Powder River Subbasin Plan

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Prepared for the
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 Powder River Subbasin 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 Powder River 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 Powder 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 Powder 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. 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 Powder 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 Powder 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 Powder 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 Powder 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 weeds 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. The impacts of increased urban growth need to be managed by municipalities and counties in concert with other activities called for in this plan.

Final recommendations

Implementation in the Powder 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 Powder 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 Powder 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 Powder subbasins. The Powder is one of the subbasins that have 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 officals 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

Contract Entities and Planning Participants

Multiple agencies and entities are involved in managing and protecting fish and wildlife populations and their habitats in the Powder 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 Powder 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 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 Powder subbasin is 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. Powder River subbasin 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 includes scientific experts who guide 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 guides and participates in developing the biological objectives, strategies, research, monitoring and evaluation sections of the plan and reviews 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 Powder Subbasin Management Plan was developed, four methods of outreach and public and government participation were used in the Powder subbasin:

- Technical team meetings and workshops
- Planning team meetings
- Attendance and presentation at Baker County Natural Resource Committee meetings
- Attendance and presentation at Powder 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 Powder 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 Powder 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 Powder 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 Powder Basin Planning Team and the Baker County Association of Conservation Districts intend the Powder 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 Powder Subbasin. This plan is intended to provide resources necessary to develop activities forwarding the vision of the Powder Basin Planning Team at both subbasin/programmatic scales and to provide the context and information for developing site specific projects. The Powder 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 Powder Subbasin Assessment provides the analysis and background information to support the recommendations made in the Powder 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 Powder 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 Powder Subbasin Management Plan. The completed document was submitted by Baker County Association of Conservation Districts (BCACD). The forgoing sections detail the entities involved in resource management with the Powder 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 Powder 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 Powder River subbasin is located in the northwest portion of the Middle Snake Ecological Province (Figure 1). The subbasin is defined by the Blue Mountains to the west, the Snake River to the east, the Wallowa Mountains and Grande Ronde subbasin to the north and the Burnt River subbasin to the south. Subbasin corners are approximated by the following Townships and Ranges: NW corner (T5S/R37E), NE corner (T5S/R44E), SW corner (T9S/R36E), SE corner (T11S/R45E).

The Powder River flows 144 miles from its source in the Blue Mountains to join the Snake River at river mile (RM) 296 about 11 miles downstream of Richland, Oregon. The Powder River begins near Sumpter, Oregon (RM 144), where the McCully Fork, Cracker Creek and several smaller tributaries join, and flows east-southeast through the tailings of past dredge mining and into Phillips Lake (RM 136). The river exits Phillips Lake at RM 131, continuing east for about 7 miles before turning north through the Bowen Valley and Baker City, Oregon (RM 113). From here the river meanders the floor of the Baker Valley and passes by the cities of Haines (RM 98) and North Powder (RM 82) where it is joined by the North Powder River. The Powder River again turns southeast (RM 78), flows through Thief Valley Reservoir (RM 71), through the Lower Powder Valley and enters the Snake River System through the Powder Arm of Brownlee Reservoir (RM 10) near Richland, Oregon. Eleven dams on the Columbia and Snake rivers separate the Powder River from the Pacific Ocean.

Major streams flowing into the Powder are Eagle, Wolf, and Rock creeks and the North Powder River. Eagle Creek originates in the Eagle Cap Wilderness Area of the Wallowa Mountains and flows generally south-southeast 38 miles to join the Powder at RM 10, just above the Powder Arm of Brownlee Reservoir. Wolf Creek begins at High Summit Spring in the Blue Mountains and flows about 20 miles to meet the Powder at RM 81 near North Powder, Oregon. Rock Creek originates along Elkhorn Ridge then flows 15 miles to its confluence with the Powder River at RM 98 near Haines. The headwaters of the North Powder River also lie along Elkhorn Ridge. The North Powder flows generally north-northeast 25 miles to meet the Powder at RM 82 near the city of North Powder.

3.1.1.2 Subbasin Size

The Powder subbasin encompasses an area of about 1,750 mi^2 in northeastern Oregon. It is almost entirely contained within Baker County but includes a portion of Union County. A very small part of the subbasin, at the headwaters of Eagle Creek, is in Wallowa County.

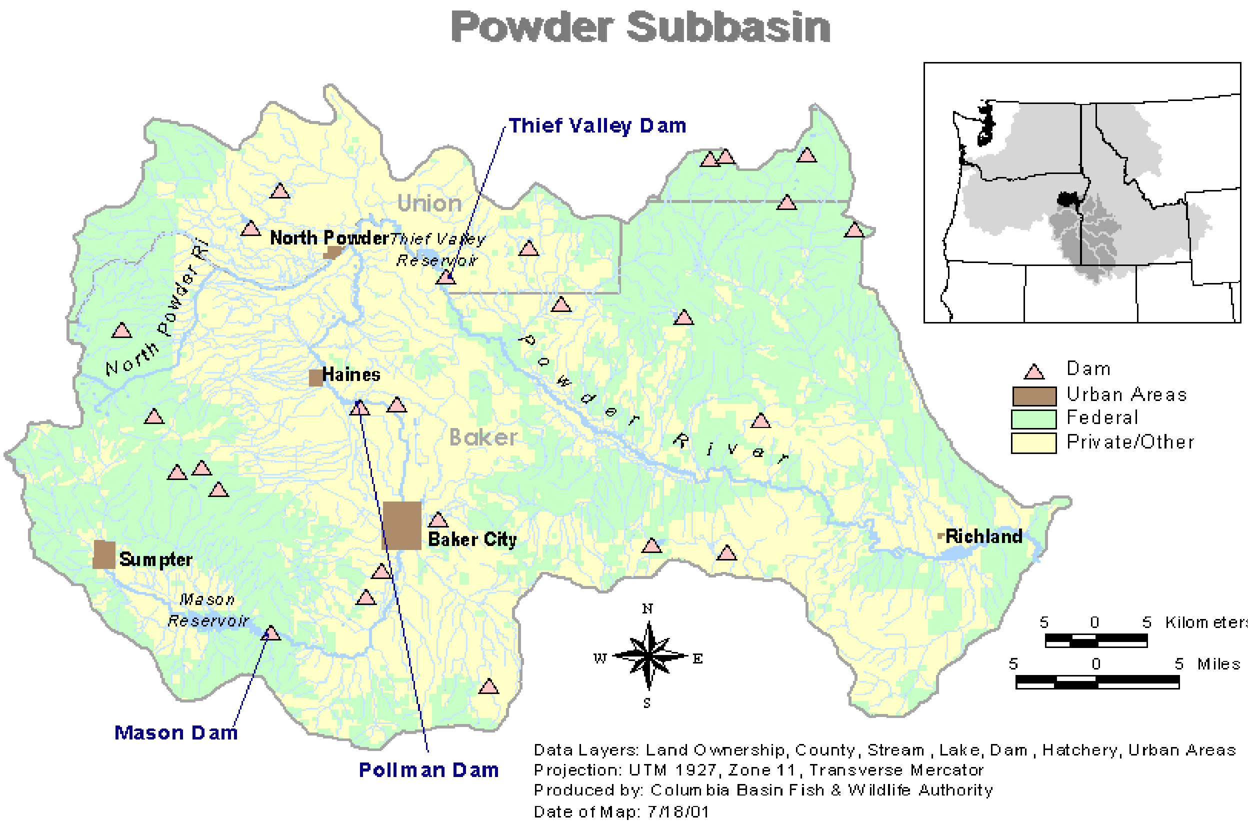


Figure 1. The Powder subbasin of the Middle Snake Province, northeast Oregon.

3.1.1.3 Geology and Topography

The earliest geologic event to shape the landscape of the upper Powder River drainage was the docking of an island arc on the edge of an earlier continent, leaving masses of metavolcanic and metasedimentary rocks about 250 million years ago. Argillites dominate these rocks, though metagabbros are also present. These exotic terrains were precursors of the Elkhorn Mountains, exposed to several million years of weathering processes.

About 20 million years ago the granitic Bald Mountain batholith was intruded below the argillites. While this did not immediately alter the shape, it resulted in gold deposits, which would alter the landscape later.

In the last 12 to 40 million years, a variety of volcanic deposits were laid down including basalts and andesitic tuffs. Block faulting was the largest force in the last 20 million years to shape the Elkhorn Mountains. This uplifting of the Elkhorns exposed the argillites and granitic rocks to water and ice erosion that are considered contemporary land sculpting processes.

The North Powder River drainage is dominated by granitic batholith rocks and metamorphic rocks both of which form soils low in clay and with high erosion potential. The northern portion of the drainage contains basalts (Wallowa Whitman National Forest 1999) of the Columbia River Basalt Group.

The Eagle Creek drainage begins high in the southern Wallowa Mountains, an area with a complex geologic history. The granitic Wallowa batholith dominates the upper Eagle Creek drainage. An estimated 3 to 7 glaciations formed numerous cirque lakes, steep ridges and craggy peaks. Some areas of the Wallowa batholith have been mineralized and contain deposits of gold, silver and copper. Erosion of these mineral-bearing rocks has resulted in deposition of gold in the alluvial benches and stream gravels of Eagle Creek and its tributaries (Wallowa Whitman National Forest 1997a).

The upper and middle reaches of the Eagle Creek drainage are dominated by metamorphosed greenstones and tuffs of the Clover Creek formation, fossiliferous limestones of the Martin Bridge formation, and slates, shales and sandstones of the Hurwal formation. The three formations represent ancient seafloor sediments formed about 100 million years ago. These sedimentary rocks contain fossils of bivalves, corals and sponges. The oldest vertebrate fossil to be discovered in Oregon was also found in these rocks. Columnar jointed olivine basalts of the Columbia River Basalt Group dominate the lower reaches of the Eagle Creek drainage.

Geology is a primary factor in predicting soil properties although in some areas of the Blue Mountains, land form and vegetation can become equally or more important. Subbasin soils derived from granitic batholith rocks are very erosive due to the rounded grain shape and near absence of clay. These soils dominate the North Powder and Wolf Creek drainages.

Soils derived from metamorphic rocks are also very low in clay and have high infiltration and percolation rates but are not considered as erosive as granitic soils. Those areas of the subbasin with Columbia River Basalts have soils primarily derived from that rock. Infiltration of these soils is generally high and permeability is generally moderate.

Soils in the upper Powder River Area are influenced by the deposition of about 1.5 feet of silty volcanic ash from the eruption of Mount Mazama 6,700 years ago.

The topography of the Powder River subbasin is varied with relatively high gradient mountain streams, deep river canyons and broad, shallow valleys. The headwaters of the Powder subbasin's streams are at elevations from 6,000 feet to nearly 9,000 feet in the Blue and Wallowa mountains. The mainstem Powder River begins near 8,000 feet, drops to about 3,300 feet in the Baker Valley and to about 1,650 feet at the confluence with the Snake River.

Stream gradients in the upper Powder River range from 20% in the high elevations of the Elkhorn Mountains to 2-4% in the lower, larger systems (Powder Basin Watershed council 2001). Gradients in the rest of the subbasin are similarly variable as high elevation headwater streams give way to low elevation, low gradient valley streams.

3.1.1.4 Climate and Weather

The major influence to the regional climate is provided by the Cascade Mountains lying nearly 200 miles to the west. This mountain range forms a barrier against potential modifying effects of warm, moist fronts emanating out of the Pacific Ocean. As a result, the overall climate is Temperate Continental – cool summer phase. The relief of the Blue Mountains creates several localized climatic effects. The diversity of landscapes between mountain ranges, rolling topography and deep, dissected canyons influences local climatic patterns. Light precipitation, low relative humidity, rapid evaporation, abundant sunshine and wide temperature and precipitation fluctuations are characteristics of this climate. The mean annual temperature is 45.5°F, the daily maximum was 106°F (08/04/1961) and the daily minimum was -39°F [(12/30/1978) USBR dataweb]. Temperature extremes of -28° F (Feb.) and 104° F (Aug.) have been recorded at the Baker City Airport. The majority of annual precipitation, which averages 10.87 in., falls as snow during winter. Portions of the subbasin commonly experience rain-on-snow events, which reduce the snow pack and may cause brief, localized flooding. Late summer and early autumn provide the area with convectional storms resulting from masses of cool air crossing the Cascades and passing over the mountains at high elevation. The hot, dry surface air violently mixes with the cool, moist upper air mass to provide lightning storms.

3.1.1.4 Land Cover

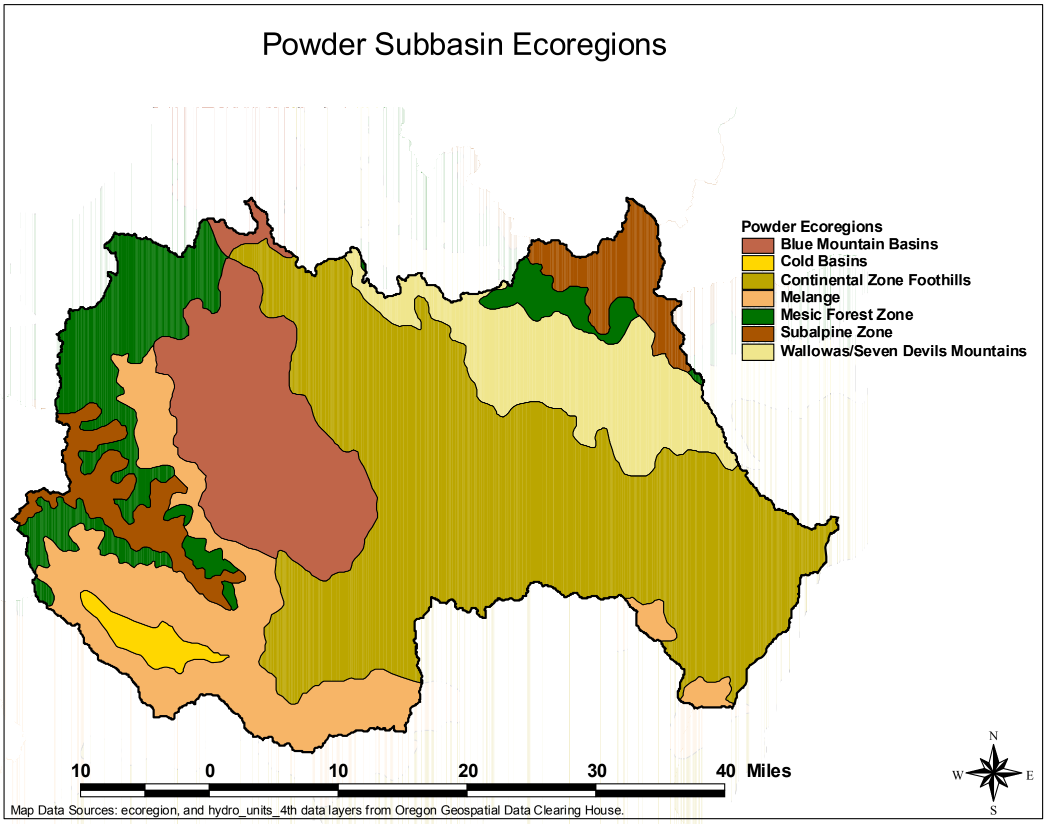


Figure 2. Ecoregions of the Powder River subbasin, Oregon

3.1.1.6 Land Use and Population

Long before the arrival of pioneers and settlers, the Cayuse, Umatilla and Nez Perce Indians utilized the hunting and fishing grounds along the length of the Powder River (USDI BLM 1994). Early Euro-American settlers came to the area on the Oregon Trail as it passed through Baker County. Settlement spread to the upper reaches of the watershed with the discovery of gold in the 1860's (Powder Basin Watershed Council, 2001).

Land ownership and use statistics have not been compiled for the Powder subbasin specifically. Information for Baker County and/or the Powder Basin including the Burnt River and Pine Creek drainages is presented here as representative of the subbasin. References here to the "Powder Basin" or "Basin" include the Burnt River and Pine Creek.

Approximately two-thirds of the Powder Basin is rangeland with livestock grazing as the primary land use. One-sixth of the Basin is forestland where timber harvest and summer livestock grazing are the main uses. Most of the remaining area is cropland and pastureland irrigated by gravity flood or sprinkler systems. Irrigated acres produce primarily grain, hay and pasture (Powder Basin Watershed Council 1996).

Most of the private land in Baker County is zoned "exclusive farm use" (EFU). Most of the remaining private land is zoned "timber-grazing", 80% of which is used primarily for grazing. Less than 10% of the private land in the county is zoned in any other category (G. Young, personal communication, 2001).

Mineral mining was important in Baker County historically. The effects of past dredge mining can be seen along stream courses throughout the subbasin in the form of tailings that line the riparian areas including 1,400 acres of tailings above Phillips Lake (Powder Basin Watershed Council 2001). Currently, mining continues to be a significant land use in the county. Baker County presently has more patented mine claims than all other Oregon counties combined. Additionally, there are many, "maybe thousands" of unpatented mineral claims in the county (G. Young, personal communication, 2001). Baker County is the only county in Oregon with a specific zoning category for "mineral extraction" (ME).

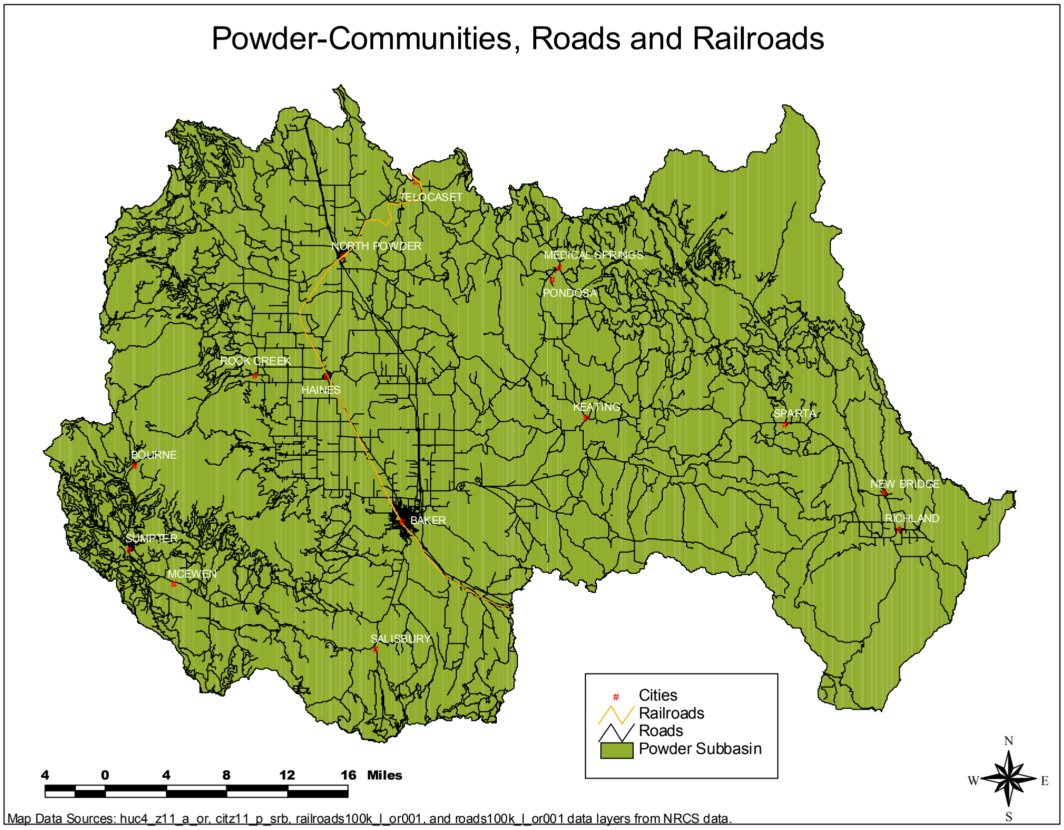


Figure 3. Communities, roads and railroads of the Powder River subbasin, Oregon.

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

The federal government is the single largest land manager in the Powder Basin (Figure 4). Within Baker County, the BLM manages 367,168 acres and the Forest Service manages 604,927 acres (Powder Basin Watershed Council 1996). Approximately half of Baker County is federally owned (G. Young, Baker County Senior Planner, personal communication, September 2001).

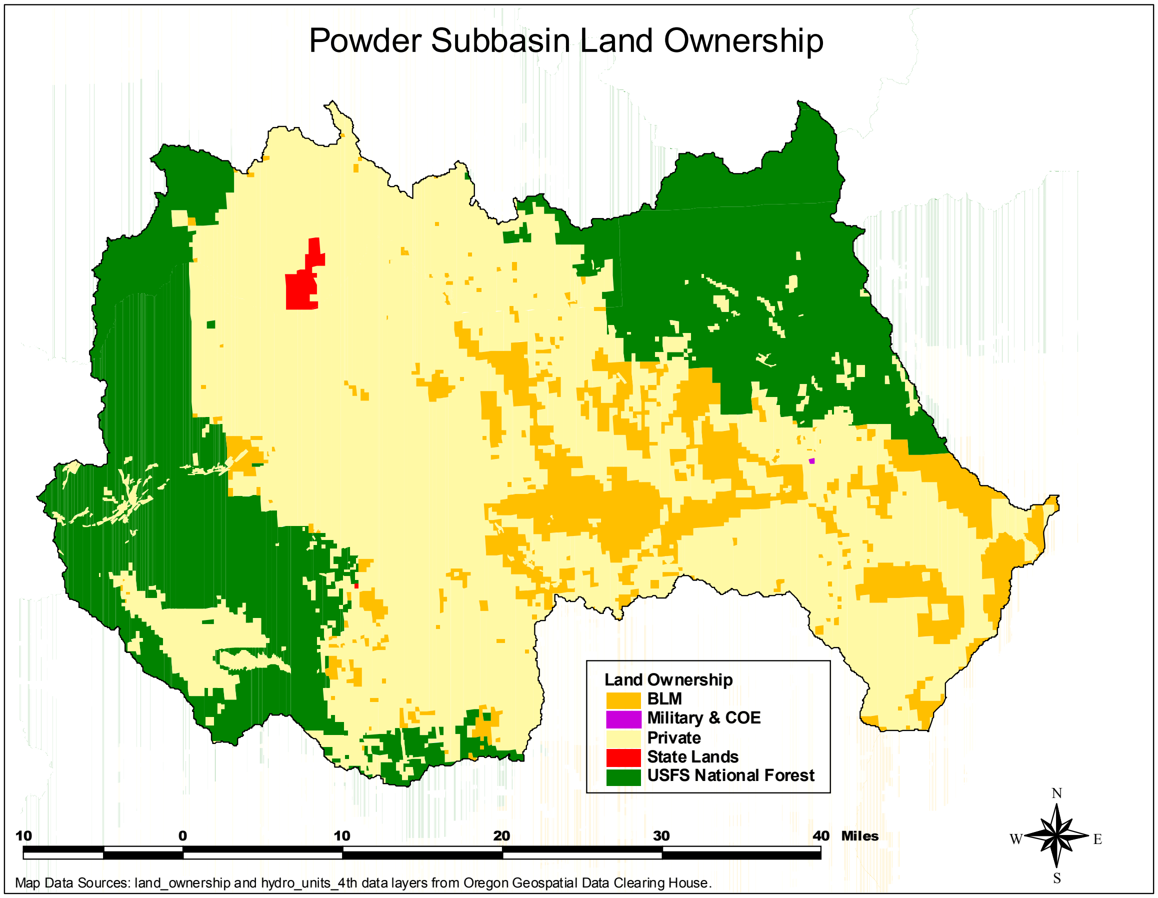


Figure 4. Land ownership in the Powder River subbasin, Oregon.

3.1.2. Subbasin Existing Water Resources

3.1.2.1 Watershed Hydrography

The Powder River subbasin is comprised of a single watershed, the Powder, with a drainage area of about 1,747 mi^2 and a perimeter of 222 mi. This watershed drains about two-thirds of Baker County. Notable streams in the Powder subbasin are listed in Table 2.

Table 2. Notable streams in the Powder subbasin, Oregon, and their points of confluence with the Powder River or its tributaries.

Main Stream	Tributary (RM)	Tributary (RM)
Powder River		
	Daly Creek (9)	

	Eagle Creek (10)	
		Little Eagle Creek (12)
		Paddy Creek (18)
		East Eagle Creek (21.5)
		West Eagle Creek (27)
	Goose Creek (36.5)	
	Ritter Creek (41)	
	Balm Creek (43)	
	Ruckles Creek (51.5)	
	Big Creek (61)	
	Jimmy Creek (79)	
	Wolf Creek (81)	
		Clear Creek (9)
	North Powder River (82)	
		Anthony Creek (10)
	Rock Creek (98)	
	Baldock Slough (102)	
	Sutton Creek (114)	
	Beaver Creek (120)	
	Denny Creek (125)	
	Deer Creek (135)	
	Cracker Creek (144)	
	McCully Fork (144)	

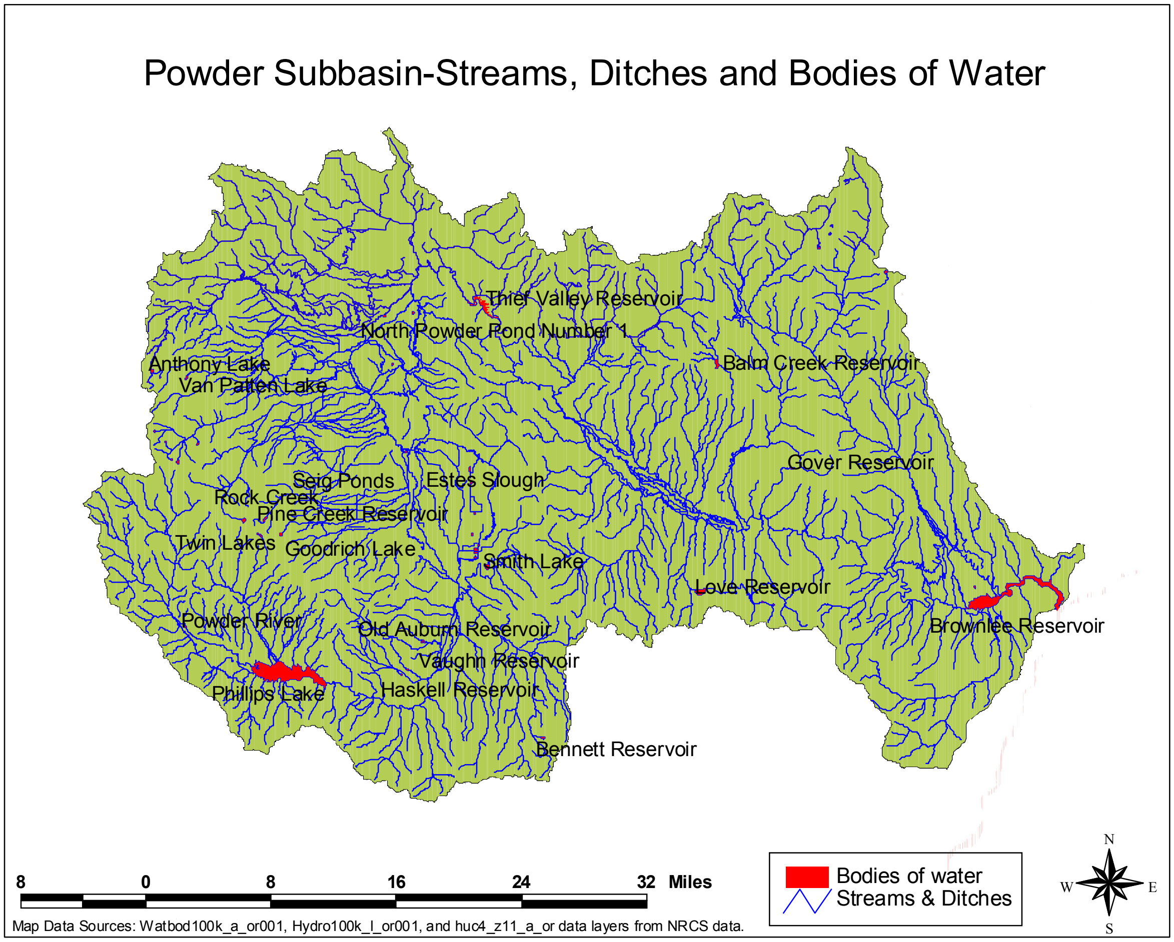


Figure 5. Streams, major ditches and reservoirs of the Powder River subbasin, Oregon.

3.1.2.2 Hydrologic Regime

The headwater streams of the Powder River subbasin are located in the Blue and Wallowa mountains at elevations between 6,000 and 9,000 feet. The timing and amount of spring runoff is dependent on winter snowpack depth and condition as well as spring weather factors such as temperature and rainfall. Seasonal peak flows in streams originating in the Blue Mountains generally occur in late April and early May. Peak flows in Eagle Creek usually occur in mid May to early June (J. Rodgers, OWRD, personal communication, 2001). Diversion of water for irrigation and municipal use has a significant effect on flow conditions and connectivity in the Powder subbasin. Portions of many streams are dry during late summer due to diversions (Wallowa Whitman National Forest 1999).

The drainage area above Thief Valley Dam is about 911 mi^2 with an average annual discharge of 141,529 acre-feet. The area above Mason Dam at Phillips Lake is about 168 mi^2 and annually discharges an average of 74,385 acre-feet (USBR dataweb).

The largest reservoir in the subbasin, Phillips Lake, has active storage capacity of 90,500 acre-feet. The maximum water storage occurred in 1983 with 86,337 acre-feet stored. The primary use of the stored water is for irrigation. Releases from the reservoir are controlled to moderate the seasonal variations in stream flow. The actual release pattern depends on available water and expected runoff for any year.

The minimum recorded monthly mean flow in the Powder River near Sumpter, Oregon (above Phillips Lake) between 1968 and 1987 was 0.4 cubic feet per second (cfs) in January

1968. The maximum recorded mean flow during the same period was 324 cfs in May, 1975 (Powder Basin Watershed Council 2001). In Eagle Creek, peak flows average 20 times as high as summer low flows.

Three aquifer types are found within the Powder River subbasin although about 41% of the subbasin has no principal aquifer (Table 3).

Table 3. Principal aquifers in the Powder River subbasin, Oregon.

Aquifer	Square Miles	Percent of Subbasin	Rock Type
No Principal Aquifer	695	40.6	N/A
Pacific Northwest basin-fill aquifers	496	29.0	Unconsolidated sand and gravel
Columbia Plateau aquifer system	355	20.7	Basalt and other volcanic rock
Miocene basaltic-rock aquifers	165	9.6	Basalt and other volcanic rock

Most surface and ground water use is for irrigation. There are four irrigation or water control districts in the Powder subbasin: Baker Valley Irrigation District, Lower Powder Irrigation District, Pilcher Creek Water Control District and Wolf Creek Water Control District. There are about 200 irrigation diversions managed by the Baker Valley Irrigation District and at least that many more in the other three districts combined (J. Colton, Baker Valley Irrigation District, personal communication August 2001). Precise information regarding the number of water rights holders in the subbasin is unavailable. Sales and subdivision of water rights over the years has created a situation where there are too many small water rights holders for accurate records to be kept. Despite the lack of details regarding water rights, it is known that the water in the Powder River subbasin is fully appropriated (J. Rodgers, personal communication, 2001); during the summer there is no remaining unappropriated water. In low-water years, available water may be inadequate to supply junior water rights holders and Phillips Lake is drawn down to extremely low levels.

3.1.2.3 Water Quality

The Oregon Department of Environmental Quality (ODEQ) has identified several stream segments in the Powder River subbasin as water quality limited (Figure 6, Table 4) Water quality limited means instream water quality fails to meet established standards for certain parameters for all for a portion of the year. Oregon's 2003 303(d) List of Water Quality Limited Waterbodies identifies seven parameters of concern in the Powder subbasin. These are flow modification, habitat modification, sedimentation, temperature, turbidity, dissolved oxygen and bacteria.

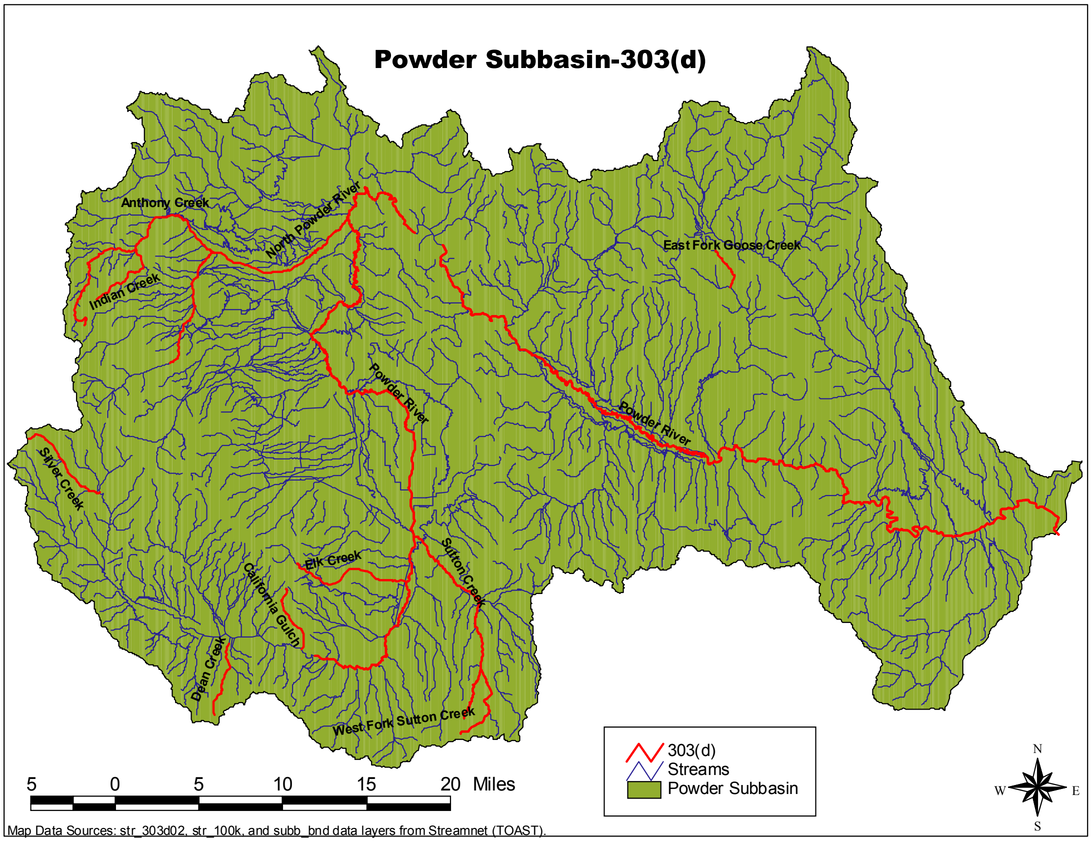


Figure 6. Powder subbasin, Oregon, 303(d) listed streams.

Table 4. Powder subbasin, Oregon, 303(d) listed stream segments and parameters of concern.

Stream Segment	Parameters of Concern
Anthony Creek	Temperature
California Gulch	Temperature
Dean Creek	Temperature
Elk Creek	Temperature
Goose Creek, East Fork	Turbidity
Indian Creek	Temperature
North Powder River	Temperature
Powder River – mouth to Thief Valley Reservoir	Temperature, Dissolved Oxygen, Fecal Coliform
Powder River – Thief Valley Reservoir to Sutton Creek	Temperature, Fecal Coliform
Powder River – Sutton Creek to National Forest Boundary	Fecal Coliform
Silver Creek	Temperature
Sutton Creek	Temperature
Sutton Creek, West Fork	Temperature

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

Water quality parameters (and standards) of temperature (64°F/55°F, rearing/spawning; 68°F redband trout; 54°F bull trout), dissolved oxygen (98% sat), habitat modification (pool frequency), and flow modification (flows) relate to the beneficial use for fish life (ODEQ 2003). Table 5 describes how temperature affects cold-water fish mortality (ODEQ 2000). Present water quality in the Powder River subbasin is a result of the interaction of present riparian condition, irrigation and seasonal climatic fluctuations. Factors which have historically affected riparian conditions include mining, grazing forestry and road building. These factors tended to be more intensive during early settlement and through the early 1900s; resource management has generally improved in more recent times.

Table 5. Modes of thermally induced cold-water fish mortality

Modes of Thermally Induced Fish Mortality	**Temperature Range**	**Time to Death**
Instantaneous Lethal Limit – Denaturing of bodily enzyme systems	> 90°F > 32°C	Instantaneous
Incipient Lethal Limit – Breakdown of physiological regulation of vital bodily processes, namely: respiration and circulation	70°F to 77°F 21°C to 25°C	Hours to Days
Sub-Lethal Limit – Conditions that cause decreased or lack of metabolic energy for feeding, growth or reproductive behavior, encourage increased exposure to pathogens, decreased food supply and increased competition from warm water tolerant species	64°F to 74°F 20°C to 23°C	Weeks to Months

Reproduced from ODEQ 2000

Water temperature is a concern in the Powder River subbasin; eleven of the thirteen 303(d) listed stream segments are listed for temperature. Federal law requires that water bodies that appear on the 303(d) list be managed to meet state water quality standards. The ODEQ's comprehensive approach for protecting water quality includes developing pollution load limits, known as Total Maximum Daily Loads (TMDLs) for both point and non-point sources. ODEQ is committed to having federally approved TMDLs on all waterbodies listed on the 1998 303(d) list by the end of the year 2007. The target date for completion of a TMDL in the Powder subbasin is 2005.

