestrial animals or as dissolved nutrients following decomposition. Reductions in salmon biomass in natal streams may limit production at one or more trophic levels.

As a result of declines in salmon biomass, salmonid populations may be experiencing a negative nutrient feedback loop. Larkin and Slaney (1997) describe the potential for a negative feedback loop from loss of salmon carcasses that could have significant impacts on the production of several fish species. Larkin and Slaney (1997) also state that in streams with small salmon escapements, stocks already in decline are likely to decrease further in a negative feedback loop.

Dissolved nutrients from the decomposition of salmon carcasses are also available for stream and riparian plant production. Bilby et al. (1996) noted that approximately 17% of the nitrogen in riparian vegetation on a coastal coho stream originated from salmon carcasses.

3.3.1.6 Harvest

Unknown

3.3.1.7 Hatcheries

Unknown

3.3.2. Terrestrial

3.3.2.1 Harvest

Although ODFW establishes species Management Objectives at the level of the Wildlife Management Unit, State- and range-wide consideration of population abundance, distribution and status is of primary importance in management of species for sustainable harvest. State-wide coordination of species management and harvest precludes the potential for undue influence of out-of-subbasin harvest on Oregon Side LMS subbasin managed species populations.

3.3.2.2 Hydropower

The extirpation of anadromous fish, especially salmon, from the subbasin due to lack of passage at dams may have had undocumented and poorly understood effects. Salmon provide enrichment to natal streams and the adjacent terrestrial environment through both direct consumption of carcasses and through decomposition. Salmon carcasses may be essential to the health of both aquatic and terrestrial systems. Salmon transport marine nutrients to natal streams, and deposit those nutrients as carcasses when they die. Salmon carcasses have been shown to increase production at several trophic levels in streams, including: periphyton production (Foggin and McClelland 1983; Kline et al. 1993; Schuldt and Hershey 1995), invertebrate production (Schuldt and Hershey 1995; Wipfli et al. 1998), and fish production (Bilby et al 1996; and Bilby et al. 1998). Nutrients from salmon are available through direct consumption by invertebrates, juvenile salmonids, and terrestrial animals or as dissolved nutrients following decomposition. Reductions in salmon biomass in natal streams may limit production at one or more trophic levels.

Salmon carcasses may be an essential source of nutrients for both aquatic and terrestrial communities. Willson and Halupka (1995) note that the availability of anadromous fish may be a critical factor in the survival and reproduction of some wildlife species. They note that wildlife species may change their distribution and breeding biology to capitalize on the abundance of anadromous fish. In addition, Cederholm (1989) described 22 species of mammals and birds that consumed coho salmon carcasses. In the Oregon Side LMS subbasin, a number of species including bald eagles, black bears and American marten would likely consume salmon carcasses if they were available and others would prey on live salmon, primarily juveniles and subadults.

Approximately 70 species in the subbasin have been identified as having some relationship, direct or indirect, with salmonids (IBIS 2004). Of these species, three are focal species in this planning effort: bald eagle, great blue heron and American marten. These species may feed on live fish or spawned-out carcasses or both. The elimination of anadromous fish may have had, and may continue to have, an effect on the productivity of these species. Additionally, although not identified in IBIS, several other focal species may have been affected by the loss of marine-derived nutrients from migratory salmonids. Insect-eating birds such as the olive-sided flycatcher may have suffered reductions in availability of insect prey due to reduced productivity of the ecosystem. Wetland and open water species such as the Columbia spotted frog and American beaver may be affected by reduced productivity of both invertebrates and vegetation with the loss of these nutrients.

3.3.2.3 Habitat

Loss of wintering habitat for neotropical migrant birds, including yellow-breasted chat and olive-sided flycatcher, is thought to be an important factor limiting numbers of birds that return to the subbasin to breed. Such out-of-basin effects are likely to continue resulting in declines in populations occurring in the vicinity of the Oregon Side LMS subbasin.

Bald eagle wintering populations are influenced by alteration to breeding habitat and specific territories outside the subbasin. Throughout North America bald eagle breeding populations have been increasing due to intensive recovery efforts and, specifically, restrictions on the use of pesticides such as DDT. This pronounced out-of-subbasin effect will likely result in increased establishment of bald eagle breeding territories within the subbasin in the near future (K. Paul, USFWS Biologist, pers. comm.).

Species that may exhibit seasonal movements into adjacent regions outside of the subbasin are likely to experience out-of-subbasin effects similar to those factors influencing population dynamics within the subbasin. Most notably in regard to big game species included within this migrant category, degradation of shrub-steppe habitat resulting from juniper encroachment and subsequent elimination of shrub forage species in adjacent areas outside of the subbasin will increase pressure on herds to congregate in areas where suitable forage does exist. Adjacent subbasins and habitat in northeast Oregon are experiencing problems similar to those noted in the Oregon Side LMS subbasin. This continued trend will likely result in increased conflicts between regional migrant herd species and residents in agricultural and developed areas.

3.4 Environment/Population Relationships

3.4.1 Aquatic

3.4.1.1 Important Environmental Factors for Species Survival by Life Stage

See Section 3.2.3 (page 46) and Section 3.5.1.2 (page 128).

3.4.2 Terrestrial

Terrestrial wildlife habitats in the Oregon Side LMS subbasin were considered based on the habitat types used by the Northwest Habitat Institute (NHI) in the Interactive Biodiversity Information System (IBIS) database. In some cases, the subbasin technical team combined two or more IBIS habitat types for discussion due to similarity of management issues and disturbance factors. The Oregon Side LMS Terrestrial Technical Team believed that, in many cases, the current and historic (pre-European settlement) acreages of several of the habitat types and, therefore, the trends in habitat status presented by IBIS were in error. For that reason, the technical team made qualitative modifications to the IBIS information with the aid of USDA Natural Resources Conservation Service (NRCS) soils and Common Resource Area maps as well as professional judgment and local knowledge. The actual acreages from IBIS are presented as the baseline from which the Technical Team made its judgments although the acreages shown include the Idaho portion of the LMS subbasin and do not include the additional area of tributaries to the Snake River south of the original Oregon Side LMS subbasin.

The scale of the available data makes it extremely difficult to precisely delineate the current size and extent of any specific wildlife habitat type. Similarly, the range of historic habitats can only be estimated and the scale is likewise very coarse. Further, the data available through IBIS include the entire Lower Middle Snake subbasin as it was considered in the Rolling Provincial Review process. The area of interest to this assessment is a portion of that subbasin plus an additional approximately 400,000 acres of upland and aquatic habitat associated with minor tributaries to the Snake River upstream to Succor Creek. Therefore, within the time frame of this effort, the wildlife habitat acreages and trends can not, with any level of certainty, be made any more accurate. While generally representative of the conditions in the subbasin, these acreages may not accurately demonstrate the direction and/or magnitude of change from historic times to the present day. Discussions of habitat status and trends in this document are undertaken in the context of a purely qualitative assessment based on the local knowledge and professional judgment of the subbasin Terrestrial Technical Team.

Wildlife Habitat Type	Status and Trend
4 - Montane Mixed Conifer Forest	
6 – Lodgepole Pine Forest and Woodlands	
Combined High-elevation Conifer Forest	These combined habitats have changed little compared with historic condition.
5 – Eastside Mixed Conifer Forest	Increasing due to conversion of former ponderosa pine habitat.
7 – Ponderosa Pine Forest and Woodlands	Decreasing due to invasion of other conifers and conversion to agriculture.
8 – Upland Aspen Forest	Trend is decreasing, imperiled.
13 – Western Juniper and Mountain Mahogany Woodlands	Juniper is increasing due to encroachment into grasslands. Mountain mahogany woodlands are decreasing. Should be discussed separately.
Combined Rare or Unique Habitats	Aspen and mountain mahogany decreasing & in need of conservation.
9 – Subalpine Parkland	
10 – Alpine Grasslands and Shrublands	
Combined Alpine and Subalpine Habitats	The trend of these two combined habitats is stable or declining slightly.
14 – Eastside Canyon Shrublands	Trend is stable or declining slightly.
15 – Eastside Grasslands	Trend in native bunchgrass is slight decline but annual grasslands have increased dramatically. Also decline in quality due to invasion of weeds.
16 – Shrub-steppe	Declining. Replaced with annual grasslands.
17 – Dwarf Shrub-steppe	Present only as small inclusions within forest habitats.
Combined Shrub-steppe	Declining.

19 – Agriculture, Pasture and Mixed Environs	Increased since historic
20 – Urban and Mixed Environs	Increased since historic
21 – Open Water – Lakes, Rivers, Streams	Increase from historic condition due to impoundments and water development.
22 – Herbaceous Wetlands	Trend is severe decline.
24 – Montane Coniferous Wetlands	Trend is static to minor decline.
25 – Eastside Riparian Wetlands	Trend is severe decline.

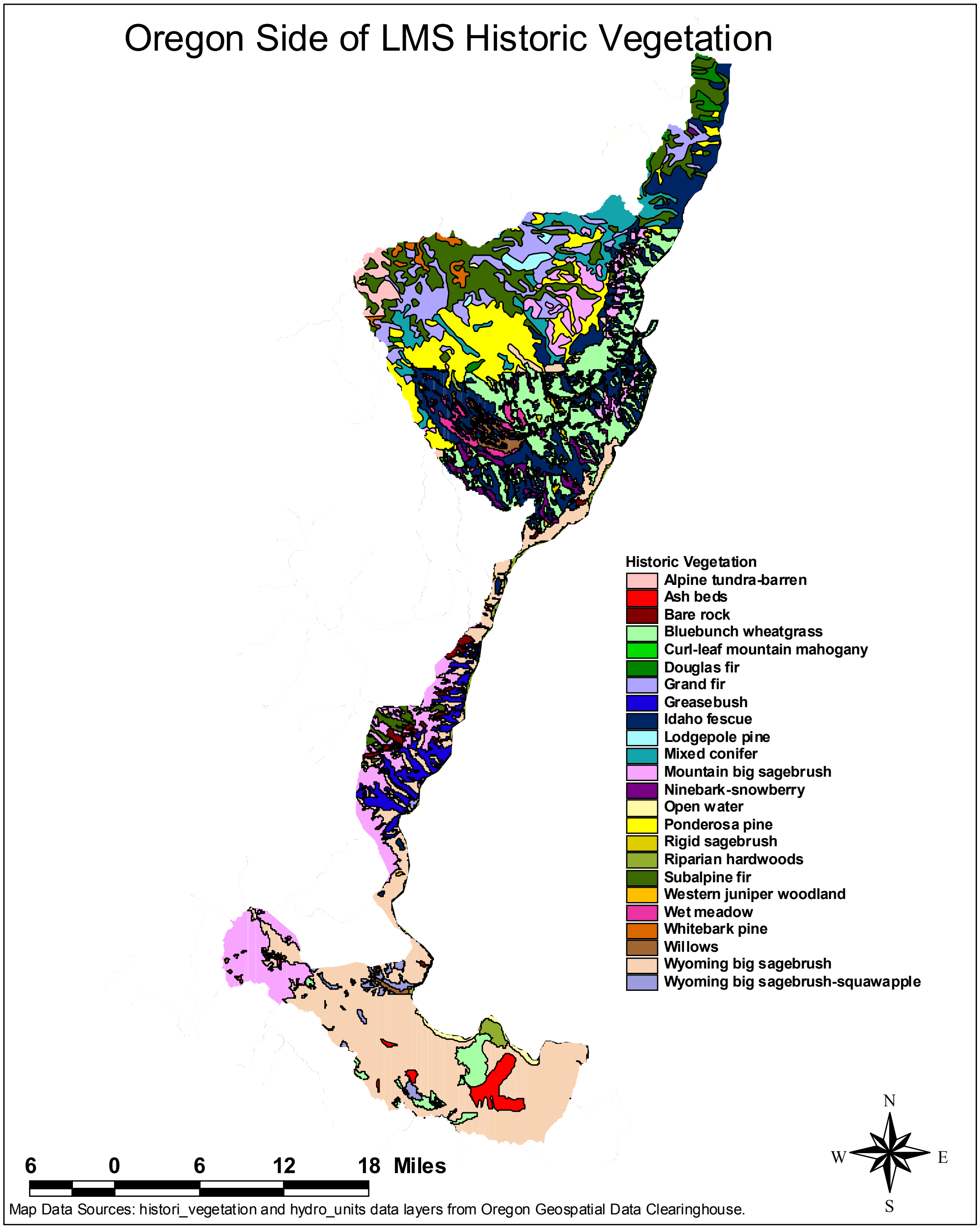


Figure 24. Historic vegetation cover in the Oregon Side LMS subbasin. Cover types do not conform to the types used in IBIS.

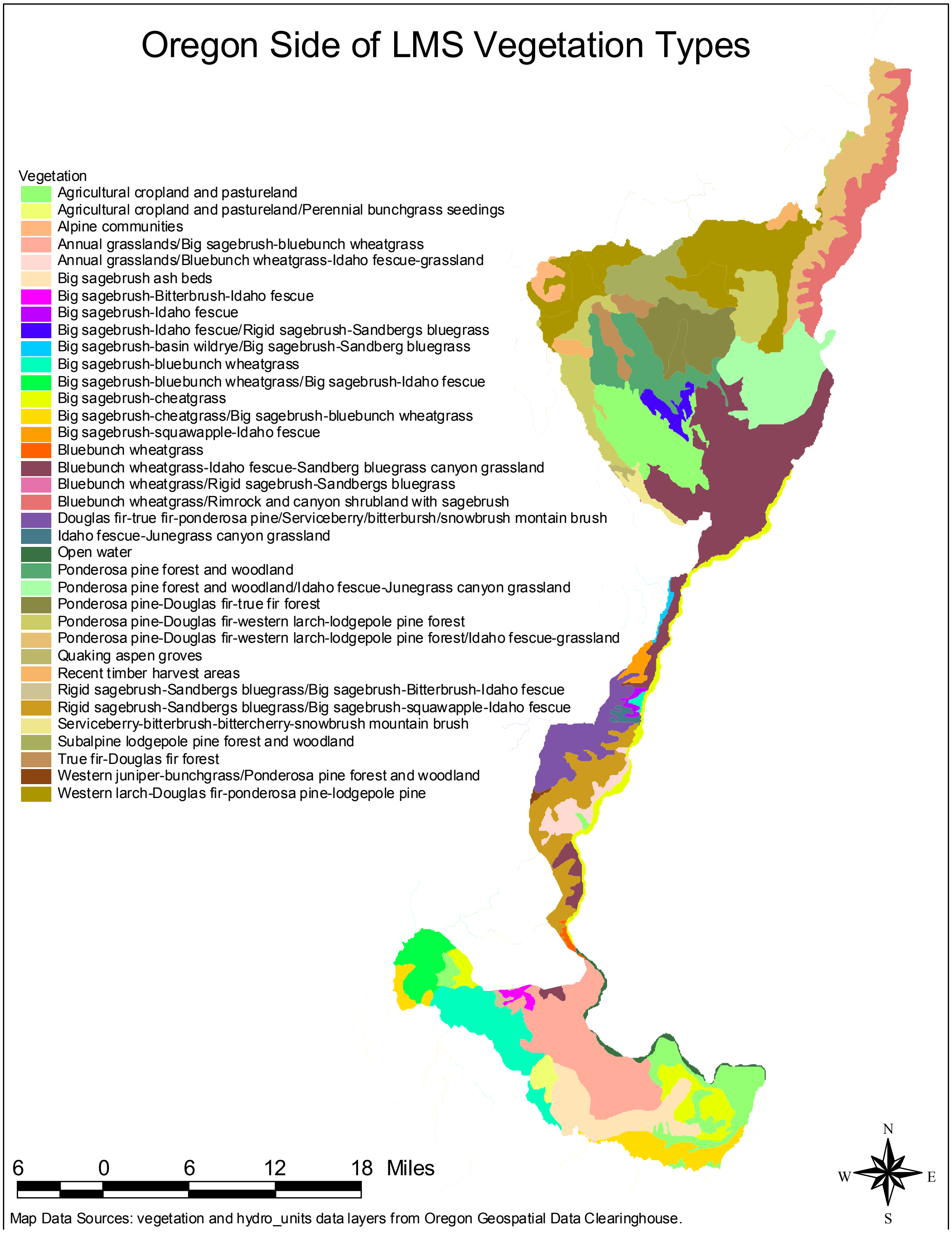


Figure 25. Current vegetation cover in the Oregon Side LMS subbasin. The cover types do not conform to the types used in IBIS.

High Elevation Forest - For the purposes of subbasin planning in general and this document, in particular, two high-elevation forested wildlife habitats (Montane Mixed Conifer and Lodgepole Pine Forest and Woodlands) will be considered together due to the strong similarity of management issues in the two types. Further, the Subbasin Technical Team feels that there is ongoing homogenization of forest types in the region, largely due to fire suppression, resulting in the loss of characteristics specific to a given type and an increase in overlap between them. Therefore, any attempt to clearly divide them for planning purposes would be artificial and would imply a level of knowledge not in evidence at this time.

Focal Species. Two focal species, American marten and olive-sided flycatcher, have been selected to represent high elevation upland forests in the Oregon Side LMS subbasin in order to capture both the older, more complex structural stage and the younger structural stage and understory species in these habitats.

The **American marten** is designated as Sensitive – Vulnerable in Oregon. It is closely associated only with these cover types (IBIS 2004) and primarily utilizes the older structural stage with complex physical structure near the ground (Buskirk and Powell 1994). Martens are associated with 15 of 26 forest structural conditions for feeding. These range from "small tree-single story" with "moderate" canopy closure to "giant tree-multi-story." They will reproduce in those same structural conditions if the necessary habitat elements are present (IBIS 2004). Martens have been found to be associated with 29 Key Environmental Correlates (KECs; IBIS 2004), most of which relate to the structural diversity of the stand. These include down wood in several different contexts, trees, snags, large branches, mistletoe brooms and dead portions of live trees. In California, the average size of snags, logs and stumps used by martens for diurnal resting sites was significantly greater than the average size of those available (Martin and Barrett 1991). Additional KECs martens are associated with include burrows, freshwater riparian and aquatic habitat elements and wetlands.

American martens perform 9 Key Ecological Functions (KEFs) involving their trophic and organismal relationships to other species (IBIS 2004). Martens consume terrestrial invertebrates, vertebrates and eggs. They are secondary cavity users and will use burrows and runways created by other species. Martens also control populations of terrestrial vertebrates through predation or displacement and aid in dispersal of seeds or fruits.

American martens occasionally feed on the carcasses of salmonids although this behavior is relatively rare (IBIS 2004). It is unknown whether the rarity of this behavior is related to availability of carcasses or preference on the part of martens although Buskirk and Ruggiero (1994) discuss the migratory nature and thus, seasonal availability, of fish as well as some birds (and their eggs) in the diets of marten.

Habitat/Focal Species Interaction – Extensive logging and wildfires have a negative impact on populations of American martens. Forests that have been logged or burned support fewer martens and those individuals have shorter life spans, are less productive, and suffer higher mortality, both natural and from trapping, than martens in undisturbed forests (Thompson 1994). Thompson and Colgan (1994) reported that martens also captured significantly lower mass of food per kilometer of travel in logged forests.

Martens are opportunistic predators, taking a wide variety of prey. Of the 19 other species listed as closely associated with these habitats, more than half (10) are potential prey for martens, 3 are less likely to be hunted but could be prey given the right circumstances and the remainder (5) compete with martens for prey. Three of the competing species, northern goshawk, great gray owl and Canada lynx may, if rarely, also prey on American martens.

The **olive-sided flycatcher** is designated Sensitive – Vulnerable in Oregon and is a Partners in Flight (PIF) species. The olive-sided flycatcher is closely associated only with the mixed conifer cover types and breeds primarily in riparian areas, ecotones between early and late successional stages and open or semi-open stands with low percentage of canopy cover (Altman and

Sallabanks 2000). Olive-side flycatchers are associated with 17 of 26 forest structural conditions for breeding (IBIS 2004); non-breeding habitat has not been studied (Marshall et al. 2003). Of those 17 structural stage associations, 3 are close associations (IBIS 2004). A "close association" is defined as "(a) species is widely known to depend on a habitat or structural condition for part or all of its life history requirements. Identifying this association implies that the species has an essential need for this habitat or structural condition for its maintenance and viability" (O'Neil and Johnson 2001, pg 4). The three closely associated structural stages are, "small tree-single story-open" canopy, "sapling/pole-open" canopy and "medium tree-single story-open" canopy.

Olive-sided flycatchers have been found to be associated with 11 KECs (IBIS 2004), most of which describe the vegetation elements and canopy of the stand. These include trees, snags, canopy layer and edges. Additional KECs Olive-sided flycatchers are associated with are freshwater riparian and aquatic habitat elements, wetlands and fire as a habitat element.