3.1.2.4 Riparian Resources

See Section 3.4.2, habitat discussions.

3.1.2.5 Wetland Resources

See Section 3.4.2, habitat discussions.

3.1.3. Identification of 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 7), wind exposure and temperature extremes, is a major influence on the ecology of the subbasin. The lower elevation valley bottom of the Powder River is generally warmer and drier than higher elevation areas of the Blue Mountains. These differences can be seen in the progression of upland vegetation communities from 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.

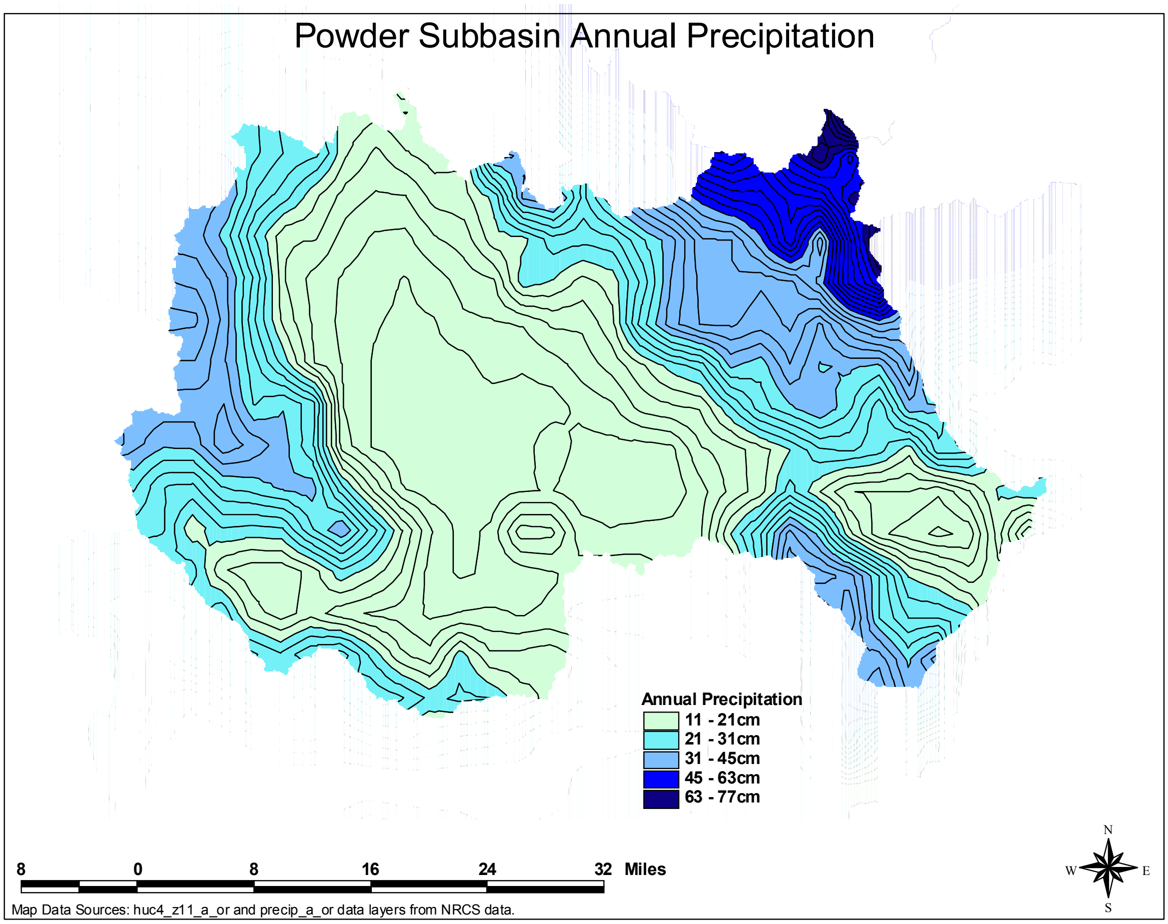


Figure 7. Precipitation patterns in the Powder River subbasin, Oregon.

3.1.3.3 Human Use Influence on Hydrology in the Subbasin

The Powder River subbasin includes numerous ditches both active and no longer in use. These ditches were constructed for use in mining and irrigation. There is, at present, no inventory of ditches in the Powder subbasin although such an inventory is in progress (J. Rodgers, personal communication, August 2001). It is not known how many of the historic ditches are still in use or how much water they carry. The South Catherine Ditch carries water from Catherine Creek in the Grande Ronde subbasin to Big Creek at the northern edge of the Powder subbasin. This out-of-basin source provides supplemental irrigation water to the Big Creek drainage. Given the absence of anadromous fish in the subbasin, screening of diversions has been minimal and low priority. However, efforts are underway to increase screening.

The Powder River subbasin contains numerous dams and impoundments. The largest of these is Phillips Lake with a storage capacity of 114,000 acre-feet (90,000 acre-feet usable storage) behind Mason Dam, completed in 1968. The OWRD lists 46 dams in the subbasin with storage capacities of 10 acre-feet or more (Table 6). Many, smaller impoundments and ponds also serve as water storage for irrigation and livestock.

There are presently no hydroelectric generating facilities in the Powder River subbasin. There is a hydropower generating facility, no longer in use, on Rock Creek. This facility, operated by the Oregon Trail Electric Cooperative, is scheduled to be decommissioned within the year.

Table 6. Powder River subbasin, Oregon dams with storage capacities of 10 acre-feet or more.

Name	Stream	Dam Height (ft)	Storage (Ac-ft)
Unnamed	First Creek and springs	10	10
Unnamed	A spring	10	25
Bacher Creek Reservoir	Bacher Creek	30	120
Baker Reservoir	Crew Springs	10	20
Balm Creek Reservoir	Balm Creek and Union Spring	65	2926
Bennett Dam	East Sutton Creek	22	206
Cranston Reservoir	Clover Creek	10	50
Crater Lake	runoff from watershed	31	190
Eagle Lake	Eagle Lake	33	844
Echo Lake Reservoir	West Eagle Creek	10	300
Fisk Reservoir-Little Park	Thorn Creek	31	280
Goodrich Reservoir	Goodrich Creek	65	603
Haines-City Lagoon #2	City sewage	14	10
Haines-City Lagoon #3	City sewage	18	10
Haskell Reservoir	Elk Creek	10	100
Homesite 1	Not listed	22	46
Hovan-Johnson Reservoir	Big Houghton Creek	10	16
Jimmy Creek Reservoir	Jimmy Creek	42	675
Killamacue Reservoir	Killamacue Lake	11	798
Laird Reservoir	Sag Creek	20	69
Licklider Dam	Griffin Gulch	20	9
Looking Glass Lake Reservoir	Eagle Creek	13	527

Love Reservoir	Love Creek, Lawrence Creek	30	920
Mason Dam	Powder River	167	114,000
Nault Reservoir	W. Fork Sutton Creek	15	49
Pilcher Creek Reservoir	Anthony and Pilcher Creeks	110	5,910
Prowell Dam	Beaver Creek	21	40
Reservoir #2	W. Fork Love Creek	10	300
Reservoir #3	W. Fork Love Creek	10	300
Rock Creek Lake	Rock Creek	28	452
Salmon Creek Reservoir	Salmon Creek	41	255
Saw Mill Gulch Reservoir	Saw Mill gulch	30	150
Shaw Reservoir	Little, Dry and Gussie creeks	48	504
Shaw South Reservoir	Juniper Gulch	18	48
Smith Lake	Powder River	26	580
Spalding-Vaughn Reservoir #2	Elk Creek-Burlap and Juniper Gulches	10	9
Spaulding-Vaughn Reservoir	Elk Creek-Burlap and Juniper Gulches	10	106
Stoddard Dam	Main Eagle Creek	10	40
Thief Valley Reservoir	Powder River	66	17,400
Turner Reservoir	Second Creek	10	50
Unnamed	First Creek and White Swan Gulch	10	100
Van Patton Lake Dam	N. Fork Dutch Flat Creek	25	583
Vogel Reservoir	Union Creek	15	30
Widman Reservoir	West Fork Love Creek	30	65
Wirth Reservoir	Big Creek	36	59
Wolf Creek Reservoir	Wolf and Anthony creeks	125	10,800

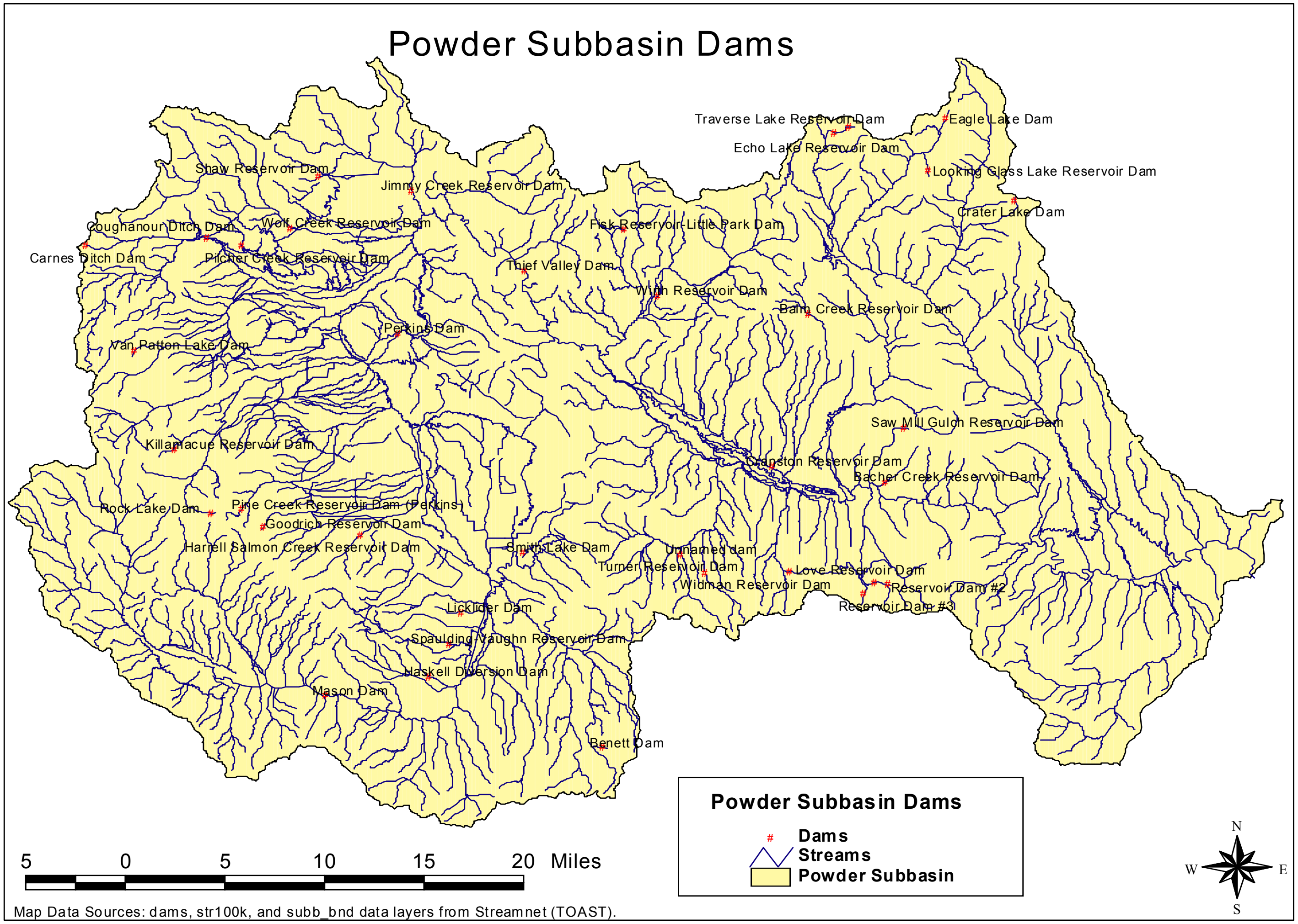


Figure 8. Dams in the Powder River subbasin, Oregon.

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

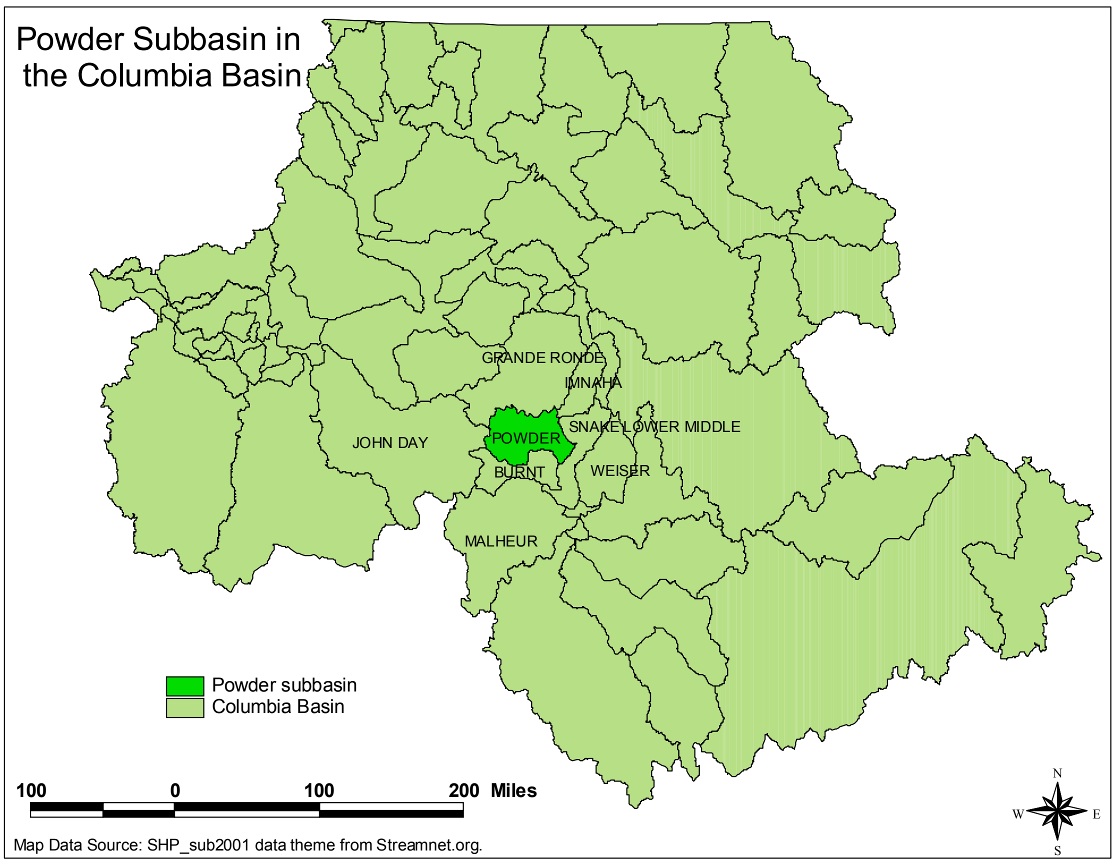


Figure 9. The Powder River subbasin within the Columbia River Basin.

3.1.4.2 Relation to the Ecological Province

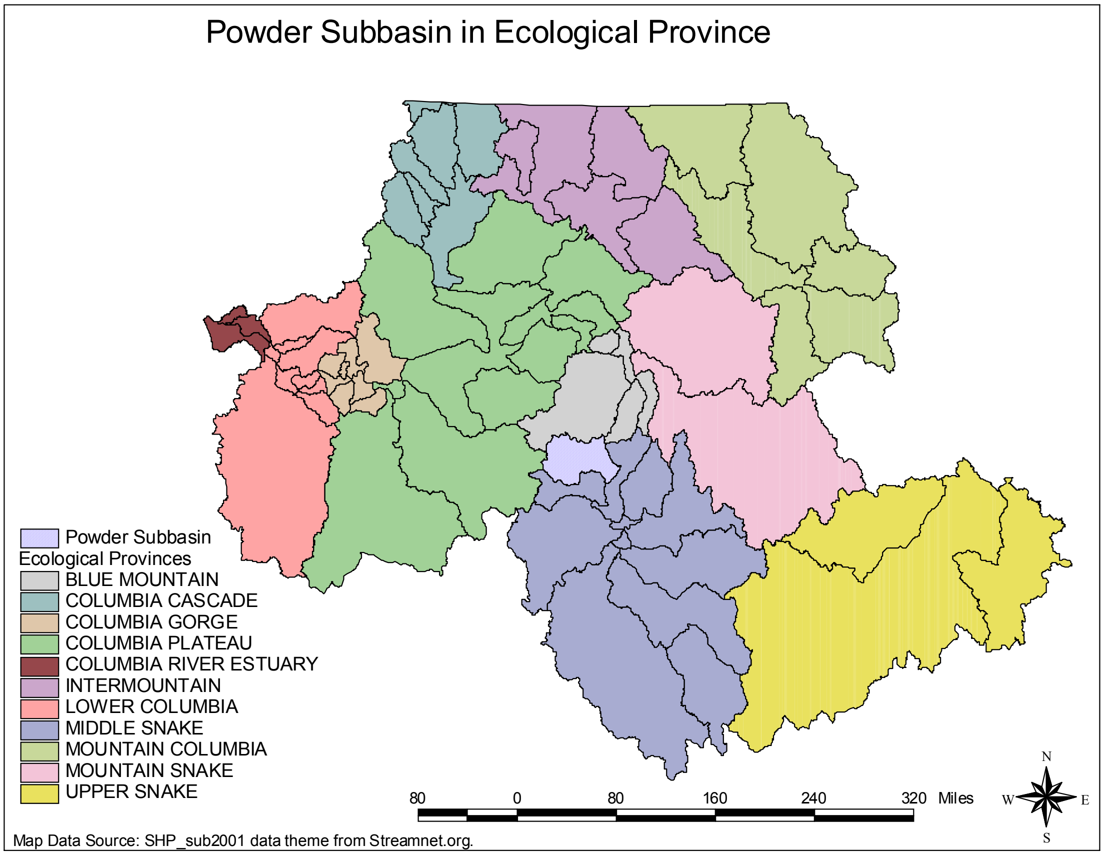


Figure 10. The Powder River subbasin within the Lower Middle Snake Ecological Province.

3.1.4.5 NOAA Fisheries Evolutionary Significant Units

Anadromous fish have been extirpated from the subbasin; the subbasin is not part of any ESU. If anadromous fish were reintroduced to the Powder River system, they would be considered part of the Snake River ESU.

3.1.4.6 USFWS Designated Bull Trout Planning Units

The Powder River 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:

The Powder River subbasin once supported healthy runs of anadromous fish as well as a variety of resident fish species. Thompson and Haas (1960) reported on the historical presence and later decline of anadromous fish in the Powder River:

> The Powder River was once an important salmon and steelhead stream. Reports from local residents indicate that Chinook salmon spawned from

> the headwaters to the lower end of the North Powder Valley. While mining, logging and irrigation undoubtedly caused these runs to decline, it was not until the construction of Thief Valley Dam in 1931 that the anadromous species were completely eliminated from the upper area of the drainage.

Chapman (1940) reports that Chinook continued to arrive at the base of the dam until the last cycle died off. Thompson and Haas (1960) reported that Chinook salmon were still present in Eagle Creek and steelhead were in Big Creek, Goose Creek and Daly Creek. Construction of the Hells Canyon Complex of dams, beginning with Brownlee Dam in 1958, created the final barrier to anadromous fish passage and eliminated the last of the salmon and steelhead runs from the subbasin.

Although the Powder River subbasin lacks anadromous fish, it does support diverse resident fish populations and an active recreational fishery. Resident fish include both native and introduced species (Appendix Table 1).

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:

A variety of wildlife species are found in the riverine, wetland and upland habitats of the Powder River subbasin. The Interactive Biodiversity Information System (IBIS) of the Northwest Habitat Institute (NHI) lists a total of 430 wildlife species for the Oregon portion of the Middle Snake Ecological Province, most of which may be found in some portion of the Powder River subbasin (Appendix Table 2). This list includes 13 amphibian species, 294 birds, 99 mammals and 24 reptiles.

Various populations of wildlife species are managed by federal and state wildlife managers throughout the subbasin including big game, furbearers, upland birds, and waterfowl. Many raptor species [e.g., golden eagle (*Aquila chrysaetos*), American kestrel (*Falco sparvarius*), northern goshawk (*Accipiter gentilis*)] inhabit the subbasin including several seasonal migrants [e.g., bald eagle (*Haliaeetus leucocephalus)*, Swainson's hawk (*Buteo swainsoni*)].

The Powder subbasin includes portions of the Sumpter, Lookout Mountain and Keating Wildlife Management Units (WMUs) and very small portions of the Catherine Creek and Starkey WMUs.

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 Powder River 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 7, Table 8).

Table 7. State and Federally listed Threatened Fish Species in the Powder subbasin.

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

Table 8. State and Federally listed Threatened and Endangered Wildlife Species potentially in the Powder 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 Powder River subbasin, one fish and 23 wildlife species are designated Species of Concern by the USFWS and NOAA Fisheries.

Table 9. Federally Designated Fish Species of Concern in the Powder River Subbasin.

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

Table 10. Federally Designated Wildlife Species of Concern potentially in the Powder River 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 woodpecker	*Picoides albolarvatus*	Species of Concern	Sensitive Critical
Columbian sharp-tailed grouse*	*Tympanuchus phasianellus*	Species of Concern	None
pygmy rabbit*	*Brachylagus idahoensis*	Species of Concern	Sensitive - Vulnerable
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

Common Name	*Scientific Name*	Federal Status	Oregon Status
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 11. State and Federal Special Status Plant Species in the Powder River 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)
upward-lobed moonwort	*Botrychium ascendens*	SOC	C	G2G3, S2	Powder, Upper John Day
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, Upper John Day, NF John Day
stalked moonwort	*Botrychium pedunculosum*	SOC	C	G2G3, S1	NF John Day
Clustered lady's-slipper	*Cypripedium fasciculatum*	SOC	C	G3G4, S2	
Cronquist's stickseed	*Hackelia cronquistii*	SOC	LT	G3, S3	Brownlee Reservoir
Red-fruited lomatium	*Lomatium erythrcarpum*	SOC	LE	G1, S1	Powder
Cusick's lupine	*Lupinus cusickii*	SOC	LE	G2, S2	Burnt
Oregon semaphoregrass	*Pleuropogon oregonus*	SOC	LT	G1, S1	Powder
Snake River goldenweed	*Pyrrocoma radiata*	SOC	LE	G3, S3	
Bartonberry	*Rubus bartonianus*	SOC	C	G2, S2	Brownlee Reservoir
Howell's spectacular thelypody	*Thelypodium howellii*	LT	LE	G3?T1, S1	Powder
Douglas clover	*Trifolium douglasii*	SOC	None	G2, S1	Brownlee Reservoir

Source: ONHP 2001 and Nature Serve Explorer www.natureserve.org
[1] SOC = Species of Concern
[2] LT = Listed Threatened; LE = Listed Endangered; C = Candidate
[3] Gx = Global Rank; Sx = State Rank (Oregon); For rank definitions, see www.natureserve.org

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 12). 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 13). 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 14). These target species and their habitats are considered for habitat mitigation throughout the Columbia Basin, including the Powder subbasin.

Table 12. 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*
American Crow	*Corvus brachyrhynchos*
Big Brown Bat	*Eptesicus fuscus*
Horned lark	*Eremophila alpestris*
Common porcupine	*Erithizon dorsatum*
Sagebrush vole	*Lagurus curtatus*
Snowshoe Hare	*Lepus americanus*
Montane Vole	*Microtus montanus*
Brown-headed Cowbird	*Molothrus ater*
Mink	*Mustela vison*
Bushy-tailed Woodrat	*Neotoma cinerea*
American Pika	*Ochotona princeps*
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 13. Functional Specialist species in the Middle Snake Ecological Province and the number of Key Environmental Functions (KEFs) performed by each (NHI-IBIS 2003).

Species Common Name	Species Scientific Name	# of KEFs
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 14. 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 in Table 15.

Table 15. 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 Powder 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. 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. There is disagreement on whether Rocky Mountain Goats are native to Oregon. Witmer and Lewis (2001) list them as an introduced species with an introduction in northeast Oregon in 1950. Verts and Carraway consider mountain goats native to Washington but introduced to Oregon. On the other hand, based on archeological evidence and historical accounts, ODFW (2003) considers mountain goats to be native to northeast Oregon and the Cascades. The subbasin technical team agrees that mountain goats were likely native to the area and were probably extirpated before the arrival of non-Native Americans. Mountain goats were selected as a focal species for subbasin planning and their historic and current distribution will be discussed in greater detail in section 3.2.4 of this document. Table 16 and Table 17 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 16. Aquatic species extirpated from the Powder subbasin

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

Table 17. Terrestrial wildlife species extirpated from the Powder 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 Powder 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 t he owners no longer wished or were able to care for the animals (e.g., bullfrog). Table 18 and Table 19 list introduced fish and wildlife species.

Table 18. Introduced fish of the Powder 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*
Walleye	*Stizostedion vitreum*		

Table 19. Introduced wildlife of the Powder 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).

Baker County is designated as a Weed Control District, formed under ORS 570.505. Its purpose is to contain, control and eradicate noxious weeds in its jurisdiction. A total of 37 noxious weeds have been listed by the Baker County Weed District (Table 20).

Table 20. Noxious weeds listed by the Baker County Weed District. A * denotes species known to occur in the subbasin.

Common Name	Scientific Name	Common Name	Scientific Name
rush skeletonweed*	*Chodrilla juncea*	hoary cress (white top)*	*Cardaria draba*
common bugloss*	*Anchusa officianalis*	Dalmatian toadflax*	*Linaria dalmatica*
yellow toadflax*	*Linaria vulgaris*	purple loosestrife	*Lythrum salicaria*
Chickory*	*Chchorium intybus*	Scotch thistle*	*Onopordum acanthium*
common tansy*	*Tanacetum vulgare*	diffuse knapweed*	*Centaurea diffusa*
spotted knapweed*	*Centaurea maculosa*	bur buttercup*	*Ranunculus testiculatus*
yellow starthistle*	*Centaurea soltitalis*	tansy ragwort*	*Senecio jacobaea*
medusahead rye*	*Teaniatherum caput-medusa*	jointed goatgrass*	*Aegilops cylindrica*
Mediterranean sage*	*Salvia aethiopis*	musk thistle*	*Carduus nutans*
perennial pepperweed*	*Lepidium latifolium*	leafy spurge*	*Euphorbia esula*
Canada thistle*	*Cirsium arvense*	common teasel*	*Dipsacus fullonum*
field dodder*	*Custuca campestris*	puncture vine*	*Tribulus terrestris*
poison hemlock*	*Conium maculatum*	common mullein*	*Verbascum thapsus*
St. Johnswort*	*Hypericum perforatum*	moth mullein*	*Verbascum blateria*
Waterhemlock*	*Circuta maculata*	morning glory*	*Convolvulus sepium*
Russian knapweed*	*Cantaurea repens*	Russian thistle*	*Salsola tenuifolia*
Dyer's woad*	*Isatis tinctoria*	Kochia*	*Kochia scoparia*
buffalo burr*	*Solanum rostratum*	black henbane*	*Hyoscyamus niger*
Venice mallow	*Hibiscus trionum*	myrtle spurge*	*Euphorbia myrsinites*

In addition to those species listed as noxious weeds, numerous other introduced plants occur in the Powder subbasin. 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 may 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 21). 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 21. 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 (A. 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 (*Oncorhynchus mykiss*)
- Bull trout (*Salvelinus confluentus*)

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:
  - Mountain goat (*Oreamnos americanus*)
- Shrub-steppe:
  - Sage grouse (*Centrocercus urophasianus*)
  - Pronghorn (*Antilocapra americana*)
- Open Water – Lakes, Rivers, Streams:
  - Bald eagle (*Haliaeetus leucocephalus*)
- Wetlands:
  - Columbia spotted frog (*Rana luteiventris*)
  - Great blue heron (*Ardea herodias*)
  - Yellow warbler (*Dendroica petechia*)
  - 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.

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 (Table 13). 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 (Appendix Table 3) 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 Powder River redband trout. However, surveys done in the Powder River and Eagle Creek drainages 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 Powder River Basin can be measured by the trend of the population growth rate (USFWS 2002). The estimate of the number of redband trout in the Powder River Subasin 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 Powder River subbasin are resident only. The steelhead life history was extirpated above Thief Valley Dam (RM 69.5) in 1932 and completely 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 life histories.

3.2.3.1.4 Carrying Capacity

No information exists as to the carrying capacity of the Powder River system for redband trout.

3.2.3.1.5 Population Trend and Risk Assessment

An estimate of the number of redband trout in the Powder River 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 Powder River subbasin holds 4 distinct populations of redband trout. These occupy the Powder River from the mouth to Thief Valley Dam, Eagle Creek, The Powder River from Thief Valley Dam to Mason Dam and the Powder River above Mason Dam (ODFW 1997). 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 Powder River 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 between Powder River 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 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

3.2.3.2-A Redband Trout Distribution

3.2.3.2.1 Current Distribution

Distribution of redband trout is widespread throughout the Powder River subbasin (Figure 11, Table 22).

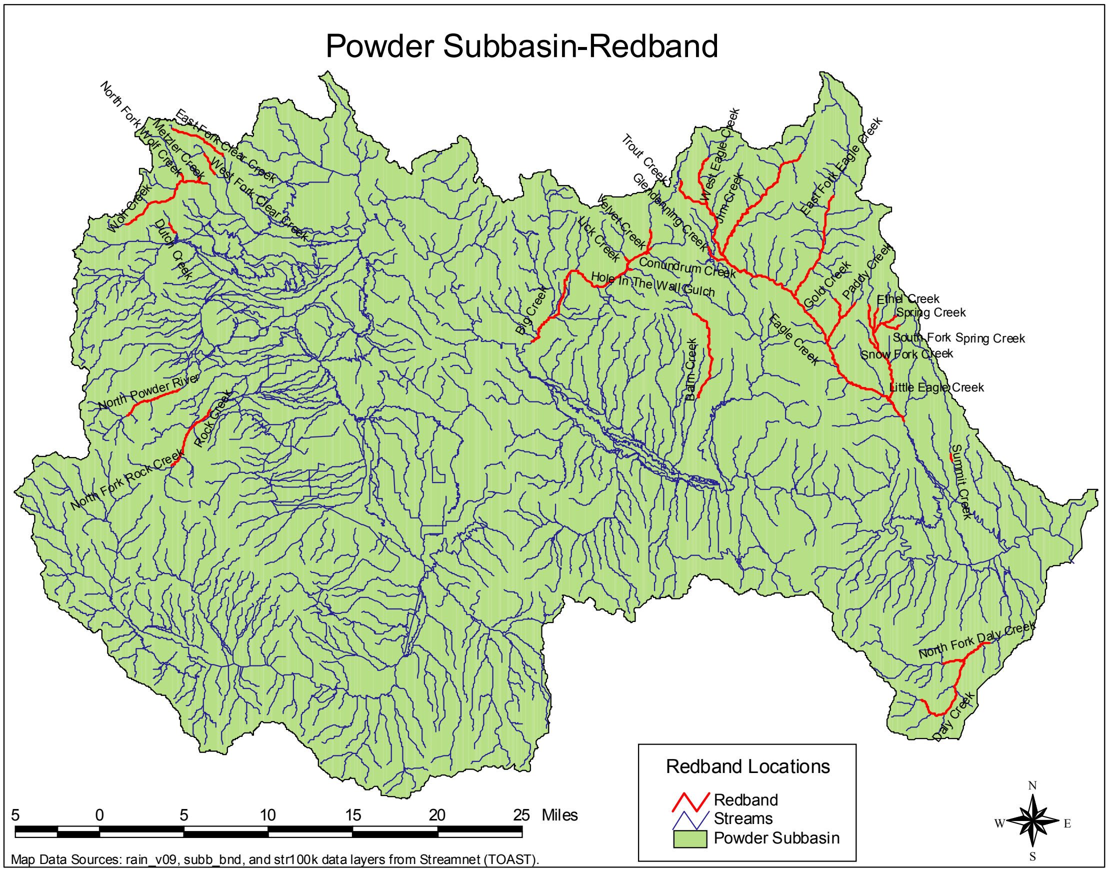


Figure 11. Distribution of redband trout (*Oncorhynchus mykiss gairdneri*) in the Powder River subbasin, Oregon.

Table 22. Species habitat range for redband trout in the Powder River subbasin. Weights were 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
Powder-1	10%	0.0	0.0	0.5	0.5	1	20%	0.0	0.0	1.0	2.0	1
Daly Cr	50%	1.5	1.0	0.5	1.0	1	60%	2.0	1.0	0.5	2.0	1
Eagle Cr-1	5%	0.5	0.1	1.0	1.0	1	20%	1.0	1.0	0.5	2.0	1
Eagle Cr 2	5%	1.0	0.1	0.5	1.0	1	15%	1.0	0.5	1.5	2.0	1
Little Eagle Cr	15%	1.0	1.5	0.5	1.0	1	20%	1.0	1.5	0.5	1.0	1
Eagle Cr-3	20%	1.0	1.5	0.2	1.0	1	40%	2.0	2.0	1.5	2.0	1
Eagle Cr EF	20%	1.0	1.0	0.2	1.0	1	25%	1.5	1.5	0.5	1.0	1
Eagle Cr WF	5%	0.5	1.0	0.2	1.0	1	15%	1.0	1.5	0.5	0.5	1
Eagle Cr-4	15%	1.0	1.5	0.2	1.0	1	20%	2.0	2.0	1.5	2.0	1
Powder-2	10%	0.0	0.0	0.5	0.5	1	20%	0.5	0.5	1.5	2.0	1
Love Cr	5%	0.5	0.5	0.5	0.1	0.5	10%	0.5	0.5	0.5	0.5	1
Goose Cr-1	10%	1.0	0.2	1.0	1.0	1	20%	1.5	0.5	1.0	1.0	1
Goose Cr-2	20%	1.0	1.0	0.2	1.0	1	25%	1.0	1.0	0.2	1.0	1
Powder-3	10%	0.5	0.1	1.5	1.0	1	20%	1.0	0.5	1.5	2.0	1
Ritter Cr	5%	0.5	0.5	0.5	0.1	0.5	10%	0.5	0.5	0.5	0.5	1
Balm-1	10%	1.0	0.2	1.0	1.0	1	20%	1.5	0.5	1.0	1.0	1
Balm-2	20%	1.0	1.0	0.2	1.0	1	25%	1.0	1.0	0.2	1.0	1
Clover Cr	10%	1.0	0.2	1.0	1.0	1	20%	1.5	0.5	1.0	1.0	1
Ruckles Cr	5%	0.5	0.5	0.5	0.1	0.5	10%	0.5	0.5	0.5	0.5	1
Tucker Cr	5%	0.5	0.1	0.5	0.5	1	10%	1.0	0.5	0.5	1.0	1
Powder-4	10%	1.0	0.1	1.5	1.0	1	20%	1.5	0.5	1.5	2.0	
Big Cr-1	10%	1.0	0.2	1.0	1.0	1	20%	1.5	0.5	1.0	1.0	1
Beagle Cr	15%	1.0	1.0	0.2	1.0	1	25%	1.0	1.0	0.2	1.0	1
Big Cr-2	20%	1.0	1.0	0.2	1.0	1	25%	1.0	1.0	0.2	1.0	1
Big Cr-3	15%	0.5	1.0	0.1	1.0	1	25%	1.0	1.0	0.2	1.0	1
Powder-5	10%	1.0	0.1	1.5	1.0	1	20%	1.5	0.5	1.5	2.0	
Powder-6	5%	0.2	0.0	1.0	0.5	1	10%	0.5	0.1	1.0	2.0	
Antelope Cr	5%	1.0	0.2	0.5	0.5	1	10%	1.0	0.2	0.5	0.5	
Jimmy Cr-1	5%	1.0	0.2	0.5	0.5	1	10%	1.0	0.2	0.5	1.0	
Jimmy Cr-2	5%	1.0	0.2	0.5	0.0	1	10%	1.0	0.2	0.5	0.5	
Wolf Cr-1	5%	0.5	0.1	0.5	0.5	1	15%	1.0	0.5	1.0	1.0	
Wolf Cr-2	15%	1.0	1.0	1.0	0.0	1	20%	1.0	1.0	1.0	0.5	
Powder NF-1	5%	1.0	0.0	1.0	1.0	1	20%	1.5	1.5	0.5	2.0	
(Warm Springs Creek)	2%	0.5	0.0	0.5	0.5	0.5	5%	0.5	0.0	0.5	0.5	1
Anthony Cr-1	7%	1.0	0.0	1.0	1.0	1	20%	1.5	1.5	0.5	1.5	1
2 includes North Fork	5%	1.0	1.0	0.5	0.5	1	20%	1.0	1.0	0.5	0.5	1
Powder NF-2	5%	1.5	0.1	0.2	1.0	1	20%	1.5	1.0	1.0	1.0	1
Powder NF-3	10%	1.5	1.5	0.5	1.0	1	20%	1.5	1.5	0.5	1.0	1
Powder-7	10%	1.0	0.5	1.0	0.5	1	25%	1.5	0.5	1.5	2.0	
Muddy Creek-1	10%	1.0	0.1	1.0	0.5	1	25%	1.5	0.5	1.0	1.5	
Muddy Creek-2	20%	1.5	1.0	0.5	0.5	1	20%	1.0	1.0	0.5	1.0	
Rock Cr-1	10%	1.0	0.1	1.0	0.5	1	25%	1.5	0.5	1.0	1.5	
Rock Cr-2	20%	1.5	1.0	0.5	0.5	1	20%	1.0	1.0	0.5	1.0	
Willow Cr-1	10%	1.0	0.1	1.0	0.5	1	25%	1.5	0.5	1.0	1.5	
Willow Cr-2	20%	1.5	1.0	0.5	0.5	1	20%	1.0	1.0	0.5	1.0	
Salmon Cr-1	10%	1.0	0.1	1.0	0.5	1	25%	1.5	0.5	1.0	1.5	
Pine Creek-1	10%	1.0	0.1	1.0	0.5	1	25%	1.5	0.5	1.0	1.5	
Pine Creek-2	20%	1.5	1.0	0.5	0.5	1	20%	1.0	1.0	0.5	1.0	
Creek-1 (Pine system)	10%	1.0	0.1	1.0	0.5	1	25%	1.5	0.5	1.0	1.5	
Creek-2 (Pine system)	20%	1.5	1.0	0.5	0.5	1	20%	1.0	1.0	0.5	1.0	
Salmon Cr-2	10%	1.0	0.1	1.0	0.5	1	25%	1.5	0.5	1.0	1.5	
Goodrich-1	10%	1.0	0.1	1.0	0.5	1	25%	1.5	0.5	1.0	1.5	
Goodrich-2	20%	1.5	1.0	0.5	0.5	1	20%	1.0	1.0	0.5	1.0	
Salmon Cr-3	10%	1.0	0.1	1.0	0.5	1	25%	1.5	0.5	1.0	1.5	

Table Continued.