Olive-sided flycatchers perform 3 KEFs involving their trophic and organismal relationships to other species. They consume terrestrial invertebrates and serve as a common host for nest parasites, especially the brown-headed cowbird. Although it is not their primary role, and therefore not a KEF, olive-sided flycatchers are preyed upon by other species. Avian, mammalian and even reptilian predators will take birds or their eggs if given the opportunity.

Habitat/Focal Species Interaction – Olive-sided flycatchers may depend upon post-fire habitat and they have likely been negatively affected by fire suppression and changes in fire frequency (Hutto 1995a). Forest management practices such as selective cutting and clearcutting, once thought to mimic natural disturbance, may provide only the appearance of early post-fire habitats but be lacking in some characteristics required by olive-sided flycatchers (Altman 2003a).

Forest management practices that have, over the past 50 years, resulted in an increase in forest openings and edge habitat would seem to have increased available habitat for the olive-sided flycatcher (Altman 2003a). However, this apparent increase in habitat has been coincident with declining populations, indicating that harvested forests may represent an "ecological trap" (Hutto 1995b); the habitat may appear suitable but reproductive success and/or survival is poor due to factors such as limited food resources, predation or parasitism (Altman 2003a). Research in northwest Oregon suggests that nest success may be higher in post-fire habitat than in forest edge habitats and harvest units (Altman 2000). Further, Altman (2003a) suggests that to maintain viable populations, olive-sided flycatchers may require nest success rates greater than 40-45%.

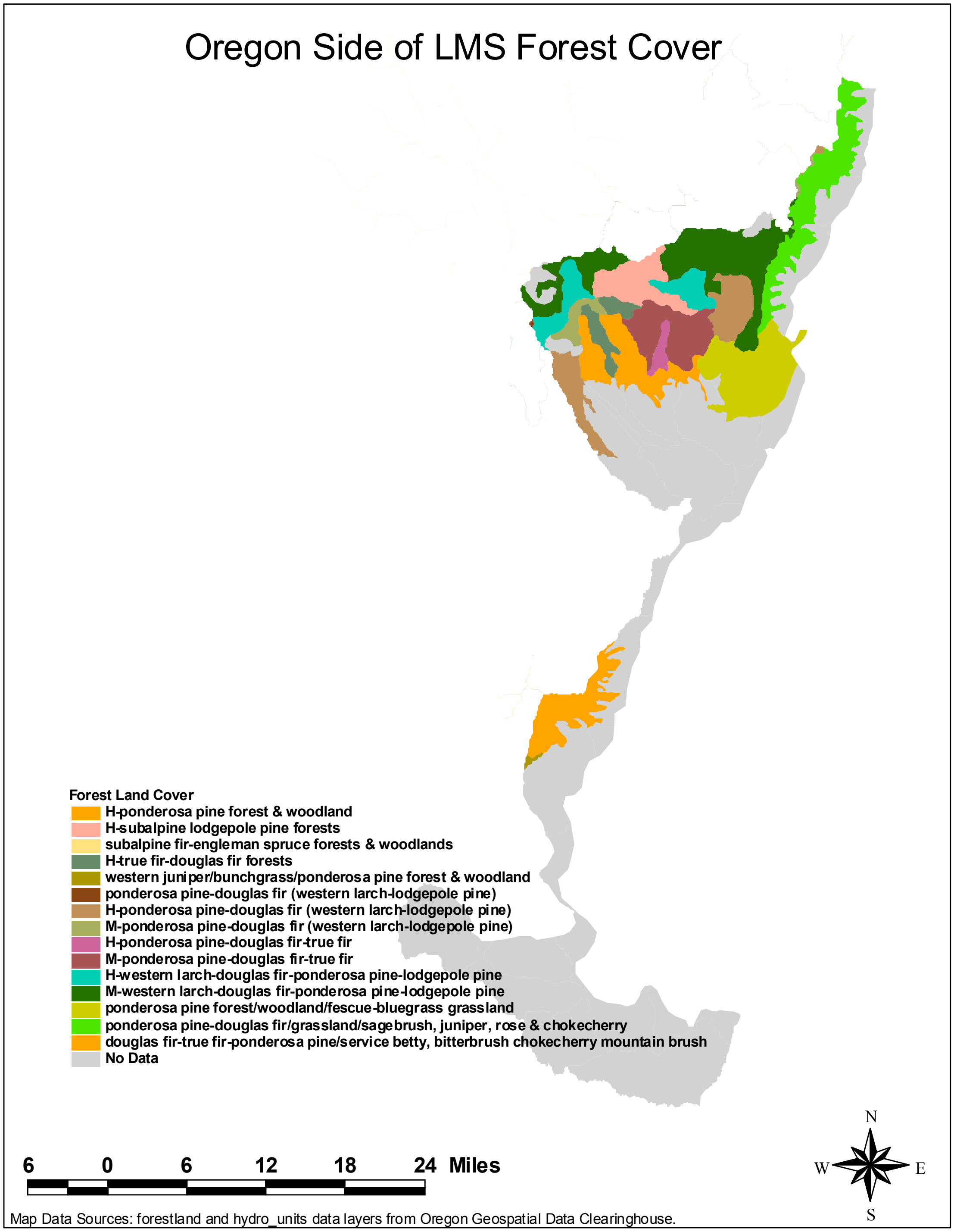
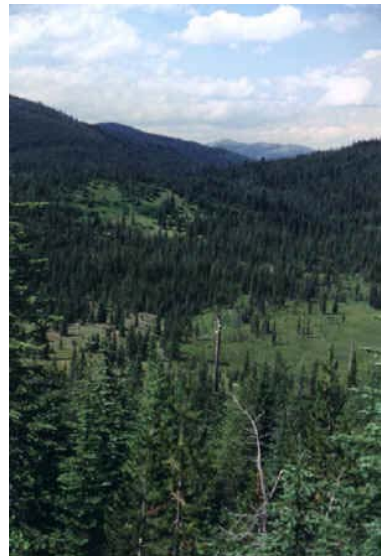


Figure 26. Forest cover in the Oregon Side LMS subbasin.

4 Montane Mixed Conifer Forest



Definition/Description:

Physical Setting. This habitat is typified by a moderate to deep winter snow pack that persists for 3 to 9 months. The climate is moderately cool and wet to moderately dry and very cold. Mean annual precipitation ranges from about 40 inches (102 cm) to >200 inches (508 cm). Elevation is mid- to upper montane, as low as 2,000 ft (610 m) in northern Washington, to as high as 7,500 ft (2,287 m) in southern Oregon.

Composition. This forest habitat is recognized by the dominance or prominence of 1 of the following species: Pacific silver fir (*Abies amabilis*), mountain hemlock (*Tsuga mertensiana*), subalpine fir (*A. lasiocarpa*), Shasta red fir (*A. magnific var. shastensi*), Engelmann spruce (*Picea engelmannii*), noble fir (*A. procera*), or Alaska yellow-cedar (*Chamaecyparis nootkatensis*). Several other trees may co-dominate: Douglas-fir (*Pseudotsuga menziesii*), lodgepole pine (*Pinus contorta*), western hemlock (*Tsuga heterophylla*), western redcedar (*Thuja plicata*), or white fir (*A. concolor*). Tree regeneration is typically dominated by subalpine fir in cold, drier eastside zones.

Subalpine fir and Engelmann spruce are major species only east of the Cascade Crest in Washington, in the Blue Mountains ecoregion, and in the northeastern Olympic Mountains (spruce is largely absent in the Olympic Mountains). Lodgepole pine is important east of the Cascade Crest throughout and in central and southern Oregon. Douglas-fir is important east of the Cascade Crest and at lower elevations on the westside.

Deciduous shrubs that commonly dominate or co-dominate the understory are big huckleberry (*V. membranaceum*), grouseberry (*V. scoparium*), dwarf huckleberry (*V. cespitosum*), fools huckleberry (*Menziesia ferruginea*), Important evergreen shrubs include dwarf Oregongrape (*Mahonia nervosa*) and Oregon boxwood (*Paxistima myrsinites*).

Status & trend: highly protected not imperiled, reduced diversity, decreased course woody debris, continued road building and forest practices in unprotected areas is a threat to late and old structure.

Key disturbance factors: fire (dominant), fungi, insects.

Species Closely Associated: bufflehead, Barrow's goldeneye, olive-sided flycatcher, long-legged myotis, big brown bat, snowshoe hare, golden-mantled ground squirrel, northern flying squirrel, bushy-tailed woodrat, common porcupine, American marten.

6 Lodgepole Pine Forest and Woodlands

Definition/Description:

Geographic Distribution. This habitat is found along the eastside of the Cascade Range, in the Blue Mountains, the Okanogan Highlands and ranges north into British Columbia and south to Colorado and California.

Physical Setting. This habitat is located mostly at mid- to higher elevations (3,000-9,000 ft [914-2,743 m]). These environments can be cold and relatively dry, usually with persistent winter snowpack. A few of these forests occur in low-lying frost pockets, wet areas, or under edaphic control (usually pumice) and are relatively long-lasting features of the landscape. Lodgepole pine is maintained as a dominant by the well-drained, deep Mazama pumice in eastern Oregon.

Composition. The tree layer of this habitat is dominated by lodgepole pine (*Pinus contorta* var. *latifolia* and *P. c. var. murrayana*), but it is usually associated with other montane conifers (*Abies concolor, A. grandis, A. magnifici var. shastensi, Larix occidentalis, Calocedrus decurrens, Pinus lambertiana, P. monticola, P. ponderosa, Pseudotsuga menziesii*). Subalpine fir (*Abies lasiocarpa),* mountain hemlock (*Tsuga mertensiana*), Engelmann spruce (*Picea engelmannii*), and whitebark pine (*Pinus albicaulis*), indicators of subalpine environments, are present in colder or higher sites. Quaking aspen (*Populus tremuloides*) sometimes occur in small numbers.

Shrubs can dominate the undergrowth. Tall deciduous shrubs include Rocky Mountain maple (*Acer glabrum*), serviceberry (*Amelanchier alnifolia*), oceanspray (*Holodiscus discolor*), or Scouler's willow (*Salix scouleriana*). These tall shrubs often occur over a layer of mid-height deciduous shrubs such as baldhip rose (*Rosa gymnocarpa*), russet buffaloberry (*Shepherdia canadensis*), shiny-leaf spirea (*Spiraea betulifolia*), and snowberry (*Symphoricarpos albus* and/or *S. mollis).* At higher elevations, big huckleberry (*Vaccinium membranaceum*) can be locally important, particularly following fire. Mid-tall evergreen shrubs can be abundant in some stands, for example, creeping Oregongrape (*Mahonia repens*), tobacco brush (*Ceanothus velutinus*), and Oregon boxwood (*Paxistima myrsinites*). Colder and drier sites support low- growing evergreen shrubs, such as kinnikinnick (*Arctostaphylos uva-ursi*) or pinemat manzanita (*A. nevadensis*). Grouseberry (*V. scoparium*) and beargrass (*Xerophyllum tenax*) are consistent evergreen low shrub dominants in the subalpine part of this habitat. Manzanita (*Arctostaphylos patula*), kinnikinnick, tobacco brush, antelope bitterbrush (*Purshia tridentata*), and wax current (*Ribes cereum*) are part of this habitat on pumice soil.

Status & trend: Region wide, the same as before 1900 and in regions may exceed its historical extent. Five percent of Pacific Northwest lodgepole pine associations listed in the National Vegetation Classification are considered imperiled.

Key disturbance factors: Fire and fire suppression; Mean fire interval of 112 years. Summer drought areas generally have low to medium-intensity ground fires occurring at intervals of 25-50 years. After the stand opens up (due to fire), shade-tolerant trees increase in number. Because lodgepole pine cannot reproduce under its own canopy, old unburned stands are replaced by shade-tolerant conifers.

Species Closely Associated: northern goshawk, great gray owl, three-toed woodpecker*, black-backed woodpecker*, snowshoe hare, red squirrel, northern pocket gopher, deer mouse, common porcupine, American marten, Canada lynx.

No. 5. Eastside (Interior) Mixed Conifer Forest

Definition/Description:

Geographic Distribution. The Eastside Mixed Conifer Forest habitat appears primarily in the Blue Mountains, East Cascades, and Okanogan Highland Ecoregions of Oregon, Washington, adjacent Idaho, and western Montana. It also extends north into British Columbia.

Physical Setting. The Eastside Mixed Conifer Forest habitat is primarily mid-montane with an elevation range of between 1,000 and 7,000 ft (305-2,137 m), mostly between 3,000 and 5,500 ft (914-1,676 m). Parent materials for soil development vary. This habitat receives some of the greatest amounts of precipitation in the inland northwest, 30-80 inches (76-203 cm)/year. Elevation of this habitat varies geographically, with generally higher elevations to the east.

Composition. This habitat contains a wide array of tree species (9) and stand dominance patterns. Douglas-fir (*Pseudotsuga menziesii*) is the most common tree species in this habitat. It is almost always present and dominates or co-dominates most overstories. Lower elevations or drier sites may have ponderosa pine (*Pinus ponderosa*) as a co-dominant with Douglas-fir in the overstory and often have other shade-tolerant tree species growing in the undergrowth. On moist sites, grand fir (*Abies grandis*), western redcedar (*Thuja plicata*) and/or western hemlock (*Tsuga heterophylla*) are dominant or co-dominant with Douglas-fir. Other conifers include western larch (*Larix occidentalis*) and western white pine (*Pinus monticola*) on mesic sites, Engelmann spruce (*Picea engelmannii*), lodgepole pine (*Pinus contorta*), and subalpine fir (*Abies lasiocarpa*) on colder sites. Rarely, Pacific yew (*Taxus brevifolia*) may be an abundant undergrowth tree or tall shrub.

Undergrowth vegetation varies from open to nearly closed shrub thickets with 1 to many layers. Throughout the eastside conifer habitat, tall deciduous shrubs include Rocky Mountain maple (*A. glabrum*), serviceberry (*Amelanchier alnifolia*), oceanspray (*Holodiscus discolor*), mallowleaf ninebark (*Physocarpus malvaceus*), and Scouler's willow (*Salix scouleriana*) at mid- to lower elevations. Medium-tall deciduous shrubs at higher elevations include fools huckleberry (*Menziesia ferruginea*), and big huckleberry (*Vaccinium membranaceum*). Widely distributed, generally drier site mid-height to short deciduous shrubs include baldhip rose (*Rosa gymnocarpa*), shiny-leaf spirea (*Spiraea betulifolia*), and snowberry (*Symphoricarpos albus, S. mollis*, and *S. oreophilus*). Low shrubs of higher elevations include low huckleberries (*Vaccinium cespitosum,* and *V. scoparium*) and five-leaved bramble (*Rubus pedatus*). Evergreen shrubs represented in this habitat are low to mid-height dwarf Oregongrape (*Mahonia nervosa* in the east Cascades and *M. repens* elsewhere), tobacco brush (*Ceanothus velutinus*), an increaser with fire, Oregon boxwood (*Paxistima myrsinites*) generally at mid- to lower elevations, beargrass (*Xerophyllum tenax*), pinemat manzanita (*Arctostaphylos nevadensis*) and kinnikinnick (*A. uva-ursi).*

Oregon Side LMS Historic acreage: 44,697

Oregon Side LMS Current acreage: 241,628

Increased acreage: 196,931

Status & trend: Roads, timber harvest, periodic grazing, and altered fire regimes have compromised these forests. Even though this habitat is more extensive than pre-1900, natural processes and functions have been modified enough to alter its natural status as functional habitat for many species. Compositional changes including loss of western white pine, which is considered imperiled, threaten diversity.

Key disturbance factors: timber harvesting and fire suppression. Timber harvesting has focused on large shade-intolerant species in mid- and late-seral forests, leaving shade-tolerant species. Fire suppression enforces those logging priorities by promoting less fire-resistant, shade-intolerant trees. The resultant stands at all seral stages tend to lack snags, have high tree density, and are composed of smaller and more shade-tolerant trees

Species Closely Associated: northern goshawk, northern pygmy owl, olive-sided flycatcher, long-legged myotis, silver-haired bat, big brown bat, snowshoe hare, golden-mantled ground squirrel, red squirrel, northern flying squirrel, northern pocket gopher, deer mouse, bushy-tailed woodrat, common porcupine, American marten, Canada lynx.

Focal Species: The **blue grouse** has been selected as focal species for this habitat type. The blue grouse is a managed (game) species in Oregon.

This species is associated with all 26 forest and all 20 non-forest structural conditions (IBIS 2004). Of the forest structural condition associations, 13 are "close" associations including 8 in giant and large tree single- and multi-story stands with open, moderate and closed canopy.

The exception is a "general" association with large tree multi-story closed canopy stands. The remaining "close" associations are with open canopy conditions of all the remaining size classes and both single- and multi-story stands. Of the non-forest structural conditions, blue grouse are "closely" associated with grass/forb, both open and closed canopy; medium shrub-open shrub overstory, both mature and seedling/young; and tall shrub-open shrub overstory, both mature and seedling/young.

Blue grouse are associated with 54 KECs involving their use of forest, shrubland and grass land habitat elements including down wood, live trees, snags, mistletoe brooms, ecotones and shrubs; ecological habitat elements including exotic plants and animals and non-vegetative elements; and freshwater riparian and aquatic habitat elements. Blue grouse may occur in shrub/steppe and grassland communities out to 1.2+ mi (2+ km) from the forest edge; in or along edge of virtually all montane forest communities with relatively open tree canopies; and in alpine/subalpine ecotones (Zwickel 1992). They also use regenerating clearcuts and riparian habitats with dense deciduous cover (Pelren 2003).

This species performs 7 KEFs related to their consumption of vegetation and invertebrates, their role as prey for primary and secondary predators and their ability to disperse seeds and fruits. During the summer, blue grouse eat the leaves and flowers of herbs; leaves, flowers, and berries of shrubs; conifer needles and invertebrates (Zwickel 1992, Csuti 1997, Pelren 2003). Arthropods compose virtually 100% of the diet of the precocial chicks, but the young birds also begin to eat vegetation in late summer and fall (Pelren 2003). In early fall in eastern Oregon, blue grouse diet increasingly includes conifer seeds, western larch needles and the berries of deciduous shrubs (Pelren 2003).

Habitat/Focal Species Interaction. Active timber harvest may create the early successional forest used for breeding and brood rearing. However, harvest may also reduce mature coniferous habitat used in winter. In eastern Oregon, prescribed burning and other methods that maintain mature, park-like stands would likely benefit the species.

7 Ponderosa Pine & Interior White Oak Forest and Woodlands

Given that white oak is virtually absent from the Oregon Side LMS subbasin, this habitat in our area would more accurately be called simply **Ponderosa Pine Forest and Woodlands.**

Definition/Description:

Geographic Distribution. This habitat occurs in much of eastern Washington and eastern Oregon, including the eastern slopes of the Cascades, the Blue Mountains and foothills, and the Okanogan Highlands. Variants of it also occur in the Rocky Mountains, the eastern Sierra Nevada, and mountains within the Great Basin. It extends into south-central British Columbia as well.

Physical Setting. This habitat generally occurs on the driest sites supporting conifers in the Pacific Northwest. It is widespread and variable, appearing on moderate to steep slopes in canyons, foothills, and on plateaus or plains near mountains. In Oregon, this habitat can be maintained by the dry pumice soils. Average annual precipitation ranges from about 14 to 30 inches (36 to 76 cm) on ponderosa pine sites in Oregon and Washington and often as snow. This habitat can be found at elevations of 100 ft (30m) in the Columbia River Gorge to dry, warm areas over 6,000 ft (1,829 m).

Composition. Ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*) are the most common evergreen trees in this habitat. The deciduous conifer, western larch (*Larix occidentalis*), can be a co-dominant with the evergreen conifers in the Blue Mountains of Oregon, but seldom as a canopy dominant. Grand fir (*Abies grandis*) may be frequent in the undergrowth on more productive sites giving stands a multilayer structure. In rare instances, grand fir can be co-dominant in the upper canopy.

The undergrowth can include dense stands of shrubs or, more often, be dominated by grasses, sedges, and/or forbs. Some Douglas-fir and ponderosa pine stands have a tall to medium-tall deciduous shrub layer of mallowleaf ninebark (*Physocarpus malvaceus*) or common snowberry (*Symphoricarpos albus*). Grand fir seedlings or saplings may be present in the undergrowth.

Status & trend: Interior Ponderosa Pine cover type is significantly less in extent than pre-1900 and Oregon White Oak cover type is greater in extent than pre-1900. The greatest structural change in this habitat is the reduced extent of the late-seral, single-layer condition. This habitat is generally degraded because of increased exotic plants and decreased native bunchgrasses. One third of Pacific Northwest Oregon white oak, ponderosa pine, and dry Douglas-fir or grand fir community types listed in the National Vegetation Classification are considered imperiled or critically imperiled.

Key disturbance factors: Fire, fire suppression, grazing; A mean fire interval of 20 years for ponderosa pine is the shortest of the vegetation types listed by Barrett et al. Currently, much of this habitat has a younger tree cohort of more shade-tolerant species that gives the habitat a more closed, multilayered canopy. For example, this habitat includes previously natural fire-maintained stands in which grand fir can eventually become the canopy dominant. Fire suppression has lead to a buildup of fuels that in turn increase the likelihood of stand-replacing fires. Heavy grazing, in contrast to fire, removes the grass cover and tends to favor shrub and conifer species. Fire suppression combined with grazing creates conditions that support cloning of oak and invasion by conifers.

Species Closely Associated: northern goshawk, flammulated owl, great gray owl, white-headed woodpecker, pygmy nuthatch, western bluebird, long-legged myotis, silver-haired bat, big brown bat, golden-mantled ground squirrel, northern pocket gopher, deer mouse, common porcupine.

Focal Species. The **white-headed woodpecker** has been selected as the focal species in ponderosa pine dominated forests. The white-headed woodpecker is closely associated with just this one habitat type in the Oregon Side LMS subbasin. It is designated a federal *Species of Concern* by the USFWS and *Sensitive – Critical* in Oregon.

White-headed woodpeckers show some degree of association with all 26 forest structural stages in IBIS (IBIS 2004) and is not considered closely associated with any of them. However, white-headed woodpeckers are dependent upon ponderosa pine dominated forests (Bull et al. 1986, Dixon 1995a, 1995b) and research indicates they primarily use late successional stages. In the central Oregon Cascades, white-headed woodpecker population density increased with increasing volumes of old growth ponderosa pine (Dixon 1995a, 1995b). The same author reported a positive association with large diameter ponderosa pines in both contiguous and fragmented sites.

White-headed woodpeckers are associated with 20 KECs including trees, snags, decay class, tree size, fruits/seeds/nuts, insect population irruptions and fire as a habitat element (IBIS 2004). The relatively low number of KECs used by this species suggests relatively high vulnerability to disturbance. That vulnerability is enhanced by the species' dependence on those KECs being present in stands dominated by ponderosa pine.

Nest cavities are typically excavated in snags although other substrates are used including stumps, leaning logs and dead tops of live trees (Milne and Hejl 1989, Frederick and Moore 1991, Dixon 1995a, 1995b). Mean diameter (dbh) of nest trees is relatively large compared with other western woodpeckers (Marshall 2003). In Oregon, mean nest tree or snag diameters of 25.6 in. (65 cm; Dixon 1995a), 31.5 in. (80 cm; Dixon 1995b) and 26.2 in. (66.5 cm; Frenzel 2000) have been reported.

White-headed woodpeckers perform 8 KEFs including seed consumption and dispersal, terrestrial invertebrate consumption, primary cavity excavation in snags or live trees and physical fragmentation of standing or down wood.

Habitat/Focal Species Interaction – The Oregon Side LMS subbasin has undergone substantial reduction in ponderosa pine dominated forest with the greatest loss in the late-seral single-layer stands (IBIS 2004). It is those late seral stands that white-headed woodpeckers are most dependent upon (Bull et al. 1986, Dixon 1995a, 1995b) although they have been documented to use areas that have undergone silvicultural treatment if large-diameter ponderosa pines and other old-growth components remain (Dixon 1995s, 1995b, Frenzel 2000).

The decline of ponderosa pine habitats has occurred due to fire suppression, which has allowed the encroachment of Douglas fir and other less fire tolerant conifer species, and to development for agriculture, especially in the lower elevation areas with moderate slopes. White-headed woodpeckers are vulnerable to the loss of this habitat given their degree of dependence upon ponderosa pine in general and late-successional and/or large diameter stands in particular.

Rare or Unique Habitats – Two wildlife habitat types, Upland Aspen Forest and Western Juniper and Mountain Mahogany Woodlands, have been combined for consideration in subbasin planning. For the purpose of this document and the composite "rare or unique habitats," only the mountain mahogany component of the western juniper and mountain mahogany woodlands will be discussed. The range of western juniper is expanding. Thus, juniper presents management challenges very different from those posed by mountain mahogany and quaking aspen. These two habitat types present similar management issues and are subject to similar disturbance factors. Both quaking aspen and mountain mahogany exist within the Oregon Side LMS subbasin as relatively small inclusions within other habitats. In both habitats, grazing prevents or reduces regeneration; as stands age and trees fall, they are not replaced by new growth. The two habitat types are discussed below.

Status and Trend. The western juniper component of the Western Juniper and Mountain Mahogany Woodlands habitat type is increasing due to encroachment into grasslands and shrub-steppe. Both the aspen and mountain mahogany types have declined in the Oregon Side LMS subbasin since pre-European settlement and continue to decline today.

Focal Species. Quaking aspen and mountain mahogany, themselves were selected as the focal species for these habitats, they provide the dominant vegetative cover in their respective habitats and thus, define the habitat. In both habitats, providing for recruitment of young trees is a necessary management consideration.

Habitat/Focal Species Interaction. In the case of both curlleaf mountain mahogany and quaking aspen, the focal species defines the habitat.

8 Upland Aspen Forest
Definition/Description:

Geographic Distribution. Quaking aspen groves are the most widespread habitat in North America, but are a minor type throughout eastern Washington and Oregon.

Physical Setting. This habitat generally occurs on well-drained mountain slopes or canyon walls that have some moisture. Rockfalls, talus, or stony north slopes are often typical sites. It may occur in steppe on moist microsites. This habitat is not associated with streams, ponds, or wetlands. This habitat is found from 2,000 to 9,500 ft (610 to 2,896 m) elevation.

Composition. Quaking aspen (*Populus tremuloides)* is the characteristic and dominant tree in this habitat. It is the sole dominant in many stands although scattered ponderosa pine

(Pinus ponderosa) or Douglas-fir (*Pseudotsuga menziesii*) may be present. Snowberry (*Symphoricarpos oreophilus* and less frequently, *S. albus*) is the most common dominant shrub. Tall shrubs, Scouler's willow (*Salix scouleriana*) and serviceberry (*Amelanchier alnifolia*) may be abundant. On mountain or canyon slopes, antelope bitterbrush (*Purshia tridentata*), mountain big sagebrush (*Artemisia tridentata ssp. vaseyana),* low sagebrush (*A. arbuscula*), and curl-leaf mountain mahogany (*Cercocarpus ledifolius*) often occur in and adjacent to this woodland habitat.

In some stands, pinegrass (*Calamagrostis rubescens*) may dominate the ground cover without shrubs. Other common grasses are Idaho fescue *(Festuca idahoensis*), California brome (*Bromus carinatus*), or blue wildrye (*Elymus glaucus*). Characteristic tall forbs include horsemint (*Agastache spp*.), aster (*Aster spp.),* senecio (*Senecio spp*.), coneflower (*Rudbeckia spp.).* Low forbs include meadowrue (*Thalictrum spp*.), bedstraw (*Galium spp*.), sweetcicely (*Osmorhiza spp*.), and valerian (*Valeriana spp*.).

Oregon Side LMS Historic acreage: None

Oregon Side LMS Current acreage: 128

Increased acreage: 128

Status & trend: With fire suppression and change in fire regimes, the Aspen Forest habitat is less common than before 1900. None of the 5 Pacific Northwest upland quaking aspen community types in the National Vegetation Classification is considered imperiled.

Key disturbance factors: Livestock grazing, fire suppression; Heavy livestock browsing can adversely impact aspen growth and regeneration. With fire suppression and alteration of fine fuels, fire rejuvenation of aspen habitat has been greatly reduced since about 1900. Conifers now dominate many seral aspen stands and extensive stands of young aspen are uncommon.

Species Closely Associated: common porcupine.

<u>13 Western Juniper and Mountain Mahogany Woodlands</u>

Definition/Description:

Geographic Distribution. In Oregon and Washington, this dry woodland habitat appears primarily in the Owyhee Uplands, High Lava Plains, and northern Basin and Range ecoregions. Secondarily, it develops in the foothills of the Blue Mountains and East Cascades ecoregions, and seems to be expanding into the southern Columbia Basin ecoregion, where it was naturally found in outlier stands. Many isolated mahogany communities occur throughout canyons and mountains of eastern Oregon. Juniper-mountain mahogany communities are found in the Ochoco and Blue Mountains.

Physical Setting. Western juniper and/or mountain mahogany woodlands are often found on shallow soils, on flats at mid- to high elevations, usually on basalts. Other sites range from deep, loess soils and sandy slopes to very stony canyon slopes. At lower elevations, or in areas outside of shrub-steppe, this habitat occurs on slopes and in areas with shallow soils. Mountain mahogany can occur on steep rimrock slopes, usually in areas of shallow soils or protected slopes. This habitat can be found at elevations of 1,500- 8,000 ft (457-2,438 m), mostly between 4,000-6,000 ft (1,220-1,830 m). Average annual precipitation ranges from approximately 10 to 13 inches (25 to 33 cm), with most occurring as winter snow.

Composition. Western juniper and/or mountain mahogany dominate these woodlands either with bunchgrass or shrub-steppe undergrowth. Western juniper (*Juniperus occidentalis*) is the most common dominant tree in these woodlands. Part of this habitat will have curl-leaf mountain mahogany (*Cercocarpus ledifolius*) as the only dominant tall shrub or small tree.

Mahogany may be co-dominant with western juniper. Ponderosa pine (*Pinus ponderosa*) can grow in this habitat and in some rare instances may be an important part of the canopy.

The most common shrubs in this habitat are basin, Wyoming, or mountain big sagebrush (*Artemisia tridentata ssp. tridentata, ssp. wyomingensis*, and *ssp. vaseyana*) and/or bitterbrush (*Purshia tridentata*). They usually provide significant cover in juniper stands. Low or stiff sagebrush (*Artemisia arbuscula* or *A. rigida*) are dominant dwarf shrubs in some juniper stands. Mountain big sagebrush appears most commonly with mountain mahogany and mountain mahogany mixed with juniper. Snowbank shrubland patches in mountain mahogany woodlands are composed of mountain big sagebrush with bitter cherry (*Prunus emarginata*), quaking aspen (*Populus tremuloides*), and serviceberry (*Amelanchier alnifolia*). Shorter shrubs such as mountain snowberry (*Symphoricarpos oreophilus*) or creeping Oregongrape (*Mahonia repens*) can be dominant in the undergrowth. Rabbitbrush (*Chrysothamnus nauseosus* and *C. viscidiflorus*) will increase with grazing.

Oregon Side LMS Historic acreage: 18,286

Oregon Side LMS Current acreage: 8,509

Decreased acreage: 9,777

Status & trend: This habitat is dominated by fire-sensitive species, and therefore, the range of western juniper and mountain mahogany region wide has expanded because of an interaction of livestock grazing and fire suppression. Quigley and Arbelbide concluded that in the Inland Pacific Northwest, Juniper/Sagebrush, Juniper Woodlands, and Mountain Mahogany cover types now are significantly greater in extent than before 1900. One third of Pacific Northwest juniper and mountain mahogany community types listed in the National Vegetation Classification are considered imperiled or critically imperiled.

Key disturbance factors: Fire suppression, overgrazing, changing climate

Species Closely Associated: loggerhead shrike, western small-footed myotis, Nuttall's cottontail, golden-mantled ground squirrel, deer mouse, bushy-tailed woodrat.

Combined Alpine and Subalpine Habitats:

Two wildlife habitat types, Subalpine Parkland and Alpine Grasslands and Shrublands, have been combined for discussion in subbasin planning. Both habitats occur at relatively high elevations and are largely protected from disturbances such as logging, road building and development although they are not immune to the effects of human use. Recreational pressure combined with slow regeneration of the dominant vegetation may significantly degrade these habitats over time. Alpine and subalpine habitats are described below.

Status and Trend. In the judgment of the subbasin Technical Team, alpine and subalpine habitats have remained essentially static since before Europeans came to the area and their trend at this time continues to be stable or declining slightly.

Focal Species. The **black rosy-finch** has been selected as the focal species for these high elevation habitats. It is closely associated only with these habitats. The species is designated *Sensitive – Peripheral or Naturally Rare* in Oregon.

This species is associated with 4 of 20 non-forest and none of the forest structural conditions (IBIS 2004). Those non-forest conditions with which it is associated include grass/forb-open and low shrub and seedling types. This is a species of high elevation, open habitats with bare rock, cliffs, talus and snowfields.(Contreras 2003).

Black Rosy-finches are associated with 10 KECs related to their use of shrubland/grassland habitats and abiotic habitat elements including rock, caves and snow (IBIS 2004). The low number of KECs associated with this species is an indication of its specialized habitat needs and, therefore, its potential vulnerability to loss of or disturbance to that habitat (IBIS 2004).

The black rosy-finch performs 5 KEFs including consumption of seeds and invertebrates and their role as prey for primary or secondary predators. This species feeds on seeds in the winter and both seeds and insects during the breeding season (Johnson 2002). Clark's nutcrackers may be the most common predator of black rosy-finch nests although other birds and mammals likely prey on them as well. Fledged young and adults may be taken by hawks, falcons and owls (Johnson 2002).

Habitat/Focal Species Interaction. The black rosy-finch is considered a Sensitive Species by Oregon Department of Fish and Wildlife because of its very small, geographically isolated population. Its breeding habitat is unlikely to be affected by humans because of its inaccessibility.

10 Alpine Grasslands and Shrublands

Definition/Description:

Geographic Distribution. This habitat occurs in high mountains throughout the region, including the Cascades, Olympic Mountains, Okanogan Highlands, Wallowa Mountains, Blue Mountains, Steens Mountain in southeastern Oregon, and, rarely, the Siskiyous. It is most extensive in the Cascades from Mount Rainier north and in the Wallowa Mountains.

Physical Setting. The climate is the coldest of any habitat in the region. Winters are characterized by moderate to deep snow accumulations, very cold temperatures, and high winds. Summers are relatively cool. Growing seasons are short because of persistent snow pack or frost. Blowing snow and ice crystals on top of the snow pack at and above treeline prevent vegetation such as trees from growing above the depth of the snow pack. Snow pack protects vegetation from the effects of this winter wind-related disturbance and from excessive frost heaving. Community composition is much influenced by relative duration of snow burial and exposure to wind and frost heaving. Elevation ranges from a minimum of 5,000 ft (1,524 m) in parts of the Olympics to 10,000 ft (3,048 m). The topography varies from gently sloping broad ridgetops, to glacial cirque basins, to steep slopes of all aspects. Soils are generally poorly developed and shallow, though in subalpine grasslands they may be somewhat deeper or better developed.

Composition. Most subalpine or alpine bunchgrass grasslands are dominated by Idaho fescue (*Festuca idahoensis*), alpine fescue (*F. brachyphylla*), green fescue (*F. viridula*), Rocky Mountain fescue (*F. saximontana*), or timber oatgrass (*Danthonia intermedia*), and to a lesser degree, purple reedgrass (*Calamagrostis purpurascens*), downy oat-grass (*Trisetum spicatum*) or muttongrass (*Poa fendleriana*). Forbs are diverse and sometimes abundant in the grasslands. Alpine sedge turfs may be moist or dry and are dominated by showy sedge (*Carex spectabilis*), black alpine sedge (*C. nigricans*), Brewer's sedge (*C. breweri*), capitate sedge (*C. capitata*), nard sedge (*C. nardina*), dunhead sedge (*C. phaeocephala*), or western single-spike sedge (*C. pseudoscirpoidea*).

One or more of the following species dominates alpine heaths: pink mountain-heather (*Phyllodoce empetriformis*), green mountain-heather (*P. glanduliflora*), white mountain-heather (*Cassiope mertensiana*), or black crowberry (*Empetrum nigrum*). Other less extensive dwarf-shrublands may be dominated by the evergreen coniferous common juniper (*Juniperus communis*), the evergreen broadleaf kinnikinnick (*Arctostaphylos uva-ursi*), the deciduous shrubby cinquefoil (*Pentaphylloides floribunda*) or willows (*Salix cascadensis* and *S. reticulata ssp. nivalis*). Tree species occurring as shrubby krummholz in the alpine are subalpine fir (*Abies lasiocarpa*), whitebark pine (*Pinus albicaulis*), mountain hemlock (*Tsuga mertensiana*), Engelmann spruce (*Picea engelmannii*), and subalpine larch (*Larix lyallii*).

Oregon Side LMS Historic acreage: 5,457

Oregon Side LMS Current acreage: 53,936

Increased acreage: 48,479

Status & trend: This habitat is naturally very limited in extent in the region. There has been little to no change in abundance over the last 150 years. Most of this habitat is still in good condition and dominated by native species. Threats include increasing recreational pressures, continued grazing at some sites, and, possibly, global climate change resulting in expansion of trees into this habitat. Only 1 out of 40 plant associations listed in the National Vegetation Classification is considered imperiled.

Key disturbance factors: Recreation, grazing; The major human impacts on this habitat are trampling and associated recreational impacts, e.g., tent sites. Resistance and resilience of vegetation to impacts varies by life form. Domestic sheep grazing has also had dramatic impacts, especially in the bunchgrass habitats east of the Cascades. Most natural disturbances seem to be small scale in their effects or very infrequent. Herbivory and associated trampling disturbance by elk, mountain goats, and occasionally bighorn sheep seems to be an important disturbance in some areas, creating patches of open ground, though the current distribution and abundance of these ungulates is in part a result of introductions.

Species Closely Associated: black rosy-finch, American pika, bushy-tailed woodrat, mountain goat, Rocky Mountain bighorn sheep.

9 Subalpine Parkland

Definition/Description:

Geographic Distribution. The Subalpine Parkland habitat occurs throughout the high mountain ranges of Washington and Oregon (e.g., Cascade crest, Olympic Mountains, Wallowa and Owyhee Mountains, and Okanogan Highlands), extends into mountains of Canada and Alaska, and to the Sierra Nevada and Rocky Mountains.

Physical Setting. Climate is characterized by cool summers and cold winters with deep snowpack, although much variation exists among specific vegetation types. Mountain hemlock sites receive an average precipitation of >50 inches (127 cm) in 6 months and several feet of snow typically accumulate. Whitebark pine sites receive 24-70 inches (61-178 cm) per year and some sites only rarely accumulate a significant snowpack. Summer soil drought is possible in eastside parklands but rare in westside areas. Elevation varies from 5,000 to 8,000 ft (1,524 to 2,438 m) in the eastern Cascades and Wallowa mountains.

Composition. Species composition in this habitat varies with geography or local site conditions. The tree layer can be composed of 1 or several tree species. Subalpine fir (*Abies lasiocarpa*), Engelmann spruce (*Picea engelmannii*) and lodgepole pine (*Pinus contorta*) are found throughout the Pacific Northwest. Whitebark pine (*P. albicaulis*) is found primarily in the eastern Cascade mountains Okanogan Highlands, and Blue Mountains.

Drier areas are woodland or savanna like, often with low shrubs, such as common juniper (*Juniperus communis*), kinnikinnick (*Arctostaphylos uva-ursi*), low whortleberries or grouseberries (*Vaccinium myrtillus* or *V. scoparium*) or beargrass (*Xerophyllum tenax*) dominating the undergrowth. Wetland shrubs in the Subalpine Parkland habitat include bog-laurel (*Kalmia microphylla*), Booth's willow (*Salix boothii*), undergreen willow (*S. commutata*), Sierran willow (*S. eastwoodiae*), and blueberries (*Vaccinium uliginosum* or *V. deliciosum*)

Undergrowth in drier areas may be dominated by pinegrass (*Calamagrostis rubescens*), Geyer's sedge (*Carex geyeri*), Ross' sedge (*C. rossii*), smooth woodrush (*Luzula glabrata var. hitchcockii*), Drummond's rush (*Juncus drummondii*), or short fescues (*Festuca viridula, F. brachyphylla, F. saximontana*). Various sedges are characteristic of wetland graminoid-dominated habitats: black (*Carex nigricans*), Holm's Rocky Mountain (*C. scopulorum*), Sitka (*C.*

aquatilis var. dives) and Northwest Territory (C. utriculatia) sedges. Tufted hairgrass (*Deschampsia caespitosa*) is characteristic of subalpine wetlands.

Oregon Side LMS Historic acreage: 14,298

Oregon Side LMS Current acreage: None

Decreased acreage: 14,298

Status & trend: Whitebark pine maybe declining because of the effects of blister rust or fire suppression that leads to conversion of parklands to more closed forest. Global climate warming will likely have an amplified effect throughout this habitat. Less than 10% of Pacific Northwest subalpine parkland community types listed in the National Vegetation Classification are considered imperiled.