Mill Creek-1	10%	1.0	0.1	1.0	0.5	1	25%	1.5	0.5	1.0	1.5	
e Nelson Ditch 4200')	20%	1.5	1.0	0.5	0.5	1	20%	1.0	1.0	0.5	1.0	
arble Creek System-1	10%	1.0	0.1	1.0	0.5	1	25%	1.5	0.5	1.0	1.5	
arble Creek System-2	20%	1.5	1.0	0.5	0.5	1	20%	1.0	1.0	0.5	1.0	
Salmon Cr-4	20%	1.5	1.0	0.5	0.5	1	20%	1.0	1.0	0.5	1.0	
Old Settlers Slough	5%	0.0	0.0	0.5	0.5	1	15%	0.0	0.5	1.5	1.0	
Baldock Slough	2%	0.0	0.0	0.2	0.2	1	5%	0.0	0.5	1.0	1.0	
Sutton Cr/Ebell Cr	15%	1.5	0.2	1.0	1.0	1	30%	1.5	0.5	1.0	1.5	
Powder-8	15%	1.0	1.0	0.5	1.0	1	25%	1.5	0.5	1.5	2.0	
Beaver Cr	10%	1.0	0.1	0.5	1.0	1	25%	1.0	0.5	0.5	1.0	
Powder-9	2%	0.0	0.1	0.5	0.0	1	25%	1.5	0.5	1.5	2.0	
Powder-10	10%	1.0	1.0	0.5	1.0	1	25%	1.5	0.5	1.5	2.0	
Deer Creek-1	15%	1.5	0.5	1.0	1.0	1	25%	1.5	1.0	0.5	1.0	
Deer Creek-2	15%	1.5	1.0	0.5	1.0	1	25%	1.5	1.0	0.5	1.0	
tle Dean, Clear Creeks	10%	1.0	1.0	1.0	0.0	1	10%	1.0	1.0	1.0	1.0	
Smith-Bridge-Union Cr	5%	1.0	1.0	1.0	0.0	1	10%	1.0	1.0	1.0	1.0	
Powder-11	10%	1.0	1.0	0.5	1.0	1	25%	1.5	0.5	1.5	2.0	
Gulch in upper Powder	5%	0.5	0.1	0.1	0.0	1	15%	0.5	0.5	0.1	0.5	
Cracker Cr-1	10%	1.0	1.5	0.5	1.0	1	15%	1.0	1.5	0.5	1.0	
Cracker Cr-2	5%	0.5	1.5	0.5	1.0	1	10%	1.0	1.5	0.5	1.0	
McCully Cr	10%	1.0	1.5	0.5	1.0	1	15%	1.0	1.5	0.5	1.0	

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 from 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 legal, or "catchable", fish and fingerlings in numerous locations within the subbasin. Rainbow trout released in the Powder River 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 Powder River 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 Powder River subbasin in the 1920's and 30's and again in the 1960's. Cutthroat trout were stocked into standing water bodies in the subbasin in the 1950's and 1960's. Golden trout were stocked in streams in the wilderness areas in the Eagle Creek drainage. There is little evidence that any of these introduced species except eastern brook trout persist at the current time.

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 Powder River environment by introducing genetic characters evolved in other areas. This potential is limited to local systems influenced by ongoing stocking programs. Although it is possible that introduced cutthroat or golden trout may have interbred with native redband trout, genetic sampling to date shows no evidence of this (J. Zakel, ODFW, personal communication, 5/16/2004).

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 the Powder River subbasin revealed no hybridization or introgression with non-native rainbow trout (Currens 1991b).

3.2.3 – B Bull Trout

3.2.3.1-B Bull Trout Population Data and Status

3.2.3.1.1 Abundance

No data exist regarding numerical abundance of bull trout in the Powder River subbasin.

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 Powder River 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 have undoubtedly resulted in a decrease in that capacity.

3.2.3.1.5 Population Trend and Risk Assessment

The trend in bull trout populations in the Powder River subbasin is likely a decline. Although population numbers are unknown, all Powder River populations are likely affected by population fragmentation and low numbers of adults (Kostow1995). Buchanan et al (1997) reported that the Upper Powder River populations were at moderate risk, the Indian and Anthony Creek population was at high risk and the North Powder River and Muddy Creek populations were at high risk. The eagle Creek population had been downgraded from high risk to "probably extinct."

3.2.3.1.6 Unique Population Units

The Powder River subbasin contains 10 bull trout population units. These are: Lake Creek, upper Powder River (Silver Creek and Little Cracker Creek), Rock Creek, Big Muddy Creek, Salmon Creek, Pine Creek, N.Powder River, Anthony Creek, Indian Creek, and Wolf 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 Powder River subbasin are considered, by ODFW, part of the Malheur Gene Conservation Group although the Powder River populations are currently isolated from other populations in the group. Genetic samples were collected in 1995 from bull trout in Silver Creek (upper Powder River) and from the North Powder River. Results suggest that bull trout populations from the John Day Basin and northeastern Oregon (including the Powder Basin) comprise a major genetic lineage (Spruell and Allendorf 1997).

3.2.3.1.6.3 Spatial Diversity

Bull trout in the Powder River subbasin are restricted to headwater areas where adequate instream temperatures and habitat remain.

3.2.3.2-B Bull Trout Distribution

3.2.3.2.1 Current Distribution

Bull trout are currently restricted to the headwater areas of Lake Creek, upper Powder River (Silver Creek and Little Cracker Creek), Rock Creek, Big Muddy Creek, Salmon Creek, Pine Creek, N.Powder River, Anthony Creek, Indian Creek, and Wolf Creek. Bull trout are suspected to be in Eagle Creek (J. Zakel, ODFW, personal communication, 5/23/2004).

(Figure 12, Table 23).

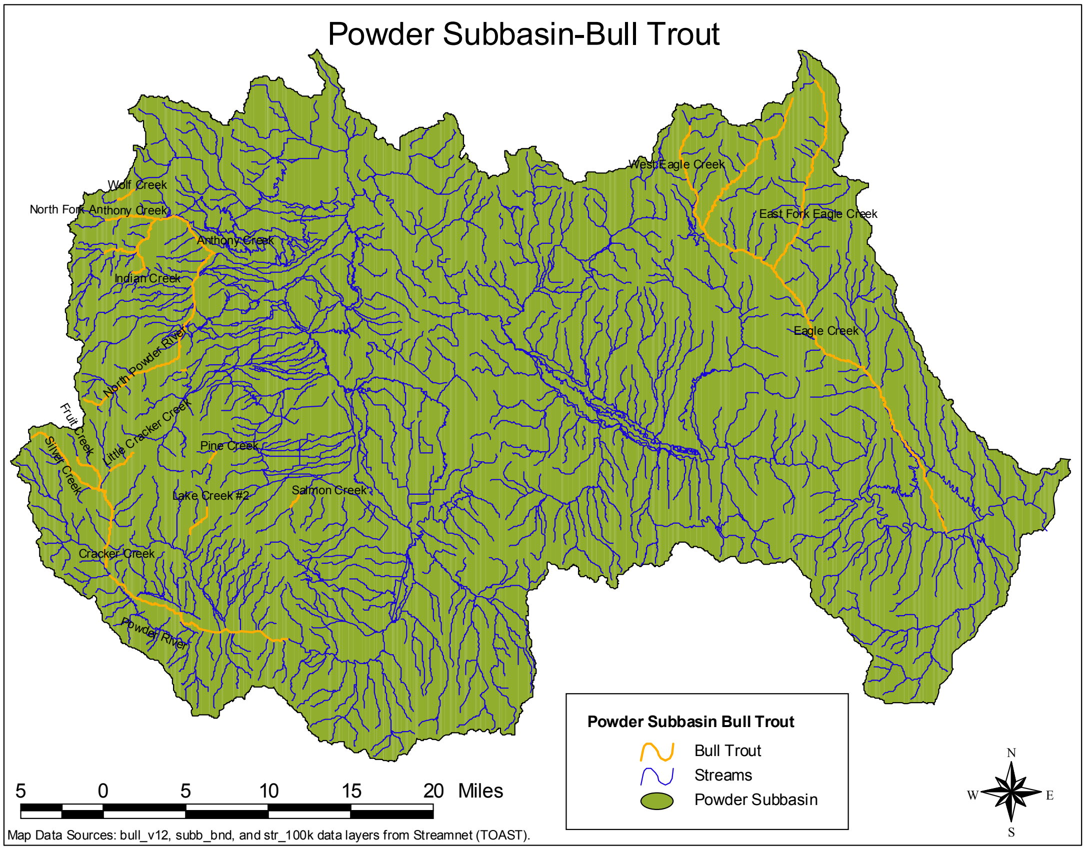


Figure 12. Distribution of bull trout (*Salvelinus confluentus*) in the Powder River subbasin, Oregon.

Table 23. Species habitat range for bull trout in the Powder River subbasin. Weights were 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
Powder-1	0%	0.0	0.0	0.0	0.0	1.5	20%	0.0	0.0	0.5	2.0	1
Daly Cr	0%	0.0	0.0	0.0	0.0	1.5	0%	0.0	0.0	0.0	0.0	1
Eagle Cr-1	0%	0.0	0.0	0.0	0.0	1.5	20%	0.0	0.0	0.5	2.0	1
Eagle Cr 2	0%	0.0	0.0	0.0	0.0	1.5	15%	0.5	0.5	1.5	2.0	1
Little Eagle Cr	0%	0.0	0.0	0.0	0.0	1.5	10%	0.5	0.5	1.0	0.5	1
Eagle Cr-3	0%	0.0	0.0	0.0	0.0	1.5	40%	2.0	2.0	2.0	2.0	1
Eagle Cr EF	0%	0.0	0.0	0.0	0.0	1.5	25%	1.0	1.5	0.5	0.5	1
Eagle Cr WF	0%	0.0	0.0	0.0	0.0	1.5	25%	1.0	1.5	0.5	0.5	1
Eagle Cr-4	0%	0.0	0.0	0.0	0.0	1.5	10%	0.5	0.5	0.0	0.5	1
Powder-2	0%	0.0	0.0	0.0	0.0	1.5	20%	0.0	0.0	0.5	2.0	1
Love Cr	0%	0.0	0.0	0.0	0.0	1.5	0%	0.0	0.0	0.0	0.0	1
Goose Cr-1	0%	0.0	0.0	0.0	0.0	1.5	10%	0.0	0.0	0.5	1.0	1
Goose Cr-2	0%	0.0	0.0	0.0	0.0	1.5	15%	0.5	0.5	0.2	1.0	1
Powder-3	0%	0.0	0.0	0.0	0.0	1.5	15%	0.0	0.0	1.0	2.0	1
Ritter Cr	0%	0.0	0.0	0.0	0.0	1.5	0%	0.0	0.0	0.0	0.0	1
Balm-1	0%	0.0	0.0	0.0	0.0	1.5	0%	0.0	0.0	0.0	0.0	1
Balm-2	0%	0.0	0.0	0.0	0.0	1.5	0%	0.0	0.0	0.0	0.0	1
Clover Cr	0%	0.0	0.0	0.0	0.0	1.5	0%	0.0	0.0	0.0	0.0	1
Ruckles Cr	0%	0.0	0.0	0.0	0.0	1.5	0%	0.0	0.0	0.0	0.0	1
Tucker Cr	0%	0.0	0.0	0.0	0.0	1.5	0%	0.0	0.0	0.0	0.0	1
Powder-4	0%	0.0	0.0	0.0	0.0	1.5	15%	0.0	0.0	1.0	2.0	1
Big Cr-1	0%	0.0	0.0	0.0	0.0	1.5	10%	0.0	0.0	1.0	1.0	1
Beagle Cr	0%	0.0	0.0	0.0	0.0	1.5	10%	0.5	0.5	0.2	0.2	1
Big Cr-2	100%	0.0	0.0	0.0	0.0	1.5	15%	1.0	1.0	0.2	0.2	1
Big Cr-3	100%	0.0	0.0	0.0	0.0	1.5	5%	0.1	0.1	0.0	0.0	1
Powder-5	100%	0.0	0.0	0.0	0.0	1.5	15%	0.0	0.2	1.0	2.0	
Powder-6	100%	0.0	0.0	0.0	0.0	1.5	15%	0.0	0.1	1.0	2.0	
Antelope Cr	0%	0.0	0.0	0.0	0.0	1.5	0%	0.0	0.0	0.0	0.0	
Jimmy Cr-1	0%	0.0	0.0	0.0	0.0	1.5	0%	0.0	0.0	0.0	0.0	
Jimmy Cr-2	0%	0.0	0.0	0.0	0.0	1.5	0%	0.0	0.0	0.0	0.0	
Wolf Cr-1	0%	0.0	0.0	0.0	0.0	1.5	10%	0.0	0.0	1.0	1.0	
Wolf Cr-2	5%	1.0	1.0	1.0	0.0	1.5	15%	1.0	1.0	1.0	0.5	
Powder NF-1	100%	0.0	0.0	0.0	0.0	1.5	20%	1.0	1.0	0.5	2.0	
(Warm Springs Creek)	0%	0.0	0.0	0.0	0.0	1.5	5%	0.0	0.0	0.5	0.2	1
Anthony Cr-1	100%	0.0	0.0	0.0	0.0	1	20%	0.5	1.5	0.5	1.0	
2 includes North Fork	15%	1.0	1.0	0.5	0.5	1.5	20%	1.0	1.0	0.5	0.5	1
Powder NF-2	1%	0.0	0.0	0.2	0.0	1.5	20%	1.5	1.0	1.0	1.0	1
Powder NF-3	10%	1.0	1.0	1.0	0.5	1.5	15%	1.0	1.0	0.5	1.0	1
Powder-7	100%	0.0	0.0	0.0	0.0	1.5	20%	0.0	0.5	1.5	2.0	
Muddy Creek-1	0%	0.0	0.0	0.0	0.0	1.5	10%	1.0	0.2	1.0	1.0	
Muddy Creek-2	1%	0.5	0.5	0.5	0.0	1.5	5%	0.1	1.0	0.5	1.0	
Rock Cr-1	100%	0.0	0.0	0.0	0.0	1.5	20%	1.0	0.2	1.0	1.0	
Rock Cr-2	100%	0.0	0.0	0.0	0.0	1.5	20%	0.5	1.0	0.5	1.0	
Willow Cr-1	100%	0.0	0.0	0.0	0.0	1.5	20%	1.0	0.2	1.0	1.0	
Willow Cr-2	100%	0.0	0.0	0.0	0.0	1.5	20%	0.5	1.0	0.5	1.0	
Salmon Cr-1	100%	0.0	0.0	0.0	0.0	1.5	10%	0.1	0.2	1.0	1.0	
Pine Creek-1	0%	0.0	0.0	0.0	0.0	1.5	20%	1.5	0.3	1.0	1.0	
Pine Creek-2	5%	1.0	1.0	1.0	0.0	1.5	20%	0.5	1.0	0.5	1.0	
Creek-1 (Pine system)	0%	0.0	0.0	0.0	0.0	1.5	0%	0.0	0.0	0.0	0.0	
Creek-2 (Pine system)	0%	0.0	0.0	0.0	0.0	1.5	0%	0.0	0.0	0.0	0.0	
Salmon Cr-2	100%	0.0	0.0	0.0	0.0	1.5	10%	0.1	0.2	1.0	1.0	
Goodrich-1	0%	0.0	0.0	0.0	0.0	1.5	20%	1.0	0.2	1.0	1.0	
Goodrich-2	0%	0.0	0.0	0.0	0.0	1.5	20%	0.5	1.0	0.5	1.0	
Salmon Cr-3	0%	0.0	0.0	0.0	0.0	1.5	20%	1.0	0.2	1.0	1.0	

Table continued.

Mill Creek-1	100%	0.0	0.0	0.0	0.0	1.5	20%	1.0	0.2	1.0	1.0	
e Nelson Ditch 4200')	0%	0.0	0.0	0.0	0.0	1.5	20%	0.5	1.0	0.5	1.0	
larble Creek System-1	0%	0.0	0.0	0.0	0.0	1.5	20%	1.0	0.2	1.0	1.0	
arble Creek System-2	0%	0.0	0.0	0.0	0.0	1.5	10%	0.1	1.0	0.5	1.0	
Salmon Cr-4	5%	1.0	1.0	1.0	0.0	1.5	20%	0.5	1.0	0.5	1.0	
Old Settlers Slough	100%	0.0	0.0	0.0	0.0	1.5	20%	0.0	1.0	1.5	1.0	
Baldock Slough	100%	0.0	0.0	0.0	0.0	1.5	10%	0.0	1.0	1.5	1.0	
Sutton Cr/Ebell Cr	0%	0.0	0.0	0.0	0.0	1.5	0%	0.0	0.0	0.0	0.0	
Powder-8	0%	0.0	0.0	0.0	0.0	1.5	20%	0.0	0.5	1.5	2.0	
Beaver Cr	0%	0.0	0.0	0.0	0.0	1.5	0%	0.0	0.0	0.0	0.0	
Powder-9	0%	0.0	0.0	0.0	0.0	1.5	20%	0.5	0.5	1.5	2.0	
Powder-10	0%	0.0	0.0	0.0	0.0	1.5	20%	1.0	1.0	1.0	2.0	
Deer Creek-1	100%	0.0	0.0	0.0	0.0	1.5	15%	1.0	1.0	0.5	1.0	
Deer Creek-2	5%	1.0	1.0	1.0	0.0	1.5	20%	1.0	1.0	0.2	1.0	
tle Dean, Clear Creeks	100%	0.0	0.0	0.0	0.0	1.5	0%	0.0	0.0	0.0	0.0	
Smith-Bridge-Union Cr	0%	0.0	0.0	0.0	0.0	1.5	0%	0.0	0.0	0.0	0.0	
Powder-11	100%	0.0	0.0	0.0	0.0	1.5	20%	1.0	1.0	1.0	2.0	
Gulch in upper Powder	0%	0.0	0.0	0.0	0.0	1.5	0%	0.0	0.0	0.0	0.0	
Cracker Cr-1	0%	0.0	0.0	0.0	0.0	1.5	15%	1.0	1.0	0.2	1.0	
Cracker Cr-2	35%	1.0	1.0	1.0	0.0	1.5	50%	1.0	1.0	0.2	1.0	
McCully Cr	0%	0.0	0.0	0.0	0.0	1.5	15%	1.0	1.0	0.2	1.0	

3.2.3.2.2 Historic Distribution

There is no known historic documentation of bull trout in the Powder subbasin prior to the 1960s; historic distribution of bull trout in the Powder is unknown. It is suspected that they were widespread in the upper Powder drainage and seasonally connected to the Snake River. Passage above RM 70 on the Powder River was blocked in 1932 by construction of Thief Valley Dam, which has no upstream fish passage (ODFW 1993b). Mason Dam, constructed in 1968, isolated bull trout in the upper Powder River from bull trout in the North Powder River and other Powder valley tributaries. Construction of Brownlee Dam in 1959 limited access of any fluvial bull trout in Eagle Creek to the pool above Brownlee Dam on the Snake River. According to a December 1965 ODFW District monthly report, a twelve inch bull trout was caught in a net set in Brownlee Reservoir in 1959, after the reservoir had filled.

Bull trout were documented in Eagle Creek and West Fork Eagle Creek in creel reports in 1965. Angler reports indicate bull trout were caught in the Martin Bridge section of Eagle Creek during July, August, and September in the mid-1980s (ODFW 1993b). Oral histories taken from longtime residents indicate Dolly Varden "bull trout" were common in Eagle Creek in the 1940s and 1950s (Gildemeister 1989).

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 in the Wallowa Mountains began in the late 1800s according to oral histories collected by Gilemeister (1992). Fingerling rainbow trout, brook trout and lake trout were stocked by packtrain and later by air. Brook trout occur in 6 lakes in the subbasin and in West Eagle, Main Eagle and Summit Creeks. Stocking of brook trout in Crater and Eagle Lakes was stopped in 1990. Gildemeister (1992) also reports that Forest Ranger Thomas H. Parker stocked the high lakes of the Elkhorns in the late 1800s or early 1920s, transporting “Dolly Varden,” whitefish and “wild” trout by packhorse.

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 the North Powder River, North Fork Anthony Creek, Cracker Creek and Rock Creek.

3.2.3.3.6 Relationship between Naturally- and Artificially-produced Populations

See above.

3.2.3.4 Harvest in the Subbasin

3.2.3.4.1 Current In-basin Harvest Levels – Direct/Indirect

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

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 6^{th} field HUCs (Figure 13). These were modified as necessary by the subbasin Technical Team to reflect habitat conditions, significant passage barriers or use by focal species. Seventy Five reaches were considered in the QHA analysis for the Powder River subbasin.

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.

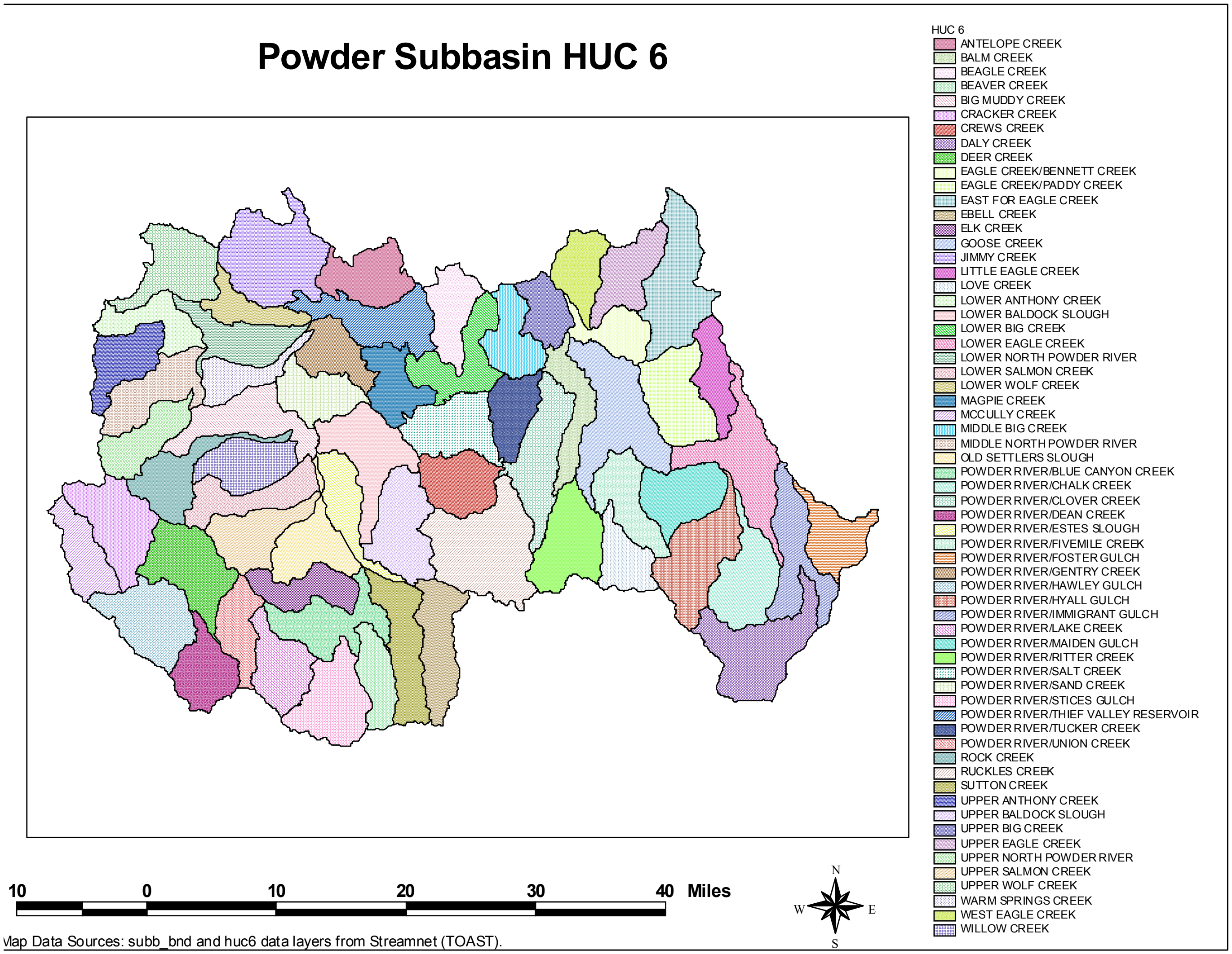


Figure 13. Level 6 HUCs used to delineate stream reaches for QHA analysis in the Powder River subbasin, Oregon.

The eleven habitat attributes considered are listed in Table 24. These are the habitat characteristics that are generally thought to be the main "drivers" of fish production and sustainability.

Table 24. 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 (Table 24) is rated for each of the 75 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 Powder River subbasin have never 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 Powder River subbasin are given for redband and bull trout in the first rows of Table 25 and Table 26. These overall life stage rank values indicate that for redband trout the aquatic technical team believes that spawning and incubation is the most important life stage, and migration the least likely to be limiting.

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 25. 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 26. 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	2.0	0.5
Channel stability	1.5	2.0	2.0	1.0
Habitat Diversity	1.0	2.0	2.0	0.0
Fine sediment	2.0	1.0	2.0	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	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 Powder River 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

Many reaches of the Powder River subbasin are moderately to severely impaired in several of the habitat attributes considered in the QHA analysis (Table 27).

Table 27. Number and percent of Powder River subbasin reaches rated at ≤ 50% of optimum for each habitat attribute.

Habitat Attribute	# Reaches at ≤ 50% Optimum	% Reaches at ≤ 50% Optimum
Riparian Condition	29	39 %
Channel Stability	25	33 %
Habitat Diversity	23	31 %
Fine Sediment	29	39 %
High Flow	18	24 %
Low Flow	41	55 %
Oxygen	19	25 %
Low Temperature	0	0 %
High Temperature	34	45 %
Pollutants	18	24 %
Obstructions	37	49 %

Channel Stability

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 several reaches of the subbasin. For example, Powder 1, Ritter Creek, Ruckles Creek, Powder River 7, Salmon Creek, Pine Creek, Gee Creek 1, Mill Creek, Sutton Creek and Powder River 10 all have significant channel stability issues. Channel stability has been compromised in these areas due to confinement by highways and railroads as well as diking and straightening associated primarily with agricultural activities. The reaches with the least impaired channel stability in the subbasin are Rock Creek 2, Gee Creek 2 and Mill Creek 2 (Appendix 4).

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 Powder River 1, Powder River 3, Ritter Creek, Ruckles Creek, Powder River 6, Jimmy Creek Wolf Creek, Hot Creek, Powder River 7, Hot Creek, Muddy Creek and others.. The highest rated reaches for riparian condition were the Rock Creek 2, Gee Creek 2 and Mill Creek 2. In general, the areas with the best riparian condition are those at higher elevations.

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.

Thirty one percent of the reaches in the subbasin were rated at 50% of optimum, or less. As with riparian condition and channel stability (and most other attributes), condition 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.

Thirteen (17%) reaches were rated at 25% of optimum or less and another 16 (21%) were rated between 25% and 50%. Those rated best for sediment include Gee Creek 2 and Mill Creek 2.

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.

Several of the subbasin's reaches (24%) were rated poorly for their inability to sustain high flow events without damage. Powder River 1 and Ruckles Creek are least able to sustain high flow events. Much of Eagle Creek and the upper reaches of several creeks including Balm, Muddy, Pine, Gee, Goodrich, Mill and Salmon Creeks were rated at optimum relative to high flows.

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 throughout the subbasin with few exceptions. The worst low flow conditions were in Powder River 1, Willow Creek 1, Salmon Creek, Pine Creek 1, Gee Creek 1, Goodrich Creek 1, Mill Creek 1 and lower Marble Creek all of which essentially dry up in late summer. In many cases, the upper reaches of those same streams were rated as optimum for low flows.

Oxygen

Oxygen is defined as the levels of dissolved oxygen (D.O.) in water column and stream substrate. A quarter of the reaches in the subbasin are impaired relative to dissolved oxygen. In general these are the same reaches in poor condition relative to channel stability, riparian condition, habitat diversity and low flow.

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; nearly all reaches were rated at 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. Twelve reaches (16%) in the subbasin were rated at 25% of optimum or less and another 29% were rated at 26% - 50% of optimum. High temperature is a problem throughout 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 a significant issue in some reaches and not an issue at all in others. In general the lower reaches of many streams have significant impairment due to pollutants, primarily from agricultural management while the upper reaches are virtually unaffected.

Obstructions

Obstructions are defined as physical barriers to the movement of fish throughout the reach. In the reference condition, the East and West Forks of Eagle Creek were rated as having some natural obstructions that may have limited fish movement. All other 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. Approximately 49% of the reaches were considered to be at 50% of optimum or less. Obstructions occur due to dams and diversion structures but also due to dewatering of the reach, or portions of it, making it impassable to fish. 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 14; 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.

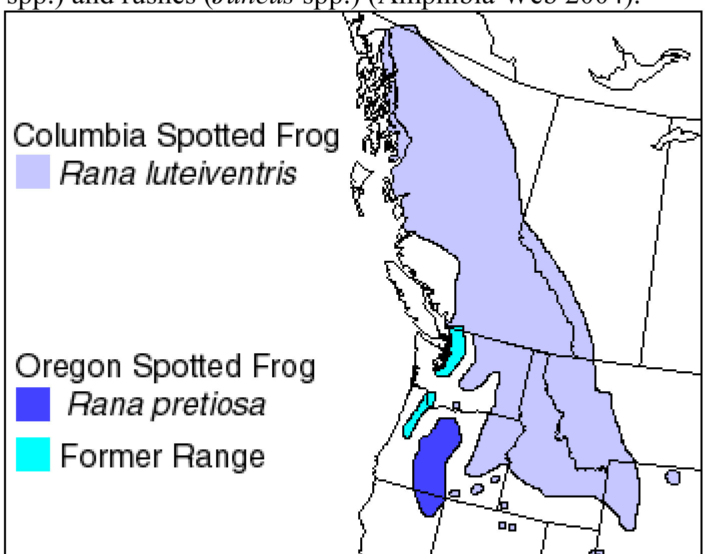


Figure 14. Current distribution of Columbia Spotted Frog (*Rana luteiventris*; USGS, Northern Prairie Wildlife Research Center; range acquired from Green et al. 1997).

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 Powder 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 15; Bull and Farrand 1977). The nationwide population is estimated at 83,000 individuals (NACWCP 2001).

In the Powder 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.

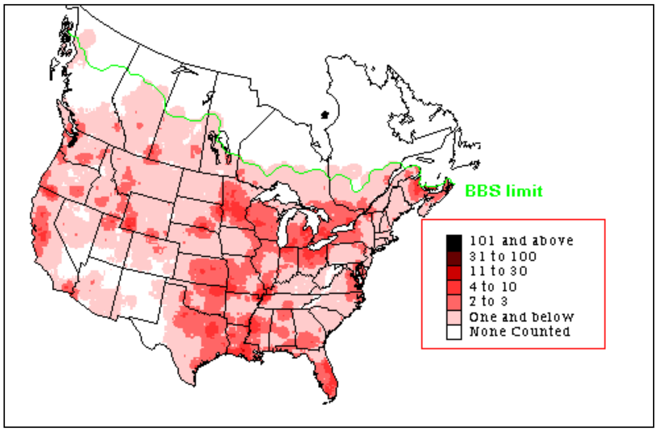


Figure 15. . Great blue heron summer distribution from Breeding Bird Survey (BBS) data (Sauer *et al.* 2003).

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

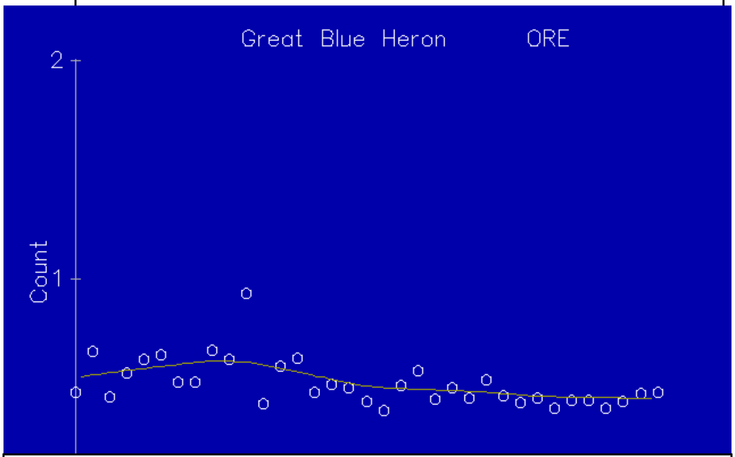


Figure 16. Great blue heron Breeding Bird Survey (BBS) Oregon trend results: 1966-2002 (Sauer *et al.* 2003).

prohibits the foreign and interstate commercial trade of feathers. 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 16). Surveys of blue heron populations are not conducted in the Powder 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

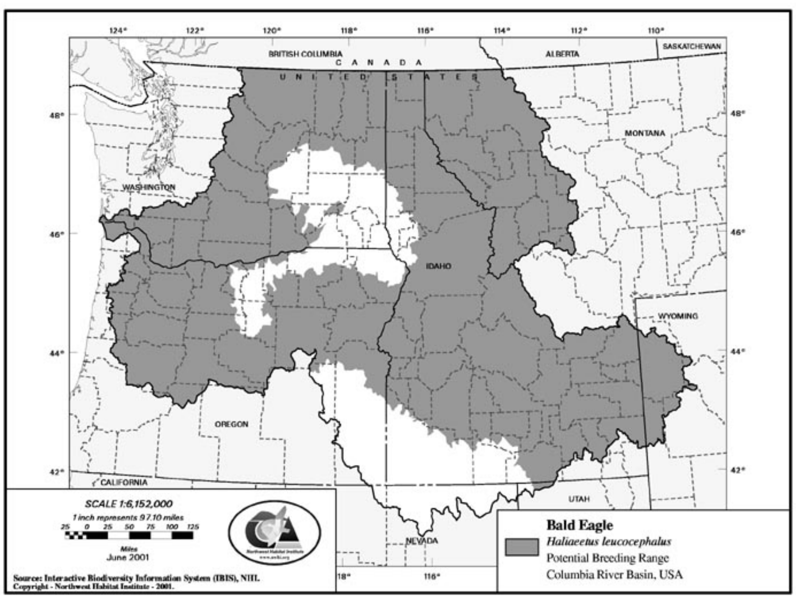


Figure 17. Breeding Distribution of the bald eagle (*Haliaeetus leucocephalus*) in the Columbia River Basin (IBIS 2003).

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). 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 are 2 known bald eagle nests in the Powder subbasin, both were active in 2003.

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 18). 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.

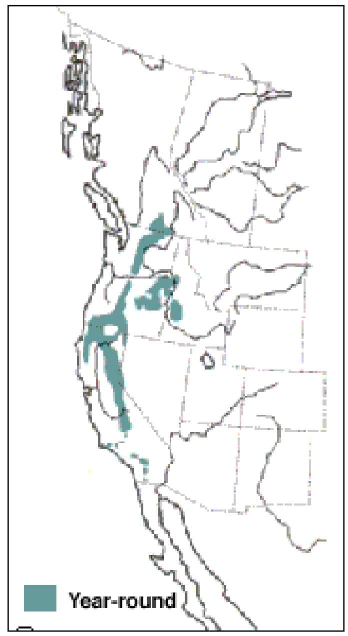


Figure 18. White-headed woodpecker breeding distribution (from BBS data) (Sauer et al. 2003).