Key disturbance factors: Fire suppression, pathogens (blister rust), logging. livestock, recreation. Fire suppression has contributed to change in habitat structure and functions. Blister rust, an introduced pathogen, is increasing whitebark pine mortality in these woodlands. Even limited logging can have prolonged effects because of slow invasion rates of trees. During wet cycles, fire suppression can lead to tree islands coalescing and the conversion of parklands into a more closed forest habitat. Livestock use and heavy horse or foot traffic can lead to trampling and soil compaction. Slow growth in this habitat prevents rapid recovery.

Species Closely Associated: Long-legged myotis, American pika.

14 Eastside (Interior) Canyon Shrublands

Definition/Description:

Geographic Distribution. This habitat occurs primarily on steep canyon slopes in the Blue Mountains and the margins of the Columbia Basin in Idaho, Oregon, and Washington. In the Oregon Side LMS subbasin, it is found primarily on the slopes above the Snake River.

Physical Setting. This habitat develops in hot dry climates in the Pacific Northwest. Annual precipitation totals 12-20 inches (31-51 cm); only 10% falls in the hottest months, July through September. Snow accumulation is low (1-6 inches [3-15 cm]), persisting only a few weeks. Sites are generally steep (>60%) on all aspects but most common on northerly aspects in deep, dry canyons. Columbia River basalt is the major geologic substrate although many sites are underlain with loess deposits mixed with colluvium. This habitat is found from 500 to 5,000 ft (152 to 1,524 m) in elevation.

Composition. Mallowleaf ninebark (*Physocarpus malvaceus*), a major dominant, bitter cherry (*Prunus emarginata*), chokecherry (*Prunus virginiana),* oceanspray (*Holodiscus discolor*) or Rocky Mountain maple (*Acer glabrum*) are the most common tall shrubs in this habitat. In moist areas, black hawthorn (*Crataegus douglasii*) may appear and can dominate some sites as a tall shrub or small tree. Other tall shrubs such as syringa (*Philadelphus lewisii*) or serviceberry (*Amelanchier alnifolia*) often dominate sites associated with talus. Common medium-tall shrubs are common snowberry (*Symphoricarpos albus*), rose (*Rosa nutkana, R. woodsii*), smooth sumac (*Rhus glabra*), and currants (*Ribes spp.).* Basin or Wyoming big sagebrush (*Artemisia tridentata ssp. tridentata* or *A. t. ssp. wyomingensis*), along with rabbitbrush (*Chrysothamnus spp*.), may be important members of these thickets in weedy sites, dry areas, or transitions with grasslands. Scattered ponderosa pine (*Pinus ponderosa*), black cottonwood (*Populus balsamifera ssp. trichocarpa*) and rarely Douglas-fir (*Pseudotsuga menziesii*) trees may be found in and adjacent to this habitat.

Status & trend: The trend in this habitat in the Oregon Side LMS subbasin is stable to slightly decreasing in the judgment of the subbasin Technical Team. Region wide, it is restricted in range and probably has increased locally in area. Johnson and Simon reported increases in common snowberry-rose communities as a response to fire suppression and heavy grazing that depleted bunchgrass cover. One of the three Eastside Canyon Shrubland community types in the National Vegetation Classification is considered imperiled.

Key disturbance factors: Fire, grazing, talus movement.

Species Closely Associated: western small-footed myotis, western pipistrelle, big brown bat, pallid bat, golden-mantled ground squirrel, deer mouse, bushy-tailed woodrat, montane vole, Rocky Mountain bighorn sheep.

Focal Species. The **canyon wren** is not closely associated with the vegetation of this habitat type but is associated with the rock cliffs and other structure that form the substrate for the vegetation.

Canyon wrens are associated with none of the forested and all 20 non-forest structural conditions (IBIS 2004). These associations range from "present" in the larger, more closed shrub habitats to "close" in grass/forb and small shrub, open overstory conditions.

This species is associated with KECs, nearly all of which relate to their use of a variety of rock formations and structures (IBIS 2004). Canyon wrens forage and nest in rock crevices, interstices and cracks. They are also associated with rivers and streams as these are the areas that support the kind of rock formations the species inhabits.

The canyon wren performs 2 KEFs including their role as predator of invertebrates and prey for other species.

Habitat/Focal Species Interaction. The relatively low number of KECs this species is associated with is indicative of relatively high vulnerability to habitat loss or degradation. However, the habitat elements of greatest importance to this species, rock cliffs and canyon walls, are subject to few instances of human disturbance. Recreational activity in nest areas is the only identified threat to these birds at this time.

<u>15 Eastside (Interior) Grasslands</u>

Definition/Description:

Geographic Distribution. This habitat is found primarily in the Columbia Basin of Idaho, Oregon, and Washington, at mid- to low elevations and on plateaus in the Blue Mountains, usually within the ponderosa pine zone in Oregon.

Physical Setting. This habitat develops in hot, dry climates in the Pacific Northwest. Annual precipitation totals 8-20 inches (20-51 cm); only 10% falls in the hottest months, July through September. Snow accumulation is low (1-6 inches [3-15 cm]) and occurs only in January and February in eastern portions of its range and November through March in the west. More snow accumulates in grasslands within the forest matrix. The grassland habitat is typically upland vegetation but it may also include riparian bottomlands dominated by non-native grasses. This habitat is found from 500 to 6,000 ft (152-1,830 m) in elevation.

Composition. Bluebunch wheatgrass (*Pseudoroegneria spicata*) and Idaho fescue (*Festuca idahoensis*) are the characteristic native bunchgrasses of this habitat and either or both can be dominant. Idaho fescue is common in more moist areas and bluebunch wheatgrass more abundant in drier areas. Rough fescue (*F. campestris*) is a characteristic dominant on moist sites in northeastern Washington. Sand dropseed (*Sporobolus cryptandrus*) or three-awn (*Aristida longiseta)* are native dominant grasses on hot dry sites in deep canyons. Sandberg bluegrass *(Poa sandbergii*) is usually present, and occasionally codominant in drier areas. Bottlebrush squirreltail (*Elymus elymoides*) and Thurber needlegrass (*Stipa thurberiana*) can be locally dominant. Annual grasses are usually present; cheatgrass (*Bromus tectorum*) is the most widespread. In addition, medusahead (*Taeniatherum caput-medusae*), and other annual bromes (*Bromus commutatus, B.*

mollis, B. japonicus) may be present to co-dominant. Moist environments, including riparian bottomlands, are often co-dominated by Kentucky bluegrass (*Poa pratensis*).

A dense and diverse forb layer can be present or entirely absent; >40 species of native forbs can grow in this habitat including balsamroots (*Balsamorhiza spp*.), biscuitroots (*Lomatium spp.*), buckwheat (*Eriogonum spp*.), fleabane (*Erigeron spp*.), lupines (*Lupinus spp*.), and milkvetches (*Astragalus spp.)*. Smooth sumac (*Rhus glabra*) is a deciduous shrub locally found in combination with these grassland species. Rabbitbrushes (*Chrysothamnus nauseosus, C. viscidiflorus*) can occur in this habitat in small amounts, especially where grazed by livestock.

Status & trend: Most of the Palouse prairie of southeastern Washington and adjacent Idaho and Oregon has been converted to agriculture. Remnants still occur in the foothills of the Blue Mountains and in isolated, moist Columbia Basin sites. The Palouse is one of the most endangered ecosystems in the U.S. with only 1% of the original habitat remaining; it is highly fragmented with most sites <10 acres. In the Oregon Side LMS subbasin, this habitat has declined slightly since pre-European settlement and those areas that remain are often in a degraded condition due to invasion by noxious weeds, especially cheat grass, and changes in the fire regime. Fifty percent of the plant associations recognized as components of eastside grassland habitat listed in the National Vegetation Classification are considered imperiled or critically imperiled.

Key disturbance factors: Grazing, conversion to cropland, invasion by non-native species; Large expanses of grasslands are currently used for livestock ranching. Deep soil Palouse sites are mostly converted to agriculture.

Species Closely Associated: Swainson's hawk, ferruginous hawk, sage grouse, sharp-tailed grouse, upland sandpiper, long-billed curlew, burrowing owl, horned lark, vesper sparrow, grasshopper sparrow, western meadowlark, western small-footed myotis, western pipistrelle, white-tailed jackrabbit, northern pocket gopher, deer mouse, montane vole, pronghorn antelope.

Focal Species. The **western meadowlark** has been selected as the focal species for this habitat. Interior grasslands represent the largest area of natural habitat of the three Oregon Side LMS habitats this species is closely associated with. The western meadowlark is designated as Sensitive – Critical in Oregon and is a HEP species used in habitat loss assessments associated with Columbia River hydropower projects. The western meadowlark is also the Oregon State Bird.

Meadowlarks are associated with 8 of 26 forest and 14 of 20 non-forest structural conditions (IBIS 2004). Of the non-forest structural conditions, they are "closely" associated with Grass/Forb-closed canopy, 3 Low Shrub-open canopy and 3 Medium Shrub-open canopy; they are "generally" associated with the 7 remaining classifications. While the species is closely associated with open canopy shrub habitats, meadowlark abundance is negatively associated with the percent of open ground (Holmes and Geupel 1998) and they have shown a preference for habitats with good grass and litter cover (Wiens and Rotenberry 1981). Singing perches such as trees, shrubs, boulders, fences and power poles, are essential components of meadowlark territories (Altman 2003b).

Western meadowlarks are associated with 21 KECs related to their use of a variety of vegetative elements, interactions with exotic species and their use of anthropogenic habitat elements such as fence posts and hedgerows.

Western meadowlarks perform 3 KEFs, all of which involve trophic relationships (IBIS 2004). Their diet varies seasonally with insects taken mostly in the spring and summer and seeds consumed more in the fall. Where it is available, meadowlarks feed on grain during winter and early spring (Altman 2003b). Meadowlarks are prey for a variety of predators. Nests are constructed on the ground and both eggs and nestlings are vulnerable to predation by foxes, domestic cats and dogs, coyotes, snakes, skunks, raccoons and other small mammals (Lanyon 1957, Bent 1958). Adult birds may be taken by various species of hawks (Lanyon 1994).

Habitat/Focal Species Interaction. On the Boardman Bombing Range in northern Oregon, the meadowlark is the most abundant species in annual grass and shrub habitats including both grazed and ungrazed sagebrush, bitterbrush and other low shrub habitats. However, their relative abundance is greatest in bitterbrush and ungrazed sagebrush habitats (Holmes and Geupel 1998). Meadowlark abundance is greater in bunchgrass and sagebrush habitats that are free from grazing (Altman 2003b). In habitats grazed by livestock or subject to other agricultural practices, nests may be trampled or destroyed by equipment such as mowers (Altman 2003b). Conversion of native habitats to non-suitable agriculture may contribute to declines in this species (Altman 2003b).

Combined Shrub-steppe - For the purposes of subbasin planning in general and this document, in particular, two shrub-steppe wildlife habitats (Shrub-steppe and Dwarf Shrub-steppe) will be considered together due to their overall similarity and the strong similarity of management issues in the two types. Further, dwarf shrub-steppe exists primarily as inclusions within shrub-steppe habitat; it would be problematic and unproductive to attempt to separate the two for either planning or management. These two habitat types are described below.

Focal Species. The **sage grouse** has been selected as focal species for shrub-steppe habitats. Seven petitions have been submitted to the U.S. Fish and Wildlife Service (USFWS) requesting listing of distinct populations and the entire species, collectively. The USFWS has determined (April 15, 2004) that the petitions and other available information provide substantial biological information indicating that further review of the status of the species is warranted. This status review will determine whether the greater sage grouse warrants listing as a threatened or endangered species.

Sage grouse are associated with none of the forest and 8 of 20 non-forest structural conditions (IBIS 2004). The species is closely associated with both the open and closed condition of grass/forb habitats as well as mature and young stages of low and medium shrubs with open overstory. It is “generally” associated with the old age class of low and medium shrubs with open overstory. Optimum sage grouse nesting habitat consists of the following: sagebrush stands containing plants 16 to 32 inches (40 to 80 cm) tall with a canopy cover ranging from 15 to 25 percent and an herbaceous understory of at least 15 percent grass canopy cover and 10 percent forb canopy cover that is at least 7 inches (18 cm) tall (BLM et al. 2000). Ideally, these vegetative conditions should be on 80 percent of the breeding habitat for any given population of sage grouse (BLM 2000).

This species is associated with 24 KECs related to its use of shrubland/grassland habitat elements including grasses, forbs, shrubs and flowers; the effects of exotic species; fire as a habitat element and anthropogenic habitat elements (IBIS 2004).

Sage grouse perform7 KEFs involving their trophic relationships as consumers of leaves, flowers, fruit and invertebrates; their role as prey for primary or secondary predators; and their function as carrier of diseases that affect other species. Sage grouse feed on several species of sagebrush as well as forbs, grasses and invertebrates. Few studies have been conducted on sage grouse predation although predation on birds and nests is thought to be the primary cause of mortality (Schroeder et al 1999). Potential predators include golden eagles and nearly every other raptor in sage grouse range, foxes, bobcats and other mammals. Nest predators include ground squirrels, badgers, weasels, coyotes and a variety of bird species.

Habitat/Focal Species Interaction. Barnett (2003:180) suggests this species may be a good indicator for shrub-steppe habitat “since they require large expanses of sagebrush with healthy, native understories.” Sage grouse are affected by anything that affects sagebrush-dominated habitat including agricultural development, large wildfires, urbanization and encroachment by western juniper. Permanent conversion of sagebrush to agricultural lands is the single greatest cause of decline in sagebrush-steppe habitat in the interior Columbia Basin (Quigley and Arbelbide 1997, BLM et al. 2000).

Mule Deer are a managed (game) species in Oregon. They have been selected as a focal species for shrub-steppe habitats in the Oregon Side LMS subbasin because of the importance of this habitat to their winter survival.

The mule deer is associated with all 26 forest and all 20 non-forest structural conditions recognized in IBIS (IBIS 2004). Mule deer are generally considered habitat generalists and their association with all structural conditions indicates they are generalists regarding structure as well. However, Verts and Carraway (1998:470) suggest they occupy the "more open, but more rugged areas" within this variety of habitats. They also note that areas used by females with young had greater species richness of the vegetation and more dense woody cover than areas used by males. Thus, although they are generalists, there are likely seasonal and age/sex differences in selection of habitat and structural stage.

Mule deer are associated with 40 KECs reflecting the many habitat elements used; the effect of exotic species on mule deer; their relationship with snow, free water and wetlands; and their interaction with anthropogenic habitat elements such as guzzlers, roads and supplemental food.

Mule deer perform 13 KEFs related to their consumption of many types of vegetation; their role as prey for a variety of predators; their creation of trails used by other species and their use of trails created by other species; and their effect on vegetation structure and composition through foraging. Mule deer are commonly considered "browsers" but they will consume a variety of plant materials and will graze heavily in some seasons (Verts and Carraway 1998). Winter is a critical period for mule deer survival. During this time they rely on new twigs of shrubs and trees, especially sagebrush, bitterbrush, rabbit brush, juniper and mountain mahogany (Verts and Carraway 1998). Mule deer, along with elk, are a primary prey species for cougars (*Puma concolor*) in northeast Oregon, as elsewhere (Nowak 1999). Mule deer, especially fawns, are also taken by black bears, coyotes and bobcats.

Habitat/Focal Species Interaction. Regarding the cause of the region-wide decline in abundance of mule deer, Connolly (1981:238) speculated that "every identified trend in land use and plant succession on the deer ranges is detrimental to deer." He believed that the quantity and quality of habitat were factors that limited the abundance of mule deer.

16 Shrub-steppe

Definition/Description:

Geographic Distribution. Shrub-steppe habitats are common across the Columbia Plateau of Washington, Oregon, Idaho, and adjacent Wyoming, Utah, and Nevada. It extends up into the cold, dry environments of surrounding mountains.

Physical Setting. Generally, this habitat is associated with dry, hot environments in the Pacific Northwest although variants are in cool, moist areas with some snow accumulation in climatically dry mountains. Elevation range is wide (300-9,000 ft [91-2,743 m]) with most habitat occurring between 2,000 and 6,000 ft (610-1,830 m). Habitat occurs on deep alluvial, loess, silty or sandy-silty soils, stony flats, ridges, mountain slopes, and slopes of lake beds with ash or pumice soils.

Composition. Characteristic and dominant mid-tall shrubs in the shrub-steppe habitat include all 3 subspecies of big sagebrush, basin (*Artemisia tridentata ssp. tridentata*), Wyoming (*A. t. ssp. wyomingensis*) or mountain (*A. t. ssp. vaseyana*), antelope bitterbrush (*Purshia tridentata*), and 2 shorter sagebrushes, silver (*A. cana*) and three-tip (*A. tripartita*). Each of these species can be the only shrub or appear in complex seral conditions with other shrubs. Common shrub complexes are bitterbrush and Wyoming big sagebrush, bitterbrush and three-tip sagebrush, Wyoming big sagebrush and three-tip sagebrush, and mountain big sagebrush and silver sagebrush. Wyoming and mountain big sagebrush can codominate areas with tobacco brush (*Ceanothus velutinus*). Rabbitbrush (*Chrysothamnus viscidiflorus*) and short-spine horsebrush (*Tetradymia spinosa*) are common associates and often dominate sites after disturbance. Big sagebrush occurs with the shorter stiff sagebrush (*A. rigida*) or low sagebrush (*A. arbuscula*) on shallow soils or high elevation sites. Many sandy areas are shrub-free or are open to patchy shrublands of bitterbrush and/or rabbitbrush. Silver sagebrush is the dominant and characteristic shrub along the edges of stream courses, moist meadows, and ponds. Silver sagebrush and rabbitbrush are associates in disturbed areas.

Status & trend: Big Sagebrush and Mountain Sagebrush cover types are significantly smaller in area than before 1900, and Bitterbrush/Bluebunch Wheatgrass cover type is similar to the pre-1900 extent. More than half of the Pacific Northwest shrub-steppe habitat community types listed in the National Vegetation Classification are considered imperiled or critically imperiled.

Key disturbance factors: Grazing, Invasion by non-natives, Conversion to agriculture; Shrub density and annual cover increase, whereas bunchgrass density decreases with livestock use. Repeated or intense disturbance, particularly on drier sites, leads to cheatgrass dominance and replacement of native bunchgrasses. Dry and sandy soils are sensitive to grazing, with needle-and-thread replaced by cheatgrass at most sites.

Species Closely Associated: Swainson's hawk, ferruginous hawk, sage grouse, long-billed curlew, burrowing owl, loggerhead shrike, vesper sparrow, sage sparrow, western meadowlark, western small-footed myotis, western pipistrelle, pallid bat, pygmy rabbit, Nuttall's cottontail, white-tailed antelope squirrel, deer mouse, bushy-tailed woodrat, sagebrush vole, pronghorn antelope.

17 Dwarf Shrub-steppe

Definition/Description:

Geographic Distribution. Dwarf-shrub and related scabland habitats are located throughout the Columbia Plateau and in adjacent woodland and forest habitats. Stiff sagebrush/Sandberg bluegrass is a major type widely distributed in the Columbia Basin, particularly associated with the channeled scablands, High Lava Plains, and in isolated spots throughout the Blue Mountains and the Palouse.

Physical Setting. This habitat appears on sites with little soil development that often have extensive areas of exposed rock, gravel, or compacted soil. The habitat is characteristically associated with flats, plateaus, or gentle slopes although steep slopes with rock outcrops are common. Scabland types within the shrub-steppe area occur on barren, usually fairly young basalts or shallow loam over basalt <12 inches (30 cm) deep. In woodland or forest mosaics, scabland soils are deeper (still <26 inches [65 cm]) but too droughty or extreme soils for tree growth. Topoedaphic drought is the major process influencing these communities on ridge tops and gentle slopes around ridgetops. Spring flooding is characteristic of scablands in concave topographic positions. This habitat is found across a wide range of elevations from 500 to 7,000 ft (152 to 2,134 m).

Composition. Several dwarf-shrub species characterize this habitat: low sagebrush (*Artemisia arbuscula*), black sagebrush (*A. nova*), stiff sagebrush (*A. rigida*), or several shrubby buckwheat species (*Eriogonum douglasii, E. sphaerocephalum, E. strictum, E. thymoides, E. niveum, E. compositum*). These dwarf-shrub species can be found as the sole shrub species or in combination with these or other low shrubs. Purple sage (*Saliva dorrii*) can dominate scablands on steep sites with rock outcrops.

Sandberg bluegrass (*Poa sandbergii*) is the characteristic and sometimes the dominant grass making up most of this habitat's sparse vegetative cover. Taller bluebunch wheatgrass (*Pseudoroegneria spicata*) or Idaho fescue (*Festuca idahoensis*) grasses may occur on the most productive sites with Sandberg bluegrass. Bottlebrush squirreltail (*Elymus elymoides*) and Thurber needlegrass (*Stipa thurberiana*) are typically found in low cover areas, although they can dominate some sites. One-spike oatgrass (*Danthonia unispicata*), prairie junegrass (*Koeleria macrantha*), and Henderson ricegrass *(Achnatherum hendersonii*) are occasionally important. Exotic annual grasses, commonly cheatgrass (*Bromus tectorum*), increase with heavy disturbance and can be locally abundant. Common forbs include serrate balsamroot (*Balsamorhiza serrata*), Oregon twinpod (*Physaria oregana*), Oregon bitterroot (*Lewisia rediviva*), big-head clover (*Trifolium macrocephalum*), and Rainier violet (*Viola trinervata*). Several other forbs *(Arenaria, Collomia, Erigeron, Lomatium,* and *Phlox* spp.) are characteristic, early blooming species. A diverse lichen and moss layer is a prominent component of these communities.
Medium-tall shrubs, such as big sagebrush (*Artemisia tridentata*), Silver sagebrush (*A. cana*), antelope bitterbrush (*Purshia tridentata*), and rabbitbrush (C*hrysothamnus* spp.)

Status & Trend: In the judgment of the subbasin Technical Team, this habitat is currently and was historically present as approximately 5-10% of the total area of shrub-steppe in the subbasin. Quigley and Arbelbide concluded that, region wide, the low sagebrush cover type is as abundant as it was before 1900. They concluded that "Low Sagebrush-Xeric" successional pathways have experienced a high level of change from exotic invasions and that some pathways of "Low Sagebrush-Mesic" are unaltered. Twenty percent of Pacific Northwest dwarf shrub-steppe community types listed in the National Vegetation Classification are considered imperiled or critically imperiled.

Key Disturbance Factors: Scabland habitats often do not have enough vegetation cover to support wildfires. Bunchgrass sites with black or low sagebrush may burn enough to damage shrubs and decrease shrub cover with repetitive burns. Many scabland sites have poorly drained soil and because of shallow soil are prone to winter flooding. Freezing of saturated soil results in "frost-heaving" that churns the soil and is a major disturbance factor in vegetation patterns. Stiff sagebrush is a preferred browse for elk as well as livestock. Native ungulates use scablands in early spring and contribute to churning of the soil surface. Scabland habitats provide little forage and consequently are used only as a final resort by livestock. Heavy use by livestock or vehicles disrupts the moss/lichen layer and increases exposed rock and bare ground that create habitat for exotic plant invasion. Exotic annual bromes have become part of these habitats with natural soil churning disturbance.

Species Closely Associated: sage grouse, long-billed curlew, vesper sparrow, western meadowlark, pallid bat, Nuttall's cottontail, deer mouse, bushy-tailed woodrat, sagebrush vole, kit fox, pronghorn antelope.

21 Open Water - Lakes, Rivers, and Streams

Definition/Description:

Geographical Distribution. Lakes in Oregon and Washington occur statewide and are found from near sea level to about 10,200 ft (3,110 m) above sea level. There are 6,000 lakes, ponds, and reservoirs in Oregon including almost 1,800 named lakes and over 3,800 named reservoirs, all amounting to 270,641 acres (109,571 ha).

Physical Setting. The lakes in the Cascades and Olympic ranges were formed through glaciation and range in elevation from 2,500 to 5,000 ft (762 to 1,524 m). Beavers create many ponds and marshes in Oregon and Washington. Craters created by extinct volcanoes, like Battleground Lake, Washington, also formed lakes. Human-made reservoirs created by dams impound water that creates lakes behind them, like Bonneville Dam on the main stem of the Columbia River. In the lower Columbia Basin, many lakes formed in depressions and rocky coulees through the process of seepage from irrigation waters.

Status & trend: The increasing trend in open water habitats has been in relationship to dam building or channelization for hydroelectric power, flood control, or irrigation purposes.

Key disturbance factors: Overgrazing, loss of vegetation (logging), channelization, eutrophication, irrigation withdrawal, over-appropriation.

Species Closely Associated: long-toed salamander, Great Basin spadefoot, western toad, Woodhouse's toad, Oregon spotted frog, Columbia spotted frog, northern leopard frog, painted turtle, western pond turtle, horned grebe, red-necked grebe, American white pelican, double-crested cormorant, great blue heron, snowy egret, Canada goose, Eurasian wigeon, redhead , greater scaup, harlequin duck, bufflehead, Barrow's goldeneye, osprey, bald eagle, mew gull, Vaux's swift, bank swallow, American dipper, western small-footed myotis, western pipistrelle, Townsend's big-eared bat, pallid bat, American beaver, mink.

Focal Species. The **bald eagle** has been selected as the focal species for this cover type. The Technical Team identified the bald eagle as epitomizing the interrelationship between aquatic and terrestrial habitats. The species is federally listed as *Threatened* and is listed as *Threatened* in Oregon. Bald eagles are a species that eats salmonids.

Bald eagles are associated with 19 of 26 forest and all 20 non-forest structural conditions although it is not identified as being "closely" associated with any of them (IBIS 2004). However, Buehler (2000:6) described nesting habitat as "mature and old-growth forest with some habitat edge, relatively close (<2 km) to water with suitable foraging opportunities." Further, preferred diurnal perch and nocturnal roost trees are super-canopy trees with easy access (Buehler 2000). Therefore, although bald eagles are generally associated with a variety of structural conditions, there is a preference for habitat that provides large or giant trees suitable for nesting, perching or roosting relatively close to foraging areas.

Bald eagles are associated with 70 KECs related to the diversity of structural conditions utilized, their relationship with fresh water riparian and aquatic and marine habitat elements, and their interaction with anthropogenic habitat elements (IBIS 2004). This species utilizes large trees and snags in both forest and non-forest contexts. They also utilize a variety of freshwater habitats, primarily for foraging, and a number of anthropogenic elements including power poles, mooring piles and hatchery facilities (IBIS 2004).

Bald eagles perform 8 KEFs related to their trophic and organismal relationships with other species (IBIS 2004). The species consumes a diversity of prey that varies by season and location. Although little is known of the food habits of nesting birds in Oregon (Isaacs and Anthony 2003a), several authors (cited in Isaacs and Anthony 2003a) recorded fish, waterfowl, seabirds, small mammals and carrion in the diets of bald eagles. The carrion included livestock that died of natural causes and the afterbirth of both sheep and cattle but no recorded cases of live-caught domestic stock were noted. In addition to utilizing available carrion, bald eagles pirate food from other species (IBIS 2004); they capture their own prey only as a last resort (Buehler 2000).

Bald eagles are among 3 Oregon Side LMS subbasin focal species and about 70 species in the subbasin overall with some relationship to salmonids (IBIS 2004). They have a "strong, consistent relationship," through consumption, with all saltwater life stages, freshwater spawning stage and carcasses (IBIS 2004). Bald eagles also have an "indirect relationship" to several fresh and saltwater life stages and carcasses (IBIS 2004). In the Pacific Northwest, including Oregon, salmon carcasses are scavenged as salmon die after spawning (Buehler 2000). However, due to timing of spawning runs in the northwest, salmon are less available to nesting eagles in Oregon and more available to wintering birds (Ofelt 1975).

Habitat/Focal Species Interaction. Bald eagles represent the interconnectedness of terrestrial and aquatic habitats in the Oregon Side LMS subbasin. They utilize large trees in wetland, riparian and upland situations for roosting, nesting and perching while requiring wetland and open water habitat for foraging. Bald eagles may be affected by impacts to any of these habitat types including loss of large trees, contamination by pesticides or other toxins, presence (and ingestion) of lead and other foreign substances and disturbance at nest and roost sites (Buehler 2000).

Wetlands – All three wetland habitat types in the subbasin; Herbaceous Wetlands, Montane Coniferous Wetlands and Eastside Riparian Wetlands; have been combined for discussion in subbasin planning. These habitats are being considered together due to their functional similarities and the similarity of management issues across the three types. All three have declined since before European settlement but the greatest losses have been to herbaceous and riparian wetland habitats due to their generally lower elevation, greater accessibility and location in areas desired for agricultural development, road building and other human activities. The three wetland habitat types are described below.

Focal Species. In spite of their functional and management similarities, wetlands have various structural, vegetative and hydrologic components. Therefore, to capture that variability, five focal species have been selected to represent wetland habitats in the Oregon Side LMS subbasin: great blue heron, yellow-breasted chat, ruffed grouse, Columbia spotted frog and American beaver.

The **great blue heron** (GBH) utilizes nearly every component of wetlands although they may be most dependent on the presence of large overstory structure for construction of communal nesting areas or rookeries. Great blue herons are a critical functional link species in the Oregon Side LMS subbasin and are a species that eats salmonids. Like bald eagles, great blue herons demonstrate the connectedness of aquatic and terrestrial habitats.

Great blue herons are generally associated with or present in 13 of 26 forest structural conditions. They are associated with 10 of 20 non-forest structural conditions, 6 for foraging only and 4 for foraging and reproduction if the necessary habitat elements are present (IBIS 2004). Average height of nest trees was 79 ft (24 m) and average dbh was 4.5 ft (1.36 m); herons nest in the top one-third of the nest tree (Henny and Bethers 1971).

Great blue herons are associated with 65 KECs related to their use of forest, shrubland, freshwater, marine and anthropogenic habitat elements (IBIS 2004). Short and Cooper (1985) provide criteria for suitable great blue heron foraging habitat. Suitable great blue heron foraging habitats are within 1.0 km of heronries or potential heronries. The suitability of herbaceous wetland, scrub-shrub wetland, forested wetland, riverine, lacustrine or estuarine habitats as foraging areas for the great blue heron is ideal if these potential foraging habitats have shallow, clear water with a firm substrate and a huntable population of small fish. Short and Cooper (1985) describe suitable great blue heron nesting habitat as a grove of trees at least 0.4 ha in area located over water or within 250m of water. These potential nest sites may be on an island with a river or lake, within a woodland dominated swamp, or in vegetation near a river or lake. Trees used as nest sites are at least 5m high and have many branches at least 2.5 cm in diameter that are capable of supporting nests. Trees may be alive or dead but must have an "open canopy" that allows an easy access to the nest.

Great blue herons perform 11 KEFs involving their trophic and organismal relationships with other species and the physical transfer of nutrients (IBIS 2004). They consume a variety of prey including terrestrial and aquatic invertebrates and terrestrial and aquatic vertebrates. GBHs also create opportunities for feeding, nesting, roosting or denning for other species through their foraging and nest building activities (IBIS 2004).

Great blue herons have a "recurrent" relationship with salmonids at various life stages in both fresh- and saltwater environments (IBIS 2004). Although herons feed on a variety of animals, fish, including salmonids, are the primary prey.

Habitat/Focal Species Interaction. Habitat destruction and the resulting loss of nesting and foraging sites, and human disturbance probably have been the most important factors contributing to declines in some great blue heron populations in recent years (Thompson 1979a; Kelsall and Simpson 1980; McCrimmon 1981). Poor water quality reduces the amount of large fish and invertebrate species available in wetland areas. Toxic chemicals from runoff and industrial discharges pose yet another threat. Although great blue herons currently appear to tolerate low levels of pollutants, these chemicals can move through the food chain, accumulate in the tissues of prey and may eventually cause reproductive failure in the herons.

Great blue herons live at the interface of aquatic and terrestrial habitats; their nesting colonies are in trees and shrubs in upland or riparian areas and foraging takes place in shallow open water and wetland communities and in upland fields. Herons feed on both terrestrial and aquatic prey.

The **yellow-breasted chat** is closely associated with wetland habitats. It is designated *Sensitive – Critical* in Oregon and is a Partners in Flight species.

Yellow-breasted chats are associated with 5 of 26 forest and 6 of 20 non-forest structural conditions (IBIS 2004). Of the forest conditions, they are closely associated with open canopy stands of shrub/seedling and sapling pole size. Of the non-forest conditions, they are closely associated with both open and closed shrub overstory stands of both mature and old tall shrubs.

This species is associated with 15 KECs including forest, shrubland and grassland habitat elements such as shrub layer and size; ecological habitat elements such as exotic animals; freshwater wetland habitats; and anthropogenic habitat elements such as hedgerows and windbreaks (IBIS 2004). The relatively low number of KECs is indicative of the species' vulnerability to habitat loss and/or degradation..

Yellow-breasted chats perform 4 KEFs related to consumption of invertebrates, dispersal of seeds or fruits and serving as prey for primary or secondary predators. This species consumes mostly invertebrates although little is known of seasonal differences in diet. Wild fruits such as strawberry, blueberry, blackberry and elderberry are also important foods for the yellow-breasted chat (Eckerle and Thompson 2001). Eggs and nestlings are taken by a variety of avian and mammalian predators.

The **Columbia spotted frog** is closely associated with herbaceous and riparian wetlands in the Oregon Side LMS subbasin and here represents the herbaceous component of wetlands. It is a federal *Candidate* for listing, is designated *Sensitive – Unclear Status* in Oregon and is a *Candidate* for listing in Washington.

Columbia spotted frogs are associated with all 26 forest and 14 of 20 non-forest structural conditions although none of these are "close" associations. The only structural conditions with which spotted frogs are not associated are the "low shrub" types, those habitats dominated by shrubs < 1.6 ft tall (IBIS 2004). With the exception of apparently little use or avoidance of low shrub communities, spotted frogs could be considered structural condition generalists.

Columbia spotted frogs are associated with 32 KECs including the influence of exotic species, their use of numerous freshwater riparian and aquatic habitat elements and the effects of anthropogenic habitat elements. The bull frog (*Rana catesbeiana*), a nonnative ranid species, occurs within the range of the spotted frog in the Great Basin. Bullfrogs are known to prey on other frogs (Hayes and Jennings 1986). They are rarely found to co-occur with spotted frogs, but whether this is an artifact of competitive exclusion is unknown at this time (USFWS 2002c). Columbia spotted frogs are found in a variety of freshwater habitats including rivers and streams, oxbows, ephemeral pools, lakes, ponds, reservoirs and wetlands.

This species performs 6 KEFs related to their consumption of aquatic vegetation, terrestrial invertebrates and aquatic macroinvertebrates; their role as prey for primary or secondary predators and the transfer of nutrients. In a study by Whitaker et al. (1982) in Grant County, OR (Blue Mountains) Columbia spotted frogs ate a wide variety of food items covering 98 food categories. Seventy-three categories consisted of insect materials, which represented 90.7% of the food by volume. Other invertebrates formed seven categories, and plant material formed three categories, representing 3.9% of the total volume. Frogs from the four variously managed sites displayed different dietary habits, indicating that land management practices may have caused changes in the abundance or composition of local insect populations.

Habitat/Focal Species Interaction: Spotted frog habitat degradation and fragmentation is probably a combined result of past and current influences of heavy livestock grazing, spring development, agricultural development, urbanization, and mining activities. These activities eliminate vegetation necessary to protect frogs from predators and UV-B radiation; reduce soil moisture; create undesirable changes in water temperature, chemistry and water availability; and can cause restructuring of habitat zones through trampling, rechanneling, or degradation which in turn can negatively affect the available invertebrate food source (IDFG et al. 1995; Munger et al. 1997; Reaser 1997; Engle and Munger 2000; Engle 2002).

Springs provide a stable, permanent source of water for frog breeding, feeding, and winter refugia (IDFG et al. 1995). Springs provide deep, protected areas which serve as hibernacula for spotted frogs in cold climates. Springs also provide protection from predation through underground openings (IDFG et al. 1995; Patla and Peterson 1996). Most spring developments result in the installation of a pipe or box to fully capture the water source and direct water to another location such as a livestock watering trough.

The reduction of beaver populations has been noted as an important feature in the reduction of suitable habitat for spotted frogs. Beaver are important in the creation of small pools with slow-moving water that function as habitat for frog reproduction and create wet meadows that provide foraging habitat and protective vegetation cover, especially in the dry interior western United States (St. John 1994).

The **American beaver** is closely associated with herbaceous and riparian wetlands as well as open water and here represents a link between these habitats. It is a critical functional link species and a furbearer managed by the Oregon Department of Fish and Wildlife. Like bald eagles and great blue herons, American beavers demonstrate the interconnectedness between aquatic and terrestrial habitats

Beavers are associated with 25 of 26 forest and 18 of 20 non-forest structural conditions (IBIS 2004). Most of these are "general" associations with the exception of "giant tree-multi-story," "grass/forb-closed" and "grass/forb-open" among the forest structural conditions. They are noted as simply "present" in those classifications. The only IBIS structural conditions with which beavers are not associated are "medium tree multi-story-moderate" of the forest and both "grass/forb-open" and grass/forb-closed" of the non-forest structural conditions. That beavers are generally associated with a variety of structural conditions, indicates they are not particularly dependent on any of them; as long as there is a zone of woody vegetation adjacent to their freshwater habitat, the structural condition of that zone is not critical to their success.

American beavers are associated with 61 KECs related to their use of forest, shrubland and grassland habitat elements; freshwater riparian and aquatic habitat elements and anthropogenic habitat elements (IBIS 2004). The relatively large number of KECs is indicative of the species' adaptability.

Beavers perform 14 KEFs related to their consumption of vegetation and the changes they cause in the environment through creation of snags, impoundment of water and burrowing in the soil. By building dams and impounding water, beavers create wetland habitats. As noted above, the reduction of beaver populations has been noted as an important feature in the reduction of suitable habitat for spotted frogs. Beaver are important in the creation of small pools with slow-moving water that function as habitat for frog reproduction and create wet meadows that provide foraging habitat and protective vegetation cover, especially in the dry interior western United States (St. John 1994). Many other wetland species use habitats created by beavers.

Habitat/Focal Species Interaction. American beavers manipulate the environment by damming streams, usually relatively low elevation, low gradient ones. This activity begins habitat succession from open water ponds to emergent wetlands to wet meadows over time and creates a variety of habitats for other species. This same activity puts beavers into conflict with humans as their preferred lower elevation streams tend to be in areas also preferred by people for agriculture or other development. Additionally, those "streams" may often be ditches or culverts. When beavers come into conflict with humans, their dams may be destroyed and the animals may be trapped and removed.

The **ruffed grouse** is thought to be an indicator of riparian condition (G. Keister, ODFW, personal communication) and was selected as focal species for riparian habitats.

Ruffed grouse are associated with 24 of 26 forest and 6 of 20 non-forest structural conditions (IBIS 2004). Of the forest structural conditions, the closest associations are with small to medium trees while in the non-forest types the associations are with tall shrub types. From a habitat perspective, tall shrubs may mimic small trees in both security and thermal cover. This species is closely associated with dense deciduous or deciduous/evergreen forest, represented by stands containing alders, quaking aspens, hawthorns and other small trees and shrubs in eastern Oregon (Durbin 1979). Dense conditions favored by ruffed grouse are characteristic of riparian zones and young, regenerating forest stands (Pelren 2003).

Ruffed grouse are associated with 49 KECs involving their use of forest, shrubland and grassland habitat elements including trees, snags, shrubs and forbs and interaction with exotic species, abiotic habitat elements, freshwater habitat elements and fire as a habitat element (IBIS 2004). Ruffed grouse utilize areas of deciduous cover extensively for feeding, roosting, and nesting. Conifers are used for winter roosting. Males conduct courtship drumming displays from a log on the ground and down wood is also use for security cover and for nesting.

This species performs 9 KEFs related to their consumption of leaves, flowers, buds and invertebrates as well as their role as prey for primary or secondary predators (IBIS 2004). Grouse are omnivorous and will consume leaves, buds and flowers of grasses and forbs, invertebrates, and fruits and berries, when available (Durbin 1979). In winter, the diet becomes more specialized including buds and seeds of deciduous trees. The buds and catkins of aspen are an especially important winter food source in much of the species' range (Pelren 2003). Ruffed grouse eggs are taken by a variety of mustelids including weasels, minks, skunks and fishers as well as foxes, raccoons, other mammals, birds and snakes. Chicks and adult birds are taken by those same predators as well as coyotes, bobcats, lynx, hawks and owls (Rusch et al. 2000).

Habitat/Focal Species Interaction. Ruffed grouse are dependent on small deciduous trees and large shrubs for both food and cover. In the winter, they require conifer trees for thermal cover. Thus, a healthy, deciduous, riparian zone adjacent to conifer forest provides preferred habitat for this species. Timber harvest can actually help improve ruffed grouse habitat by creating a mosaic of young timber stands favorable for the species (Pelren 2003). In the relatively dry Blue and Wallowa Mountains, streamside buffer zones facilitate dense stands of hawthorn and other food-producing shrubs ideals for the species (Pelren 2003).

22 Herbaceous Wetlands

Definition/Description:

Geographic Distribution. Herbaceous wetlands are found throughout the world and are represented in Oregon and Washington wherever local hydrologic conditions promote their development. This habitat includes all those except bogs and those within Subalpine Parkland and Alpine. Sedge meadows and montane meadows are common in the Blue and Ochoco mountains of central and northeastern Oregon, and in the valleys of the Olympic and Cascade mountains and Okanogan Highlands.