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 Powder River 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.

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

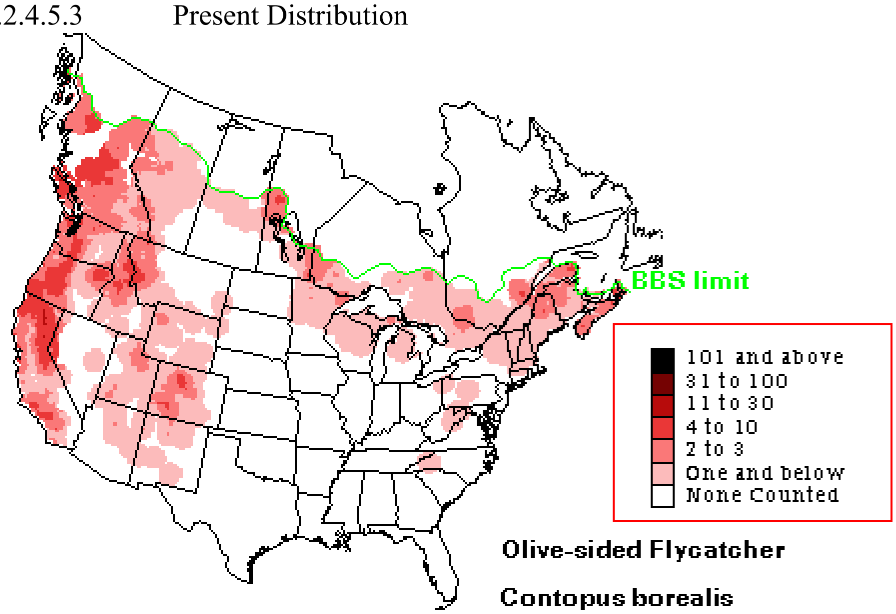


Figure 19. Breeding range of Olive-sided flycatcher (*Contopus borealis*) in North America (Sauer et al. 1997).

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 19; 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 Yellow Warbler Population (Dendroica petechia) Paul Ashley and Stacey Stovall, WDFW

3.2.4.6.1 Life History

The yellow warbler is a common species strongly associated with riparian and wet deciduous habitats throughout its North American range. It occurs along most riverine systems, including the Powder River, where appropriate riparian habitats have been protected. The yellow warbler is a good indicator of functional subcanopy/shrub habitats in riparian areas.

Yellow warblers capture and consume a variety of insect and arthropod species. The species taken vary geographically. Yellow warblers consume insects and occasionally wild berries (Lowther et al. 1999). Food is obtained by gleaning from subcanopy vegetation; the species also sallies and hovers to a much lesser extent (Lowther et al. 1999) capturing a variety of flying insects.

Pair formation and nest construction may begin within a few days of arrival at the breeding site (Lowther et al. 1999). The responsibility of incubation, construction of the nest and most feeding of the young lies with the female, while the male contributes more as the young develop.

Results of research on breeding activities indicate variable rates of hatching and fledging. Two studies cited by Lowther et al. (1999) had hatching rates of 56 percent and 67 percent. Of the eggs that hatched, 62 percent and 81 percent fledged; this represented 35 percent and 54 percent, respectively, of all eggs laid.

The yellow warbler is a long-distance neotropical migrant. Spring migrants begin to arrive in the region in April. The peak of spring migration in the region is in late May (Gilligan et al. 1994). Southward migration begins in late July, and peaks in late August to early September; very few migrants remain in the region in October (Lowther et al. 1999).

Little has been published on annual survival rates. Roberts (1971) estimated annual survival rates of adults at 0.526, although Lowther et al. (1999) felt this value underestimated survival because it did not account for dispersal. The oldest yellow warbler on record lived to be nearly 9 years old (Klimkiewicz et al. 1983).

3.2.4.6.2 Habitat

The yellow warbler is a riparian obligate species most strongly associated with wetland habitats and deciduous tree cover. Yellow warbler abundance is positively associated with deciduous tree basal area, and bare ground; abundance is negatively associated with mean canopy cover, and cover of Douglas-fir (*Pseudotsuga menziesii*), Oregon grape (*Berberis nervosa*), mosses, swordfern (Polystuchum munitum), blackberry (*Rubus discolor*), hazel (*Corylus cornuta*), and oceanspray (*Holodiscus discolor*; Rolph 1998).

3.2.4.6.3 Present Distribution

The yellow warbler breeds across much of the North American continent, from Alaska to Newfoundland, south to western South Carolina and northern Georgia, and west through parts of the southwest to the Pacific coast (Figure 20; AOU 1998). This species is a long-distance migrant and has a winter range extending from western Mexico south to the Amazon lowlands in Brazil (AOU 1998). Neither the breeding nor winter ranges appear to have changed (Lowther et al. 1999).

3.2.4.6.4 Current Population Data and Status

Yellow warblers are demonstrably secure globally. Yellow warbler is one of the more common warblers in North America (Lowther et al. 1999). Information from Breeding Bird Surveys indicates that the population is stable in most areas.

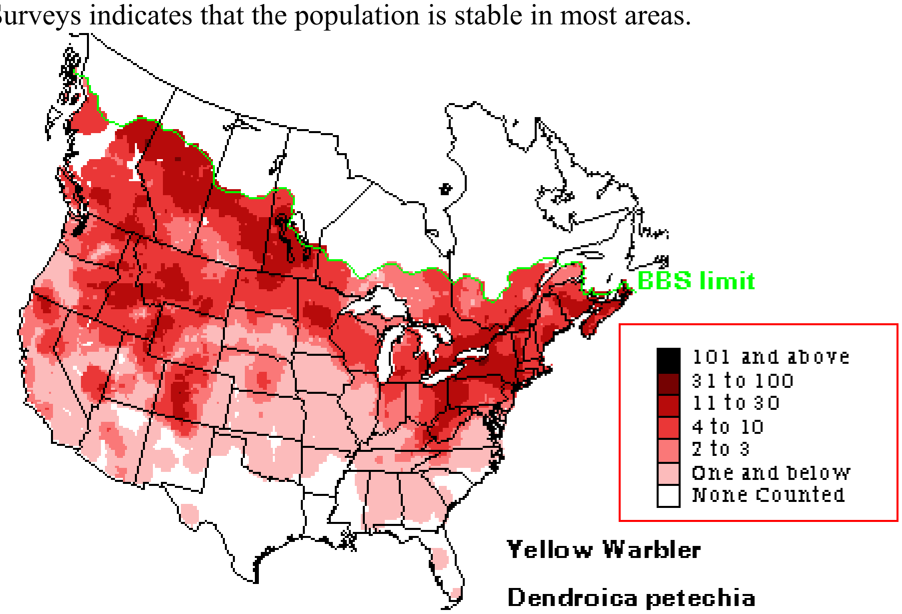


Figure 20. Breeding range of the Yellow Warbler (*Dendroica petechia*; Sauer et al. 1997)

3.2.4.6.5 Historic Habitat Distribution

3.2.4.6.6 Current Habitat Distribution

3.2.4.6.7 Limiting Factors

Habitat loss due to hydrological diversions and control of natural flooding regimes (e.g., dams) resulting in reduction of overall area of riparian habitat, conversion of riparian habitats, inundation from impoundments, cutting and spraying for ease of access to water courses, gravel mining, etc.

Habitat degradation from: loss of vertical stratification in riparian vegetation, lack of recruitment of young cottonwoods, ash, willows, and other subcanopy species; stream bank stabilization (e.g., riprap) which narrows stream channel, reduces the flood zone, and reduces extent of riparian vegetation; invasion of exotic species such as reed canary grass and blackberry;

overgrazing which can reduce understory cover; reductions in riparian corridor widths which may decrease suitability of the habitat and may increase encroachment of nest predators and nest parasites to the interior of the stand.

Hostile landscapes, particularly those in proximity to agricultural and residential areas, may have high density of nest parasites (brown-headed cowbird) and domestic predators (cats), and be subject to high levels of human disturbance.

Increased use of pesticide and herbicides associated with agricultural practices may reduce insect food base.

3.2.4.7 Ruffed Grouse (Bonasa umbellus)

3.2.4.7.1 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.

3.2.4.7.2 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).

3.2.4.7.3 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).

3.2.4.7.4 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).

3.2.4.7.5 Historic Habitat Distribution

3.2.4.7.6 Current Habitat Distribution

3.2.4.7.7 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).

3.2.4.8 Blue Grouse(Dendragopus obscurus)

3.2.4.8.1 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).

3.2.4.8.2 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).

3.2.4.8.3 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).

3.2.4.8.4 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).

3.2.4.8.5 Historic Habitat Distribution

3.2.4.8.6 Current Habitat Distribution

3.2.4.8.7 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).

3.2.4.9 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).

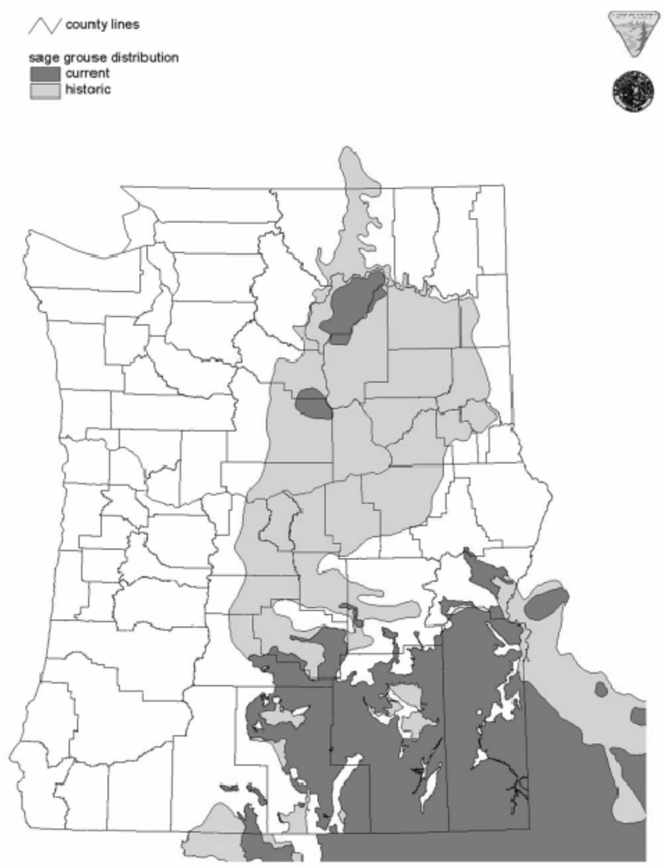


Figure 21. A comparison of current and historic distribution of sage grouse in Oregon and Washington.

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 28).

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 28. 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).

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

3.2.4.10.1 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).

3.2.4.10.2 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).

3.2.4.10.3 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).

3.2.4.10.4 Current Population Data and Status

Little is known of the actual population numbers of beaver in Oregon or in the Powder 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 Powder subbasin appears to be increasing somewhat (G. Keister, ODFW, personal communication, 4/1/2004).

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

3.2.4.10.5 Historic Habitat Distribution

3.2.4.10.6 Current Habitat Distribution

3.2.4.10.7 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.

3.2.4.11.1 American Marten (Martes Americana) Charles Gobar, USFS

3.2.4.11.1 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).

3.2.4.11.2 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).

3.2.4.11.3 Present Distribution

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

3.2.4.11.4 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.

3.2.4.11.5 Historic Habitat Distribution

3.2.4.11.6 Current Habitat Distribution

3.2.4.11.7 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).

3.2.4.12 Mountain Goat (Oreamnos americanus) Keith Paul, USFWS and P. Matthews, ODFW

3.2.4.12.1 Life History

Mountain goats are Artiodactyls (even-toed ungulates) and members of the family Bovidae, sub-family Caprinae, and the tribe Rupicaprini (Hibbs 1966, Rideout and Hoffman 1975). The only living species of its genus, Oreamnos americanus is closely related to the chamois (Rupicapra rupicapra) of Europe, and the serow (Capricornus sp.) and goral (Naemorhedus sp.) of Asia (Casebeer it al. 1950, Wigal and Coggins 1982, Chadwick 1983).

Although still open to debate (Rideout 1978), 4 subspecies of the mountain goat have been named: O. a. missoulae in Alberta, southeastern British Columbia, Montana, and Idaho; O. a. americanus in western British Columbia and Washington; O.a. kennedyi in the Copper River area of Alaska; and O.a. columbiae in northern British Columbia, Yukon, and southern Alaska. Cowan and McCrory (1970) examined 167 skulls and found no cranial features diagnostic of these subspecies and suggested there was no justification for their designation. Under the above classification scheme, Oregon's indigenous mountain goats were O. a. americanus. However, mountain goats reintroduced to Oregon have genetic history from each of the 4 subspecies listed above.

The Rocky Mountain goat (RMG) is stocky, with a slender neck, thin black horns, and a short tail. The feet are larger than those of mountain sheep, with oval hooves and prominent dew "claws." RMGs consequently are able to traverse weaker snow crusts than are mountain sheep (Geist 1971; Rideout and Hoffman 1975).

RMGs have a broad food tolerance and eat almost any forage including species not normally used by other ungulates (ODFW 2003). However, they tend to select flower-heads, buds, or foliage parts that are presumably more nutritious (Casebeer et al. 1950). Grasses are preferred in most areas and are used year round if available (Saunders 1955, Chadwick 1973, Smith 1976).

RMGs are polygamous and breed between early November and Mid-December (Geist 1964). Dominant males are very active, moving between herds in search of estrous females, and tending such females throughout their 2-3 day receptive period (DeBock 1970, Chadwick 1983).

Mountain goats defend a mobile personal space and the structure of the herd is based on a dominance hierarchy. Dominance is determined largely by the sizes of competitors, but also influenced by an individual's health and vigor. Kids are dominated by yearlings, yearlings by 2-year olds and 2-year olds by adults. Within any sex and age category dominance, between any two goats, is asserted by the larger, healthier, more vigorous individual. In adults hierarchical position improves with age, increasing size, and experience, and declines as health and vigor decline in older individuals. Because of their size and strength, young two year old males are usually capable of dominating females.

3.2.4.12.2 Habitat

RMG habitat varies throughout North America ranging from dense coastal forests at sea level in Alaska (Smith 1986) and British Columbia (Hebert and Turnbull 1977) to alpine basins in Colorado (Hibbs 1967) and Oregon (Matthews and Coggins 1994). Good goat habitat is dominated by cliffs or extremely steep rocky slopes (Kerr 1965, Holroyd 1967, Johnson 1983, Chadwick 1983).

3.2.4.12.3 Present Distribution

As a result of reintroduction efforts mountain goats now exist in the Wallowa and Elkhorn Mountains and upper Hells Canyon. Mountain goats have not been successfully reestablished in the Columbia Gorge. It was suggested that earlier release efforts failed as a result of small transplant size, scattering of individual goats, and paucity of male goats (Matthews and Coggins, 1994). Other small isolated herds of goats now occur on Vinegar Hill, Mount Ireland, and in the Strawberry Mountains. These herds of goats are believed to have been started from individuals dispersing from the Elkhorn Mountains.

3.2.4.12.4 Current Population Data and Status

The Wallowa Mountain goat herd originated from 5 separate releases. The population grew from the original transplant of five animals to a minimum population of 30 animals by 1966. The population was static through the mid 1980's, with the population estimate never exceeding 45 animals. Kid recruitment improved following the 1980's releases and has continued to remain moderately high with a mean of 39 kids/100 adults since 1990. The 2003 population estimate for the Wallowa Mountains was 230 goats. Goats are beginning to pioneer vacant habitat adjacent to traditional core use areas, which will help to establish subpopulations throughout the Wallowas. Habitat is available for an estimated 600 mountain goats in the Wallowa Mountains.

Mountain goats in the Elkhorn Mountains were established from 3 releases. In 1987 annual surveys were initiated. Kid to adult ratios have been high and resulted in a rapidly expanding population. Thirty-six animals have been removed from the Elkhorn herd for transplant stock since July 2000. The 2003 population estimate was 150 goats. Individuals from this population continue to move into adjacent habitat including Vinegar Hill and the Strawberry Mountains. The Elkhorn's are capable of maintaining an estimated 200 goats.

Mountain goats transplanted to Hells Canyon in July 2000 and 2003 are continuing to be monitored. Reproduction in the Sluice Creek herd has been good and the population estimate for 2003 was 40 animals.

3.2.4.12.5 Historic Habitat Distribution

Probably no other large mammal has prompted more controversial discussions over its' historical presence in Oregon than has the Mountain goat. There are numerous reasons for the controversy; mountain goats have always occurred in remote, inaccessible, patchy, and disjunct habitats. The habitats where the mountain goat would have occurred were not areas the first American/European explorers, and settlers, would have normally been traveling, hunting, camping, or living in.

Matthews and Coggins (1995) concluded that mountain goats were "indigenous to the northeast corner of Oregon and most likely portions of the Oregon Cascades". They believe that goats disappeared from Oregon during, or prior to, European settlement in the early 19th century. Matthews and Coggins (1994) theorize that improved mobility (horses) and firearms may have influenced tribal hunting impacts on mountain goats.

3.2.4.12.6 Current Habitat Distribution

Mountain goat habitat varies throughout North America ranging from dense coastal forests at sea level in Alaska (Smith 1986) and British Columbia (Hebert and Turnbull 1977) to alpine basins in Colorado (Hibbs 1967) and Oregon (Matthews and Coggins 1994). Goat habitats are dominated by cliffs or extremely steep rocky slopes (Kerr 1965, Holroyd 1967, Johnson 1983, Chadwick1983). Cliff habitat is often broken by narrow chutes of talus or lush avalanche slopes. These steep rocky cliff areas are interspersed with or adjacent to less precipitous areas of quality forage. Sun and wind swept south to west facing slopes limit snow depth and provide greatest food availability during winter months. North and east facing slopes often have greater snow, water accumulations and provide succulent forage for summer utilization.

3.2.4.12.7 Limiting Factors

Because of the habitats that goats prefer, very little landscape manipulation is possible. Therefore, habitat that is available for RMG should be protected (if not already) and human access to that habitat should be limited by discouraging trails and roads that allow motorized vehicles. In areas where monitoring indicates overuse of forage species, goat management may include density reduction, use of techniques to discourage goat use or redistribute animals, or protection of specific plant communities (ODFW).

Research in Oregon by Vaughan (1975), found that low productivity was more likely responsible for lack of population growth rather than high mortality. Research also indicates that RMG populations are very sensitive to over-harvest, and goats cannot sustain harvest rates typical of other ungulate species (Haywood et al. 1980, Adams and Bailey 1982, Gonzalez-Voyer et al. in press).

3.2.4.13 Pronghorn (Antilocapra americana)

3.2.4.13.1 Life History

Pronghorn are endemic to North America, where they have lived for more than 10 million years. They are opportunistic foragers and shift use of forage depending on availability, succulence and nutritional value. In shrub-steppe habitats, pronghorn diets are composed of approximately 7% grasses, 29% forbs and 64% shrubs (Yoakum 1990).

In Oregon, most females breed during the 2-3 weeks following August 20; rarely do they breed after September 20 (Einarson 1948). The gestation period is about 250 days (O'Gara 1978); most young are born during the 3rd week in May (Einarson 1948).

Fawn growth is very rapid. Fawns in Alberta gained about 27.2 kilograms before their first winter. Yearling pronghorn during their second winter are similar in mass to adults (Mitchell 1980).

3.2.4.13.2 Habitat

Pronghorn occupy large expanses of flat or low, rolling terrain lacking major barriers to seasonal movements and with a mixed vegetative community of grasses, forbs and shrubs (Yoakum and O'Gara 2000). "Shrub-steppe is the second highest producing landscape for pronghorn" (Yoakum and O'Gara 2000:570).

3.2.4.13.3 Present Distribution

Currently populations are established in the shrub-steppe habitats of the eastern portion of the state (Verts and Carraway 1998;).

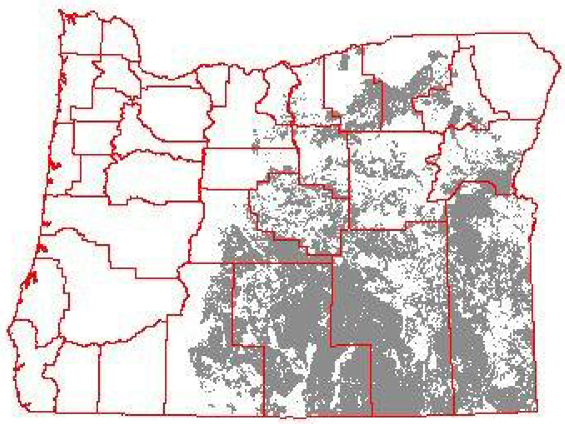


Figure 23. Current distribution of pronghorn (*Antilocapra americana*) in Oregon (from ONHIC).

3.2.4.13.4 Current Population Data and Status

Aerial surveys and harvest records indicate that pronghorn populations in Oregon fluctuate through increases and decreases but have generally continued to increase since the 1950's (G. Keister, ODFW, personal communication, 4/29/2004; Verts and Carraway 1998). The population of pronghorn in the Powder subbasin is estimated to be about 250 animals located generally in the eastern portion of the subbasin near Auburn Creek.

3.2.4.13.5 Historic Habitat Distribution

3.2.4.13.6 Current Habitat Distribution

3.2.4.13.7 Limiting Factors

Weather, including droughts, cold temperatures and deep, crusted snow may limit pronghorn distribution and productivity. However, anthropogenic barriers to movement, heavy livestock grazing and other habitat modifications magnify the detrimental effects of climatic conditions.

Pronghorn, especially fawns, are taken by a variety of predators. Studies in Oregon have shown that coyote predation was the primary cause of fawn mortality (Trainer et al. 1983).

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 24). 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 24. 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 Powder 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 (Powder Subbasin Technical Team, personal communication, 4/1/2004).

3.2.5.2 Curlleaf Mountain Mohogany (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 Powder subbasin, it often occurs on shallow-soiled south slopes with bitter brush, sagebrush and bunchgrass.

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 Powder 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 Powder 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.

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 Powder River system.

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

There are no hatcheries in the subbasin.

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 Powder River 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 Powder 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.

3.3.2.3 Habitat

Loss of wintering habitat for neotropical migrant birds, including yellow warbler 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 Powder River 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 Powder River 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 42) and Section 3.5.1.2 (page 120).

3.4.2 Terrestrial

Terrestrial wildlife habitats in the Powder 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 Powder 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 (Table 29).

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. 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 primarily qualitative assessment based on the local knowledge and professional judgment of the subbasin terrestrial Technical Team.

Table 29. Historic and current extent, and change from historic, of wildlife habitat types as presented by IBIS (http://ibis.nwhi.org) and the Powder Terrestrial Technical Team comments regarding habitat acreages and trends.

Wildlife Habitat Type	Historic Acres	Current Acres	Change from Historic	Subbasin Technical Team Comments
4 - Montane Mixed Conifer Forest	6,537	49,651	+43,144	Underrepresented in historic data.
6 – Lodgepole Pine Forest and Woodlands	72,399	520	-71,897	
Combined High-elevation Conifer Forest	78,936	50,171	-28.765	Direction & magnitude of change in combined habitats is realistic.
5 – Eastside Mixed Conifer Forest	44,697	241,628	+196,931	Increase realistic due to conversion of former ponderosa pine habitat.
7 – Ponderosa Pine Forest and Woodlands	286,663	96,282	-190,381	Direction and magnitude of change are realistic.
8 – Upland Aspen Forest	0	128	+128	Grossly underrepresented in both historic and current data due to small patch size. Estimate current as 3,000 ac. Trend is decreasing, imperiled.
13 – Western Juniper and Mountain Mahogany Woodlands	18,286	8,509	-9,777	Juniper is increasing due to encroachment into grasslands. Mountain mahogany woodlands are decreasing. Should be discussed separately.
Combined Rare or Unique Habitats	18,286	8,637	-9,649	Aspen and mountain mahogany decreasing & in need of

				conservation.
9 – Subalpine Parkland	14,298	0	-14,298	
10 – Alpine Grasslands and Shrublands	5,457	53,936	+48,479	
Combined Alpine and Subalpine Habitats	19,755	53,936	+34,181	The trend of these two combined habitats should be stable or declining slightly.
15 – Eastside Grasslands	119,468	42,580	-76,888	This habitat is not present. These acres s/b classified as shrub-steppe.
16 – Shrub-steppe	523,082	440,759	-82,323	Direction & magnitude of change is generally realistic.
17 – Dwarf Shrub-steppe	0	0	0	This habitat is and was historically present as 5-10% of total shrub-steppe.
Combined Shrub-steppe	523,082	440,759	-82,323	Trend generally realistic.
19 – Agriculture, Pasture and Mixed Environs	0	106,103	+106,103	
20 – Urban and Mixed Environs	0	6,773	+6,773	
21 – Open Water – Lakes, Rivers, Streams	2,224	7,694	+5,470	
22 – Herbaceous Wetlands	0	37,472	+37,472	Underrepresented in historic data. Trend s/b severe decline.
24 – Montane Coniferous Wetlands	0	1,066	+1,066	Underrepresented in historic data. Trend s/b static to minor decline.
25 – Eastside Riparian Wetlands	0	0	0	Grossly underrepresented in both historic and current data, likely due to narrow, linear character of habitat. Trend s/b decline.

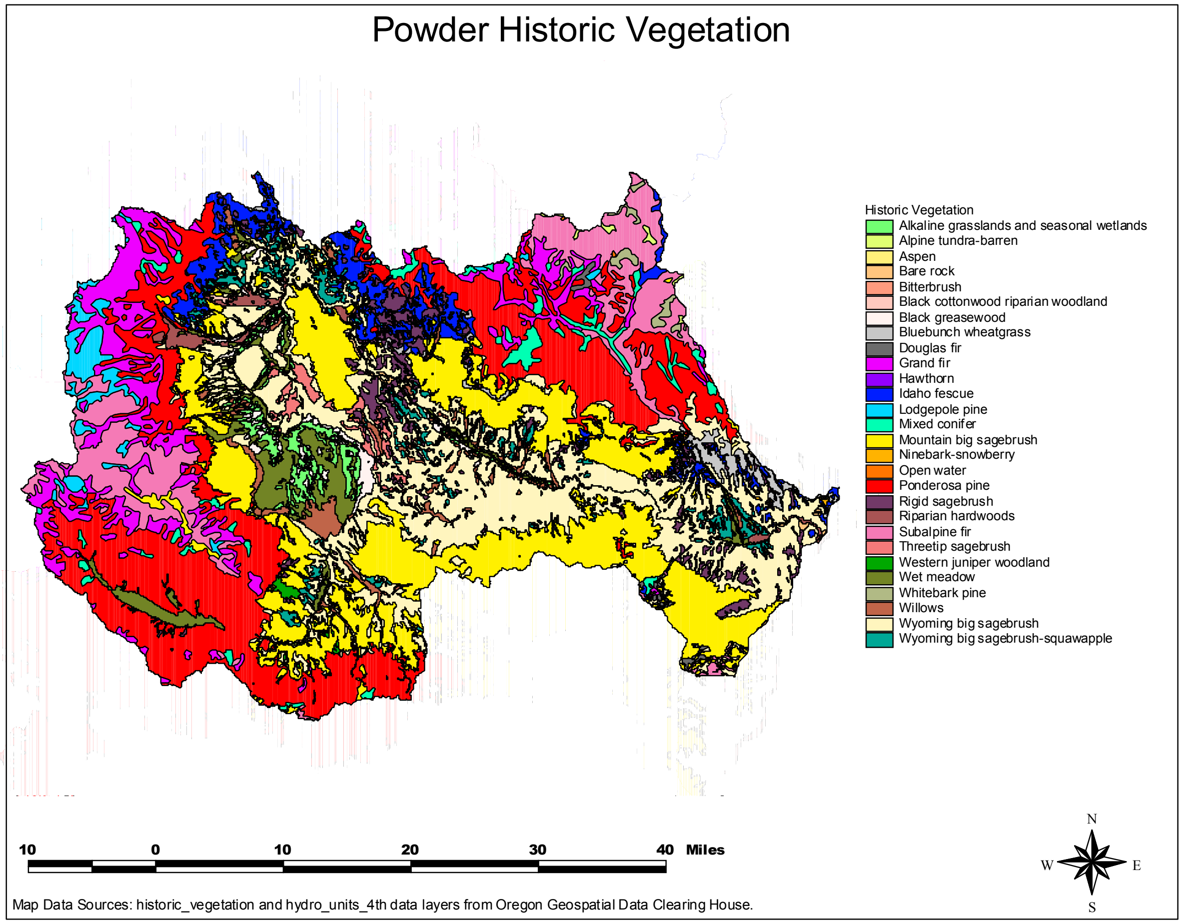


Figure 25. Historic vegetation cover in the Powder River subbasin, Oregon. Vegetation types depicted here are not consistent with the types used in IBIS.

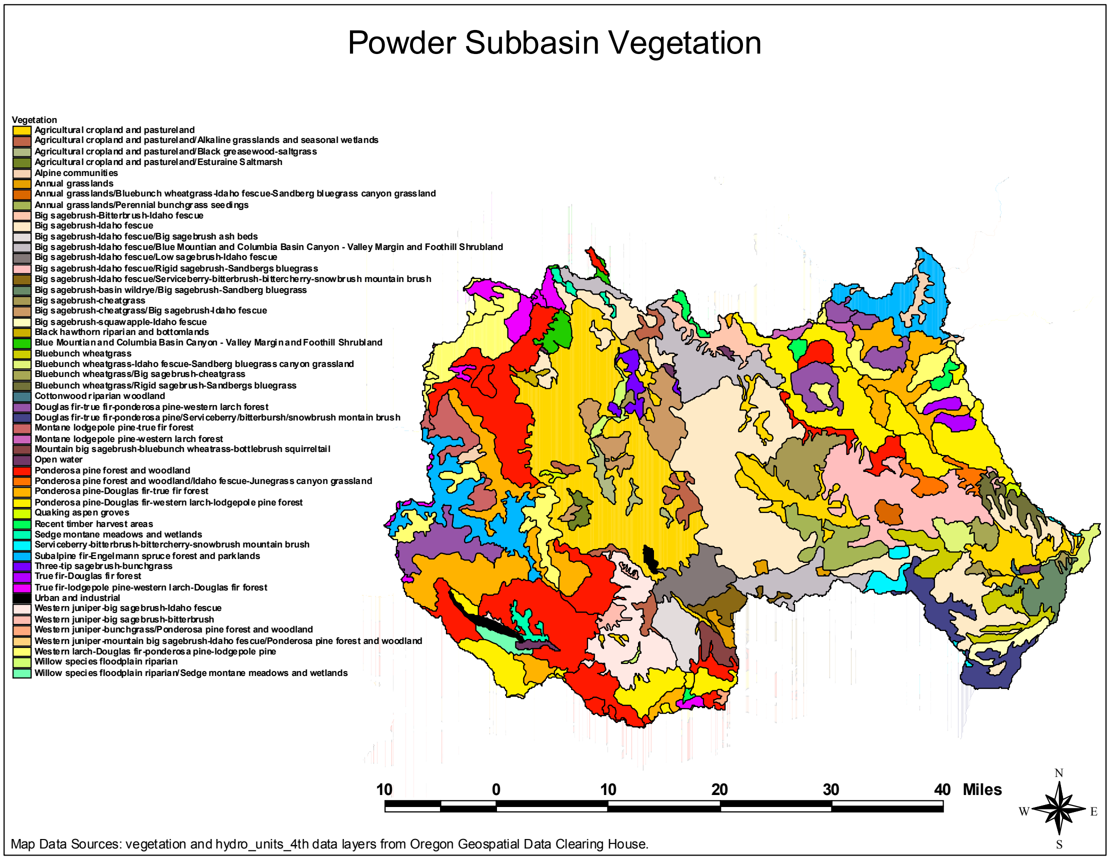


Figure 26. Current vegetation cover in the Powder River subbasin, Oregon. The vegetation types depicted here are not consistent with the types used in IBIS.

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. These three habitat types are described below.

Powder River Historic acreage: 9,595
Powder River Current acreage: 12,987
Increased acreage: 3,392

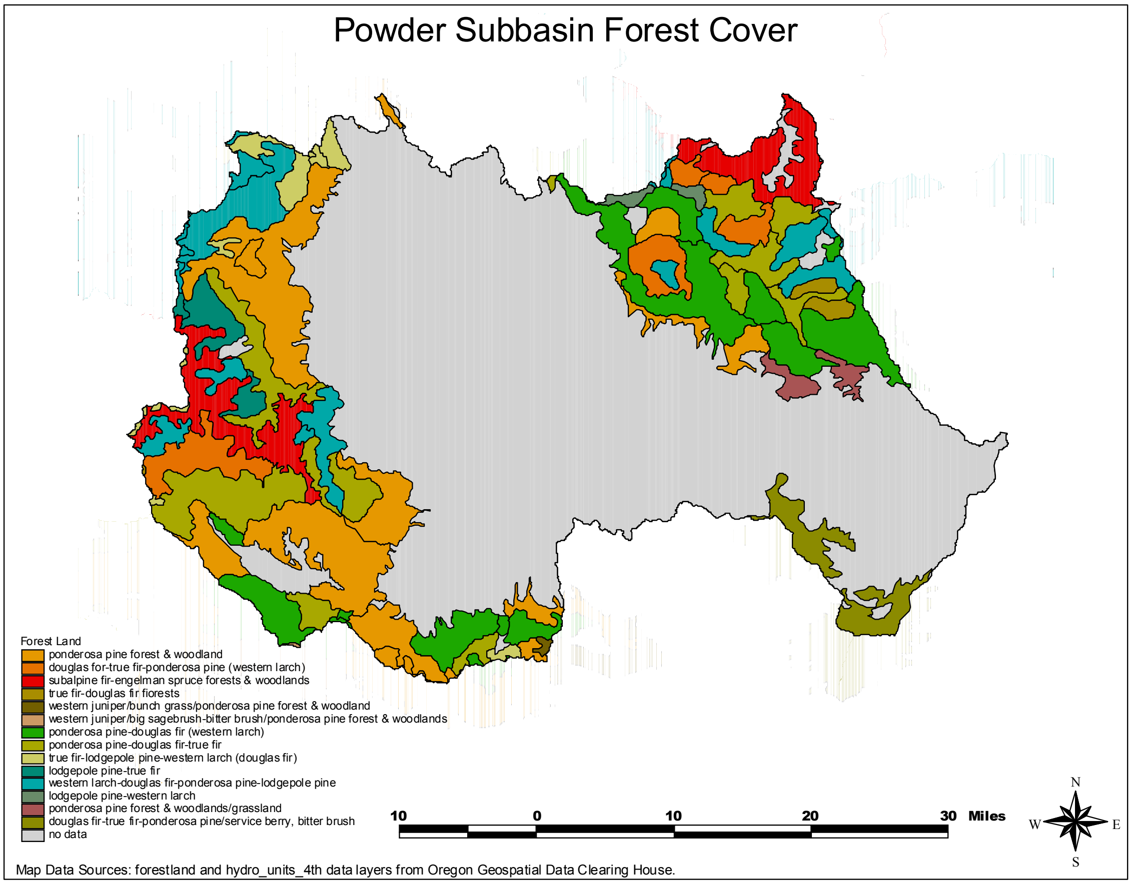


Figure 27. Forest cover in the Powder River subbasin, Oregon.

Focal Species. Two focal species, American marten and olive-sided flycatcher, have been selected to represent high elevation upland forests in the Powder 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.

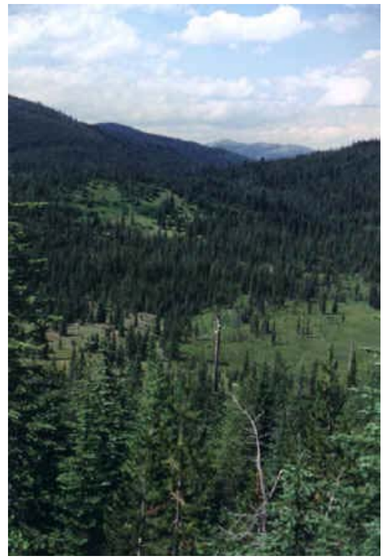
Olive-sided flycatchers perform 3 KEFs involving their trophic and organismal relationships to other species. They consume terrestrial invertebrates and serve as a common host for nest parasites, especially the brown-headed cowbird. Although it is not their primary role, and therefore not a KEF, olive-sided 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%.

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*).

Powder Historic acreage: 6,537

Powder Current acreage: 49,651

Increased acreage: 43,144

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.

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).*

Powder Historic acreage: 44,697
Powder 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. Note: IBIS write up discusses many species that don't occur in GR subbasin.

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, flammulated owl, 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.

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.

Powder Historic acreage: 72,399

Powder Current acreage: 520

Decreased acreage: 71,879

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).*

Powder Historic acreage: 44,697
Powder 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 Powder River 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.

Powder Historic acreage: 286,663

Powder Current acreage: 96,282

Decreased acreage: 190,381

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 Powder 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 Powder subbasin has undergone at least 60% 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 Powder 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.

Powder Historic acreage: 18,286
Powder Current acreage: 8,637

Decreased acreage: 9,649

Status and Trend. The above acreages and trend of these combined habitats fail to illustrate the true condition of these species and habitats. 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 are most likely underrepresented in the data, both historic and current, due to their relatively small patch sizes and the coarse nature of the data. Nevertheless, both habitats have declined in the Powder 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*.).

Powder Historic acreage: None

Powder 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.

13 Western Juniper and Mountain Mahogany Woodlands

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.

Powder Historic acreage: 18,286

Powder 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.

<u>Combined Alpine and Subalpine Habitats:</u>

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.

Powder Historic acreage: 19,755

Powder Current acreage: 53,936

Increased acreage: 34,181

Status and Trend. Both habitats are likely underrepresented in the historic vegetation data. This makes it appear as though there has been a substantial increase in alpine and subalpine habitats since pre-European settlement. In the judgment of the subbasin Technical Team, this is inaccurate; 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 mountain goat (*Oreamnos americana*) has been selected as the focal species for these high elevation habitats. It is closely associated only with these habitats. The mountain goat is a game species managed by the Oregon Department of Fish and Wildlife.

Mountain goats are associated with 5 of 20 non-forest and 5 of 26 forest structural conditions in IBIS although not closely associated with any of them (IBIS 2004). Mountain goats feed in the various forest and non-forest structural conditions and will breed in the non-forest structural conditions if the necessary habitat elements are present. Cliffs and rock outcrops provide security cover. Nannies utilize the least accessible and most secure crannies for parturition and the first days with new born kids (von Elsner-Schack 1986). Nursery groups and even large adult males stay close to such cliffs most of the time. Cliffs are important for thermal regulation. Overhangs, caves, lee sides of rocks or ridges, and dense conifers near cliffs provide shelter from sever weather. These features also provide protection from cold soaking rains and excessive heat during summer. In the Wallowa Mountains, Wallowa County, the area intensively used by mountain goats had less timber and more slide rock and cliff rock than did the entire area available to the goats. Use of forest and rock structural features varied seasonally with timbered areas used primarily during the winter (Vaughan 1975).

Rocky Mountain goats are associated with 26 KECs including trees; tree canopy; ecotones; moss; lichens; rock cliffs, outcrops and ridges; snow fields and free water. Timbered areas are generally used in the winter for thermal cover or to avoid deep snow. Ecotones appear to be important KECs as mountain goats are associated with edges in both forested and non-forested habitats. Cliffs and rock outcrops provide security cover. Nannies utilize the least accessible and most secure crannies for parturition and the first days with new born kids (von Elsner-Schack 1986). Nursery groups and even large adult males stay close to such cliffs most of the time.

Rocky Mountain goats perform 4 KEFs involving their trophic and organismal relationships with other species. Mountain goats are grazers; they eat grasses and forbs. They also both create runways used by other species and use runways created by other species. Although it is not their primary role, and therefore not a KEF, mountain goats are preyed upon by other species. A variety of large carnivores prey on mountain goats; cougars (*Puma concolor*) are likely the most serious predator (Rideout and Hoffmann 1975).

Habitat/Focal Species Interaction. Mountain goats feed on a variety of vegetation. Some forage species are used seasonally based on availability. Where foraging areas are restricted, mountain goats may have a negative effect on areas of the habitat. In the Wallowa Mountains, the primary winter feeding area was, by March, "overgrazed to the point that practically all vegetative material was removed" (Vaughan 1975: 63-64). Alpine ecosystems are fragile, due in part to shallow, rocky soils and a short growing season. The impact mountain goats have had on them since their reintroduction has not been assessed (Verts and Carraway 1998).

Rocky Mountain goats and other species closely associated with alpine and subalpine habitats (e.g., pika, bushy-tailed woodrat and bighorn sheep) make extensive use of the rock features common to these habitats for escape and hiding cover. These species forage in forest, shrub and grassland areas adjacent to these rock features and are thus dependent upon a mosaic of vegetative and non-vegetative habitat elements.

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*).

Powder Historic acreage: 5,457
Powder 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.

Powder Historic acreage: 14,298
Powder 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.

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.

Powder Historic acreage: 523,082
Powder Current acreage: 440,759
Decreased acreage: 82,323

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).

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.

Powder Historic acreage: 523,082

Powder Current acreage: 440,759

Decreased acreage: 82,323

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.) occasionally appear in these scablands.

Powder Historic acreage: 0

Powder Current acreage: 0

Increased acreage: 0

Status & Trend: This habitat is unrepresented in the IBIS data although, 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.

Powder Historic acreage: 2,224

Powder Current acreage: 7,694

Increased acreage: 5,470

Status & trend: The principal trend 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 20 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 2003), several authors (cited in Isaacs and Anthony 2003) 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 Powder 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 Powder 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.

Powder Historic acreage: 0
Powder Current acreage: 38,538
Increased acreage: 38,538

All three wetland types are grossly underrepresented in the historic data and the Montane Coniferous and Eastside Riparian wetlands are underrepresented in the current data as well. Although precise numbers of acres of these habitats are unknown, the subbasin Technical Team believes that all three have suffered declines ranging from minor to severe (**Error! Reference source not found.**).

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 Powder subbasin: great blue heron, yellow warbler, 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 Powder River 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 10 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 warbler** is found primarily in riparian wetlands with a forest understory or shrub component and here represents that shrubby understory. It is a PIF species and a HEP species used in habitat loss assessments associated with Columbia River hydropower projects.

Yellow warblers are associated with 6 of 26 forest and 6 of 20 non-forest structural conditions. Although most of these associations are "general," they are "closely" associated with mature and old tall shrub overstory with both open and closed canopies (IBIS 2004).

Yellow warblers are associated with 15 KECs related to their use of forest, shrubland and freshwater riparian habitats and their relationship with exotic species, insect population irruptions and anthropogenic habitat elements (IBIS 2004). The species is strongly associated with riparian and wet deciduous habitats throughout its North American range. It occurs along most riverine systems, including the Columbia River, where appropriate riparian habitats have been protected. The yellow warbler is a good indicator of functional subcanopy/shrub habitats in riparian areas.

Yellow warblers perform 4 KEFs involving their consumption of terrestrial invertebrates and role as prey for primary or secondary predators. They may also help control insect populations and serve as a common interspecific host. Yellow warblers feed primarily on insects and other arthropods although wild fruits occasionally are eaten (Stevenson and Anderson 1994). Adults, eggs and nestlings are preyed upon by a variety of predators including jays, weasels, snakes, foxes, crows, skunks and domestic cats (several authors cited in Lowther et al. 1999). Yellow warblers are common hosts for nest parasitism by brown-headed cowbirds. Where the two species are sympatric, warblers respond aggressively to cowbird presence (several authors cited in Lowther et al. 1999). They frequently respond to cowbird parasitism by building over the parasitized clutch creating multi-tiered nests (Peck and James 1987).

Habitat/Focal Species Interaction. Yellow warblers in eastern Oregon breed and generally forage within or from perches in deciduous riparian vegetation (Scheuering 2003). Because of its close association with this habitat type, this species is vulnerable to habitat destruction, especially by grazing (Taylor and Littlefield 1986, Sanders and Edge 1998). Further, conversion of forest and scrubland to agricultural uses has benefited the brown-headed cowbird and may have increased the negative impacts of these brood parasites on yellow warbler populations (Ortega and Ortega 2000).

The **Columbia spotted frog** is closely associated with herbaceous and riparian wetlands in the Powder River 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 14 of 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 18 of 26 forest and 18 of 20 non-forest structural conditions (IBIS 2004). None of these associations are "close" as the species is listed as simply "present" in all of the above structural conditions. That beavers are present in 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*).

Powder Historic acreage: None
Powder 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 spagefoot, 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*).

Powder Historic acreage: None

Powder 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 warbler 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 53), ten of eleven habitat factors were identified as limiting the survival and productivity of fish, specifically bull trout and redband trout, in the Powder River subbasin. These factors are:

- Riparian Condition
- Channel Stability
- Habitat Diversity
- Fine Sediment
- High Flow
- Low Flow
- Oxygen
- High Temperature
- Obstructions
- Pollutants

Some reaches are in poor condition relative to all these attributes (e.g., Ritter Creek), while others may suffer impairment of one or two attributes but be satisfactory in others (e.g., Big 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 both bull trout and redband trout 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 low temperature was found not to be limiting although oxygen and pollutants are serious problems in a relatively low number of reaches. 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 focal species survival. The habitat factors critical to this life stage were riparian condition, channel stability, habitat diversity, low flow, oxygen, high temperature and pollutants. All of these were found to be limiting, to some degree, in the subbasin.

Winter rearing was the life stage ranked third in importance to the survival of redband and bull trout in the subbasin. The critical factors for redband trout in this life stage were channel stability, habitat diversity, fine sediment, high flow, oxygen and pollutants. For bull trout, the critical factors were all those listed for redband plus riparian condition and low temperature. Of these, only low temperature was not found to be limiting survival and productivity of redband and bull trout. Little or no water is released from Thief Valley Reservoir during the winter affecting winter rearing in that reach. Hutchison and Fortune (1967) suggested that " Guarantees of certain releases during these periods, even if relatively small, would greatly increase fish production capabilities of the river" section below the reservoir.

Migration was the life stage thought least important to redband 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, low flow, high flow, oxygen, pollutants and obstructions were found to be limiting to some degree.

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 87).

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 Powder River 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 Powder 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.

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

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:

Channel Stability: 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.

Riparian Conditions: Riparian conditions are also a primary determinant of the success of the focal species. Appropriate riparian conditions vary with respect to ecoregion, as well as with channel condition. Consequently, riparian enhancement is tied in many areas to channel restoration. As with channel condition, natural disturbance factors influence the potential riparian community both in space and time. Consequently, restoration is best thought of in terms of trend across a broader landscape. Further, riparian restoration is likely to have beneficial effects across the range of habitat attributes considered in this assessment. As with channel conditions an additional hypothesis is that the management-related activities that have contributed to currently degraded riparian 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 bull trout and redband trout 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.

Obstructions: Obstructions to fish movement can be found throughout the subbasin and limit the ability of redband trout and bull trout to exhibit the range of life histories inherent in the species. Nevertheless, the inability of redband and bull trout to migrate does not limit their survival in the subbasin; migration was considered the least important life stage for the species in the QHA model. Removal of passage barriers would contribute to the distribution of the species by allowing them into areas they do not currently occupy and it may contribute to the genetic diversity of the populations by allowing exchange of genetic material between areas.

3.6.2. Terrestrial Assessment Synthesis

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

Habitat Status/Change:

Estimated Acres of Habitat	Current	Historic	Difference	% Change
	50,171	78,936	-28,765	-57

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. 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:

Estimated Acres of Habitat	Current	Historic	Difference	% Change
	241,628	44,697	+196,931	+441

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:

Estimated Acres of Habitat	Current	Historic	Difference	% Change
	96,282	286,663	-190,381	-66

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.
- Residential and 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:

Estimated Acres of Habitat	Current	Historic	Difference	% Change
	8,637	18,286	-9,649	-53

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: Mountain Goat

Habitat Status/Change:

Estimated Acres of Habitat	Current	Historic	Difference	% Change
	53,936	19,755	+34,181*	+173*

* These habitats are underrepresented in the historic data; the trend should be stable or 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 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. Mountain goats represent species that prefer/require a mosaic of forested, open and rocky habitat elements for thermal cover, forage and security cover.

Management Strategies:

- Fire management to prevent continued encroachment of conifers into grassland habitats which reduces foraging habitat.
- Manage recreational access to minimize impacts to vegetation and disturbance to mountain goats, especially females with young.
- Public education to reduce goat/recreation conflicts in sensitive areas.

Data Gaps and M&E Needs:

- Identify habitat links and corridors for dispersing mountain goats.
- Higher resolution habitat maps which show location and extent of alpine and subalpine habitats.

Wildlife Habitat Type: Shrub-steppe
Focal Species: Sage Grouse, Pronghorn

Habitat Status/Change:

Estimated Acres of Habitat	Current	Historic	Difference	% Change
	440,759	523,082	-82,323	-16

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.
Pronghorn represent species that occupy large expanses of flat or low, rolling terrain lacking major barriers to seasonal movements and with a mixed vegetative community of grasses, forbs and shrubs.

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:

Estimated Acres of Habitat	Current	Historic	Difference	% Change
	7,694	2,224	+5,470	+246

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 Warbler, Ruffed Grouse, American Beaver.

Habitat Status/Change:

Estimated Acres of Habitat	Current	Historic	Difference	% Change
	38,538	0*	+38,538*	N/A

*Wetland habitats are grossly underrepresented in the IBIS data, both historic and current. The trend in this habitat type should be a moderate to severe decline when all wetland types are considered together.

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 have 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 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 warbler 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 warbler 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 120) should be addressed to optimize fish habitat within the limits of the social, cultural and economic framework of the communities of the Powder River 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 124)

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 28; Figure 29; Appendix 4, Table 34, Table 35). 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, the North Fork Powder River 3 was the reach with the highest protection ranking in the subbasin. It was followed by Gee Creek 2 (Pine System), Mill Creek 2, Rock Creek 2 and McCully Creek to round out the top 5.

Bull trout are found in just 9 of the 75 reaches in this analysis; bull trout are not currently present in 4 of the top 5 reaches for protection in the redband trout analysis. The highest rated reaches for habitat protection relative to bull trout were North Fork Powder River 3 (also received #1 protection rating for redband), Pine Creek 2, Wolf Creek 2, Cracker Creek 2 and Salmon Creek 4.

3.6.5.2 Aquatic Habitat to Reestablish Access

Several of the subbasin's reaches would benefit from reestablishment of access for fish. Notably, Powder River 1, Willow Creek 1, Salmon Creek 1, Pine Creek 1, Gee Creek 1, Salmon Creek 2, Goodrich Creek 1, Salmon Creek 3, Mill Creek 1 and Powder River 10 were rated at 0% of optimum due to total barriers to fish passage, from dams and diversions or seasonal dewatering of the reach, and would benefit 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 28, Figure 29; Appendix 4, Table 34, Table 35). The rankings are based on the greatest habitat value gained by conducting restoration activities.

Bull trout were historically present in 57 of the 75 reaches in the Powder River subbasin; the habitat restoration rankings cover a broader area than the protection rankings because restoration may make way for recolonization of areas previously abandoned by bull trout. The results of the QHA analysis indicate a top ranking for restoration followed by a "tie" for second ranking among 4 reaches. All of the top rated reaches for bull trout are also highly ranked in restoration potential for redband trout. Eight reaches were ranked #1 in restoration for redband trout.

Pine Creek 1 was ranked #1 in restoration for bull trout and for redband trout. Bull trout are absent from this reach currently but were in the reach historically and are present in the adjacent, upstream reach (Pine Creek 2) which ranked #2 for protection for bull trout. Goodrich Creek 1 was also ranked highly for restoration for both redband and bull trout. Bull trout were in the reach historically, but are absent at this time. Salmon Creek 3 received a high restoration ranking and, like Pine Creek 1, is downstream and adjacent to a reach where bull trout currently persist (Salmon Creek 4) and that was rated highly for protection. Other reaches with high restoration value for both bull trout and redband trout were Mill Creek 1 and Marble Creek 1. The remaining top rated reaches for redband trout were Salmon Creek 1, Gee Creek 1 and Salmon Creek 2.

Restoration activities undertaken in Pine Creek 1 and Salmon Creek 3 would have valuable benefits for both redband and bull trout. With bull trout in the systems above these areas, habitat improvement that includes removal of passage barriers would allow natural recolonization of these historic habitats.

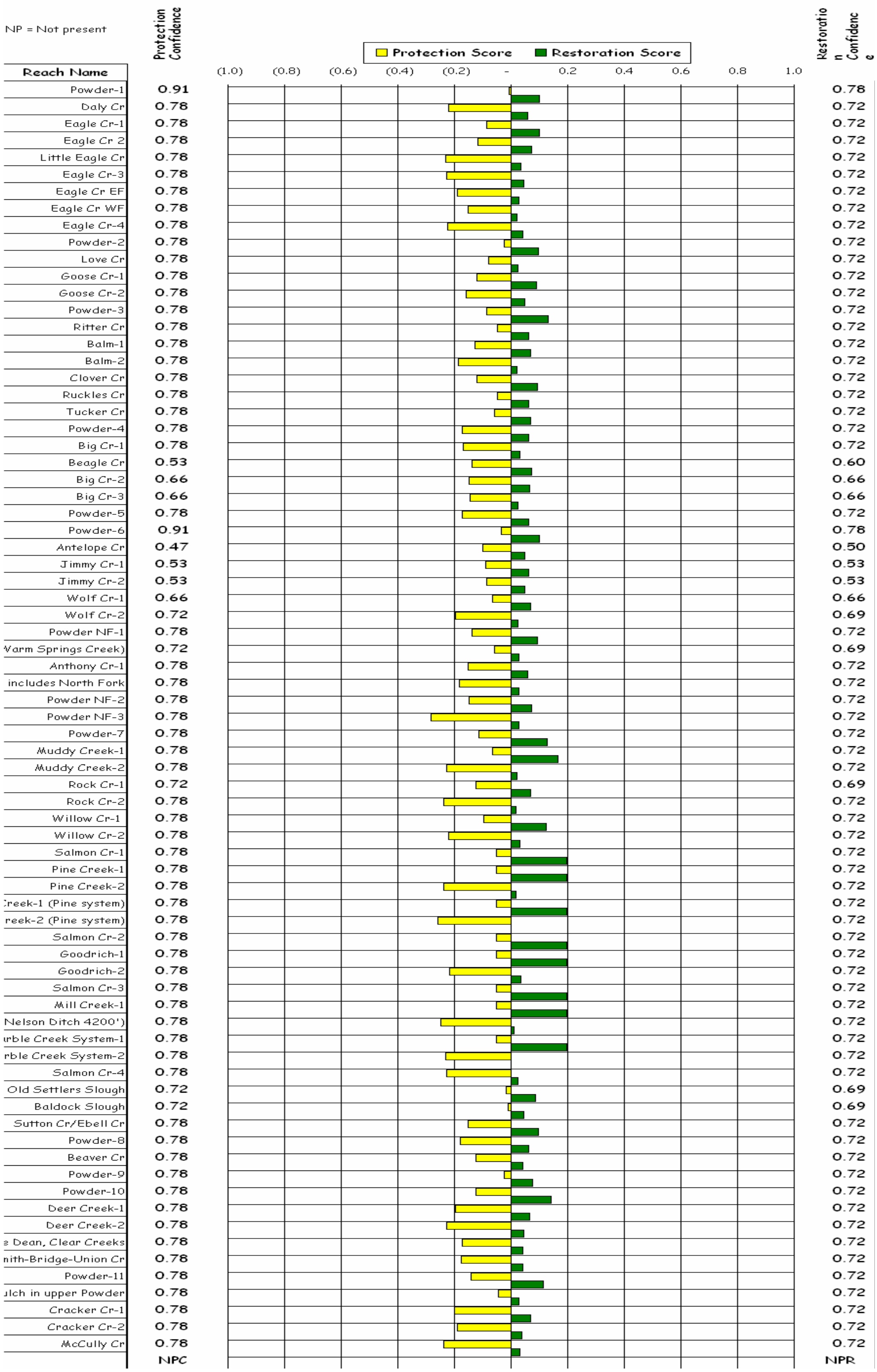


Figure 28. QHA tornado diagram depicting protection and restoration scores for redband trout in the Powder River subbasin, Oregon.

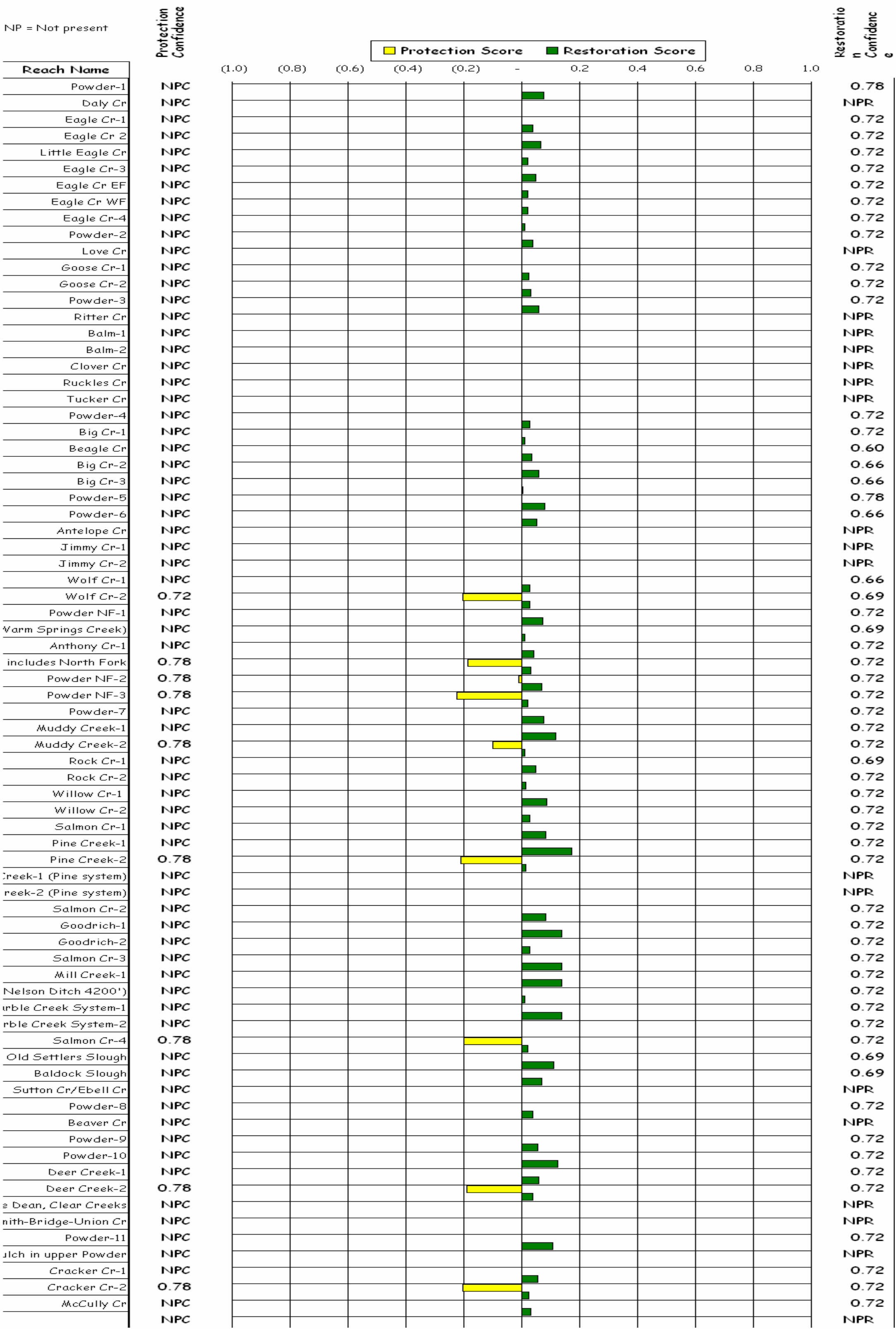


Figure 29. QHA tornado diagram depicting protection and restoration scores for bull trout in the Powder River subbasin, Oregon.

4. Inventory of Existing Activities (Private, Local, State, Federal)

4.1. Existing Legal Protection

Protected Areas:
US Forest Service

- *Eagle Cap Wilderness Area*. The Eagle Cap Wilderness Area lies in the heart of the Wallowa Mountains on the Wallowa-Whitman National Forest and encompasses 361,446 acres. First established as a primitive area in 1930, the Eagle Cap Wilderness became a part of the National Wilderness Preservation System with the passage of the Wilderness Act of 1964. The mainstem, West Fork and East Fork of Eagle Creek all begin in the Eagle Cap Wilderness Area.

US Bureau of Land Management

- *National Historic Oregon Trail Interpretive Center.* The National Historic Oregon Trail Interpretive Center is located at Flagstaff Hill east of Baker City and encompasses more than 500 acres. The area and interpretive center are managed to allow visitors the opportunity to view the original wagon ruts left by travelers on the Oregon Trail and the native vegetation of the area and to get an historical perspective on the trail and its users.
- *Powder River Canyon Area of Critical Environmental Concern*. Public lands encompassing 5,880 acres in the Powder River Canyon, between Thief Valley Reservoir and Highway 203 in the Keating Valley, are designated and will be managed as an ACEC. Within the ACEC, 2,385 acres of BLM managed land are included in the Powder Wild and Scenic River. The ACEC will be managed to protect raptor habitat, wildlife habitat, cultural resources, and to maintain scenic qualities while allowing for compatible recreational uses.
- *Keating Riparian Research Natural Area/Area of Critical Environmental Concern*. The Keating Riparian RNA/ACEC is comprised of approximately 2,173 acres of BLM managed land on Balm, Clover, and Sawmill Creeks. The area is managed to protect riparian values and wildlife habitat. Eighty acres within the ACEC will be managed as a Research Natural Area (RNA) to protect and maintain natural riparian ecologic systems for research and educational purposes.
- *Oregon Trail Area of Critical Environmental Concern.* Seven parcels of public lands with remnants of the Oregon National Historic Trail, encompassing approximately 1,495 acres, are designated and will be managed as an ACEC to preserve the unique historic resource and visual qualities of these areas. These lands are located within both the Burnt and Powder River subbasins.
- *Hunt Mountain Area of Critical Environmental Concern*. Approximately 2,230 acres of BLM managed land on Hunt Mountain are designated as an ACEC to protect and maintain habitat for mountain goats and big game, and to protect habitat for sensitive plant species identified by the Oregon National Heritage Program.

Oregon Department of Fish and Wildlife

- *Elkhorn Wildlife Area.* Located on the east slopes of the Elkhorn Range of the Blue Mountains in Union and Baker counties, the Elkhorn Wildlife Area consists of 10 separate tracts with a total of 9,630.22 acres. Of this total, 6,566.42 acres are owned by ODFW, 1,727.80 acres are public lands under management agreement and 1,336.0 acres are private lands under lease for management by ODFW. The Elkhorn Wildlife Area is managed primarily: 1) to mitigate the loss of traditional big game winter range, 2) to provide supplemental or subsistence feed for wintering elk and deer to alleviate damage to private lands, 3) to provide habitat for big game and other wildlife indigenous to the area, and 4) to provide hunting and other wildlife oriented recreation opportunities for the public. In addition to deer and elk, management of the Elkhorn Wildlife Area benefits a wide array of game and non-game fish and wildlife species. A complete list of species known to use the wildlife area can be found in the Long Range Management Plan (ODFW 1993a).

- *North Powder Ponds Public Access.* With 2 ponds located on the boundary between Union and Baker counties, the North Powder Ponds Public Access areas total 36 acres and are co-managed by ODFW and Oregon Department of Transportation (ODOT). They are managed primarily as habitat for aquatic birds and to provide angling opportunities for the public.
- *Red Ridge Wildlife Area*. Located in Baker County, the Red Ridge Wildlife Area is 30 acres of riparian habitat maintained by a spring in grassland. This area is co-managed by ODFW and the BLM as a watering site for mule deer and other wildlife.
- *Salisbury Wildlife Area.* The Salisbury Wildlife Area is a 6-acre tract of riparian habitat in Baker County co-managed by ODFW and ODOT for a variety of wildlife including neotropical migrant songbirds.
- *Baldock Slough*. The Baldock Slough area is 12 acres set aside for a variety of non-game wildlife.
- *Haines Pond.* Haines Pond is a 4 acre site managed for public access and angling.
- *Miles Wetland*. Miles Wetland consists of 600-acres in a conservation easement located east of North Powder.

Baker County

- *Sumpter Valley Wildlife Area*. Managed by Baker County, the Sumpter Valley Wildlife Area consists of 1,587 acres of ponds and riparian habitat in the area dominated by dredge tailings from historic mining activity. The area is managed to provide nesting habitat for Canada goose and other waterfowl.

Wild and Scenic Rivers

Portions of the Powder and North Powder Rivers and Eagle Creek are designated as federal Wild and Scenic under the Omnibus Oregon Wild and Scenic Rivers Act and are sub-classified as wild, scenic or recreational. These stream segments are: the Powder River from Thief Valley Dam to the Highway 203 bridge, a distance of 11.7 miles (scenic); the North Powder River from its headwaters to the National Forest Boundary, a distance of 6.0 miles (scenic); and Eagle Creek from its headwaters below Eagle Lake to the National Forest Boundary at Skull Creek, a distance of 27 miles (wild - 4 miles; scenic - 6 miles; recreational – 17 miles). The BLM prepared a management plan for the Powder River segment, which describes the Outstanding Remarkable Values (ORVs) that made the reach eligible under the Wild and Scenic Rivers Act (BLM 1994).

Federal Cave Resources

Four caves in the Eagle Creek drainage were nominated in 1995 under the Federal Cave Resources Protection Act of 1988. One cave has been determined to qualify as “significant” under the regulations. The other three are listed under “inadequate information” and require further investigation.

4.2. Existing Plans

- *US Forest Service and Bureau of Land Management*

The U.S. Forest Service is required to manage habitat to maintain viable populations of anadromous fish and other native and desirable non-native vertebrate species. A **Land and Resource Management Plan** (Forest Plan) was developed for the Wallowa-Whitman National Forest (USDA 1990). This Forest Plan guides all natural resource management activities, establishes forest-wide multiple-use goals and objectives, and establishes management standards and guidelines for the Wallowa Whitman National Forest. The forest plan is currently under revision.

The Bureau of Land Management, in accordance with the Federal Land Policy and Management Act of 1976, is required to manage public lands to protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values. A **Resource Management Plan** was developed for the Vale District Office, Baker Resource Area (USDI 1989). Both the USFS and BLM are required by the Clean Water Act to ensure that activities on administered lands comply with requirements concerning the discharge or run-off of pollutants.

In the Columbia River Basin, the Forest Service and the Bureau of Land Management manage salmonid habitat under the direction of **PACFISH** (USDA and USDI 1994) and **INFISH** (Inland Native Fish Strategy; USDA 1995). These interim management strategies aim to protect areas that contribute to salmonid recovery and improve riparian habitat and water quality throughout the Basin, including the Powder subbasin. These strategies have also facilitated the ability of the federal land managers to meet requirements of the ESA and avoid jeopardy. PACFISH guidelines are used in areas east of the Cascade Crest for anadromous fish. INFISH is for the protection of habitat and populations of listed resident fishes outside anadromous fish habitat.

The **Interior Columbia Basin Ecosystem Management Project** (ICBEMP) is a regional-scale land-use plan that covers 63 million acres of federal lands in Oregon, Washington, Idaho, and Montana http://www.icbemp.gov/.

The Bureau of Land Management is developing the **Northeastern Oregon Assembled Land Exchange** (NOALE) for the retention, exchange, and disposal of public land (USDI 1998). The goal of the exchange is to enable the BLM to more effectively meet ecosystem management objectives, to consolidate BLM managed lands for more effective and efficient resource protection, enhancement, and use; and to ensure that retained lands have sufficient public benefit to merit the costs of management (Land Exchange Act).

- *US Fish and Wildlife Service*

The U.S. Fish and Wildlife Service administers the Endangered Species Act (ESA) for resident fish and wildlife. This act provides for the development of **Recovery Plans** and directs enforcement of federal protection laws.

The USFWS also administers the **Lower Snake River Fish and Wildlife Compensation Plan (LSRCP)** authorized by the Water Resources Development Act of 1976 (Public Law 94-587). The goal of the LSRCP is to mitigate and compensate for fish and wildlife resource losses caused by construction and operation of the four lower Snake River dams and navigation lock projects (FWS 1998).

- *NOAA Fisheries*

  The National Oceanic and Atmospheric Administration administers the **ESA** as it pertains to anadromous fish only. NOAA Fisheries has jurisdiction over actions pertaining to Snake River spring and fall Chinook salmon and Snake River Basin Steelhead where they occur in the subbasin.
- *Environmental Protection Agency*

  The U.S. Environmental Protection Agency is responsible for implementing and administering the **Clean Water Act** (CWA). Accelerated and strengthened efforts to achieve clean water and aquatic habitats was the intent of the Clean Water Initiative (1998), the core of which is the **Clean Water Action Plan (CWAP)**, a federal partnership to promote and enhance locally based watershed improvements (the Unified Federal Policy for Ensuring a Watershed Approach to Federal Land and Resource Management). Restoration strategies called **Total Maximum Daily Loads (TMDL)** are being developed for the Columbia River mainstem and tributaries (including the Powder subbasin), based on court orders and negotiated agreements through CWA litigation. EPA serves an oversight and advisory role in development of TMDLs.
- *Senate Bill 1010*

  Senate Bill 1010 gives the Oregon Department of Agriculture (ODA) management authority to develop Water Quality Management plans for agricultural lands where such actions are required by state or federal law, such as TMDL requirements. The **Water Quality Management Plan** should be crafted in such a way to assist landowners in the local area in prevention and control of water pollution resulting from agricultural activities.
- *Oregon Plan*

  Passed into law in 1997 by Executive Order, the **Oregon Plan for Salmon and Watersheds** (http://www.oregon-plan.org/) and the **Steelhead Supplement to the Oregon Plan** outlines a statewide approach to ESA concerns based on watershed restoration and ecosystem management to protect and improve salmon and steelhead habitat in Oregon.
- *Oregon Department of Fish and Wildlife*

  Oregon Department of Fish and Wildlife is responsible for protecting and enhancing Oregon fish and wildlife and their habitats for present and future generations. Management of the fish and wildlife and their habitats in the Powder subbasin is guided by ODFW policies and federal and state legislation. Direction for ODFW fish and wildlife management and habitat protection is based on the amendments and statutes passed by the Oregon Legislature. For example, **Oregon Administrative Rule (OAR) 635 Division 07 – Fish Management and Hatchery Operation** sets forth policies on general fish management goals, the **Natural Production Policy**, the **Wild Fish Management Policy**, and other fish management policies and **OAR 635 Division 008 – Department of Wildlife Lands** sets forth management goals for each State Wildlife Area. Another pertinent ODFW policy is the **Oregon Guidelines for Timing of In-Water Work** to **Protect Fish and Wildlife Resources** (ODFW 1997b). In addition to the OAR's, ODFW has developed a variety of species-specific management plans. http://www.dfw.state.or.us/

    - Mule Deer Management Plan (2003)
    - Elk Management Plan (2003)
    - Bighorn Sheep and Rocky Mountain Goat Management Plan (2003)
    - Cougar Management Plan (1993)
    - Black Bear Management Plan (1987)
    - Migratory Game Bird Program Strategic Management Plan (1993)
    - Oregon Wildlife Diversity Plan (1999)
    - Oregon's Trout Plan
    - Warmwater Fish Plan

- Comprehensive Plan for Production and Management of Oregon's Anadromous Salmon and Trout, Part III: Steelhead Plan
- Native Fish Conservation Policy

➲ *Oregon Department of Agriculture*

The Department of Agriculture has developed the **Oregon Noxious Weed Strategic Plan** to assist in controlling the spread of noxious weeds on public and private land.

➲ *Oregon Department of Forestry*

The Oregon Department of Forestry enforces the **Oregon Forest Practices Act** (OAR 629-Division 600 to 680 and ORS 527) regulating commercial timber production and harvest on state and private lands. The OFPA contains guidelines to protect fish bearing streams during logging and other forest management activities, which address stream buffers, riparian management, and road maintenance.

➲ *County Governments*

County Commissioners have established **Comprehensive Plans** for land use within each county in Oregon. The Plan is designed to establish certain regulatory control over specific activities to 1) ensure open space, 2) protect scenic, historic, and natural resources for future generations, and 3) promote healthy and visually attractive environments in harmony with the natural landscape. Big game winter range and certain sensitive species sites are offered some protection by county plans. Some counties also assist with funding of county watershed activities in collaboration with OWEB.

➲ *Powder Basin Watershed Council*

Under House Bill 2215 and its successor, HB 3441, the State of Oregon has authorized the formation of watershed councils in an attempt to include local knowledge and cooperation in addressing Oregon's environmental issues. Baker County has convened and legally recognizes this Council as empowered to shoulder the responsibility of retaining, restoring and enhancing the health of its watersheds. The Council's mission is to: Analyze watershed conditions, develop short and long-range plans and projects to protect or improve watershed conditions, educate the people in the community about the watershed conditions and function, enlist the people in the community to participate in the projects, develop peer and/or legislative partnerships when needed to achieve results and remain in compliance with legislative and legal requirements.

4.3. Existing Management Programs

➲ *Bonneville Power Administration*

The Bonneville Power Administration has mitigation responsibility for fish and wildlife restoration under the **Fish and Wildlife Program** of the Northwest Power and Conservation Council as related to hydropower development. It is also accountable and responsible for mitigation related to federal Biological Opinions and Assessments for recovery of threatened, endangered, and sensitive species. The recently released FCRPS Biological Opinion calls for the BPA to expand habitat protection measures on non-federal lands. BPA plans to rely on the Council's program as its primary implementation tool for the FCRPS BiOp off-site mitigation requirements.