Physical Setting. This habitat is found on permanently flooded sites that are usually associated with oxbow lakes, dune lakes, or potholes. Seasonally to semi-permanently flooded wetlands are found where standing freshwater is present through part of the growing season and the soils stay saturated throughout the season. Some sites are temporarily to seasonally flooded meadows and generally occur on clay, pluvial, or alluvial deposits within montane meadows, or along stream channels in shrubland or woodland riparian vegetation. In general, this habitat is flat, usually with stream or river channels or open water present. Elevation varies between sea level to 10,000 ft (3,048 m), although infrequently above 6,000 ft (1,830 m).

Composition. Various grasses or grass-like plants dominate or co-dominate these habitats. Cattails (*Typha latifolia*) occur widely, sometimes adjacent to open water with aquatic bed plants. Several bulrush species (*Scirpus acutus, S. tabernaemontani, S. maritimus, S. americanus, S. nevadensis)* occur in nearly pure stands or in mosaics with cattails or sedges (*Carex spp.).* Burreed *(Sparganium angustifolium , S. eurycarpum*) are the most important graminoids in areas with up to 3.3 ft (1m) of deep standing water. A variety of sedges characterize this habitat. Some sedges (*Carex aquatilis, C. lasiocarpa, C. scopulorum, C. simulata, C. utriculata, C. vesicaria*) tend to occur in cold to cool environments. Other sedges (*C. aquatilis var. dives, C. angustata, C. interior, C. microptera, C. nebrascensis*) tend to be at lower elevations in milder or warmer environments. Slough sedge (*C. obnupta*), and several rush species (*Juncus falcatus, J. effusus, J. balticus*) are characteristic of coastal dune wetlands that are included in this habitat. Several spike rush species (*Eleocharis spp.)* and rush species can be important. Common grasses that can be local dominants and indicators of this habitat are American sloughgrass (*Beckmannia syzigachne*), bluejoint reedgrass (*Calamagrostis canadensis*), mannagrass (*Glyceria spp*.) and tufted hairgrass (*Deschampsia caespitosa*). Important introduced grasses that increase and can dominate with disturbance in this wetland habitat include reed canary grass (*Phalaris arundinacea*), tall fescue (*Festuca arundinacea*) and Kentucky bluegrass *(Poa pratensis*).

Oregon Side LMS Historic acreage: None
Oregon Side LMS Current acreage: 37,472
Increased acreage: 37.472

Status & trend: Nationally, herbaceous wetlands have declined and the Pacific Northwest is no exception. A keystone species, the beaver, has been trapped to near extirpation in parts of the Pacific Northwest and its population has been regulated in others. Herbaceous wetlands have decreased along with the diminished influence of beavers on the landscape. Quigley and Arbelbide concluded that herbaceous wetlands are susceptible to exotic, noxious plant invasions.

Key disturbance factors: Direct alteration of hydrology (i.e., channeling, draining, damming) or indirect alteration (i.e., roading or removing vegetation on adjacent slopes) results in changes in amount and pattern of herbaceous wetland habitat. This habitat is maintained through a variety of hydrologic regimes that limit or exclude invasion by large woody plants. Beavers play an important role in creating ponds and other impoundments in this habitat.

Species Closely Associated: long-toed salamander, Great Basin spadefoot, western toad, Woodhouse's toad, Oregon spotted frog, Columbia spotted frog, northern leopard frog, painted turtle, western pond turtle, horned grebe, red-necked grebe, great blue heron, snowy egret, Canada Goose, redhead, bufflehead, sandhill crane, Franklin's gull, black tern* pallid bat, American beaver, deer mouse, montane vole, raccoon, mink.

24 Montane Coniferous Wetlands

Definition/Description:

Geographic Distribution. This habitat occurs in mountains throughout much of Washington and Oregon. This includes the Cascade Range, Olympic Mountains, Okanogan Highlands, Blue and Wallowa mountains.

Physical Setting. This habitat is typified as forested wetlands or floodplains with a persistent winter snow pack, ranging from moderately to very deep. The climate varies from moderately cool and wet to moderately dry and very cold. Mean annual precipitation ranges from about 35 to >200 inches (89 to >508 cm). Elevation is mid- to upper montane, as low as 2,000 ft (610 m) in northern Washington, to as high as 9,500 ft (2,896 m) in eastern Oregon. Topography is generally mountainous and includes everything from steep mountain slopes to nearly flat valley bottoms. Gleyed or mottled mineral soils, organic soils, or alluvial soils are typical. Subsurface water flow within the rooting zone is common on slopes with impermeable soil layers. Flooding regimes include saturated, seasonally flooded, and temporarily flooded. Seeps and springs are common in this habitat.

Composition. Indicator tree species for this habitat, any of which can be dominant or co-dominant, are Engelmann spruce (*Picea engelmannii*), subalpine fir (*Abies lasiocarpa*), lodgepole pine (*Pinus contorta*), western hemlock (*T. heterophylla*), or western redcedar (*Thuja plicata*) on the eastside. Lodgepole pine is prevalent only in wetlands of eastern Oregon. Douglas-fir (*Pseudotsuga menziesii*) and grand fir (*Abies grandis*) are sometimes prominent on the eastside. Quaking aspen *(Populus tremuloides*) and black cottonwood (*P. balsamifera ssp. trichocarpa*) are in certain instances important to co-dominant, mainly on the eastside.

Dominant or co-dominant shrubs include swamp gooseberry (R. lacustre), red-osier dogwood (*Cornus sericea*), Douglas' spirea (*Spirea douglasii*), common snowberry (*Symphoricarpos albus*), mountain alder (*Alnus incana*), Sitka alder (*Alnus viridis ssp. sinuata*). The dwarf shrub bog blueberry (*Vaccinium uliginosum*) is an occasional understory dominant. Shrubs more typical of adjacent uplands are sometimes co-dominant, especially big huckleberry (*V. membranaceum*), oval-leaf huckleberry (*V. ovalifolium*), grouseberry (*V. scoparium*), and fools huckleberry (*Menziesia ferruginea*).

Oregon Side LMS Historic acreage: None

Oregon Side LMS Current acreage: 1,066

Increased acreage: 1,066

Status & trend: This habitat is naturally limited in its extent and has probably declined little in area over time. This type is probably relatively stable in extent and condition, although it may be locally declining in condition because of logging and road building. Five of 32 plant associations representing this habitat listed in the National Vegetation Classification are considered imperiled or critically imperiled.

Key disturbance factors: Roads, logging, insects, fungi.

Species Closely Associated: long-toed salamander, tailed frog*, western toad, bufflehead, big brown bat, snowshoe hare, deer mouse.

3.4.3 Interspecies Relationships

3.4.3.1 Identification of Fish Interspecies Relationships

The range of relationships among aquatic wildlife includes predation, competition, displacement and others. Many relationships among the species of the subbasin are subtle and may not be visible to the casual observer. Nevertheless, the stability of aquatic ecosystems rests on these relationships. The loss of anadromous fish in the subbasin has disrupted many of the interspecies relationships by removing some of the "players." This disruption may have had undocumented and poorly understood effects on the remaining aquatic species of the subbasin.

3.4.3.2 Identification of Wildlife Interspecies Relationships

The range of interspecies relationships among terrestrial wildlife includes predation, competition, displacement, creation and use of physical structures and others. Many of the relationships among the species of the subbasin are subtle and may not be visible to the casual observer. The terrestrial focal species considered in this plan have been selected by habitat type; those that utilize habitats widely separated geographically, climatically and/or vegetatively are less likely to interact than those that occupy the same or similar habitats. Of the focal species utilizing similar habitats, American beavers create and manipulate wetland habitats by impounding water in streams and ditches. This activity creates habitat used by Columbia spotted frogs, great blue heron, yellow warbler and many other species. Columbia spotted frogs may serve as prey for great blue herons and great blue herons (particularly the young) may be preyed upon by bald eagles.

3.4.3.3 Identification of Key Relationships between Fish and Wildlife

As with the relationships between wildlife species, there is a wide range of relationships between fish and terrestrial wildlife. The most obvious type of relationship is trophic including consumption of fish by bald eagles and great blue herons, consumption of fish carcasses by bald eagles and American martens and consumption of Columbia spotted frogs and their eggs by fish. Carcasses of spawned-out anadromous fish also contribute natural, marine nutrients to the terrestrial ecosystem (see section 3.3, *Out of Subbasin Effects*). In addition to trophic relationships, yellow-breasted chat and other riparian habitat species dislodge invertebrates from streamside shrubs and trees making them available to aquatic predators, and beavers create wetland and backwater habitats that produce vegetation and invertebrates for consumption by fish and provide security areas for rearing young fish. Further, wildlife use of riparian areas affects bank structure and water quality.

3.5 Identification and Analysis of Limiting Factors/Conditions

3.5.1. Description of Historic Factors Leading to Decline of Focal Species/Ecological Function-Process – Aquatic

3.5.1.1 Key Factors Inhibiting Populations and Ecological Processes

Through the QHA analysis described in Section 3.2.3.5 (Page 55), five of eleven habitat factors were identified as limiting the survival and productivity of fish, specifically bull trout and redband trout, in the Oregon Side LMS subbasin. These factors are:

- ➲ Channel Stability

- Habitat Diversity
- Fine Sediment
- Low Flow
- High Temperature

Some reaches are in poor condition relative to all these attributes (e.g., Pine Creek 1), while others may suffer impairment of one or two attributes but be satisfactory in others (e.g., Sag Creek 1). Many of the above limiting factors are interdependent; projects that address one may result in improvements to another. For example, high temperature, and its impact on fish, is affected by low flow, habitat diversity, obstructions and riparian condition. Channel stability is interactive with riparian condition, habitat diversity and high flow. Fine sediment may be partly a result of channel stability, riparian condition and habitat diversity. Thus, the factors limiting fish populations in the subbasin should not be viewed as independent issues but as an interdependent and interactive continuum of habitat conditions.

3.5.1.2 Key Factors for all Life Stages

The subbasin Technical Team felt that spawning and incubation was the most important life stage to the survival of all focal species in the subbasin. The factors most critical to that life stage of redband trout were fine sediment, oxygen, low temperature and pollutants. Of these, only fine sediment was found to be limiting. For bull trout, those same factors plus riparian condition and high flow were considered critical to the life stage. In the reaches where bull trout are currently found, these habitat attributes are generally satisfactory.

Summer rearing was thought to be the second most important life stage to redband and bull trout survival and third in importance to steelhead and salmon. The habitat factors critical to this life stage were riparian condition, channel stability, habitat diversity, low flow, oxygen, high temperature and pollutants. Of these, 3 were found to be limiting.

Migration was the second most important life stage for steelhead and Chinook salmon. Barriers to migration are the reason these species have been extirpated from the subbasin. Few physical barriers exist within the subbasin so this attribute would likely not be limiting if anadromous fish were reintroduced to the subbasin.

Winter rearing was the life stage ranked third in importance to the survival of redband and bull trout and least important for salmon and steelhead in the subbasin . The critical factors for redband trout and steelhead in this life stage were channel stability, habitat diversity, fine sediment, high flow, oxygen and pollutants. For bull trout and Chinook, the critical factors were all those listed for redband and steelhead plus low temperature.

Migration was the life stage thought least important to redband and bull trout in the subbasin. The factors critical to redband trout at this life stage were high flow, oxygen, pollutants and obstructions. In addition to those mentioned for redband trout, low flow is critical to bull trout. Of these, only low flow was found to be limiting.

3.5.1.3 Determine Key Disturbance Factors inside the Subbasin Limiting Populations

See above

3.5.1.4 Determine Key Disturbance Factors outside the Subbasin Limiting Populations

See Section 3.3 *Out of Subbasin Effects* (Page 93)

3.5.1.5 Identify where Human Intervention can or can not have Beneficial Effects

Human intervention can have beneficial effects in improving most of the limiting factors described above, within the limitations of social and economic will to effect that intervention. For example, while it is unlikely that irrigation diversions and/or withdrawals will be curtailed in favor of in-stream flows and at the expense of a large portion of the economy of the area, efforts to increase efficiency of diversions and irrigation systems, may have beneficial effects by increasing summer flows. Restoration of riparian areas through planting of native woody vegetation may, over time, have beneficial effects to channel stability, high temperature and habitat diversity. Much of the lower portion of the Pine Creek subbasin is private land; any habitat interventions considered there must be culturally, socially and economically feasible for landowners or they are unlikely to gain acceptance.

3.5.2. Description of Historic Factors Leading to Decline of Focal Species/Ecological Function-Process – Terrestrial

3.5.2.1 Key Factors Inhibiting Populations and Ecological Processes

The subbasin Terrestrial Technical Team identified 9 categories of factors limiting distribution and productivity of focal species: Habitat loss and/or degradation, habitat fragmentation, predation and/or competition by non-native species, disease transmission by non-native species, water quality, grazing, human activity/disturbance, reduced food base, potential for overharvest. These limiting factors are discussed in individual focal species accounts and are summarized here.

Habitat loss and or degradation is the most commonly noted factor limiting distribution and productivity of focal species in the subbasin and it applies to a number of habitat types or structural stages within habitat types.

- Wetlands: The Oregon Side LMS subbasin has seen substantial reductions in wetland habitats due to draining, diking and ditching for agricultural and residential development and flood control.
- Riparian – Large Trees: Large riparian trees, mostly cottonwood and willow, have been lost to agricultural development, road building and other activities. Further, where large trees remain to grow old and fall, grazing prevents their replacement from the understory.
- Riparian – sub-canopy: The sub-canopy layer of shrubs and young trees in riparian zones have often been lost along with large trees to agricultural development, grazing, road building and other activities.
- Ponderosa pine forest – especially late and old structure (LOS): Ponderosa pine stands have been reduced by a variety of means. Fire suppression and changes in fire regime have allowed encroachment of less fire resistant species such as Douglas-fir and conversion of stands to Interior Mixed Conifer. Timber harvest has reduced the amount of old-growth forest and associated large diameter trees and snags. In lower elevation areas, agricultural and residential development has contributed to loss and degradation of properly functioning ecosystems.
- Mixed Conifer forest – early post-fire structural stage: Fire suppression has reduced availability of this successional stage and reduced habitat diversity in mixed conifer forests.
- Mixed conifer forest – late and old structure: Timber harvest and stand-replacement fires have reduced old growth and associated large trees and structural diversity.
- Shrub-steppe: Development for agricultural and residential use as well as road construction have contributed to destruction and fragmentation of this habitat. Range

improvement programs change the species composition of the vegetation communities, often degrading habitat values.

Predation and/or competition by non-native species can be an issue for many of the terrestrial species in the subbasin. Among the subbasin's focal species, this is exemplified by the Columbia spotted frog and the potential negative effects of non-native fishes and bullfrogs.

Water quality is noted as a limiting factor for great blue herons and Columbia spotted frogs although water quality would presumably have an impact on virtually every species using a given body of water.

Quaking aspen and curlleaf mountain mahogany are both limited by lack of recruitment due to grazing by both domestic and wild ungulates.

Human activity can have a limiting effect on species when important sites such as nest and roost sites are disturbed (e.g., bald eagle and great blue heron).

Use of pesticides may reduce the food base of insect-eating species such as olive-sided flycatcher.

While not currently identified as a problem in the subbasin, overharvest of managed species such as beaver and American marten could limit population growth. Carefully managed harvest seasons, low pelt prices and fewer trappers currently prevent overharvest.

3.5.2.2 Key Disturbance Factors inside the Subbasin Limiting Populations

Summarized above.

3.5.2.3 Key Disturbance Factors outside the Subbasin Limiting Populations

See Section 3.3 *Out of Subbasin Effects.*

3.5.2.4 Opportunities for Human Intervention to Have/not have a Beneficial Effect

Human intervention can have a beneficial effect through protection, restoration and enhancement of threatened and/or declining habitats such as old-growth ponderosa pine, wetlands and shrub-steppe. Beneficial effects can be realized with the use of adaptive management techniques that utilize monitoring to evaluate the effectiveness of management actions and allow for timely response when actions are deemed ineffective or worse, causing adverse effects.

3.5.2.5 Conditions that can be Corrected by Human Intervention

Loss of wetland habitats can be corrected through wetland restoration and enhancement. Shrub-steppe can be restored through control of exotic vegetation and grazing management. Loss of structural diversity in forested habitats can be corrected through management that leaves larger trees and snags and allows for a more natural mosaic of structural conditions.

3.6 Synthesis/Interpretation

3.6.1. Subbasin-wide Working Hypothesis – Aquatic

Of the eleven habitat attributes considered in this analysis the following factors are the most limiting:

<u>Channel Stability:</u> Channel stability (the condition of the channel in regard to its ability to move laterally and vertically and to form a "normal" sequence of stream unit types) is a primary determinant of the success of redband trout. Classification of channels allows a mechanism to adequately capture the expected condition of the channel with respect to habitat quality, and can be used to evaluate the potential of a given stream reach. Caveats to this hypothesis are that 1) a

systematic subbasin-wide understanding of reference and current channel types does not currently exist, but could be assembled using existing methodologies (e.g., Rosgen, 1996; OWEB, 1999); 2) local metrics describing the range of appropriate habitat characteristics by channel type does not currently exist, but could be assembled from existing data and expertise; and 3) in evaluating the current health of the channel system we must consider variability due to stochastic disturbance events. A final hypothesis is that the management-related activities that have contributed to currently degraded channel conditions can be reversed with limited impacts to the social and economic fabric of local communities.

Low flows: Unlike the previous two biological objectives, which can be achieved with little impact to the economy of the local area, addressing the limiting factors that result from low-flows is more problematic. However, efforts to increase the efficiency of diversion and irrigation systems, coupled with restoration of riparian areas and removal of physical barriers may result in substantial benefits to the aquatic community.

High Temperature: High temperature is a significant limiting factor for the summer rearing period/life stage in most reaches of the subbasin. Restoration efforts that address low flow, riparian condition, habitat diversity and passage barriers will help reduce high water temperatures and/or provide opportunities for fish to escape to cooler refugia during periods of high water temperature.

Fine Sediment: Spawning and incubation was identified as the most important life stage to the persistence of focal species in the subbasin and fine sediment was identified as the factor most limiting to that life stage. Sediment load comes from a variety of sources and must, therefore, be addressed in a number of ways. Restoration to improve channel stability, riparian condition and low flows will all help to decrease fine sediment in the system.

Habitat Diversity: Like fine sediment, habitat diversity is affected by a number of the other habitat attributes and can be addressed directly through recreation of stream channels to imitate the natural diversity or by addressing other habitat factors and gaining habitat diversity as an additional benefit. Restoration of the riparian vegetation will, over time, result in large wood in the stream while addressing channel stability will result in a healthier, more diverse channel.

3.6.2. Terrestrial Assessment Synthesis

Wildlife Habitat Type: Combined High-Elevation Conifer Forest
Focal Species: Olive-sided Flycatcher, American Marten

Habitat Status/Change:

These combined habitats have changed little in extent compared with the historic condition.

Factors Affecting Habitats and Focal Species:

- Fire suppression has changed the structural condition and increased fuel load, causing lower frequency, higher intensity, often stand replacing fires.
- Timber harvesting has focused on large, shade intolerant species in mid- to late-seral forests resulting in stands composed of smaller, shade tolerant trees.
- Fire suppression has reduced availability of early post-fire habitats and the mosaic of seral and edge habitat.

- Extensive logging and wildfires alter the structural composition of forests making them less suitable for martens and other species requiring large, old stand structure.

High-Elevation Conifer Forest Working Hypothesis:
Factors affecting this habitat type involve changes in structural and seral diversity due primarily to timber harvesting, fire suppression and wildfires. Overall, the quantity of this habitat type has increased although the quality has deteriorated in local areas. Loss of diversity has resulted in relatively small, isolated pockets of habitat for specialist species which require specific structural or seral stages of conifer forest habitat.

Recommended Range of Management Conditions:
Late-successional mixed conifer forest: The American marten represents species that prefer/require late-successional conifer forest with complex physical structure near the ground and with large standing snags and stumps.
Early post-fire mixed conifer forest: Olive-sided flycatchers represent wildlife species that require forest openings and edge habitat, especially early post-fire habitats. Forest management practices, such as timber harvest, once thought to mimic natural disturbance may be detrimental to species such as the olive-sided flycatcher.

Management Strategies:

- Protect extant habitat in good condition through easements and acquisitions; protect poor quality habitat and/or lands with habitat potential adjacent to existing protected lands (avoid isolated parcels/wildlife population sinks).
- Fund and coordinate weed control efforts on both public and private lands.
- Coordinate with public and private land managers on the use of prescribed fire and stand management practices.
- Restore forest function by providing key environmental correlates through prescribed burns and silvicultural practices.
- Identify and protect wildlife habitat corridors/links.

Data Gaps and M&E Needs:

- Habitat quality data; assessment data bases do not address habitat quality.
- Finer resolution habitat maps which show location and extent of high-elevation conifer forests.
- Finer resolution GIS habitat type maps that include structural component and KEC data.
- GIS soils products.
- Significant lack of local population/distribution data for American marten and olive-sided flycatcher
- Current mixed conifer and lodgepole pine structural condition/habitat data.

Wildlife Habitat Type: Eastside (Interior) Mixed Conifer Forest
Focal Species: Blue Grouse

Habitat Status/Change:

This habitat has increased due to encroachment into ponderosa pine zones.

Factors Affecting Habitats and Focal Species:

- Fire suppression has changed the structural condition and increased fuel load, causing lower frequency, higher intensity, often stand replacing fires.
- Fire suppression in lower elevation ponderosa pine forest has allowed encroachment of less fire-tolerant conifers into those habitats, thereby increasing the range of mixed conifer stands.
- Timber harvesting has focused on large, shade intolerant species in mid- to late-seral forests resulting in stands composed of smaller, shade tolerant trees.
- Fire suppression has reduced availability of early post-fire habitats and the mosaic of seral and edge habitat.
- Extensive logging and wildfires alter the structural composition of forests.

Eastside (Interior) Mixed Conifer Forest Working Hypothesis:
Factors affecting this habitat type involve changes in structural and seral diversity due primarily to timber harvesting, fire suppression and wildfires. Overall, the quantity of this habitat type has increased due to conversion of former ponderosa pine stands to mixed conifer types. Loss of diversity has resulted in relatively small, isolated pockets of habitat for specialist species which require specific structural or seral stages of conifer forest habitat.

Recommended Range of Management Conditions:
The blue grouse represents species which prefer late successional mixed conifer forest in a range of open to closed canopy conditions.

Management Strategies:

- Protect extant habitat in good condition through easements and acquisitions; protect poor quality habitat and/or lands with habitat potential adjacent to existing protected lands (avoid isolated parcels/wildlife population sinks).
- Fund and coordinate weed control efforts on both public and private lands.
- Coordinate with public and private land managers on the use of prescribed fire and stand management practices.
- Restore forest function by providing key environmental correlates through prescribed burns and silvicultural practices.
- Identify and protect wildlife habitat corridors/links.

Data Gaps and M&E Needs:

- Habitat quality data; assessment data bases do not address habitat quality.
- Finer resolution habitat maps which show location and extent of mixed conifer forest.
- Finer resolution GIS habitat type maps that include structural component and KEC data.
- GIS soils products.
- Current mixed conifer structural condition/habitat data.

Wildlife Habitat Type: Ponderosa Pine Forest and Woodlands
Focal Species: White-headed Woodpecker

Habitat Status/Change:

This habitat has declined due to encroachment of other conifer species.

Factors Affecting Habitats and Focal Species:

- Species and size-selective timber harvesting has reduced the amount of old growth and associated large diameter trees and snags.
- Fire suppression has favored less fire-tolerant species and allowed conversion of ponderosa pine habitat to mixed conifer.
- Agricultural development has contributed to loss and degradation of properly functioning ecosystems.
- Fire suppression has contributed to habitat degradation, especially declines in understory shrubs and forbs due to increased density of small shade-tolerant trees. High risk of loss of remaining ponderosa pine overstories from stand-replacement fires due to high fuel loads in densely stocked understories.
- Invasion of exotic plants has altered understory conditions and increased fuel loads.
- Overgrazing has resulted in reduced recruitment of sapling trees, especially pines.
- Fragmentation of remaining tracts has had a negative effect on species with large area requirements.
- Hostile landscapes, particularly those in proximity to agricultural and residential areas, may have high density of nest parasites (brown-headed cowbird), exotic nest competitors (European starling), and domestic predators (cats), and may be subject to high levels of human disturbance.

Ponderosa Pine Forest and Woodland Working Hypothesis:
Factors affecting this habitat type are direct loss of habitat due primarily to timber harvest, suppression of low-intensity ground fires, wildfires, mixed conifer encroachment, development, reduction of habitat diversity and function resulting from invasion by exotic species and overgrazing. The principal habitat diversity stressor is the spread and proliferation of mixed forest conifer species within ponderosa pine communities due primarily to changes in the fire regime from high frequency, low intensity burns to low frequency, high intensity (stand replacing) fires. Habitat loss and fragmentation (including fragmentation resulting from extensive areas of undesirable vegetation), coupled with poor habitat quality of existing vegetation have resulted in extirpation and/or significant reductions in ponderosa pine habitat obligate wildlife.

Recommended Range of Management Conditions:
Mature ponderosa pine forest: The white-headed woodpecker represents species that require/prefer large patches(greater than 350 acres) of open, mature/old growth ponderosa pine stands with canopy closure of 10-50 percent and snags and stumps for nesting (nesting stumps and snags greater than 31 inches DBH).

Management Strategies:

- Protect extant habitat in good condition through easements and acquisitions; protect poor quality habitat and/or lands with habitat potential adjacent to existing protected lands (avoid isolated parcels/wildlife population sinks).

- Coordinate with public and private land managers on the use of prescribed fire and stand management practices.
- Restore forest function by providing key environmental correlates through prescribed burns and silvicultural practices.
- Fund and coordinate weed control efforts on both public and private land.
- Identify and protect wildlife habitat corridors/links.

Data Gaps and M&E Needs:

- Habitat quality data; assessment data bases do not address habitat quality.
- Finer resolution habitat maps which show location and extent of ponderosa pine stands.
- Finer resolution GIS habitat type maps that include structural component and KEC data.
- GIS soils products.
- Significant lack of local population/distribution data for white-headed woodpeckers.
- Current ponderosa pine structural condition/habitat variable data.

Wildlife Habitat Type: Combined Rare or Unique Habitats
Focal Species: Quaking Aspen and Curlleaf Mountain Mahogany

Habitat Status/Change:
Aspen and mountain mahogany are in decline and in need of conservation.

Factors Affecting Habitats and Focal Species:
- Fire suppression and changes in the fire regime have reduced both aspen and mountain mahogany regeneration.
- Heavy browsing by domestic livestock and wild ungulates can limit regeneration by aspen and mountain mahogany and have a negative effect on young trees that do survive.
- Fire suppression and the resultant increase in fire return interval has effectively eliminated aspen's competitive advantage and allowed invasion of aspen stands by more shade-tolerant conifers.
- Fire suppression has increased competition by conifers in mountain mahogany stands.
- Increases in exotic annuals such as cheatgrass have reduced mountain mahogany reproduction in many areas as the seeds seldom germinate in established plant communities.

Rare and Unique Habitats Working Hypothesis:
Both quaking aspen and curlleaf mountain mahogany stands have decreased in both size and distribution due primarily to fire suppression and grazing. Encroachment by conifers, largely a result of fire suppression, further restricts recruitment in both habitats. These somewhat rare habitats serve as an important part of a diverse forested ecosystem and may serve vital functions in the survival of species that use them.

Recommended Range of Management Conditions:
Quaking aspen: Self-regenerating aspen stands are dominated by quaking aspen although scattered individuals of ponderosa pine and Douglas-fir may be present. A relatively short fire return interval maintains the competitive advantage conferred by aspen's clonal reproduction and prevents dominance by conifers.
Curlleaf mountain mahogany: Mountain mahogany often occurs in pure stands but may co-dominate with other shrubs. The understory is relatively sparse, leaving bare mineral soil for mountain mahogany seed germination.

Management Strategies:
- Protect extant stands of aspen and mountain mahogany through fencing to exclude both big game and livestock and through livestock management.
- Remove conifers from stands of aspen and mountain mahogany to allow recruitment of young trees to size classes beyond the reach of browsing wildlife.
- Promote use of low-intensity ground fires to regenerate aspen.

Data Gaps and M&E Needs:
- Finer resolution habitat maps which show location and extent of aspen and mountain mahogany stands.
- Lack of data regarding timing and type of use of these habitats by wildlife.
- Lack of data regarding the effect of altered water tables on aspen.
- Lack of data regarding the genetic relatedness of aspen clones.

Wildlife Habitat Type: Combined Alpine and Subalpine Habitats
Focal Species: Black Rosy-finch

Habitat Status/Change:
The trend of these combined habitats is stable to declining slightly.

Factors Affecting Habitats and Focal Species:

- Fire suppression has allowed the encroachment of whitebark pine into areas previously dominated by grasslands increasing the coverage of subalpine parkland and decreasing alpine grasslands and shrublands.
- Human recreation is a major factor affecting alpine grassland and shrubland habitat through trampling and other types of disturbance.
- Recreational activities may disturb or displace mountain goats into marginal habitat with negative repercussions for reproduction and survival.

Alpine and Subalpine Habitats Working Hypothesis:
Alpine and subalpine habitats in the Oregon Side LMS subbasin are highly protected from development. Threats to these habitats are from recreational use and fire management that result in habitat degradation and changes in composition.

Recommended Range of Management Conditions:
Diverse alpine and subalpine habitats. The black Rosy-finch represents species that prefer/require a mosaic of open and rocky habitat elements for foraging, nesting and security cover.

Management Strategies:

- Fire management to prevent continued encroachment of conifers into open habitats.
- Manage recreational access to minimize impacts to vegetation and nesting birds.
- Public education to reduce wildlife/recreation conflicts in sensitive areas.

Data Gaps and M&E Needs:

- Identify habitat links and corridors.
- Higher resolution habitat maps which show location and extent of alpine and subalpine habitats.
- Significant lack of data regarding population and distribution of black rosy-finch.

Wildlife Habitat Type: Eastside Canyon Shrublands
Focal Species: Canyon Wren

Habitat Status/Change:
The trend in this habitat is stable to declining slightly.

Factors Affecting Habitats and Focal Species:

- Fire suppression and heavy grazing have depleted bunchgrass cover in some areas allowing expansion of this shrub habitat
- Talus movement alters shrub cover.
- Invasion of noxious weeds alters vegetation communities.

Rare and Unique Habitats Working Hypothesis:
Although this habitat is similar in extent to historic times, the majority of this habitat type in the subbasin has no protection from development and/or changes in land management and is vulnerable to future losses.

Recommended Range of Management Conditions:
The canyon wren represents species that occupy steep, rocky canyon walls, cliff faces, rimrock, and boulder piles in open arid country.

Management Strategies:

- Protect extant areas of canyon shrublands.
- Fund and coordinate weed control efforts on both public and private land.

Data Gaps and M&E Needs:

- Finer resolution habitat maps which show location and extent of eastside canyon shrublands.

Wildlife Habitat Type: Eastside Grasslands
Focal Species: Western Meadowlark

Habitat Status/Change:

The trend in native bunchgrass habitat is a slight decline but annual grasslands have increased dramatically. There is a decline in quality of grassland habitat due to the invasion of weeds.

Factors Affecting Habitats and Focal Species:

- Extensive, permanent habitat conversion, primarily to cropland and pasture, resulting in fragmentation of remaining tracts.
- Degradation of habitat values from intensive grazing and invasion of exotic plant species.
- Fire management and wildfires alter the vegetative communities.
- Loss and reduction of cryptogramic crusts, which help maintain the ecological integrity of grassland communities.
- Human disturbance during breeding and nesting season of grassland dependent species such as the meadowlark.

Eastside Grasslands Working Hypothesis:

The major factors affecting this habitat type are direct loss of habitat due primarily to conversion to agriculture, reduction of habitat diversity and function resulting from invasion of exotic vegetation and wildfires and overgrazing. The principal habitat diversity stressor is the spread and proliferation of annual grasses and noxious weeds such as cheatgrass and yellow-star thistle that either supplant and/or radically alter entire native bunchgrass communities significantly reducing wildlife habitat quality. Habitat loss and fragmentation (including fragmentation resulting from extensive areas of undesirable vegetation), coupled with poor habitat quality of existing vegetation have resulted in extirpation and/or significant reductions in grassland obligate wildlife species.

Recommended Range of Management Conditions:

The western meadowlark represents species that depend upon native grassland habitats dominated by native grasses such as bluebunch wheatgrass and Idaho fescue. The range of conditions recommended for eastside grassland habitat includes:

- Native bunchgrasses greater than 40 percent cover
- Native forbs 10-30 percent cover
- Herbaceous vegetation height greater than 10 inches
- Visual obstruction readings at least 6 inches
- Native, non-deciduous shrubs less than 10 percent cover
- Exotic vegetation/noxious weeds less than 10 percent cover

Management Strategies:

- Protect extant habitat in good condition through easements and acquisitions; protect poor quality habitat and/or lands with habitat potential adjacent to existing protected lands (avoid isolated parcels/wildlife population sinks).
- Fund and coordinate weed control efforts on both public and private lands.
- Restore grassland function by providing vegetation structural elements through reestablishment of native plant communities where practical and cost effective.
- Identify and protect wildlife habitat corridors/links.
- Promote research and development of bio-control agents for noxious weeds.
- Promote landowner education in identification and management of noxious weeds.

Data Gaps and M&E Needs:

- Habitat quality data. Assessment data bases do not address habitat quality.
- Higher resolution habitat maps which accurately show location and extent of grassland habitats.
- Refined habitat maps including CRP program/field delineations.
- GIS soils products including wetland delineations.
- Grassland-obligate species data.
- Efficacy of bio-control agents for noxious weeds.

Wildlife Habitat Type: Shrub-steppe
Focal Species: Sage Grouse

Habitat Status/Change:

This habitat is in decline in the subbasin, largely due to replacement by annual grasslands.

Factors Affecting Habitats and Focal Species:

- Extensive, permanent habitat conversion resulting in fragmentation of remaining tracts.
- Degradation of habitat values from intensive grazing and invasion of exotic plant species.
- Fire management, either suppression or over-use and wildfires.
- Loss and reduction of cryptogramic crusts, which help maintain the ecological integrity of shrub-steppe communities.
- Loss of big sagebrush communities to brush control.
- Human disturbance during breeding and nesting season.
- Nest predation and/or parasitism.

Shrub-steppe Working Hypothesis:

The major factors affecting this habitat type are direct loss of habitat due primarily to conversion to agriculture, reduction of habitat diversity and function resulting from invasion of exotic vegetation and wildfires and livestock grazing. The principal habitat diversity stressor is the spread and proliferation of annual grasses and noxious weeds such as cheatgrass and yellow-star thistle that either supplant and/or radically alter entire native bunchgrass communities significantly reducing wildlife habitat quality. Habitat loss and fragmentation (including fragmentation resulting from extensive areas of undesirable vegetation), coupled with poor habitat quality of existing vegetation have resulted in extirpation and/or significant reductions in shrub-steppe obligate wildlife species.

Recommended Range of Management Conditions:

The sage grouse represents shrub-steppe obligate species that require habitats dominated by sagebrush within large tracts of shrub-steppe habitat. Optimum sage grouse nesting habitat consists of the following: sagebrush stands containing plants 16 to 32 inches (40 to 80 cm) tall with a canopy cover ranging from 15 to 25 percent and an herbaceous understory of at least 15 percent grass canopy cover and 10 percent forb canopy cover that is at least 7 inches.

Mule deer represent species that utilize a variety of vegetation communities within the shrub-steppe zone.

Management Strategies:

- Protect extant habitat in good condition through easements and acquisitions; protect poor quality habitat and/or lands with habitat potential adjacent to existing protected lands (avoid isolated parcels/wildlife population sinks).
- Fund and coordinate weed control efforts on both public and private lands.
- Restore shrubland function by providing vegetation structural elements through reestablishment of native plant communities where practical and cost effective.
- Identify and protect wildlife habitat corridors/links.

Data Gaps and M&E Needs:

- Habitat quality data. Assessment data bases do not address habitat quality.
- Higher resolution habitat maps which accurately show location and extent of shrubland habitats.

- Refined habitat maps including CRP program/field delineations.
- GIS soils products including wetland delineations.
- Shrub-steppe obligate species data.

Wildlife Habitat Type: Open Water – Lakes, Rivers and Streams.
Focal Species: Bald Eagle

Habitat Status/Change:
This habitat has increased compared with the historic condition due to impoundments and water development, especially the damming of the Snake River.

Factors Affecting Habitats and Focal Species:

- Irrigation withdrawal/over appropriation results in very low water levels in some lakes and streams affecting habitat values for aquatic species.
- Loss and/or degradation of riparian vegetation affects water temperature and availability of terrestrial invertebrates to aquatic ecosystems.
- Degradation of habitat values from invasion of exotic aquatic plant species.
- Degradation of habitat values, both aquatic and riparian, due to livestock grazing.
- Degradation of habitat values due to channelization and alteration of bank structure and stability.
- Human disturbance during breeding and nesting season.
- Loss of large riparian trees for nesting and roosting.

Open Water Habitats Working Hypothesis:
Open water habitats may have actually increased since European settlement due to impoundments and development for agriculture, livestock and human use although the quality of these habitats for wildlife may not equal their natural counterparts. The major factors affecting open water habitats in the subbasin are those that affect water quality (e.g., eutrophication, temperature, high sediment load) and riparian condition.

Recommended Range of Management Conditions:
The bald eagle represents species that live at the interface of aquatic and terrestrial habitats, requiring healthy areas of both to satisfy all their life history requirements. Quality habitat includes open water areas that support healthy populations of prey including fish and waterfowl and a healthy riparian zone with native vegetation and diverse structure including large trees.

Management Strategies:

- Protect extant habitat in good condition through easements and acquisitions; protect poor quality habitat and/or lands with habitat potential adjacent to existing protected lands (avoid isolated parcels/wildlife population sinks).
- Protect water quality through existing regulations and guidance.
- Fund and coordinate weed control efforts on both public and private lands.
- Restore riparian function by providing vegetation structural elements through reestablishment of native plant communities where practical and cost effective.
- Restore degraded and/or channelized streams to natural condition where practical and cost effective
- Identify and protect wildlife habitat corridors/links.

Data Gaps and M&E Needs:

- Habitat quality data. Assessment data bases do not address habitat quality.
- Higher resolution habitat maps which accurately show location and extent of open water and riparian habitats.
- Monitor restoration projects to assess relative success of various methods.
- Monitor bald eagle nests to record nest success and fledgling survival.

Wildlife Habitat Type: Wetlands
Focal Species: Columbia Spotted Frog, Great Blue Heron, Yellow-breasted Chat, Ruffed Grouse, American Beaver.

Habitat Status/Change:
Wetlands in the subbasin have decline substantially.

Factors Affecting Habitats and Focal Species:

- Extensive, permanent habitat conversion/draining.
- Habitat alteration from 1) hydrological diversions resulting in reduced stream flows and reduction in overall area of riparian habitat; loss of vertical stratification in riparian vegetation and lack of recruitment of young cottonwoods, willows, etc. and 2) stream bank stabilization which narrows stream channel, reduces the flood zone and reduces the extent of riparian vegetation.
- Habitat degradation from livestock grazing which can widen channels, raise water temperatures, reduce understory cover, etc.
- Habitat degradation from conversion of native wetland and riparian vegetation to invasive exotics such as reed canary grass, purple loosestrife, perennial pepperweed and Russian olive.
- Hostile landscapes, particularly those in proximity to agricultural and residential areas, may have high density of nest parasites (brown-headed cowbird), exotic nest competitors (European starling), and domestic predators (cats), and may be subject to high levels of human disturbance.
- Human disturbance during breeding and nesting season.
- Nest predation and/or parasitism.
- Chemical pollutants and other water quality issues may reduce productivity and/or survival of Columbia spotted frogs.

Wetlands Working Hypothesis:
The major factors affecting this habitat type are direct loss of habitat due primarily to urban/agricultural development, reduction of habitat diversity and function resulting from invasion of exotic vegetation, livestock overgrazing and fragmentation. The principal habitat diversity stressor is the spread and proliferation of invasive exotics. This, coupled with poor habitat quality of existing vegetation has resulted in extirpation and/or significant reductions in wetland- and riparian-obligate wildlife species.

Recommended Range of Management Conditions:
The Columbia spotted frog represents species that require shallow-water habitats with emergent vegetation and that are productive of invertebrate prey. The ruffed grouse represents species that utilize diverse riparian habitats. The great blue heron represents species that live at the interface of aquatic and terrestrial habitats as it forages in either relatively shallow water for aquatic prey or in fields and pastures for terrestrial prey and nests and roosts in large riparian trees. The yellow-breasted chat represents species that utilize riparian scrub-shrub or riparian understory shrub habitats. The American beaver, like the great blue heron, represents species that require both aquatic and terrestrial elements of the ecosystem to satisfy all their life history needs. Further, beavers shape the environment by creating wetlands that often progress through successional stages of siltation and vegetation growth to become meadows and/or riparian areas.