➲ *U.S.D.A. Natural Resources Conservation Service*

Within the U.S. Department of Agriculture (USDA), the Natural Resources Conservation Service (NRCS) oversees the implementation of conservation programs to help solve natural resource concerns. The **Environmental Quality Incentives Program** (EQIP), established in the 1996 Farm Bill, provides a voluntary conservation program for farmers and ranchers who face serious threats to soil, water, and related natural resources. The **Conservation Reserve Program** (CRP) puts sensitive croplands under permanent vegetative cover. The **Conservation Reserve Enhancement Program** (CREP) helps to establish forested riparian buffers. The **Wetlands Reserve Program** (WRP) helps with wetland restoration efforts. The NRCS assists landowners to develop farm conservation plans and provides engineering and other support for habitat protection and restoration (PL 566). Additional programs administered by the NRCS include the **Grassland Reserve Program**, **Wildlife Habitat Incentives Program**, **Conservation Security Program, Forest Land Enhancement Program** and **Farm and Ranch Lands Protection Program**.

- *Oregon State Police*

  The Fish and Wildlife Division of the Oregon State Police (OSP) is responsible for enforcement of fish and wildlife regulations in the State of Oregon. **The Coordinated Enforcement Program** (CEP) promotes effective enforcement by coordinating enforcement priorities and plans by and between OSP officers and ODFW biologists.
- *Blue Mountains Elk Initiative*

  The **Blue Mountains Elk Initiative** is a federal, private, state and tribal partnership to improve elk habitat in the Blue Mountains of Oregon and Washington. The mission of the Initiative is to more effectively manage elk and elk habitat in the Blue Mountains with an emphasis on working closely with landowners to alleviate damage, using more than 90 percent of funding for on-the-ground projects and obtaining consensus on elk management from all partners and interested groups.
- *Baker County*

  OWEB provides funding for locally administered **Small Grants Program** from the watershed improvement fund.
- *Baker County Noxious Weeds*

  The **Baker County Noxious Weed Cost Share Program** provides assistance in control of specified weeds and it funded by a county weed levy.
- *Oregon Department of Agriculture*

  The **Weed Board Grants Program** is tied to Oregon Lottery funds.
- *Bureau of Land Management*

  Taylor Grazing Act **Rangeland Improvement Program** funds are administered by the BLM and funded from grazing fees.

4.4. Existing Restoration and Conservation Projects

In the Powder River subbasin, there is no central location or database for tracking natural resource conservation and restoration projects. A request from the subbasin planning lead entity, the Baker County Association of Soil and Water Conservation Districts, to government agencies and private land owners for information on existing projects went unanswered. Therefore, no list of recent and ongoing projects is presented at this time.

4.5. Gap Assessment of Existing Protections, Plans, Programs and Projects

Without a centralized list of the projects under way and/or completed in the subbasin, an assessment of gaps in those projects and programs is problematic. Nevertheless, the aquatic and terrestrial assessments generally validate the direction of recent conservation and restoration activities in the subbasin and emphasize the need to continue these activities on a larger scale.

Much of the conservation and restoration work undertaken recently in the subbasin has been on private land. These projects are approached opportunistically, that is when funding and landowner willingness permit. Private landowners have participated in habitat restoration for a variety of reasons: a desire to improve habitat, fear of future regulation, testimonials from other participating landowners, cost share opportunity, etc. Although there may have been higher priority actions, or higher priority reaches in which to pursue conservation and/or restoration, those actions or areas may have been inaccessible due to lack of landowner participation and/or funding.

We believe there are sufficient protective mechanisms, laws, management plans and programs to provide the framework for habitat protection and restoration in the subbasin. Additionally projects over the last decade have generally targeted the same limiting factors as have been identified in this assessment. The QHA model may assist subbasin planners to more precisely target restoration work to stream reaches, watersheds and fish populations where the work will be the most beneficial to aquatic habitats and fish populations.

5. Management Plan

5.1. Vision for the Subbasin

Our Vision:

"The Vision for the Powder subbasin is to work through a collaborative process to achieve a healthy and sustainable ecosystem with diverse aquatic and terrestrial species and their habitats which also supports the social, cultural and economic well-being of the local communities within the subbasin for the benefit of present and future generations."

Goal:

Implementation of a partnership-driven Management Plan that protects and enhances the natural ecological functions, habitats and biological diversity while sustaining the economic and social vitality of the communities in the region.

5.2 Biological Objectives

Objectives:

1. Promote watershed and community health through innovation and cooperation by engaging all stakeholders through an open, assessable and collaborative process.

2. Maintain or improve watershed conditions for water quality and quantity by assessing water supply and use, and developing strategies for meeting current and future both in-stream and out-of-stream objectives..

3. Maintain or improve fish and wildlife habitats to support recovering populations of threatened or endangered species, diverse populations of native species and sustainable populations of recreationally valued species.

4. Use credible scientific information to understand, protect and improve the most critical aspects of a healthy watershed.

Guiding Principles:

1. Promote healthy ecosystems within the context of a natural resource based economy.

2. Encourage collaborative means to develop projects within small watershed areas (micro-watershed projects) and partnerships between private landowners and public agencies on mixed ownerships. This method will allow stakeholders and agencies to work together for the benefit of the watershed and create win-win situations.

3. Use methods that result in self-sustaining restoration compared to methods that require continued maintenance or periodic reestablishment.

4. Balance the use of passive and active restoration projects. Passive restoration aims at addressing the activities that are causing degradation or preventing recovery. Active restoration is used where past activities prevent natural processes (or cause slow recovery) from being effective.

5. Emphasize strategies aimed at restoring watershed processes and functions over treatment of conditions. Priority will be given to projects that benefit a number of factors.

6. Use principles of adaptive management to learn from experience compared to using inflexible standards and guides for restoration projects.

5.3. Prioritized Strategies

Generic aquatic and terrestrial strategies are listed below. The list is organized by general purpose and type of action or project. When combined with the spatial extent of limiting factors in the subbasin and in watersheds as summarized above in Section 3.5, this list constitutes the Aquatic and Terrestrial Strategies. Site-level projects can then be proposed to carry out the Powder Subbasin Plan Strategies, and meet the needs of the NWPPC Columbia Fish and Wildlife Program.

The term “Improve” is being used to describe an action that will be set forth by standards of the agencies or landowners on a site specific basis and to a point ecologically, environmentally and economically practical and feasible.

5.3.1 Aquatic Species

1) Purpose: Improve Riparian and Wetland Habitats
    a. Proper grazing management
    b. Establish buffers and riparian fencing
    c. Reestablish wetlands
    d. Seeding and planting vegetation
    e. Conservation Easements
2) Purpose: Improve Stream Channel Processes
    a. Develop off-channel habitat
    b. Remove/modify levies, berms, or dikes where appropriate
3) Purpose: Reduce Water Pollution
    a. Irrigation and water management
    b. Pesticide management
    c. Nutrient management
    d. Sewage and stormwater
4) Purpose: Reduce Upland Erosion and Sedimentation
    a. Agricultural lands – irrigated cropland, pasture and rangeland
    b. Forest management

5) Purpose: Improve In-stream channel habitat
    a. Large woody debris, boulder placement
    b. Bank stabilization
6) Purpose: Improve habitat connectivity and fish passage
    a. Fish passage at dams and irrigation water diversion structures
    b. Barriers at roads (culverts)
    c. Barriers created by dewatered reaches
    d. Approved fish screens
7) Purpose: Minimize detrimental effects of exotic species
    a. Education and enforcement to prevent illegal introductions
    b. Exotic species management

5.3.2 Terrestrial Species

1) Purpose: Achieve healthy forest ecosystem function and processes
    a. Prescribed fire
    b. Selective thinning and fuels reduction
    c. Road management and off-road travel
2) Purpose: Improve riparian habitat function
    a. Develop site-specific grazing management prescriptions
    b. Provide water developments in adjacent upland areas to encourage cattle/wildlife use of non-riparian habitats
    c. Pasture and exclosure fencing
    d. Encourage a diversity of shrub species
    e. Identify areas with impaired function and prescribe restoration techniques that will restore hydrologic and ecologic functioning
3) Improve Sage-brush steppe habitats
    a. Control Juniper encroachment
    b. Sage-brush control in appropriate areas
    c. Encourage reestablishment of native vegetation
    d. Noxious weed control

5.4. Consistency with ESA/CWA Requirements

These areas are addressed throughout the plan.

5.5 Research, Monitoring and Evaluation

Monitoring and Evaluation

The focus of our Monitoring and Evaluation program below is on the strategy level, not on the project level. It is not intended to be 'field ready', rather it is a first step in program development. Current or on-going projects frequently incorporate the Monitoring and Evaluation needs identified in this section.

A list of short-term indicators to measure the successful implementation of strategies that achieve desired objectives, and the expected long-term biological outcome, are provided to guide monitoring in the Powder subbasin (Table 30, Table 31).

Table 30. Indicators and expected biological outcome used to evaluate success of implemented strategies in achieving AQUATIC objectives in the Powder subbasin.

Objective	Strategy	Short-term Indicators to measure success	Long-term Biological Outcome
Maintain and increase bull trout abundance (greater that or equal to 500 adults) within each of the local population watersheds as identified by US Fish and Wildlife	Maintain existing local population levels by protecting or improving existing water temperature, stream flows, habitat quality and invasion from non-native species	Non-declining trends in water temperature, flow, habitat quality, passage	Non-declining population trends
	Increase populations to at least 500 adults within each defined watershed	Increased population	Increased population
	By 2020, assess and implement activities which will maintain or improve habitat within each defined watershed	Improved habitat	Expanded abundance
Ensure continued existence of redband trout populations at or near current levels	Expedite analysis of archived data and encourage additional genetic sampling	Genetic baseline and/or profiles of redband trout	Long-term population viability
	Improve degraded habitat to promote natural distribution of native resident fish	Improved habitat	Expanded abundance
Improve flow in limited reaches and spring complexes	Assessments for designation of adequate flow requirements where appropriate	Number of adequate flow designations	Improved populations, viability, distribution and abundance of aquatic species
	Continue and expand efforts aimed at increasing base flows and improve flow timing through riparian and wetland enhancements. Implement forest and agricultural Best Management Practices (BMP)	Increase base flows. Hydrograph improvements. Number of forest and agricultural BMPs implemented and acreage affected	Improved population and abundance of aquatic species
Reduce water temperatures to levels meeting applicable	Improve riparian and wetland areas to restore hydrologic	Hydrograph improvement, increased flows,	Improved population and abundance of aquatic species

water quality standards for life stage specific needs of aquatic focal species	function and where impairment has impacted temperatures	decreased stream temperatures	
	Promote efforts aimed at increasing streamside shading	Increased shading, increased miles of streams meeting shade and temperature criteria	Improved population and abundance of aquatic species
Reduce instream sedimentation to levels that meet applicable water quality standards and measures and establish and upward trend in the number of stream miles meeting such criteria	Reduce sediment inputs by cooperatively implementing practices that address problems from logging, mining, agriculture and other historic and current sediment-producing activities	Embeddedness	Improved population and abundance of aquatic species
By 2015, develop a nutrient allocation plan for the subbasin which investigates the potential benefits to fish and wildlife of nutrient additions or reductions	Target nutrient additions or reduction efforts accordingly to benefit aquatic and terrestrial species		
Reduce number of artificially blocked streams	Modify or remove, if possible, known barriers limiting aquatic species	Decreased number of barriers	Expanded population and diversity of species
	Modify or remove, if possible, human-caused barriers	Decreased number of barriers	Expanded population and diversity of species
Improve aquatic habitat diversity and complexity in tributary and mainstem where focal species populations are limited	Continue aquatic habitat improvement efforts consistent with existing federal, state and local habitat improvement plans and guidelines	Upward trend in habitat conditions including: Embeddedness/fines, temperature, riparian condition, high/low flows, bank stability, structure density/distribution, water quality	Improved population and abundance of aquatic species
	Address priority problems with protection and restoration activities designed to promote development of more	Improved riparian condition, decreased temperature, decreased embeddedness/fines, increased base flow	Improved population and abundance of aquatic species

	complex and diverse habitats through improved watershed condition and function. This will involve coordination of activities aimed at individual components such as temperature and sedimentation		
	Improve ecosystem functions – identify and rehabilitate upland, riparian and wetland areas	Improved riparian condition, decreased temperature, decreased embeddedness/fines, increased base flow	Improved population and abundance of aquatic species

Table 31. Indicators and expected biological outcome used to evaluated success of implemented strategies in achieving TERRESTRIAL objectives in the Powder subbasin.

Objective	Strategy	Short-term Indicators to measure success of Strategy	Long-term Biological Outcome
Protect and improve existing quality, quantity and diversity of native plant communities providing habitat to native wildlife species by preventing the introduction of noxious weeds and invasive exotic plants into native habitats	Prevent noxious weed infestations by minimizing ground-disturbing activities in habitats highly susceptible to weed invasion through local cooperation and revegetation following disturbance	Reduction in the number of new infestations, decreasing number of acres that need to be treated each year. Reduction of acreage of incidents of invasive noxious plant infestations related to fire impacts.	Native plant communities without invasive noxious plant problems
	Prevent dispersal by encouraging the use of weed-free seeds and feeds. Limit the transportation of weed seeds and other propagules from vehicles and livestock	Programs implemented and policies enacted, such as establishment of weed-free regulations, posting of signs regarding weed-free seed use and others	Fewer opportunities for introductions
	Minimize establishment of new invaders by supporting early	Reduction in the number of new infestations, decreasing number of	Native plant communities without invasive noxious plant problems

	detection and eradication programs	acres that need to be treated each year.	
Reduce the extent and density of established noxious weeds and restore native habitats	Treat weed infestations using the area and species identified and prioritized by Baker County Weed Board	Number of infested acres treated. Number of infestations treated	Reduced number of infestations. Reduced acreage of infestations
	Control or mitigate for the adverse impact of invasive vegetation in reservoir drawdown zones	Number of infested acres in drawdown (net reduction in infestation)	Reduced acreage of infestations
	Reestablish native plant communities after successful weed eradication efforts	Acres of restored native habitat	Increase in native plant communities without invasive noxious weed problems
	Encourage BMP and land use that will decrease the likelihood of invasion. Use the most effective and environmentally appropriate biological, mechanical or chemical treatments for control	Implementation rates of BMPs	Native plant communities without invasive noxious weeds problems and more environmentally sound
Manage forest and shrub-steppe habitats that would allow ecosystem processes and succession	Increase fire suppression efforts in shrub-steppe to limit the size and intensity of wildfires to mimic the historic fire regime	Number of acres burned and long-term alterations to vegetative structure	Reduced risk of high intensity fires Reduction in coverage of non-native annuals
	Rehabilitate burned area following methods to increase seed germination success. Emphasize use of native shrub, grass and forb species in rehabilitation seed mixture, when possible	Number of acres successfully treated and restored to native sagebrush habitat	Increased shrub-steppe and forest habitat Improved shrub-steppe and forest habitat quality and quantity
	Avoid damage, maintain and improve existing native species during rehabilitation		Habitat fore perennial native species are not damaged in the long-term by rehabilitation

	efforts		efforts
Reduce the negative impacts of livestock grazing on the fish, wildlife and plant populations in the subbasin. Protect and improve riparian, wet meadow and native upland habitats	Reduce or eliminate grazing impacts by encouraging establishment of riparian pasture systems, exclusion fences (passable to wildlife), off-site watering areas, riparian conservation easements or consider retirement of grazing permits in priority areas. Adjust seasonal timing of livestock grazing to minimize soil compaction, erosion, noxious weed propagation and conflicts with wildlife	Update allotments management plans and adhere to standards and guidelines Number of acres exhibiting a change in the condition of the vegetation (e.g. from poor to fair, or fair to good range condition) Number of cooperators participating in conservation practices	Increased number of livestock operations compatible with resource objectives
	Identify concentrated feeding areas negatively impacting water quality and design management actions to minimize sediment inputs to streams	Number of concentrated feeding operations in existence with adequate safeguards to reduce water quality impacts Management actions taken to reduce impacts that result in measurable changes on the ground that improve water quality conditions	Improved water quality
Reduce conflicts between livestock and native wildlife and plant populations	Protect important plant populations by developing grazing management plans to limit adverse impacts to rare or culturally important plant populations	Updates to allotment management plans on public lands	Maintenance or restoration of rare or culturally important plant populations
	Prevent seed dispersal by minimizing the potential for livestock to spread noxious weeds through weed-	Special use permits on federal lands incorporate weed-free information	Fewer opportunities for introduction

	free hay programs, quarantine requirements and other actions		
	Alter grazing management to minimize livestock and native species conflicts	Updates to allotment management plans	Improved quality
Protect mature pine/fir trees and stand habitats	Maintain existing stands and individual trees and encourage the planting of ponderosa pine in existing state, federal and private reforestation efforts	Acres of existing ponderosa pine communities that are protected	Increase in number of protected acres of ponderosa pine communities
	Continue existing, and develop new, programs that work to improve low elevation pine/fir forests	Increase in acreage of low elevation pine/fir forests	Improved habitat quality
Protect existing shrub-steppe habitats from additional fragmentation and degradation. Prevent the additional loss of shrub-steppe habitats Restore areas important for focal species	Protect existing important habitats (particularly big game winter range and rare plant habitat) from conversion	Increase number of acres of winter range Increase in number of protected areas	Increased winter range available to big game
	Restore fragmented and degraded sagebrush habitats	Number of acres of restored shrub-steppe habitat	Increase in number of acres of functioning quality shrub-steppe habitat
	On private lands, when possible, assist private landowners in restoring native vegetation	Number of landowners participating in agricultural land programs	Increase in the number of protected acres of shrub-steppe habitat
Protect, enhance or restore wetlands and spring habitats or create new wetlands to mitigate for permanently lost wetlands	Protect wetland and springs habitats through public education, promotion of BMPs, promotion of alternative grazing strategies and the installation of alternative forms of water for livestock	Decreasing trend in number of acres of wetland habitat lost	Increase in number of protected acres of wetland habitat
	Restore wetland habitats by improving wetland function and	Number of acres of restored wetland habitat	Number of acres of restored wetland habitat

	quality		
	Create and/or establish wetlands where it will help mitigate the impacts of point sources of pollution	Number of acres of restored wetland habitat	Number of acres of restored wetland habitat
	Where priority wetlands and springs exist on private land, collaborate with private landowners, communicate and cooperate with landowners to protect or improve wetland and spring habitats	Number of acres of restored wetland habitat	Number of acres of restored wetland habitat
	Continue effective activities, and develop new activities, that work to protect and restore wet meadow, wetland and spring habitats	Number of acres of restored wetland habitat	Number of acres of restored wetland habitat
Protect, enhance or restore riparian habitats	Restore prioritized degraded riparian areas in coordination with existing plans and programs addressing riparian habitats, when possible	Number of acres of restored habitat	Increase in number of acres of functioning quality riparian habitat
	Protect riparian communities through conservation easements, land exchanges, promotion of BMPs, land stewardship, promotion of alternative grazing strategies and the installation of alternative forms of water for livestock	Decreasing trend in number of acres of riparian habitat lost	Increase in the number of protected acres of riparian habitat
	Minimize road and other land use impacts in riparian areas	Miles of roads in riparian areas	Improved water quality
	Protect and restore	Number of	Increase in the number

	riparian communities in agricultural lands through increased enrollment by landowners in the Conservation Reserve Program (CRP), conservation easements and other agricultural land programs	landowners participating in agricultural land programs	of protected acres of riparian habitat
	Increase stewardship and public knowledge by increasing understanding of the importance of riparian habitat through education programs for the general public, irrigation districts, water users, land owners and land managers	Decreasing trend in number of acres of riparian habitat lost	Increase in number of acres of functioning quality riparian habitat

6. Appendices

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6.2 Appendix 2: Species Tables

Appendix Table 1. Fish species known to occur in the Powder subbasin.

Species	Origin	Distribution
Redband trout (*Oncorhynchus mykiss gibbsi*)	N	Widespread
Rainbow trout (*Oncorhychus mykiss*)	N	Widespread
White sturgeon (*Acipenser transmontanus*)	N	Rare in Powder Arm of Brownlee Reservoir
Mountain whitefish (*Prosopium williamsoni*)	N	Mainstem
Brook trout (*Salvelinus fontinalis*)	I	Widespread
Bull trout (*Salvelinus confluentus*)	N	Elkhorn tributaries
Lake trout (*Salvelinus namaycush*)	I	Few high lakes
Mottled sculpin (*Cottus bairdi*)	N	mainstem and tributaries
Slimy sculpin (*Cottus cognatus*)	N	mainstem and tributaries
Torrent sculpin (*Cottus rhotheus*)	N	mainstem and tributaries
Shorthead sculpin (*Cottus confuses*)	N	mainstem and tributaries
Piaiute sculpin (*Cottus beldingi*)	N	mainstem and tributaries
Carp (*Cyprinus carpio*)	I	Low Gradient Streams
Northern pikeminnow (*Ptychocheilus oregonensis*)	N	Mainstem
Chiselmouth (*Acrocheilus alutaceus*)	N	Widespread
Peamouth (*Mylocheilus caurinus*)	N	Widespread
Longnose dace (*Rhinichthys cataractae dulcis*)	N	Widespread
Speckled dace (*Rhinichthys osculus*)	N	Widespread
Redside shiner (*Richardsonius balteatus balteatus*)	N	Widespread
Largescale sucker (*Catostomus macrocheilus*)	N	Widespread
Mountain sucker (*Catostomus platyrhynchus*)	N	Widespread
Bridgelip sucker (*Catostomus columbianus*)	N	Widespread
Black crappie (*Poxomis nigromaculatus*)	I	Lakes, Ponds, Low Gradient
White crappie (*Poxomis annularis*)	I	Lakes, Ponds, Low Gradient
Largemouth bass (*Micropterus salmoides*)	I	Lakes, Ponds, Low Gradient
Smallmouth bass (*Micropterus dolomieui*)	I	Lakes, Ponds, Low Gradient
Bluegill (*Lepomis macrochirus*)	I	Lakes, Ponds, Low Gradient
Pumpkinseed (*Lepomis gibbosus*)	I	Lakes, Ponds, Low Gradient
Warmouth (*Lepomis gulosis*)	I	Lakes, Ponds, Low Gradient
Yellow perch (*Perca flavescens*)	I	Lakes, Ponds, Low Gradient
Channel catfish (*Ictalurus punctatus*)	I	Lakes, Ponds, Low Gradient
Flathead catfish (*Pylodictis olivaris*)	I	Lakes, Ponds, Low Gradient
Brown bullhead (*Ameiurus nebulosus*)	I	Lakes, Ponds, Low Gradient

Appendix Table 2. Wildlife species in the Powder River subbasin.

Common Name	Scientific Name	OR Occurrence	OR Breeding Status
Amphibians			
Tiger Salamander	*Ambystoma tigrinum*	occurs	breeds

Long-toed Salamander	*Ambystoma macrodactylum*	occurs	breeds
Western Red-backed Salamander	*Plethodon vehiculum*	occurs	breeds
Tailed Frog	*Ascaphus truei*	occurs	breeds
Great Basin Spadefoot	*Scaphiopus intermontanus*	occurs	breeds
Western Toad	*Bufo boreas*	occurs	breeds
Woodhouse's Toad	*Bufo woodhousii*	occurs	breeds
Pacific Chorus (Tree) Frog	*Pseudacris regilla*	occurs	breeds
Red-legged Frog	*Rana aurora*	occurs	breeds
Oregon Spotted Frog	*Rana pretiosa*	occurs	breeds
Columbia Spotted Frog	*Rana luteiventris*	occurs	breeds
Northern Leopard Frog	*Rana pipiens*	occurs	breeds
Bullfrog	*Rana catesbeiana*	non-native	breeds
Total Amphibians:	**13**		
Birds			
Common Loon	*Gavia immer*	occurs	non-breeder
Pied-billed Grebe	*Podilymbus podiceps*	occurs	breeds
Horned Grebe	*Podiceps auritus*	occurs	breeds
Red-necked Grebe	*Podiceps grisegena*	occurs	breeds
Eared Grebe	*Podiceps nigricollis*	occurs	breeds
Western Grebe	*Aechmophorus occidentalis*	occurs	breeds
Clark's Grebe	*Aechmophorus clarkii*	occurs	breeds
American White Pelican	*Pelecanus erythrorhynchos*	occurs	breeds
Double-crested Cormorant	*Phalacrocorax auritus*	occurs	breeds
American Bittern	*Botaurus lentiginosus*	occurs	breeds
Least Bittern	*Ixobrychus exilis*	occurs	breeds
Great Blue Heron	*Ardea herodias*	occurs	breeds
Great Egret	*Ardea alba*	occurs	breeds
Snowy Egret	*Egretta thula*	occurs	breeds
Cattle Egret	*Bubulcus ibis*	occurs	breeds
Green Heron	*Butorides virescens*	occurs	breeds
Black-crowned Night-heron	*Nycticorax nycticorax*	occurs	breeds
White-faced Ibis	*Plegadis chihi*	occurs	breeds
Turkey Vulture	*Cathartes aura*	occurs	breeds
Greater White-fronted Goose	*Anser albifrons*	occurs	non-breeder
Snow Goose	*Chen Ccaerulescens*	occurs	non-breeder
Ross's Goose	*Chen rossii*	occurs	non-breeder
Canada Goose	*Branta canadensis*	occurs	breeds
Trumpeter Swan	*Cygnus buccinator*	occurs	breeds
Tundra Swan	*Cygnus columbianus*	occurs	non-breeder
Wood Duck	*Aix sponsa*	occurs	breeds
Gadwall	*Anas strepera*	occurs	breeds
Eurasian Wigeon	*Anas penelope*	occurs	non-breeder
American Wigeon	*Anas americana*	occurs	breeds
Mallard	*Anas platyrhynchos*	occurs	breeds
Blue-winged Teal	*Anas discors*	occurs	breeds
Cinnamon Teal	*Anas cyanoptera*	occurs	breeds
Northern Shoveler	*Anas clypeata*	occurs	breeds
Northern Pintail	*Anas acuta*	occurs	breeds
Green-winged Teal	*Anas crecca*	occurs	breeds
Canvasback	*Aythya valisineria*	occurs	breeds

Redhead	*Aythya americana*	occurs	breeds
Ring-necked Duck	*Aythya collaris*	occurs	breeds
Greater Scaup	*Aythya marila*	occurs	non-breeder
Lesser Scaup	*Aythya affinis*	occurs	breeds
Harlequin Duck	*Histrionicus histrionicus*	occurs	breeds
Surf Scoter	*Melanitta perspicillata*	occurs	non-breeder
Bufflehead	*Bucephala albeola*	occurs	breeds
Common Goldeneye	*Bucephala clangula*	occurs	non-breeder
Barrow's Goldeneye	*Bucephala islandica*	occurs	breeds
Hooded Merganser	*Lophodytes cucullatus*	occurs	breeds
Common Merganser	*Mergus merganser*	occurs	breeds
Red-breasted Merganser	*Mergus serrator*	occurs	non-breeder
Ruddy Duck	*Oxyura jamaicensis*	occurs	breeds
Osprey	*Pandion haliaetus*	occurs	breeds
White-tailed Kite	*Elanus leucurus*	occurs	breeds
Bald Eagle	*Haliaeetus leucocephalus*	occurs	breeds
Northern Harrier	*Circus cyaneus*	occurs	breeds
Sharp-shinned Hawk	*Accipiter striatus*	occurs	breeds
Cooper's Hawk	*Accipiter cooperii*	occurs	breeds
Northern Goshawk	*Accipiter gentilis*	occurs	breeds
Red-shouldered Hawk	*Buteo lineatus*	occurs	breeds
Swainson's Hawk	*Buteo swainsoni*	occurs	breeds
Red-tailed Hawk	*Buteo jamaicensis*	occurs	breeds
Ferruginous Hawk	*Buteo regalis*	occurs	breeds
Rough-legged Hawk	*Buteo lagopus*	occurs	non-breeder
Golden Eagle	*Aquila chrysaetos*	occurs	breeds
American Kestrel	*Falco sparverius*	occurs	breeds
Merlin	*Falco columbarius*	occurs	bred historically
Gyrfalcon	*Falco rusticolus*	occurs	non-breeder
Peregrine Falcon	*Falco peregrinus*	occurs	breeds
Prairie Falcon	*Falco mexicanus*	occurs	breeds
Chukar	*Alectoris chukar*	non-native	breeds
Gray Partridge	*Perdix perdix*	non-native	breeds
Ring-necked Pheasant	*Phasianus colchicus*	non-native	breeds
Ruffed Grouse	*Bonasa umbellus*	occurs	breeds
Sage Grouse	*Centrocercus urophasianus*	occurs	breeds
Spruce Grouse	*Falcipennis canadensis*	occurs	breeds
Blue Grouse	*Dendragapus obscurus*	occurs	breeds
Sharp-tailed Grouse	*Tympanuchus phasianellus*	reintroduced	breeds
Wild Turkey	*Meleagris gallopavo*	non-native	breeds
Mountain Quail	*Oreortyx pictus*	occurs	breeds
California Quail	*Callipepla californica*	occurs	breeds
Northern Bobwhite	*Colinus virginianus*	non-native	breeds
Virginia Rail	*Rallus limicola*	occurs	breeds
Sora	*Porzana carolina*	occurs	breeds
American Coot	*Fulica americana*	occurs	breeds
Sandhill Crane	*Grus canadensis*	occurs	breeds
Black-bellied Plover	*Pluvialis squatarola*	occurs	non-breeder
American Golden-Plover	*Pluvialis dominica*	occurs	non-breeder
Pacific Golden-Plover	*Pluvialis fulva*	occurs	non-breeder

Snowy Plover	*Charadrius alexandrinus*	occurs	breeds
Semipalmated Plover	*Charadrius semipalmatus*	occurs	non-breeder
Killdeer	*Charadrius vociferus*	occurs	breeds
Black-necked Stilt	*Himantopus mexicanus*	occurs	breeds
American Avocet	*Recurvirostra americana*	occurs	breeds
Greater Yellowlegs	*Tringa melanoleuca*	occurs	non-breeder
Lesser Yellowlegs	*Tringa flavipes*	occurs	non-breeder
Solitary Sandpiper	*Tringa solitaria*	occurs	non-breeder
Willet	*Catoptrophorus semipalmatus*	occurs	breeds
Spotted Sandpiper	*Actitis macularia*	occurs	breeds
Upland Sandpiper	*Bartramia longicauda*	occurs	breeds
Whimbrel	*Numenius phaeopus*	occurs	non-breeder
Long-billed Curlew	*Numenius americanus*	occurs	breeds
Marbled Godwit	*Limosa fedoa*	occurs	non-breeder
Red Knot	*Calidris canutus*	occurs	non-breeder
Sanderling	*Calidris alba*	occurs	non-breeder
Semipalmated Sandpiper	*Calidris pusilla*	occurs	non-breeder
Western Sandpiper	*Calidris mauri*	occurs	non-breeder
Least Sandpiper	*Calidris minutilla*	occurs	non-breeder
Baird's Sandpiper	*Calidris bairdii*	occurs	non-breeder
Pectoral Sandpiper	*Calidris melanotos*	occurs	non-breeder
Dunlin	*Calidris alpina*	occurs	non-breeder
Stilt Sandpiper	*Calidris himantopus*	occurs	non-breeder
Short-billed Dowitcher	*Limnodromus griseus*	occurs	non-breeder
Long-billed Dowitcher	*Limnodromus scolopaceus*	occurs	non-breeder
Common Snipe	*Gallinago gallinago*	occurs	breeds
Wilson's Phalarope	*Phalaropus tricolor*	occurs	breeds
Red-necked Phalarope	*Phalaropus lobatus*	occurs	non-breeder
Franklin's Gull	*Larus pipixcan*	occurs	breeds
Bonaparte's Gull	*Larus philadelphia*	occurs	non-breeder
Mew Gull	*Larus canus*	occurs	non-breeder
Ring-billed Gull	*Larus delawarensis*	occurs	breeds
California Gull	*Larus californicus*	occurs	breeds
Herring Gull	*Larus argentatus*	occurs	non-breeder
Caspian Tern	*Sterna caspia*	occurs	breeds
Common Tern	*Sterna hirundo*	occurs	non-breeder
Forster's Tern	*Sterna forsteri*	occurs	breeds
Black Tern	*Chlidonias niger*	occurs	breeds
Rock Dove	*Columba livia*	non-native	breeds
Band-tailed Pigeon	*Columba fasciata*	occurs	breeds
Mourning Dove	*Zenaida macroura*	occurs	breeds
Yellow-billed Cuckoo	*Coccyzus americanus*	occurs	breeds
Barn Owl	*Tyto alba*	occurs	breeds
Flammulated Owl	*Otus flammeolus*	occurs	breeds
Western Screech-owl	*Otus kennicottii*	occurs	breeds
Great Horned Owl	*Bubo virginianus*	occurs	breeds
Snowy Owl	*Nyctea scandiaca*	occurs	non-breeder
Northern Pygmy-owl	*Glaucidium gnoma*	occurs	breeds
Burrowing Owl	*Athene cunicularia*	occurs	breeds
Barred Owl	*Strix varia*	occurs	breeds

Great Gray Owl	*Strix nebulosa*	occurs	breeds
Long-eared Owl	*Asio otus*	occurs	breeds
Short-eared Owl	*Asio flammeus*	occurs	breeds
Boreal Owl	*Aegolius funereus*	occurs	breeds
Northern Saw-whet Owl	*Aegolius acadicus*	occurs	breeds
Common Nighthawk	*Chordeiles minor*	occurs	breeds
Common Poorwill	*Phalaenoptilus nuttallii*	occurs	breeds
Black Swift	*Cypseloides niger*	occurs	breeds
Vaux's Swift	*Chaetura vauxi*	occurs	breeds
White-throated Swift	*Aeronautes saxatalis*	occurs	breeds
Black-chinned Hummingbird	*Archilochus alexandri*	occurs	breeds
Calliope Hummingbird	*Stellula calliope*	occurs	breeds
Broad-tailed Hummingbird	*Selasphorus platycercus*	occurs	breeds
Rufous Hummingbird	*Selasphorus rufus*	occurs	breeds
Belted Kingfisher	*Ceryle alcyon*	occurs	breeds
Lewis's Woodpecker	*Melanerpes lewis*	occurs	breeds
Williamson's Sapsucker	*Sphyrapicus thyroideus*	occurs	breeds
Red-naped Sapsucker	*Sphyrapicus nuchalis*	occurs	breeds
Red-breasted Sapsucker	*Sphyrapicus ruber*	occurs	breeds
Downy Woodpecker	*Picoides pubescens*	occurs	breeds
Hairy Woodpecker	*Picoides villosus*	occurs	breeds
White-headed Woodpecker	*Picoides albolarvatus*	occurs	breeds
Three-toed Woodpecker	*Picoides tridactylus*	occurs	breeds
Black-backed Woodpecker	*Picoides arcticus*	occurs	breeds
Northern Flicker	*Colaptes auratus*	occurs	breeds
Pileated Woodpecker	*Dryocopus pileatus*	occurs	breeds
Olive-sided Flycatcher	*Contopus cooperi*	occurs	breeds
Western Wood-pewee	*Contopus sordidulus*	occurs	breeds
Willow Flycatcher	*Empidonax traillii*	occurs	breeds
Least Flycatcher	*Empidonax minimus*	occurs	non-breeder
Hammond's Flycatcher	*Empidonax hammondii*	occurs	breeds
Gray Flycatcher	*Empidonax wrightii*	occurs	breeds
Dusky Flycatcher	*Empidonax oberholseri*	occurs	breeds
Pacific-slope Flycatcher	*Empidonax difficilis*	occurs	breeds
Cordilleran Flycatcher	*Empidonax occidentalis*	occurs	breeds
Black Phoebe	*Sayornis nigricans*	occurs	breeds
Say's Phoebe	*Sayornis saya*	occurs	breeds
Ash-throated Flycatcher	*Myiarchus cinerascens*	occurs	breeds
Western Kingbird	*Tyrannus verticalis*	occurs	breeds
Eastern Kingbird	*Tyrannus tyrannus*	occurs	breeds
Loggerhead Shrike	*Lanius ludovicianus*	occurs	breeds
Northern Shrike	*Lanius excubitor*	occurs	non-breeder
Cassin's Vireo	*Vireo cassinii*	occurs	breeds
Hutton's Vireo	*Vireo huttoni*	occurs	breeds
Warbling Vireo	*Vireo gilvus*	occurs	breeds
Red-eyed Vireo	*Vireo olivaceus*	occurs	breeds
Gray Jay	*Perisoreus canadensis*	occurs	breeds
Steller's Jay	*Cyanocitta stelleri*	occurs	breeds
Western Scrub-Jay	*Aphelocoma californica*	occurs	breeds
Pinyon Jay	*Gymnorhinus cyanocephalus*	occurs	breeds