Management Strategies:

- Protect extant habitat in good condition through easements and acquisitions; protect poor quality habitat and/or lands with habitat potential adjacent to existing protected lands (avoid isolated parcels/wildlife population sinks).
- Fund and coordinate weed control efforts on both public and private lands.
- Work with Conservation Districts, NRCS, Forest Service, landowners et al., to implement best management practices in wetland and riparian areas in conjunction with CRP, CREP, WHIP, WRP and other programs.
- Restore wetland function by providing vegetation structural elements through reestablishment of native plant communities where practical and cost effective.
- Restore riparian area function with enhancements, livestock exclusions, in-stream structures and bank modification if necessary, and stream channel restoration activities.
- Identify and protect wildlife habitat corridors/links.
- Develop a beaver management plan to promote the reestablishment/reintroduction of beaver into headwater and mid-elevation habitats.

Data Gaps and M&E Needs:

- Habitat quality data. Assessment data bases do not address habitat quality.
- Higher resolution habitat maps which accurately show location and extent of wetland and riparian habitats.
- Refined habitat maps including CREP program/field delineations.
- GIS soils products including wetland delineations.
- Wetland/riparian obligate species data. Significant lack of local population/distribution data for Columbia spotted frog, yellow-breasted chat and beaver

3.6.3. Desired Future Conditions – Aquatic

3.6.3.1 Listed Species (recovery goals)

Bull Trout - from the Draft Recovery Plan for Bull Trout and Proposed Critical Habitat (USFWS 2002):

"The goal of the bull trout recovery plan is to ensure the long-term persistence of self-sustaining, complex interacting groups of bull trout distributed across the species native range, so that the species can be delisted. To achieve this goal the following objectives have been identified for bull trout in the Hells Canyon Complex Recovery Unit:

- Maintain current distributions of bull trout and restore distributions in previously occupied areas within the Hells Canyon Complex Recovery Unit.
- Maintain stable or increasing trends in adult bull trout abundance.
- Restore and maintain suitable habitat conditions for all life history stages and forms.
- Conserve genetic diversity and provide opportunity for genetic exchange.

3.6.3.2 Non-listed Species

There are no known population statistics for redband trout in the subbasin. Therefore, numerical population targets are unrealistic. Rather, habitat limiting factors should be addressed while research and monitoring are conducted to gain better insight into the population status of the species in the subbasin.

3.6.3.3 Habitat

The habitat limiting factors listed in Section 3.5.1 (page 127) should be addressed to optimize fish habitat within the limits of the social, cultural and economic framework of the communities of the Oregon Side LMS subbasin.

3.6.4. Desired Future Conditions – Terrestrial

3.6.4.1 Listed Species (recovery goals)

The only federally listed species selected as a focal species is the bald eagle. This species is very near delisting by the USFWS (K. Paul, USFWS, personal communication) and recovery goals are unlikely to be relevant to this plan.

3.6.4.2 Non-listed Species

Little is known of the population numbers of most of the focal species. Thus, numerical population targets are impractical and not very helpful in developing management objectives. Rather, habitat conditions should be addressed as research and monitoring are conducted to gain better insight into the population status of focal species.

3.6.4.3 Habitat

See Section 3.6.2 (page 131).

3.6.5. Opportunities

3.6.5.1 Aquatic Habitat for High Priority Protection

The QHA analysis resulted in a list of priorities for habitat protection (Figure 27, Figure 28, Figure 29, Figure 30; and Appendix 4, Table 39, Table 40, Table 41, Table 42). The rankings are based on the greatest value gained by protecting a given reach. In other words, the highest ranked reach is the reach in the best overall condition resulting in the greatest benefit for the species in question from protecting it.

For redband trout, Pine Creek 5 was the reach with the highest protection ranking in the subbasin. It was followed by Lake Fork Creek, Clear Creek 2, North Fork Pine Creek 2 and East Pine Creek to round out the top 5.

Bull trout are found in 12 of the 15 reaches in this analysis. The highest rated reaches for habitat protection relative to bull trout were Pine Creek 4, East Pine Creek 2, Lake Fork Creek, North Fork Pine Creek 2 and Pine Creek 5.

Chinook salmon and steelhead are not present in the system so the reaches were not rated for protection relative to these 2 species.

3.6.5.2 Aquatic Habitat to Reestablish Access

Several of the subbasin's reaches would benefit from reestablishment of access for fish. Sag Creek would benefit most from efforts to reestablish access.

3.6.5.3 Aquatic Habitat for Restoration

The QHA analysis resulted in a list of priorities for habitat restoration (Figure 27, Figure 28, Figure 29, Figure 30; and Appendix 4, Table 39, Table 40, Table 41, Table 42). The rankings are based on the greatest habitat value gained by conducting restoration activities.

Four of the top five rated reaches for restoration for redband trout are also among the top five for bull trout. East Pine Creek 1, Pine Creek 3, North Fork Pine Creek 1 and Pine Creek 4 are all rated as high value for restoration for both bull trout and redband trout. In addition, Clear Creek 1 is highly ranked for redband trout and Pine Creek 2 is highly ranked for bull trout.

The top five ranked reaches for restoration to benefit Chinook salmon and steelhead if they were reintroduced to the system are the same as those for redband trout. In other words, efforts to restore habitat for one focal species will provide benefits to all of the native aquatic community.

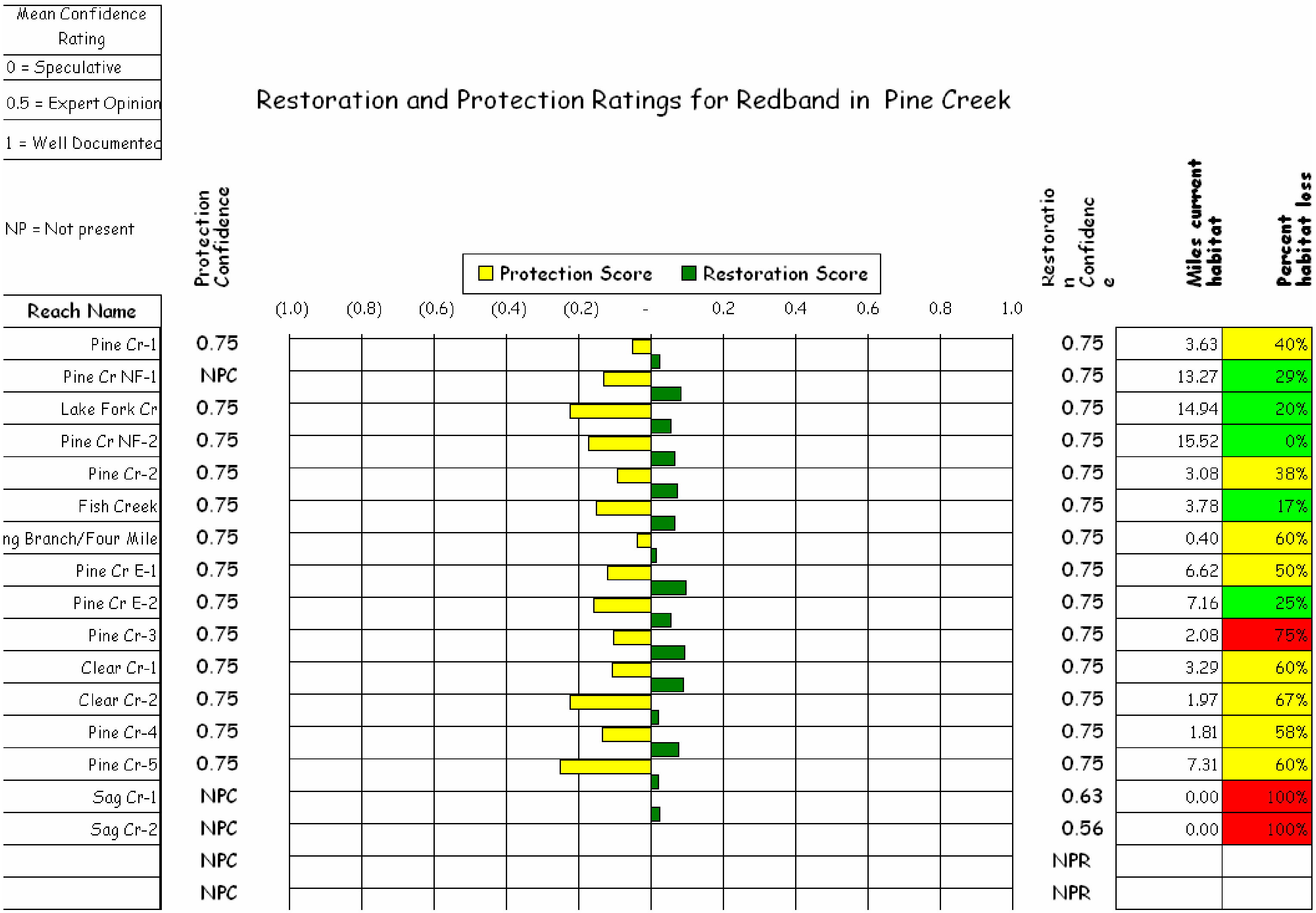


Figure 27. QHA tornado diagram depicting protection and restoration scores for redband trout in the Oregon Side LMS subbasin, Oregon.

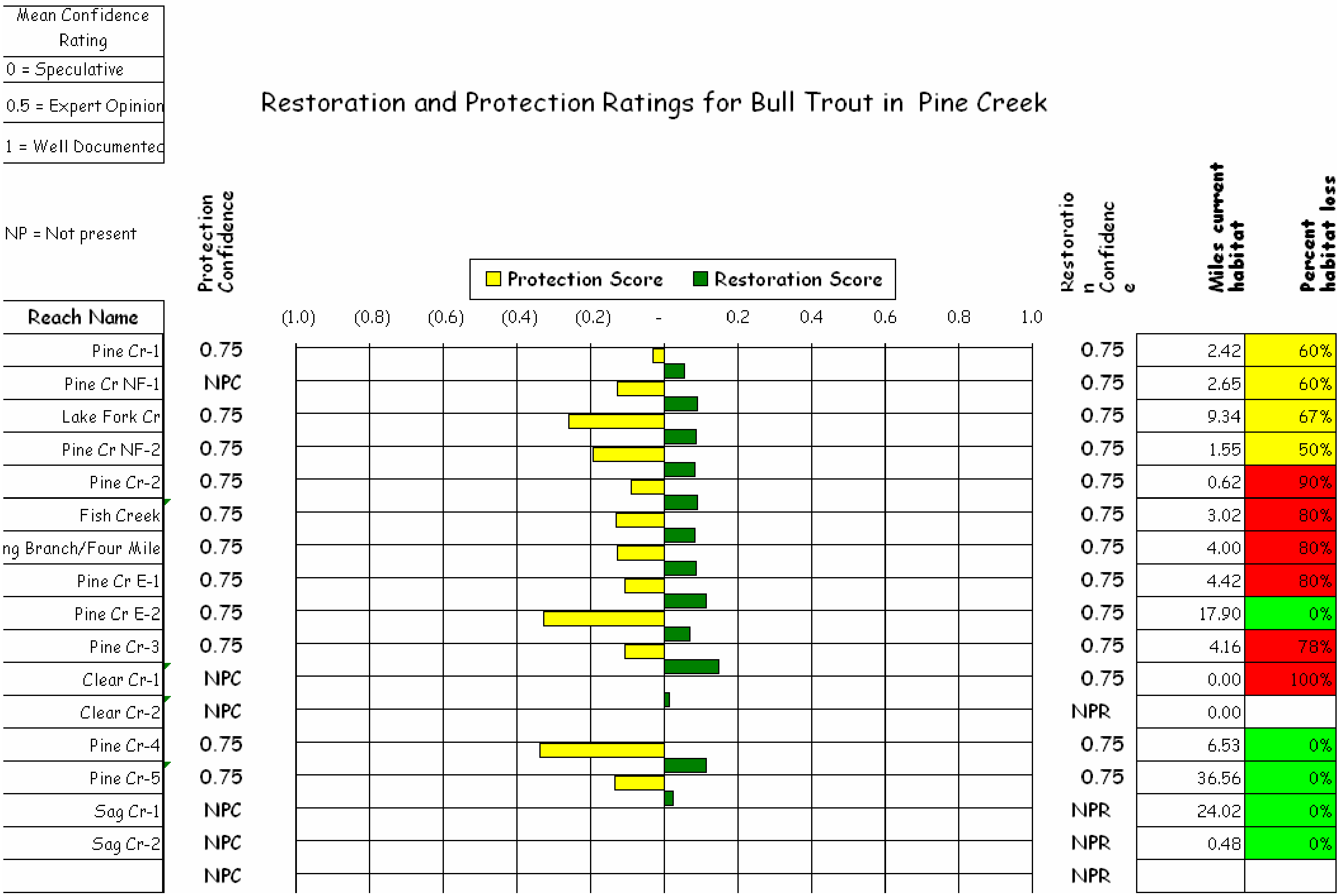


Figure 28. QHA tornado diagram depicting protection and restoration scores for bull trout in the Oregon Side LMS subbasin, Oregon.

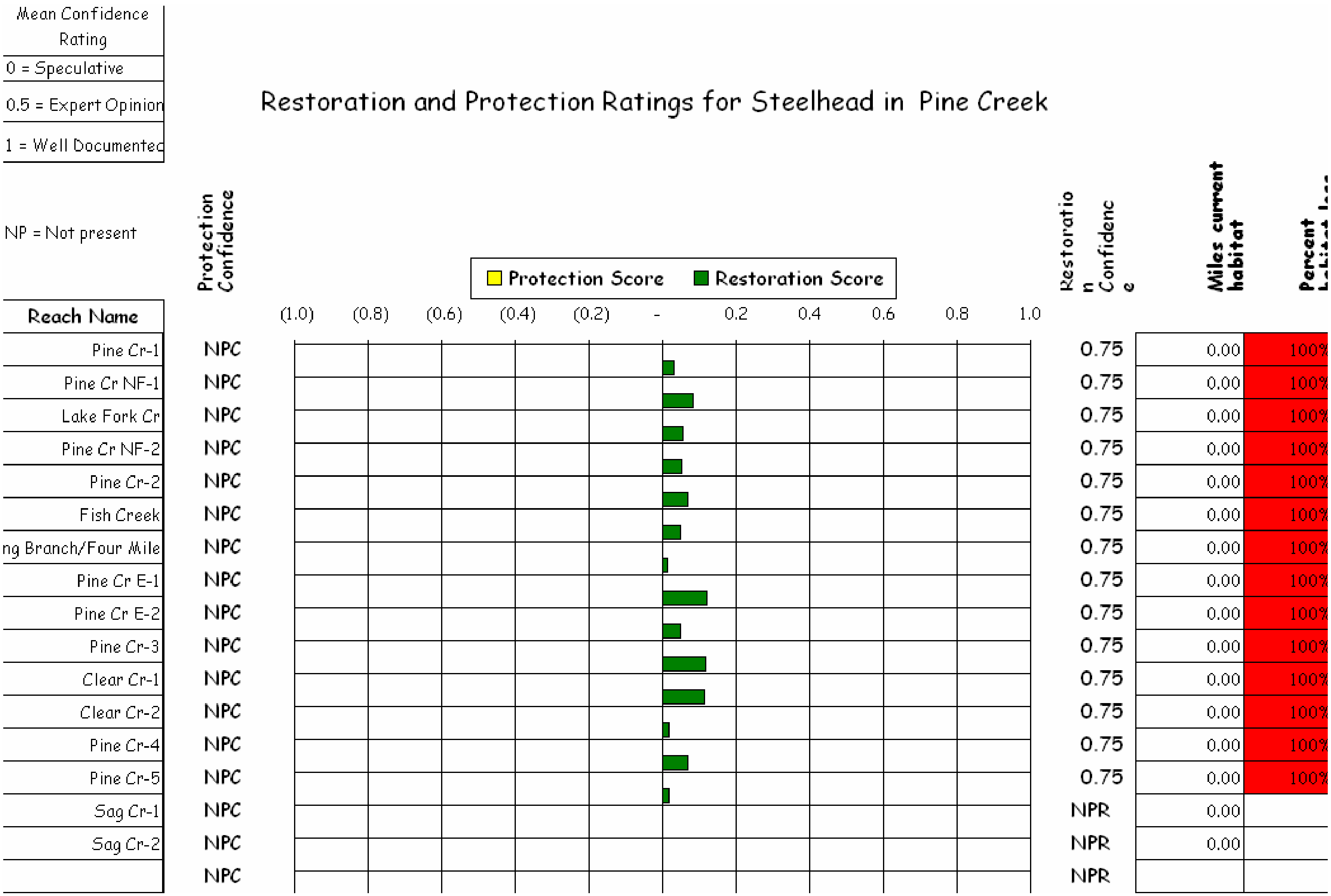


Figure 29. QHA tornado diagram depicting protection and restoration scores for steelhead in the Oregon Side LMS subbasin. Oregon.

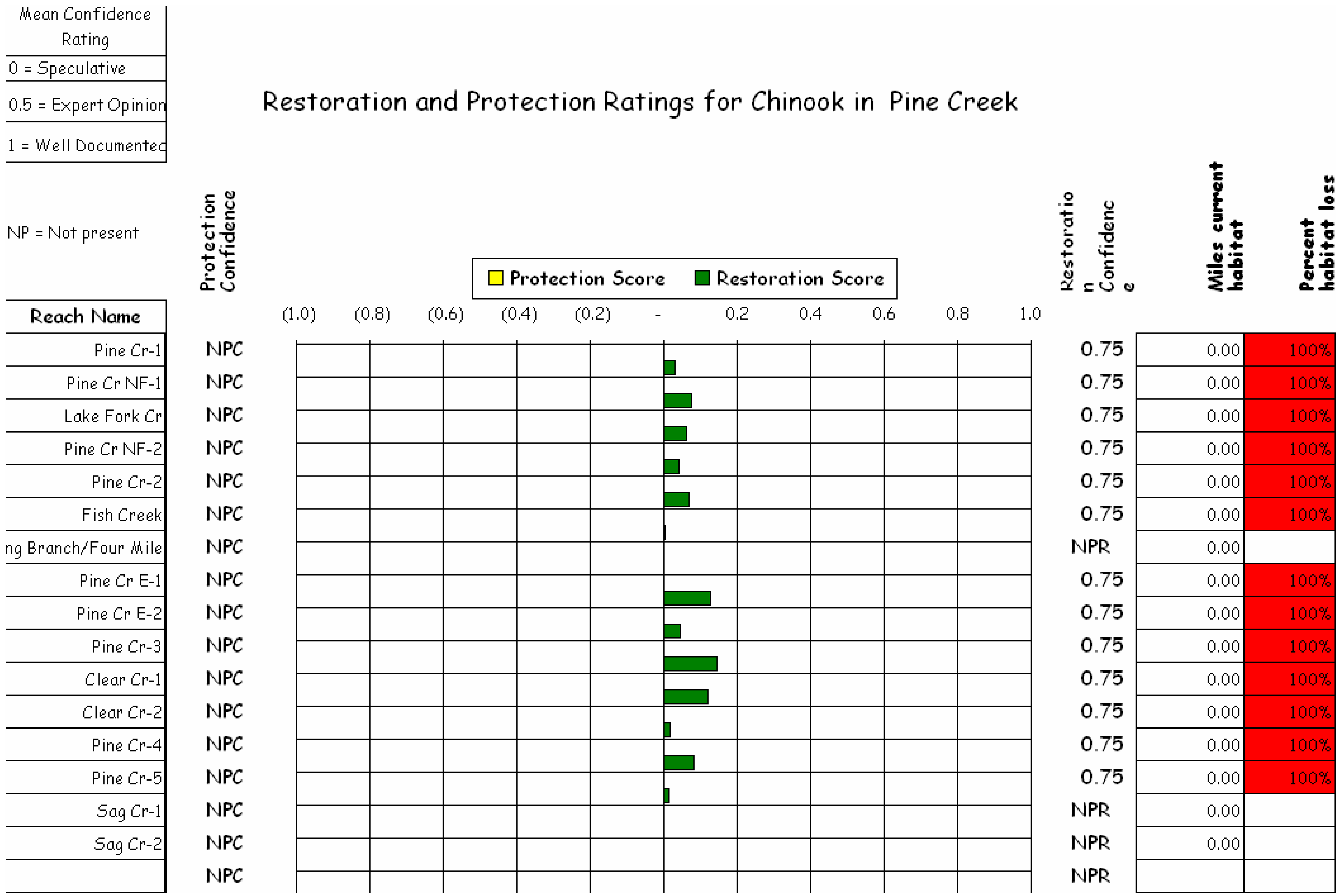


Figure 30. QHA tornado diagram depicting protection and restoration scores for Chinook salmon in the Oregon Side LMS subbasin, Oregon.