Clark's Nutcracker	*Nucifraga columbiana*	occurs	breeds
Black-billed Magpie	*Pica pica*	occurs	breeds
American Crow	*Corvus brachyrhynchos*	occurs	breeds
Common Raven	*Corvus corax*	occurs	breeds
Horned Lark	*Eremophila alpestris*	occurs	breeds
Purple Martin	*Progne subis*	occurs	breeds
Tree Swallow	*Tachycineta bicolor*	occurs	breeds
Violet-green Swallow	*Tachycineta thalassina*	occurs	breeds
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	occurs	breeds
Bank Swallow	*Riparia riparia*	occurs	breeds
Cliff Swallow	*Petrochelidon pyrrhonota*	occurs	breeds
Barn Swallow	*Hirundo rustica*	occurs	breeds
Black-capped Chickadee	*Poecile atricapillus*	occurs	breeds
Mountain Chickadee	*Poecile gambeli*	occurs	breeds
Chestnut-backed Chickadee	*Poecile rufescens*	occurs	breeds
Oak Titmouse	*Baeolophus inornatus*	occurs	breeds
Juniper Titmouse	*Baeolophus griseus*	occurs	breeds
Bushtit	*Psaltriparus minimus*	occurs	breeds
Red-breasted Nuthatch	*Sitta canadensis*	occurs	breeds
White-breasted Nuthatch	*Sitta carolinensis*	occurs	breeds
Pygmy Nuthatch	*Sitta pygmaea*	occurs	breeds
Brown Creeper	*Certhia americana*	occurs	breeds
Rock Wren	*Salpinctes obsoletus*	occurs	breeds
Canyon Wren	*Catherpes mexicanus*	occurs	breeds
Bewick's Wren	*Thryomanes bewickii*	occurs	breeds
House Wren	*Troglodytes aedon*	occurs	breeds
Winter Wren	*Troglodytes troglodytes*	occurs	breeds
Marsh Wren	*Cistothorus palustris*	occurs	breeds
American Dipper	*Cinclus mexicanus*	occurs	breeds
Golden-crowned Kinglet	*Regulus satrapa*	occurs	breeds
Ruby-crowned Kinglet	*Regulus calendula*	occurs	breeds
Blue-gray Gnatcatcher	*Polioptila caerulea*	occurs	breeds
Western Bluebird	*Sialia mexicana*	occurs	breeds
Mountain Bluebird	*Sialia currucoides*	occurs	breeds
Townsend's Solitaire	*Myadestes townsendi*	occurs	breeds
Veery	*Catharus fuscescens*	occurs	breeds
Swainson's Thrush	*Catharus ustulatus*	occurs	breeds
Hermit Thrush	*Catharus guttatus*	occurs	breeds
American Robin	*Turdus migratorius*	occurs	breeds
Varied Thrush	*Ixoreus naevius*	occurs	breeds
Gray Catbird	*Dumetella carolinensis*	occurs	breeds
Northern Mockingbird	*Mimus polyglottos*	occurs	non-breeder
Sage Thrasher	*Oreoscoptes montanus*	occurs	breeds
European Starling	*Sturnus vulgaris*	non-native	breeds
American Pipit	*Anthus rubescens*	occurs	breeds
Bohemian Waxwing	*Bombycilla garrulus*	occurs	non-breeder
Cedar Waxwing	*Bombycilla cedrorum*	occurs	breeds
Orange-crowned Warbler	*Vermivora celata*	occurs	breeds
Nashville Warbler	*Vermivora ruficapilla*	occurs	breeds
Yellow Warbler	*Dendroica petechia*	occurs	breeds

Yellow-rumped Warbler	*Dendroica coronata*	occurs	breeds
Black-throated Gray Warbler	*Dendroica nigrescens*	occurs	breeds
Townsend's Warbler	*Dendroica townsendi*	occurs	breeds
Hermit Warbler	*Dendroica occidentalis*	occurs	breeds
American Redstart	*Setophaga ruticilla*	occurs	breeds
Northern Waterthrush	*Seiurus noveboracensis*	occurs	breeds
Macgillivray's Warbler	*Oporornis tolmiei*	occurs	breeds
Common Yellowthroat	*Geothlypis trichas*	occurs	breeds
Wilson's Warbler	*Wilsonia pusilla*	occurs	breeds
Yellow-breasted Chat	*Icteria virens*	occurs	breeds
Western Tanager	*Piranga ludoviciana*	occurs	breeds
Green-tailed Towhee	*Pipilo chlorurus*	occurs	breeds
Spotted Towhee	*Pipilo maculatus*	occurs	breeds
American Tree Sparrow	*Spizella arborea*	occurs	non-breeder
Chipping Sparrow	*Spizella passerina*	occurs	breeds
Clay-colored Sparrow	*Spizella pallida*	occurs	non-breeder
Brewer's Sparrow	*Spizella breweri*	occurs	breeds
Vesper Sparrow	*Pooecetes gramineus*	occurs	breeds
Lark Sparrow	*Chondestes grammacus*	occurs	breeds
Black-throated Sparrow	*Amphispiza bilineata*	occurs	breeds
Sage Sparrow	*Amphispiza belli*	occurs	breeds
Savannah Sparrow	*Passerculus sandwichensis*	occurs	breeds
Grasshopper Sparrow	*Ammodramus savannarum*	occurs	breeds
Fox Sparrow	*Passerella iliaca*	occurs	breeds
Song Sparrow	*Melospiza melodia*	occurs	breeds
Lincoln's Sparrow	*Melospiza lincolnii*	occurs	breeds
Swamp Sparrow	*Melospiza georgiana*	occurs	non-breeder
White-throated Sparrow	*Zonotrichia albicollis*	occurs	non-breeder
Harris's Sparrow	*Zonotrichia querula*	occurs	non-breeder
White-crowned Sparrow	*Zonotrichia leucophrys*	occurs	breeds
Golden-crowned Sparrow	*Zonotrichia atricapilla*	occurs	non-breeder
Dark-eyed Junco	*Junco hyemalis*	occurs	breeds
Lapland Longspur	*Calcarius lapponicus*	occurs	non-breeder
Snow Bunting	*Plectrophenax nivalis*	occurs	non-breeder
Black-headed Grosbeak	*Pheucticus melanocephalus*	occurs	breeds
Lazuli Bunting	*Passerina amoena*	occurs	breeds
Bobolink	*Dolichonyx oryzivorus*	occurs	breeds
Red-winged Blackbird	*Agelaius phoeniceus*	occurs	breeds
Tricolored Blackbird	*Agelaius tricolor*	occurs	breeds
Western Meadowlark	*Sturnella neglecta*	occurs	breeds
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	occurs	breeds
Brewer's Blackbird	*Euphagus cyanocephalus*	occurs	breeds
Brown-headed Cowbird	*Molothrus ater*	occurs	breeds
Bullock's Oriole	*Icterus bullockii*	occurs	breeds
Gray-crowned Rosy-Finch	*Leucosticte tephrocotis*	occurs	breeds
Black Rosy-finch	*Leucosticte atrata*	occurs	breeds
Pine Grosbeak	*Pinicola enucleator*	occurs	breeds
Purple Finch	*Carpodacus purpureus*	occurs	breeds
Cassin's Finch	*Carpodacus cassinii*	occurs	breeds
House Finch	*Carpodacus mexicanus*	occurs	breeds

Red Crossbill	*Loxia curvirostra*	occurs	breeds
White-winged Crossbill	*Loxia leucoptera*	occurs	non-breeder
Common Redpoll	*Carduelis flammea*	occurs	non-breeder
Pine Siskin	*Carduelis pinus*	occurs	breeds
Lesser Goldfinch	*Carduelis psaltria*	occurs	breeds
American Goldfinch	*Carduelis tristis*	occurs	breeds
Evening Grosbeak	*Coccothraustes vespertinus*	occurs	breeds
House Sparrow	*Passer domesticus*	non-native	breeds
Total Birds:	**294**		
Mammals			
Virginia Opossum	*Didelphis virginiana*	non-native	breeds
Preble's Shrew	*Sorex preblei*	occurs	breeds
Vagrant Shrew	*Sorex vagrans*	occurs	breeds
Montane Shrew	*Sorex monticolus*	occurs	breeds
Water Shrew	*Sorex palustris*	occurs	breeds
Merriam's Shrew	*Sorex merriami*	occurs	breeds
Coast Mole	*Scapanus orarius*	occurs	breeds
California Myotis	*Myotis californicus*	occurs	breeds
Western Small-footed Myotis	*Myotis ciliolabrum*	occurs	breeds
Yuma Myotis	*Myotis yumanensis*	occurs	breeds
Little Brown Myotis	*Myotis lucifugus*	occurs	breeds
Long-legged Myotis	*Myotis volans*	occurs	breeds
Fringed Myotis	*Myotis thysanodes*	occurs	breeds
Long-eared Myotis	*Myotis evotis*	occurs	breeds
Silver-haired Bat	*Lasionycteris noctivagans*	occurs	breeds
Western Pipistrelle	*Pipistrellus hesperus*	occurs	breeds
Big Brown Bat	*Eptesicus fuscus*	occurs	breeds
Hoary Bat	*Lasiurus cinereus*	occurs	non-breeder
Spotted Bat	*Euderma maculatum*	accidental	non-breeder
Townsend's Big-eared Bat	*Corynorhinus townsendii*	occurs	breeds
Pallid Bat	*Antrozous pallidus*	occurs	breeds
American Pika	*Ochotona princeps*	occurs	breeds
Pygmy Rabbit	*Brachylagus idahoensis*	occurs	breeds
Nuttall's (Mountain) Cottontail	*Sylvilagus nuttallii*	occurs	breeds
Snowshoe Hare	*Lepus americanus*	occurs	breeds
White-tailed Jackrabbit	*Lepus townsendii*	occurs	breeds
Black-tailed Jackrabbit	*Lepus californicus*	occurs	breeds
Least Chipmunk	*Tamias minimus*	occurs	breeds
Yellow-pine Chipmunk	*Tamias amoenus*	occurs	breeds
Yellow-bellied Marmot	*Marmota flaviventris*	occurs	breeds
White-tailed Antelope Squirrel	*Ammospermophilus leucurus*	occurs	breeds
Townsend's Ground Squirrel	*Spermophilus townsendii*	occurs	breeds
Merriam's Ground Squirrel	*Spermophilus canus*	occurs	breeds
Piute Ground Squirrel	*Spermophilus mollis*	occurs	breeds
Belding's Ground Squirrel	*Spermophilus beldingi*	occurs	breeds
Columbian Ground Squirrel	*Spermophilus columbianus*	occurs	breeds
Golden-mantled Ground Squirrel	*Spermophilus lateralis*	occurs	breeds
Eastern Gray Squirrel	*Sciurus carolinensis*	non-native	breeds
Eastern Fox Squirrel	*Sciurus niger*	non-native	breeds
Red Squirrel	*Tamiasciurus hudsonicus*	occurs	breeds

Douglas' Squirrel	*Tamiasciurus douglasii*	occurs	breeds
Northern Flying Squirrel	*Glaucomys sabrinus*	occurs	breeds
Northern Pocket Gopher	*Thomomys talpoides*	occurs	breeds
Botta's (Pistol River) Pocket Gopher	*Thomomys bottae*	occurs	breeds
Townsend's Pocket Gopher	*Thomomys townsendii*	occurs	breeds
Great Basin Pocket Mouse	*Perognathus parvus*	occurs	breeds
Little Pocket Mouse	*Perognathus longimembris*	occurs	breeds
Dark Kangaroo Mouse	*Microdipodops megacephalus*	occurs	breeds
Ord's Kangaroo Rat	*Dipodomys ordii*	occurs	breeds
Chisel-toothed Kangaroo Rat	*Dipodomys microps*	occurs	breeds
American Beaver	*Castor canadensis*	occurs	breeds
Western Harvest Mouse	*Reithrodontomys megalotis*	occurs	breeds
Deer Mouse	*Peromyscus maniculatus*	occurs	breeds
Canyon Mouse	*Peromyscus crinitus*	occurs	breeds
Pinon Mouse	*Peromyscus truei*	occurs	breeds
Northern Grasshopper Mouse	*Onychomys leucogaster*	occurs	breeds
Desert Woodrat	*Neotoma lepida*	occurs	breeds
Bushy-tailed Woodrat	*Neotoma cinerea*	occurs	breeds
Southern Red-backed Vole	*Clethrionomys gapperi*	occurs	breeds
Heather Vole	*Phenacomys intermedius*	occurs	breeds
Montane Vole	*Microtus montanus*	occurs	breeds
Long-tailed Vole	*Microtus longicaudus*	occurs	breeds
Water Vole	*Microtus richardsoni*	occurs	breeds
Sagebrush Vole	*Lemmiscus curtatus*	occurs	breeds
Muskrat	*Ondatra zibethicus*	occurs	breeds
Black Rat	*Rattus rattus*	non-native	breeds
Norway Rat	*Rattus norvegicus*	non-native	breeds
House Mouse	*Mus musculus*	non-native	breeds
Western Jumping Mouse	*Zapus princeps*	occurs	breeds
Common Porcupine	*Erethizon dorsatum*	occurs	breeds
Coyote	*Canis latrans*	occurs	breeds
Gray Wolf	*Canis lupus*	extirpated	bred-historically
Red Fox	*Vulpes vulpes*	occurs	breeds
Kit Fox	*Vulpes velox*	occurs	breeds
Gray Fox	*Urocyon cinereoargenteus*	occurs	breeds
Black Bear	*Ursus americanus*	occurs	breeds
Grizzly Bear	*Ursus arctos*	extirpated	bred-historically
Raccoon	*Procyon lotor*	occurs	breeds
American Marten	*Martes americana*	occurs	breeds
Fisher	*Martes pennanti*	occurs	breeds
Ermine	*Mustela erminea*	occurs	breeds
Long-tailed Weasel	*Mustela frenata*	occurs	breeds
Mink	*Mustela vison*	occurs	breeds
Wolverine	*Gulo gulo*	occurs	breeds
American Badger	*Taxidea taxus*	occurs	breeds
Western Spotted Skunk	*Spilogale gracilis*	occurs	breeds
Striped Skunk	*Mephitis mephitis*	occurs	breeds
Northern River Otter	*Lutra canadensis*	occurs	breeds
Mountain Lion	*Puma concolor*	occurs	breeds
Lynx	*Lynx canadensis*	occurs	breeds

Bobcat	*Lynx rufus*	occurs	breeds
Feral Horse	*Equus caballus*	non-native	breeds
Rocky Mountain Elk	*Cervus elaphus nelsoni*	occurs	breeds
Black-tailed Deer (westside)	*Odocoileus hemionus columbianus*	occurs	breeds
White-tailed Deer (eastside)	*Odocoileus virginianus ochrourus*	occurs	breeds
Moose	*Alces alces*	accidental	non-breeder
Pronghorn Antelope	*Antilocapra americana*	occurs	breeds
Mountain Goat	*Oreamnos americanus*	reintroduced	breeds
Bighorn Sheep	*Ovis canadensis*	occurs	breeds
Total Mammals:	**99**		
Reptiles			
Painted Turtle	*Chrysemys picta*	occurs	breeds
Western Pond Turtle	*Clemmys marmorata*	occurs	breeds
Southern Alligator Lizard	*Elgaria multicarinata*	occurs	breeds
Mojave Black-collared Lizard	*Crotaphytus bicinctores*	occurs	breeds
Long-nosed Leopard Lizard	*Gambelia wislizenii*	occurs	breeds
Short-horned Lizard	*Phrynosoma douglassii*	occurs	breeds
Desert Horned Lizard	*Phrynosoma platyrhinos*	occurs	breeds
Sagebrush Lizard	*Sceloporus graciosus*	occurs	breeds
Western Fence Lizard	*Sceloporus occidentalis*	occurs	breeds
Side-blotched Lizard	*Uta stansburiana*	occurs	breeds
Western Skink	*Eumeces skiltonianus*	occurs	breeds
Western Whiptail	*Cnemidophorus tigris*	occurs	breeds
Rubber Boa	*Charina bottae*	occurs	breeds
Racer	*Coluber constrictor*	occurs	breeds
Ringneck Snake	*Diadophis punctatus*	occurs	breeds
Night Snake	*Hypsiglena torquata*	occurs	breeds
Common Kingsnake	*Lampropeltis getula*	occurs	breeds
California Mountain Kingsnake	*Lampropeltis zonata*	occurs	breeds
Striped Whipsnake	*Masticophis taeniatus*	occurs	breeds
Gopher Snake	*Pituophis catenifer*	occurs	breeds
Western Ground Snake	*Sonora semiannulata*	occurs	breeds
Western Terrestrial Garter Snake	*Thamnophis elegans*	occurs	breeds
Common Garter Snake	*Thamnophis sirtalis*	occurs	breeds
Western Rattlesnake	*Crotalus viridis*	occurs	breeds
Total Reptiles:	**24**		
Total Species:	**430**		

Appendix Table 3. Terrestrial Focal Species Selection Matrix for the Powder subbasin indicating species with any state or federal special status, critical functional link and/or functional specialization with additional annotations for number of KEFs, habitat associations, Partners in Flight species (PIF) and Habitat Evaluation Procedure species (HEP). Focal Species selected are highlighted.

Common Name	Oregon Federal Status	Oregon State Status	Functional Specialist	Critical Functional Link Species	# of KEFs (based on BM Province data)	# of Habitats Closely Associated With	# of Habitats in Decline or Threatened	Oregon Game Species	Oregon PIF Priority & Focal Species	HEP Species
Long-toed Salamander				Yes	1	3	0			
Tailed Frog		SV				1	0			
Great Basin Spadefoot				Yes		2	0			
Western Toad		SV				3	0			
Columbia Spotted Frog	C	SUS				2	0			
Northern Leopard Frog		SC				2	0			
Painted Turtle		SC				1	0			
Western Pond Turtle		SC	Yes			2	0			
Desert Horned Lizard		S				0	0			
Sagebrush Lizard		SV				0	0			
Ringneck Snake			Yes			0	0			
Western Rattlesnake		SV				0	0			
Horned Grebe		SPN				2	0			
Red-necked Grebe		SC				2	0			
American White Pelican		SV				1	0			
Double-crested Cormorant				Yes		1	0			
Great Blue Heron				Yes	3	3	0			
Turkey Vulture			Yes			0	0			
Canada Goose				Yes	1	3	0	Game Bird		

Eurasian Wigeon			Yes			1	0	Game Bird		
Redhead				Yes	1	2	0	Game Bird		
Greater Scaup				Yes	1	1	0	Game Bird		
Harlequin Duck		SUS	Yes			1	0	Game Bird		
Bufflehead		SUS				4	0	Game Bird		
Barrow's Goldeneye		SUS				2	0	Game Bird		
Osprey			Yes			1	0			
Bald Eagle	LT	LT								
Northern Goshawk		SC				1	0			
Swainson's Hawk		SV				3	2		PIF	
Ferruginous Hawk		SC				2	2		PIF	
Merlin			Yes			0	0			
Gyrfalcon			Yes			0	0			
Peregrine Falcon		LE	Yes			0	0			
Sage Grouse		SV				2	2	Game Bird		
Spruce Grouse		SUS				0	0	Game Bird		
Mountain Quail		SUS				0	0	Game Bird		
Sandhill Crane		SV				2	0			
Upland Sandpiper		SC				1	1			
Long-billed Curlew		SV				3	2			
Franklin's Gull		SPN				1	0			
Mew Gull				Yes	2	1	0			
Black Tern				Yes	1	1	0			

Flammulated Owl		SC				2	1		PIF	
Great Horned Owl				Yes		0	0			
Snowy Owl			Yes			0	0			
Northern Pygmy-owl		SC	Yes			1	0			
Burrowing Owl		SC				2	2		PIF	
Great Gray Owl		SV				2	2		PIF	
Boreal Owl		SUS	Yes			0	0			
Common Nighthawk		SC	Yes			0	0			
Common Poorwill			Yes			0	0		PIF	
Black Swift		SPN	Yes			0	0		PIF	
Vaux's Swift			Yes			1	0		PIF	
White-throated Swift			Yes			0	0		PIF	
Black-chinned Hummingbird				Yes	1	0	0			
Rufous Hummingbird				Yes	2	0	0		PIF	
Lewis's Woodpecker		SC				0	0		PIF	
Williamson's Sapsucker		SUS		Yes		0	0		PIF	
White-headed Woodpecker		SC				1	1		PIF	
Three-toed Woodpecker		SC				1	1			
Black-backed Woodpecker		SC				1	1		PIF	
Pileated Woodpecker		SV				0	0		PIF	
Olive-sided Flycatcher		SV	Yes			2	0		PIF	
Western Wood-pewee			Yes			0	0		PIF	
Willow Flycatcher		SV/US				0	0		PIF	
Loggerhead Shrike		SV				3	2		PIF	
American Crow				Yes	2	2	0			
Horned Lark	C	SC		Yes		1	1		PIF	
Bank Swallow		SUS				1	0		PIF	
Pygmy Nuthatch		SV				1	1			
Brown Creeper			Yes			0	0		PIF	

Rock Wren			Yes			0	0			
Canyon Wren			Yes			0	0			
Winter Wren			Yes			0	0		PIF	
American Dipper						1	0		PIF	
Western Bluebird		SV				1	1		PIF	
Yellow-breasted Chat		SC				0	0		PIF	
Spotted Towhee				Yes		0	0			
Vesper Sparrow		SC				3	2		PIF	
Black-throated Sparrow		SPN				0	0		PIF	
Sage Sparrow		SC				1	1		PIF	
Grasshopper Sparrow		SV/PN				2	1		PIF	
Bobolink		SV				1	0			
Western Meadowlark		SC				3	2		PIF	
Brown-headed Cowbird				Yes	1	1	0			
Black Rosy-finch		SPN				1	0			
House Finch				Yes	3	2	0			
Virginia Opossum				Yes	1	2	0			
Preble's Shrew			Yes			0	0			
Western Small-footed Myotis		SUS				4	3			
Long-legged Myotis		SUS				3	1			
Fringed Myotis		SV				0	0			
Long-eared Myotis		SUS	Yes			0	0			
Silver-haired Bat		SUS				2	1			
Western Pipistrelle			Yes			3	2			
Big Brown Bat				Yes	1	6	1			
Townsend's Big-eared Bat		SC				1	0			
Pallid Bat		SV				3	1			
American Pika				Yes	1	1	0			
Pygmy Rabbit		SV				1	1			
Nuttall's (Mountain)				Yes		3	3			

Cottontail										
Snowshoe Hare				Yes	1	4	1			
White-tailed Jackrabbit		SUS				1	1			
Golden-mantled Ground Squirrel				Yes	2	4	2			
Eastern Fox Squirrel						2	0			
Red Squirrel				Yes	1	2	1			
Douglas' Squirrel						0	0			
Northern Flying Squirrel						2	0			
Northern Pocket Gopher				Yes	1	5	3			
American Beaver				Yes	4	2	0	Game Mammal		
Deer Mouse				Yes	3	10	5			
Bushy-tailed Woodrat				Yes	1	6	2			
Montane Vole				Yes	1	3	1			
Sagebrush Vole				Yes		1	1			
Common Porcupine				Yes		5	2			
Black Bear				Yes	6	0	0	Game Mammal		
Grizzly Bear				Yes		0	0			
Raccoon				Yes	2	3	0	Game Mammal		
American Marten		SV				3	1	Game Mammal		
Mink				Yes	1	2	0	Game Mammal		
Mountain Lion				Yes		0	0	Game Mammal		
Lynx	LT		Yes			2	1			
Rocky Mountain Elk				Yes	2	0	0	Game Mammal		

Mule Deer						0	0	Game Mammal		
White-tailed Deer						0	0			
Pronghorn Antelope						2	2	Game Mammal		
Mountain Goat						1	0	Game Mammal		
Rocky Mountain Bighorn Sheep						1	0	Game Mammal		

[1] Federal Status: C = Candidate; LT = Listed Threatened; LE = Listed Endangered
[2] State Status OR: SV = Sensitive-Vulnerable; SC = Sensitive-Critical; SUS = Sensitive-Unclear Status; SPN = Sensitive-Peripheral or Naturally Rare; LE = Listed Endangered; LT = Listed Threatened

6.3 Appendix 3: Comprehensive Species Accounts

6.3.1 Sage Grouse

Sage Grouse (*Centrocercus urophasianus*) Keith Paul, USFWS

Sage Grouse, BLM et al. 2000.

Introduction

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). The first written accounts of this species were based on observations by the Lewis and Clark expedition in 1805, when the species was widespread in the West (Schroeder et al. 1999). Sage grouse were an important game species for Native Americans and European settlers and continue to be valued for hunting and food (Storch 2000). Because of the stunning display of sage grouse on their strutting grounds, they have become popular with naturalists and bird watchers.

Due to loss, fragmentation, and degradation of greater sage grouse habitat and large reductions of their population, seven petitions have been submitted to the U.S. Fish and Wildlife Service (Service) requesting listing of distinct populations and the entire species, collectively. The Service determined that there was not significant information available to classify the greater sage grouse into two distinct population segments (the western and eastern subspecies of sage grouse). In a recent news release dated April 15, 2004, the Service announced its completion of evaluating three petitions to list the greater sage grouse rangewide as either threatened or endangered. The Service has determined 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.

Concern about long-term declines in sage grouse populations has prompted western State wildlife agencies and Federal agencies such as the Bureau of Land Management (BLM), U.S. Forest Service, and the Service to engage in a variety of cooperative efforts aimed at conserving and managing sagebrush habitat for the benefit of sage grouse and other sagebrush-dependent species.

Description, Life History, and Habitat Requirements
Description

Adult male sage grouse has fuscous upperparts, profusely marked with drab gray and white; tail long and pointed; primaries plain brown; chin and throat sepia (blackish); sides of neck, breast, and upper belly whitish and slightly distended, forming a ruff; belly and undertail-coverts sepia, with large white spots on tips of undertail-coverts; thighs buff (Schroeder et al. 1999). Head has yellow fleshy comb above eye, and long filoplumes that arise from back of the neck (Schroeder et al. 1999). During courtship displays, tail fanned and breast distended, exposing two yellow ocher patches of bare skin (cervical apteria) on lower throat and breast (Schroeder et al. 1999). These apteria briefly exposed during the display, appearing as round balloons. The adult female is similar to the male but smaller and has fuscous feathers, marked with drab gray and white on head and breast, creating a more cryptic appearance overall than in male (Schroeder et al. 1999). Female also lacks cervical apteria and has smaller comb over eye than male (Schroeder et al. 1999).

Life History

Diet

Sagebrush dominates diet during late autumn, winter, and early spring (Girard 1937, Rasmussen and Griner 1938, Bean 1941, Batterson and Morse 1948, Patterson 1952, Leach and Hensley 1954, Barber 1968, Wallestad et al. 1975, Schroeder et al. 1999). Sage grouse eat numerous species of sagebrush, including big, low (*Artemisia arbuscula*), silver (*Artemisia cana*), and fringed (*Artemisia fridida*) (Remington and Braun 1985, Welch et al. 1988, 1991, Myers 1992, Schroeder et al. 1999). Insects are an important component of the juvenile diet, especially during the first three weeks of life; after which forbs increase in importance as juveniles age (Patterson 1952, Trueblood 1954, Klebenow and Gray 1968, Savage 1968, Peterson 1970, Johnson and Boyce 1990, Drut et al. 1994, Pyle and Crawford 1996, Schroeder et al. 1999). Although insects are also eaten by adults during spring and summer, forbs and sagebrush dominate their diet (Rasmussen and Griner 1938, Moos 1941, Knowlton and Thornley 1942, Patterson 1952, Leach and Hensley 1954, Schroeder et al. 1999).

Reproduction

The breeding of sage grouse begins in mid-March when the males start to congregate on the leks (BLM et al. 2000). Females come to the leks to mate and generally nest in the vicinity (BLM et al. 2000). Nesting rates vary from year to year and from area to area (Bergerud 1988, Coggins 1998, Connelly et al 1993, Gregg 1991, and Schroeder 1997). This variation is most likely a result of the quality of available nutrition and the general health of pre-laying females (Barnett and Crawford 1994). At least 70% of the females in a population will initiate a nest each year, with higher nest initiation rate recorded during years of higher precipitation in comparison to periods of drought (Coggins 1998). Renesting rates by females who have lost their first clutch are 10 to 40 % (Bergerud 1988, Connelly et al. 1993, Eng 1963, Patterson 1952, and Petersen 1980). Clutch size per nest normally ranges from seven to ten eggs (Connelly unpub., Schroeder 1997, Wakkinen 1990, BLM et al. 2000).

Breeding Territory/Home Range

Adult males are highly territorial on leks, actively defending areas of 53.8-1076 ft² (5-100 m²) (Simon 1940, Patterson 1952, Dalke et al 1960, Hartzler 1972, Wiley 1973, Gibson and Bradbury 1987, Schroeder et al. 1999). Yearling males rarely defend territories or breed, although they are physiologically capable of breeding (Eng 1963). Leks vary from 1 to 16 ha in size because of number of males attending lek and topography of lek site (Scott 1942, Patterson 1952, Wiley 1973, Schroeder et al. 1999). Male sage grouse are not territorial off leks (Schroeder et al. 1999). Home range for sage grouse may exceed 579 mi² (1,500 km²) (Connelly, unpub. data, cited in BLM et al. 2000). Sage grouse may have two or more seasonal ranges including a breeding range, a brood-rearing range, and a winter range (BLM et al. 2000).

Migration/Overwintering

Sage grouse populations can be migratory or non-migratory (Beck 1975, Berry and Eng 1985, Connelly et al 1988, Fischer 1994, Wakkinen 1990, and Wallestad 1975, BLM et al. 2000), depending on location and associated land form. Where topographic relief allows, sage grouse generally move to higher elevations from spring through fall as snow melts and plant growth advances (BLM et al. 2000). Non-migratory populations may spend the entire year within an area of 38.61 mi² (100 km²) or less in size

(BLM et al. 2000). In migratory populations, seasonal movements may exceed 46.5 mi (75 km) (Connelly et al. 1998, Dalke et al. 1963, BLM et al. 2000).

Survivorship

Annual survival rates for yearling and adult sage grouse vary from 35 to 85 percent for females, and from 38 to 54 percent for males (Connelly et al. 1994, Wallestad 1975, and Zablan 1993, BLM et al. 2000). Lower survival rates for males may be related to the higher predation rates on males during the lekking season (Swensen 1986). Sage grouse tend to live longer than other upland gamebird species; individual birds four to five years old are common (BLM et al. 2000).

Mortality

Predation on eggs and birds is the primary cause of mortality (Schroeder et al. 1999). Other causes of mortality include human disturbance, livestock, farm machinery, moving vehicles, electric or telephone wires, fences, pesticides, fire flood, drought, sun exposure, heavy rain, and cold (Borell 1939, Bean 1941, Batterson and Morse 1948, Patterson 1952, Dalke et al. 1963, Rogers 1964, Wallestad 1975, Barber 1991, Schroeder et al. 1999).

Habitat Requirements

Breeding

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). Examples of lek sites include landing strips, old lake beds or playas, low sagebrush flats, openings on ridges, roads, crop land, and burned areas (Connelly et al. 1981, Gates 1985, BLM et al. 2000). The lek is considered the center of year-round activity for resident grouse populations (Eng and Schladweiler 1972, Wallestad and Pyrah 1974, Wallestad and Schladweiler 1974). On the average, most nests are located within 4 miles (6.2 km) of the lek; however some females or hens may nest more than 12 miles (20 km) away from the lek (Autenrieth 1981, Fischer 1994, Hanf et al. 1994, Wakkinen et al. 1992, BLM et al. 2000). Most sage grouse nests are located under sagebrush plants (Gill 1965, Gray 1967, Patterson 1952, Schroeder et al. 1999, Wallestad and Pyrah 1974, 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). Ideally, these vegetative conditions should be on 80 percent of the breeding habitat for any given population of sage grouse (BLM 2000).

Non-breeding

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). Sagebrush canopy can be highly variable (Beck 1977, Eng and Schladweiler 1972, Patterson 1952, Robertson 1991, Wallestad et al. 1975, BLM et al. 2000). Sage grouse tend to select areas with both high canopy and taller Wyoming big sagebrush (*A. t. wyomingensis*) and feed on plants highest in protein content (Remington and Braun 1985, Robertson 1991, BLM et al 2000). It is critical that sagebrush be exposed at least 10 to 12 inches (25 to 30 cm) above snow level to provide food and cover for wintering sage grouse (Hupp and Braun 1989, BLM et al. 2000). If snow covers the sagebrush, the birds move to areas where sagebrush is exposed. Therefore, good wintering habitat consists of sagebrush with 10 to 30 percent canopy cover on 80 percent of the wintering area (BLM et al. 2000).

Population and Distribution

Distribution

Historic Distribution

Historically, sage grouse occurred in at least 16 states and three Canadian provinces. Since then, sage grouse have been extirpated from British Columbia, Arizona, Utah, Montana, New Mexico, Colorado, Wyoming, Alberta, Oklahoma, Kansas, Nebraska, South Dakota, North Dakota, and Nebraska (Connelly and Braun 1997, Braun 1998, Schroeder et al. 1999). It is unclear whether birds in Oklahoma and Kansas represented a distinct population (Schroeder et al. 1999). Historically, it is estimated that 220 million acres (81 million ha) of sagebrush-steppe vegetation types existed in North America (McArthur and Ott 1996), making it one of the most widespread habitats in the country (BLM et al. 2000). However, much of this habitat has been lost or degraded over the last 100 years (BLM et al. 2000).

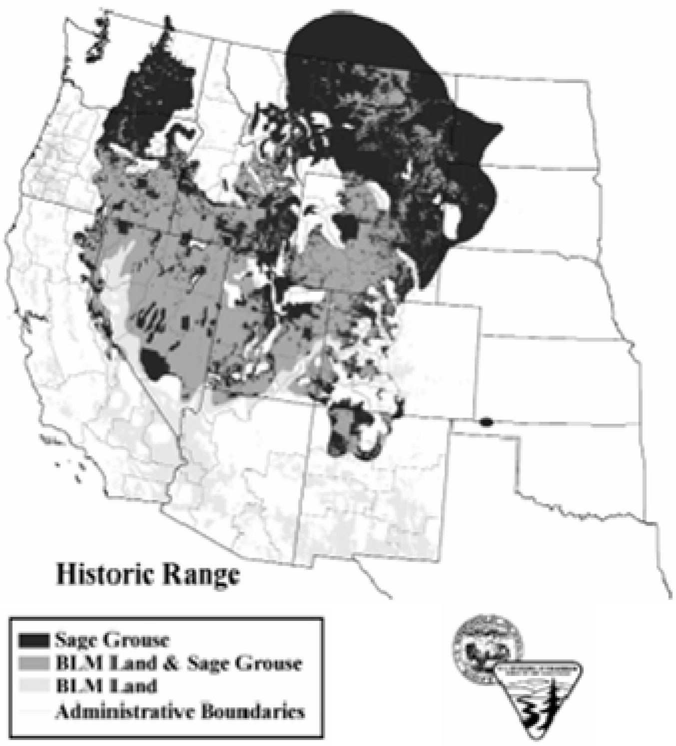

Figure 1. Sage Grouse historic range map (BLM et al. 2000)

Current Distribution

Currently, in states and provinces that still have sage grouse, their range has been reduced. 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). 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).

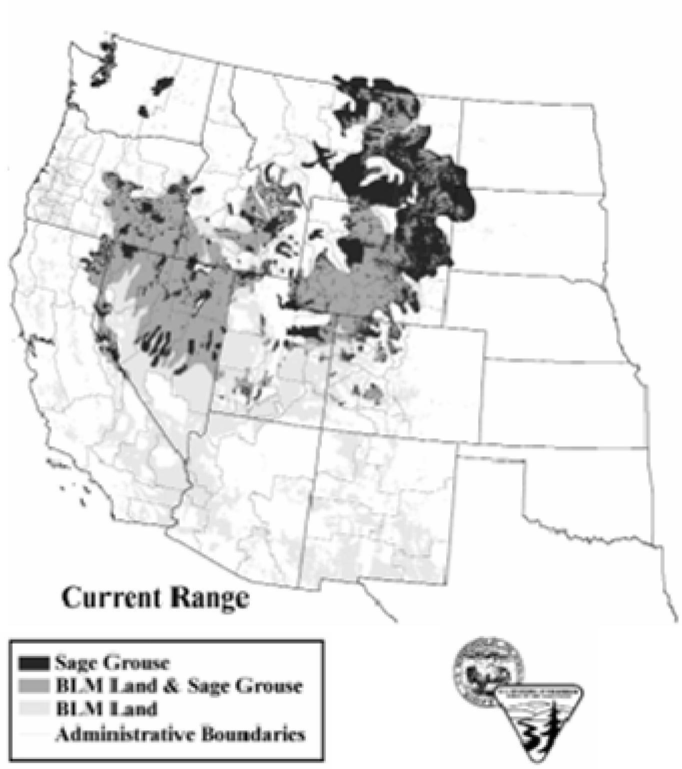

Figure 2. Sage Grouse current range map (BLM et al. 2000)

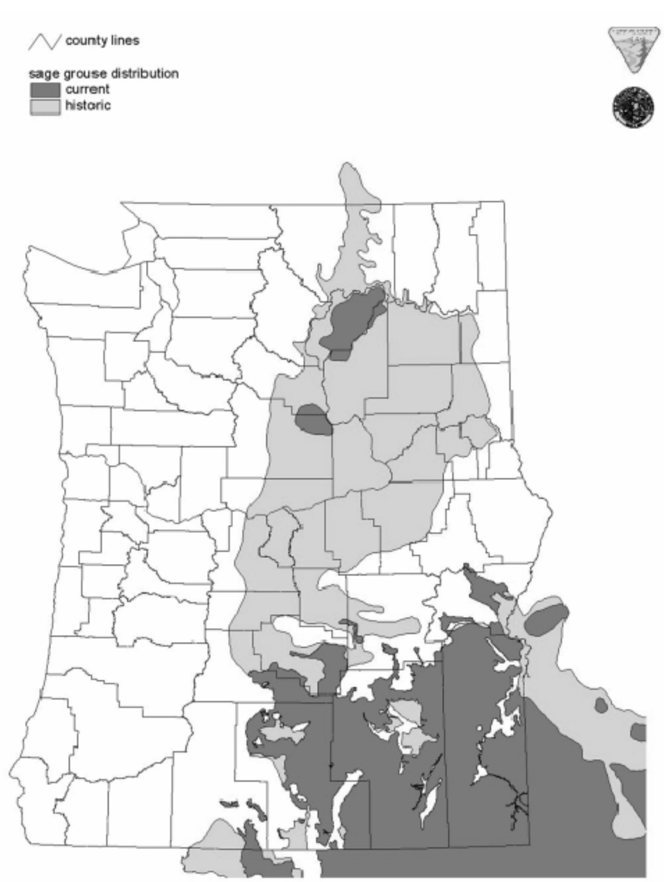

Figure 3. Current verses historic sage grouse rangemap

in Oregon and Washington (BLM et al. 2000).

Population

Historic Population

Historically, there may have been roughly 1.6 million and 16 million sage grouse rangewide prior to European expansion across western North America (65 Federal Register 51578).

Current Population and Status

Rangewide, with the extirpation of sage grouse from several states, and the reduction and degradation of sagebrush-steppe habitat, the numbers of sage grouse have been reduced significantly. Between 1985 and 1994, populations declined by an average of 33% (Storch 2000). Braun (1998) estimated a rangewide sage grouse population of 142,000 in 1998, clearly lower than historic levels.

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 (see Table 1).

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 1. Minimum Population Estimate of Adult Sage Grouse in Oregon, 1992 (ODFW 1993).

Oregon upland game bird harvest data (1993-2002) is shown below (Table 2).

Table 2. Source - ODFW Upland Game Bird Harvest 1993-2002.

Year	Sage Grouse	Year	Sage Grouse
1993	973	1998	839
1994	1,015	1999	808
1995[1]	857	2000	716
1996	1,015	2001	976
1997[1]	681	2002	549

[1] Concern for integrity of data collected in 1997. 1995 survey conducted by OSU.

Continuing Threats

Numerous activities have adversely impacted, and continue to have potential to adversely impact, the distribution and quality of sage grouse and their habitat. In addition, natural events and the human response to them could directly impact sage grouse, as well as their habitats (BLM et al. 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).

Prior to the 1980's, herbicide treatment of large tracts of rangeland (primarily 2, 4-D) was a common method of reducing sagebrush (Braun 1987, BLM et al. 2000). In many cases, broad herbicide treatment may have contributed to declines in sage grouse breeding populations (Enyeart 1956, Higby 1969, Peterson 1970, Wallestad 1975, BLM et al. 2000).

Various livestock management practices have altered sage grouse habitat over the last century. In many areas, grazing has contributed to long-term changes in plant communities and reduced certain habitat components, such as biological crusts that contribute to the health of sagebrush-steppe habitat (Mack and Thompson 1982, Quigley and Arbelbide 1997, Wisdom et al. 2000, BLM et at. 2000).

Fire has altered sage grouse habitat on the landscape in Oregon. Existing BLM fire management plans have not, for the most part, identified sage grouse habitat as a high priority for protection (BLM et al. 2000). Repeated wildfires have favored invasion by cheatgrass (*Bromus tectorum*) and other exotic species (Pellant 1990, Valentine 1990, BLM et al. 2000). Conversion to cheatgrass alters the fire frequency from the historic 32-70 years in sagebrush-steppe habitat ecosystems to five years or less (Wright and others 1979). Additionally, prescribed fire has also contributed to the decrease in Wyoming big sagebrush habitat and sage grouse brood-rearing habitat (Connelly et al. 1994, Fischer et al. 1996, BLM et al. 2000).

The lack of prompt and appropriate fire rehabilitation following a wildfire can present additional threats to sage grouse habitat (BLM et al. 2000). If cheatgrass or any of a number of other exotic plant species are present before a fire occurs, they are likely to become more dominant afterwards if the area is not properly rehabilitated (BLM et al. 2000).

Power lines, fences, roads and urban development have all had an adverse impact on sage grouse habitat and their populations (Braun 1998).

Juniper expansion may also be contributing to declining sage grouse populations by reducing suitable sagebrush-steppe habitat (BLM et al. 2000).

Management Goals and Objectives

For detailed BLM management goals, objectives, and strategies see:
Greater Sage-Grouse and Sagebrush-Steppe Ecosystems Management Guidelines, August 21, 2000 (BLM et al. 2000).

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6.3.2 Pronghorn

Pronghorn (*Antilocapra americana*) M. Cathy Nowak, CTWC

Life History

Pronghorn are endemic to North America, where they have lived for more than 10 million years. They are opportunistic foragers and shift use of forage depending on availability, succulence and nutritional value. In shrub-steppe habitats, pronghorn diets are composed of approximately 7% grasses, 29% forbs and 64% shrubs (Yoakum 1990). Forbs may be more important when correction factors for digestibility are applied. Forbs are highly nutritious and provide water needed for survival and reproduction (Ellis 1970, Smith and Beale 1980) although they are only seasonally available. Shrubs are more important forage in winter, offering higher protein values than forbs in the same season (Barrett 1974, Yoakum 1990). Grasses may be heavily grazed during spring and fall "green-up" but remain about 10% of the total annual diet in all habitats (Yoakum et al. 1995). Einarson (1948) listed 12 species of shrubs, 29 species of forbs and 22 species of grasses and grasslike plants that pronghorn were observed to consume in Oregon.

In Oregon, most females breed during the 2-3 weeks following August 20; rarely do they breed after September 20 (Einarson 1948). The gestation period is about 250 days (O'Gara 1978); most young are born during the 3rd week in May (Einarson 1948). In Oregon, Einarson (1948) recorded 975 births. Of these, 46.6 % were of twins and 53.4 % were single births. In another Oregon study, Trainer et al. (1983) reported a mean number of fawns per doe of 1.76 indicating a higher instance of twinning than that reported by Einarson. However, by late summer the fawn:doe ratio in the Powder subbasin is reduced to about 30:100 due largely to predation, especially by coyotes (G. Keister, ODFW, personal communication, 4/29/2004).

Fawn growth is very rapid. Fawns in Alberta gained about 27.2 kilograms before their first winter. Yearling pronghorn during their second winter are similar in mass to adults (Mitchell 1980).

Habitat

Pronghorn occupy large expanses of flat or low, rolling terrain lacking major barriers to seasonal movements and with a mixed vegetative community of grasses, forbs and shrubs (Yoakum and O'Gara 2000). "Shrub-steppe is the second highest producing landscape for pronghorn" (Yoakum and O'Gara 2000:570). Pronghorn in Oregon primarily use areas dominated by big sagebrush (*Artemisia tridentata*) or playas (Einarson 1948, Good and Crawford 1978, Herrig 1974). Water, either the free compound or available in plant material, may be the predominate influence in seasonal use of sites by pronghorn in Oregon (Good and Crawford 1978, Herrig 1974). Pronghorn avoid habitats with vegetation >75 cm tall, rough terrain and arid, flat desert (Herrig 1974).

Current Distribution

In Oregon, pronghorn originally occurred throughout the area east of the Cascade Range, except for the Blue and Wallowa Mountains, as well as two areas west of the Cascades (Bailey 1936). Pronghorn were nearly extirpated in Oregon by 1900 but have greatly increased since that time. Currently populations are established in the shrub-steppe habitats of the eastern portion of the state (Verts and Carraway 1998; Figure 1).

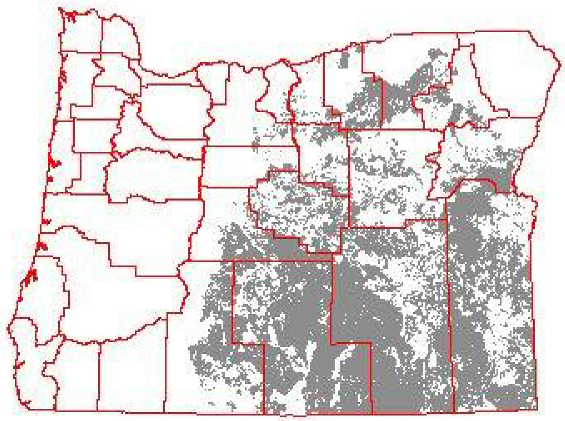

Figure 1. Current distribution of pronghorn (*Antilocapra americana)* in Oregon (from ONHIC).

Historic Distribution

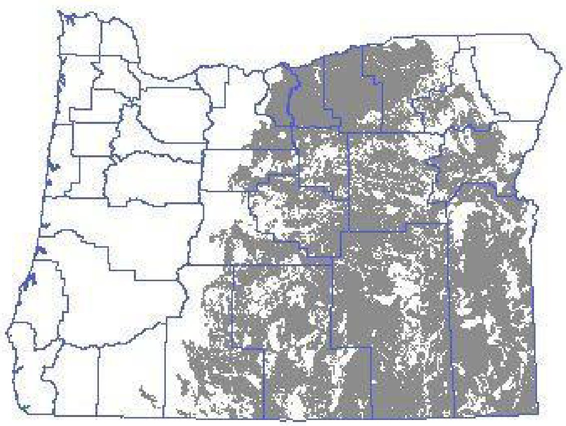

Figure 2. Historic distribution of pronghorn in Oregon (from ONHIC).

Population Data and Status

Population densities in other states ranged from 0.6 to 3.3 pronghorn/km^2 (Kitchen and O'Gara 1982). In Oregon, population densities are variable, but generally within the range reported elsewhere. Aerial surveys and harvest records indicate that pronghorn populations in Oregon fluctuate through increases and decreases but have generally continued to increase since the 1950's (G. Keister, ODFW, personal communication, 4/29/2004; Verts and Carraway 1998).

The population of pronghorn in the Powder subbasin is estimated to be about 250 animals located generally in the eastern portion of the subbasin near Auburn Creek. These animals can variously be found from Virtue flat to Daly Creek and north to Thief Valley Reservoir. In the Powder River subbasin, as elsewhere, pronghorn gather in large herds during winter but spread out in smaller groups to a wider area during spring and summer (G. Keister, ODFW, personal communication 4/29/2004).

Limiting Factors

Weather, including droughts, cold temperatures and deep, crusted snow may limit pronghorn distribution and productivity. However, anthropogenic barriers to movement, heavy livestock grazing and other habitat modifications magnify the detrimental effects of climatic conditions. Favorable weather, on the other hand, usually results in population increases despite hunting and other predation (Yoakum and O'Gara 2000).

Pronghorn, especially fawns, are taken by a variety of predators. Studies in Oregon have shown that coyote predation was the primary cause of fawn mortality (Trainer et al. 1983). Nevertheless, Yoakum and O'Gara (2000) suggest predation that limits population stability or growth is usually associated with poor habitat conditions or a small pronghorn population coupled with a large population of predators.

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6.3.3 American Marten

American marten (Martes americana)

Distribution

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

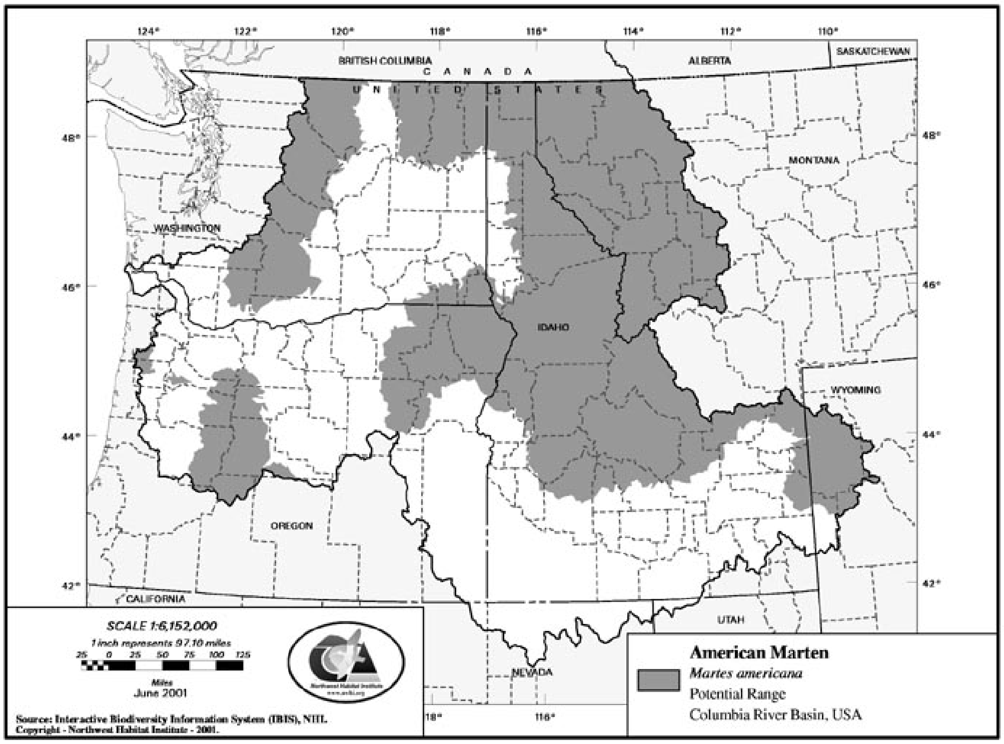

Figure 1. Current Distribution of American marten (*Martes americana*) in the Columbia River Basin (IBIS 2004).

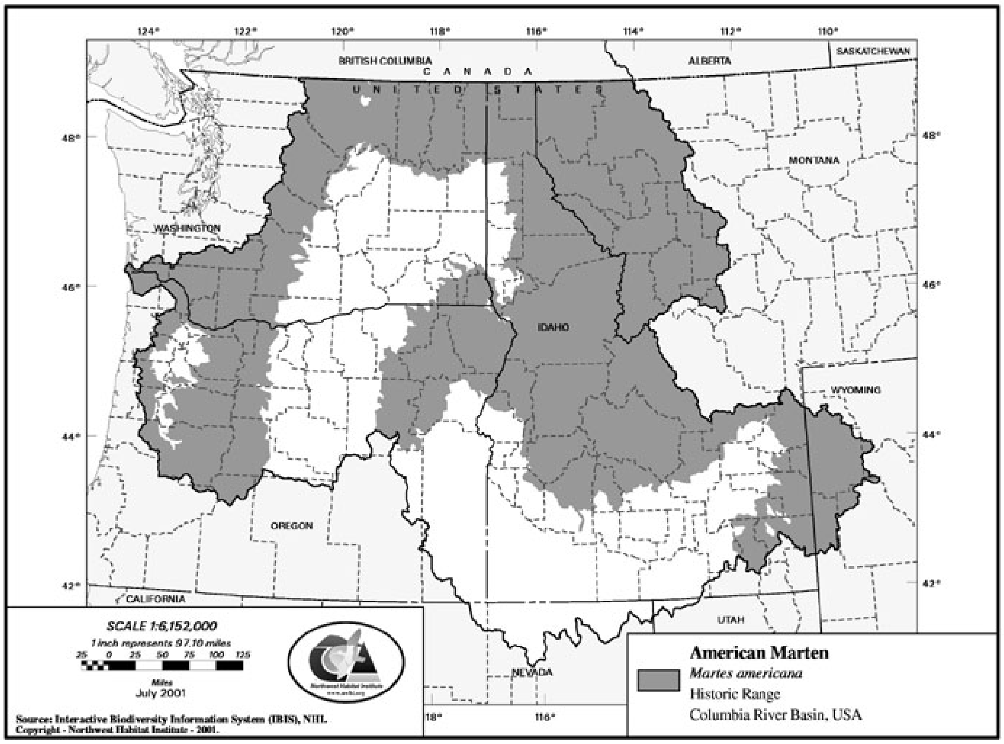

Figure 2. Historic distribution of American marten (*Martes americana*) in the Columbia River Basin (IBIS 2004).

Habitat and Density

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).

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).

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

*Evelyn Bull – working on marten studies

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.

Reported annual harvest of martens in Union and Wallowa Counties, OR (ODFW)

	Union	Wallowa		Union	Wallowa		Union	Wallowa
1969-1970	2		1978-1979	3		1987-1988		6
1970-1971	3		1979-1980		4	1988-1989	1	10
1971-1972	1		1980-1981		1	1989-1990		1
1972-1973		2	1981-1982		1	1990-1991	9	
1973-1974			1982-1983	2	1	1991-1992	2	
1974-1975		2	1983-1984			1992-1993		

1975-1976			1984-1985		10	1993-1994	9	2
1976-1977		18	1985-1986	8	10	1994-1995		1
1977-1978		4	1986-1987	1	29			

Diet

In Montana, remains of mammals occurred in 93.3% of 1,758 fecal droppings of martens; birds occurred in 12.0%, insects in 19.0%, and fruits in 29.2%. In California (Zielinski et al. 1983) and in Wyoming (Murie, 1961) the diet of martens is much the same as that in Montana (cited in Verts and Carraway 1998).

Remarks

We know little firsthand of the marten in Oregon, but we suspect that populations here likely will not increase greatly if short-rotation timber harvest and single-species replanting continue as recommended forest-management practices. Other practices, more of the past than of the present-such as burning or otherwise removing slash, snags, and downed logs, and large clear-cuttings-likely are detrimental to marten populations (Verts and Carraway 1998).

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6.3.4 Olive-sided Flycatcher

Olive-sided flycatcher (*Contopus cooperi*) Keith Paul, USFWS

Introduction

The olive-sided flycatcher is one of the most recognizable breeding birds of Oregon's coniferous forests with its resounding, three-syllable, whistled song *quick, three beers* (Altman 2003) and its position of prominence perched atop a large tree or snag (Altman and Sallabanks 2000). This flycatcher undergoes one of the longest and most protracted migrations of all Nearctic migrants, wintering primarily in Panama and the Andes Mountains of South America (Altman and Sallabanks 2000).

Description, Life History, and Habitat Requirements

Description

The olive-sided flycatcher is a relatively large, somewhat bulky, large-headed, short-necked flycatcher that perches erect and motionless at the top of a tall tree or snag except when singing or darting out to capture flying insects (Altman 2003). The overall olive-gray plumage is generally nondescript except for a whitish stripe down the breast and belly which gives the impression of an unbuttoned vest, and white patches between the wings and lower back (Altman 2003).

Life History

<u>Diet</u>

Olive-sided flycatchers prey almost exclusively on flying insects including flying ants, beetles, moths, and dragonflies, but with a particular preference for bees and wasps (Bent 1942, Altman 2003).

Olive-sided flycatchers forage mostly from high, prominent perches at the top of snags or the dead tip or uppermost branch of a live tree (Altman 2003). 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 (Altman 2003). Foraging behavior as an air-sallying insectivore requires exposed perches and unobstructed air space, thus tall trees or snags and broken canopy provide a better foraging environment than closed-canopy forest (Altman 2003, Altman and Sallabanks 2000). During the early reproductive period, the males usually forage from the tops of the tallest trees and snags, and females forage at lower heights and near the nest (Altman 2000, 2003).

<u>Reproduction</u>

Olive-sided flycatcher territory establishment and pairing begins upon arrival to breeding grounds (Altman 2003). 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 (Altman and Sallabanks 2000). Olive-sided flycatchers are monogamous. They produce 3-4 eggs per clutch and one clutch per pair. Incubation period lasts 14-15 days, nestling period lasts approximately 19-22. The hatching of nestlings from a successful first nest occurs mostly in second week of July. Olive-sides flycatchers will renest after a failed clutch until about July 1. The latest fledging of nestlings is August 30 (Altman 2000). Adults remain with fledglings for up to two weeks (Altman 2003).

Females appear to choose the nest site; nests are most often found in coniferous trees (Altman and Sallabanks 2003). The nest is constructed primarily, if not totally, by the female (Altman and Sallabanks 2003). The foundation of the nest is built with larger twigs, while smaller twigs and larger rootlets are used to frame the nest. They will often use arboreal lichens to cover edges of nest rim and to line the cup of the nest (Altman and Sallabanks 2000); grasses, fine rootlets, or pine needles may also be used to line the nest (Bent 1942)

Breeding Territory/Home Range

Nesting pairs are generally well spaced and require relatively large territory. While estimates of territory size vary, most are 24.7-49.2 acres (10-20 ha) per pair (Altman 1997) and some as large as 100 ac (40-45 ha) per pair (Altman 2003).

Migration/Overwintering

The olive-sided flycatcher is a long distance, complete migrant between its breeding grounds in North American and its wintering grounds in Central and South America (Murphy 1989). They have the longest migration route of any flycatcher breeding in North America (Murphy 1989).

In Oregon, the spring migration of olive-sided flycatchers 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).

Survivorship

There is limited knowledge of the life-span of olive-sided flycatchers. From Bird Banding Laboratory data, two individuals that were banded and recaptured were at least seven years old.

Mortality

Very limited data exists. In one instance, sibling competition caused mortality (Altman and Sallabanks 2000). Other data shows that olive-sided flycatcher remains were discovered in a peregrine nest (Cade et al. 1968).

Habitat Requirements

General

The olive-sided flycatcher breeds only in coniferous forests of North America and is associated with forest openings and forest edge. During migration olive-sided flycatchers 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 (Altman 2003). Olive-sided flycatchers have been observed moving north through sagebrush flats in Malheur and Harney Counties, OR (M. Denny p.c., cited *in* Altman 2003).

Breeding/Foraging

Olive-sided flycatchers breed in coniferous forest, particularly in the following circumstances: within forest burns where snags and scattered tall, live trees remain; near water along the wooded shores of streams, lakes, rivers, beaver ponds, marshes, and bogs, often where standing dead trees are present; at the juxtaposition of late- and early-successional forest such as meadows, harvest units, or canyon edges; and in open or semi-open forest stands with a low percentage of canopy cover (Altman and Sallabanks 2000). In the Blue Mountains, territorial birds are found mostly along stream courses and around wet openings (M. Denny p.c. cited *in* Altman 2003). Tall, prominent trees and snags, which serve as foraging and singing perches, are common features of all nesting habitat.

Wintering/Foraging

Wintering habitat is similar to that on breeding grounds; forest edges and forest openings, especially where scattered tall trees or snags are present (AOU 1983, Stotz et al. 1992, 1996, Ridgely and Tudor 1994, Altman and Sallabanks 2000). They are most commonly found in mature evergreen forest (Petit et al. 1995, particularly montane forest (Willis et al. 1993, Ridgely and Tudor 1994, Stotz et al. 1996).

Population and Distribution
Distribution

Historic Distribution

The historic distribution of olive-side flycatchers is similar to the distribution today. Several Breeding Bird Atlases, including Michigan (Evers 1991), New York (Peterson 1988), Ontario (Cheskey 1987), and Monterey Co., CA (Roberson and Tenney 1993), report few significant changes in distribution during the twentieth century (Altman and Sallabanks 2000).

Current Distribution

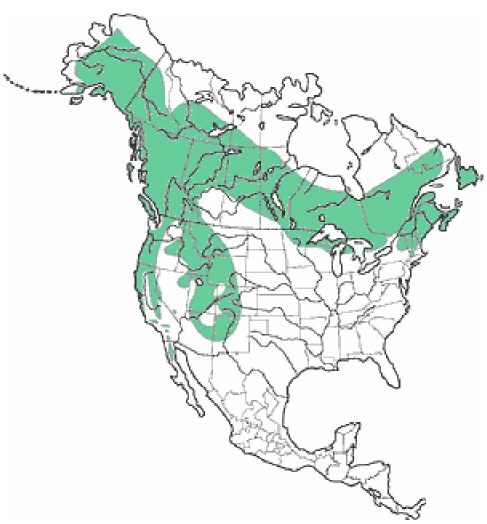

Figure 1. Birds of North America – Breeding distribution of the olive-sided flycatcher in North and Middle America.

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 (Altman 2003).

Principal migratory route is throughout the forest of western North America, Mexico, and Central America (Bent 1942, Gabrielson and Lincoln 1959, Altman 2003).

Olive-sided flycatchers winter primarily in Panama and the Andes of northern and western South America, from northwestern Venezuela south through Ecuador to southeast Peru and northern Bolivia (Fitzpatrick 1980, DeGraaf and Rappole 1995, Altman 2003).

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

Population

Historic Population

Historic population numbers of olive-sided flycatchers are unknown.

Current Population 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) analysis, and for most state and physiographic region analyses (Sauer et al. 1997, Altman 2003). In Oregon, there has been a highly significant ($p < 0.01$) statewide decline of 5.1% per year from 1966-96 (Sauer et al. 1997, Altman 2003).

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 by Hutto (1995a), 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 (Altman, 2003). The ability of forest management practices (e.g., selective cutting, clearcutting) to mimic natural disturbance regimes caused by forest fires has been questioned. Habitat created by these forest management scenarios may provide only the appearance of early post-fire habitat, but be lacking in some attributes or resources required by olive-sided flycatchers (Altman, 2003).

During the past 50 years, forest management resulted in an increase in forest openings and edge habitat, which has seemingly increased habitat for the olive-sided flycatcher. However, this dichotomy of increased habitat availability and declining populations may indicate that harvested forest represents an "ecological trap" (Hutto 1995b), where habitat may appear suitable, but reproductive success and/or survival is poor due to factors such as limited food resources, predation, or parasitism (Altman, 2003).

Continuing Threats

One of the largest continuing threats to the olive-sided flycatcher is deforestation in Central and South America. Diamond (1991), calculated that olive-sided flycatchers would lose 39% of their wintering habitat in the Andean montane forests between 1980 and 2000. This loss is in addition to habitat loss prior to 1980.

Continuing threats within the breeding range of olive-sided flycatcher include habitat loss to conversion to non-forest, alteration/degradation of habitat, reduced availability and acquisition of food resources, pesticides, and nest predation (Altman and Sallabanks 2003).

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Shaw Creek Bird Supply. Olive-sided flycatcher photo. Used with permission 4/23/04. http://www.shawcreekbirdsupply.com

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6.3.5 Blue Grouse

Blue Grouse (*Dendragapus obscurus*) Keith Paul, USFWS

Introduction

The blue grouse is found singly in mature pine or fir forests, generally in open woods or clearings. It is larger and more wary than the spruce grouse (*Falcipennis Canadensis*). The two populations of grouse integrate broadly where ranges meet.

The blue grouse is the largest of Oregon's three forest grouse. This grouse is known for its distinctive hooting call emitted by courting males in the spring and its extravagant courtship display. The hooting is created by air expelled from large yellow air sacs located on the sides of their throat (ODFW 2004).

Blue grouse can attain high population densities and are still distributed throughout most of their historic range. Occupation of relatively inaccessible montane forests during much of the year contributes to a healthy current status in most areas (Zwicklel 1992).

Description, Life History, and Habitat Requirements

Description

The blue grouse is a heavy-bodied grouse with moderately long, rounded wings and a moderately long unspecialized tail (Zwickel 1992). In the Pacific range, the male averages darker overall, tail is slightly rounded or wedge-shaped, and tail feathers are round tipped with narrow, light gray tips. In display, Pacific range males show warty, bright yellow air sacs on their neck with a less extensive white-feathered border (Sibley 2000). Males are predominantly dull gray, while females are mottled brown (Pelren 2003).

Life History

Diet

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 include conifer seeds, western larch needles and the berries of deciduous shrubs (Pelren 2003). Mike Denny reported that huckleberries are a common food source July-September in the Blue Mountains (Pelren 2003). Crawford et al. (1986a) found early fall diets of blue grouse in northeastern Oregon were composed of over 50 plant and animal species, but primarily contained short-horned grasshoppers, prickly lettuce, yellow salsify, wild buckwheat, and snowberry (Pelren 2003). During the winter months blue grouse generally rely heavily on needles, seeds, and buds of conifers, including firs, pine, hemlock, and larch (Csuti 1997, Zwickel 1992, Pelren 2003). In eastern Oregon, needles from Douglas-fir and needles and buds from ponderosa pine composed the majority of the diet during the winter (Pelren 2003).

Reproduction

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 will usually mate with several females. After copulation, females move to isolated locations to nest (Pelren 2003). The average number of eggs per clutch in northeast Oregon was 7.7, which represents the largest mean clutch size for any blue grouse population for which such data exists (Pelren and Crawford 1999). Egg laying occurs at the approximate rate of one egg every 1.5 days and when all eggs have been laid incubation begins and hatching occurs approximately 26 days later (Zwickel 1992). Hatch dates in northeast Oregon range from May 1 to July 8 (Crawford et al. 1986b), while mean hatch date was May 31 (Pelren and Crawford 1999). Chicks are precocial and gain rudimentary flight in approximately two weeks (Pelren 2003).

Females choose the nest site and the nest is almost always outside male territories (Zwickel 1992), perhaps to avoid repeated courtship advances. Nests are rarely within about 164 ft (50 m) of one another, suggesting spacing (Zwickel 1992). The nest is a scrape filled with grass and leaves, built in cover at the forest edge, and usually near water (Csuti et al. 1997). Pelren and Crawford (1999) observed the greatest nesting success among nests beneath logs (Pelren 2003).

Breeding Territory/Home Range

As cited in Zwickel (1992) in spring/summer, average size and range in size of territories of adult males: southeast Alberta averaged 1.48 ac (0.6 ha) (Boag1966); Montana averaged 1.98 ac (0.8 ha) (Martinka 1972); Colorado averaged 3.71 ac (1.5 ha) (Hoffman 1981); and coastal British Columbia averaged 5.19 ac (2.1 ha) (McNicholl 1978). Female home range size varies widely and seasonally among females (Bendell and Elliot 1967, Zwickel 1992).

Survivorship

The first year survival of blue grouse is low (Zwickel 1992). As few as 10% of the previous year's hatchlings are recruited; the highest rate of mortality is in the first two weeks of life (Zwickel and Bendell 1967). Maximum known longevity for adult male BG is ≥ 14 years, and for females ≥ 11 years (Zwickel et al. 1989).

Mortality

Most nest failures result from predation (Zwickel et al. 1988). Nest predation is carried out by both mammals and birds. Known adult predators include northern goshawk (*Accipiter gentiles*), red-tailed hawk (*Buteo jamaicensis*), prairie falcon (*Falco mexicanus*), great-horned owl (*Bubo virginianus*), and Canada lynx (*Lynx Canadensis*). Other birds and mammals are likely predators also.

Habitat Requirements

Breeding/Foraging

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).

Nesting habitat ranges from nearly bare ground with no overhead cover to dense vegetation beneath full forest canopies (Zwickel 1992, Pelren and Crawford 1999, Pelren 2003). Individuals in northeast Oregon were found predominantly on the ground during summer (Popper et al 1996, Pelren 2003).

Migration

The distance between winter and spring range varies from none to several miles (kilometers) (Pelren 2003). While most upland game birds migrate down from higher elevations in the winter, blue grouse actually migrate up in elevation in the winter (ODFW 2004). An adult female in the Wallowa Mountains moved 7.5 mi (12 km) between winter and spring range (Pelren 1996, 2003). Elevational movements between winter and spring range have been documented in numerous studies (Zwickel 1992), and likely occur in response to spatially separated spring and winter habitats in some areas (Pelren 2003).

Wintering/Foraging

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). Individuals may remain in the same tree continuously for several weeks. Both sexes and age groups in northeast Oregon selected open park-like stands of mature ponderosa pine and Douglas-fir rather than more heavily forested stands

(Pelren 1996, 2003). Blue grouse occasionally roost beneath the surface of snow in winter; this aids in Thermoregulation and/or predator-avoidance, and likely occurs in Oregon where snow depths are adequate (Pelren 2003).

Population and Distribution

Distribution

The blue grouse is a local short-distance migrant throughout the coniferous forests of the North American Cordillera (Zwickel 1992, Pelren 2003). Blue grouse are residents of the southeastern corner of the Northwest Territories, south Yukon, British Columbia, western Alberta, and the islands of Alaska's southeastern panhandle. The range extends south through the Coast Range, Cascades, and Olympic Mountains in Washington, the contiguous mountains of western and northeastern Oregon, and the Sierra Nevada mountains of Idaho, Montana, Wyoming, Utah, and Colorado, with fragmented populations in Arizona and New Mexico (Pelren 2003).

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).

Population

Historic

Blue grouse still occupy most of their original range, though historical accounts suggest densities in some areas were greater than now (Zwickel 2003). There is has been a decrease in suitable habitat due to agricultural conversion.

Population

Historic

There is no historic population data for blue grouse.

Current Population 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 blue grouse 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). Oregon upland game bird harvest data (1993-2002) is shown below (Table 1). Despite intensive study of blue grouse over the last 40 years, ability to predict population levels and trends remain poor (Zwickel 1992).

Table 1. Source - ODFW Upland Game Bird Harvest 1993-2002.

Year	Blue Grouse	Year	Blue Grouse
1993	15,734	1998	28,664
1994	20,380	1999	38,405
1995[1]	22,895	2000	31,775
1996	33,120	2001	42,429
1997[1]	33,382	2002	42,301

[1] Concern for integrity of data collected in 1997. 1995 survey conducted by OSU.

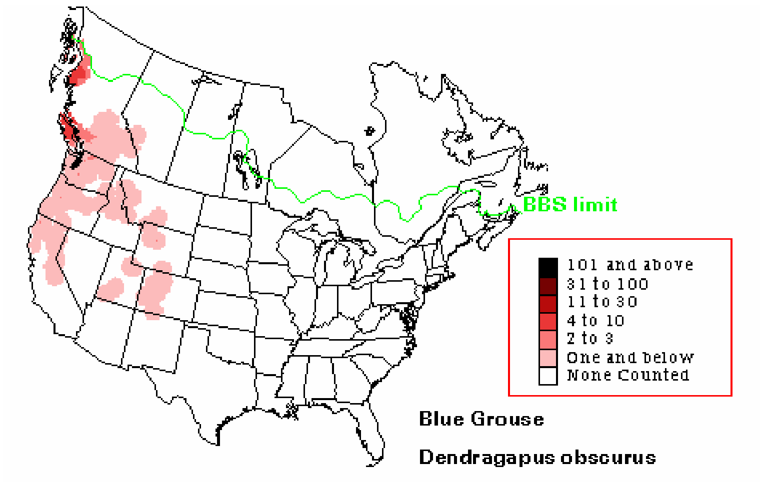

Figure 1. Blue Grouse breeding distribution from BBS data (1982-1996) (Sauer et al. 2001)

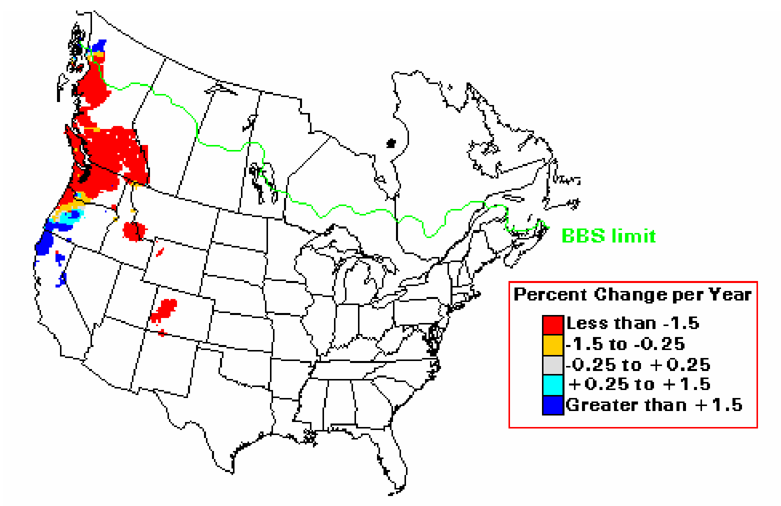

Figure 2. Blue Grouse trend from BBS data (1966-1996) (Sauer et al. 1996)

Factors Affecting Population Status

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

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6.3.6 White-headed Woodpecker

White-headed Woodpecker (*Picoides albolarvatus*). Paul Ashley and Stacey Stovall. 2004. Southeast Washington Subbasin Planning Ecoregion Wildlife Assessment.

Introduction

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

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.

White-headed Woodpecker Life History, Key Environmental Correlates, and Habitat Requirements

Life History

Diet

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.

Reproduction

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.

The woodpeckers fledge about 3-5 birds every year. During the breeding season (May to July) the male roosts in the cavity with the young until they are fledged. The incubation period usually lasts for 14 days and the young leave the nest after about 26 days. White-headed woodpeckers have one brood per breeding season and there is no replacement brood if the first brood is lost.

The woodpeckers are not very territorial except during the breeding season. They are not especially social birds outside of family groups and pair bonds and generally do not have very dense populations (about 1 pair bond per 8 ha).

Nesting

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 Trembling Aspen, live Ponderosa pine trees and fence posts (Cannings *et al.* 1987).

In general, nesting locations in the South Okanagan, British Columbia have ranged between 450 - 600m (Blood 1997), with large diameter snags being the preferred nesting tree. Their nesting cavities range from 2.4 to 9 m above ground, with the average being about 5m. New nests are excavated each year and only rarely are previous cavities re-used (Garrett *et al.* 1996).

Migration

The white-headed woodpecker is a non-migratory bird.

Habitat Requirements

Breeding

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 low as 10ha (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 between 30 - 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).

White-headed Woodpecker Population and Distribution

Population

Historic

No data are available.

Current

No data are available.

Distribution

Historic

No data are available.

Current

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. 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. See Figure_100, Figure_101, and Figure_102 for current distribution.

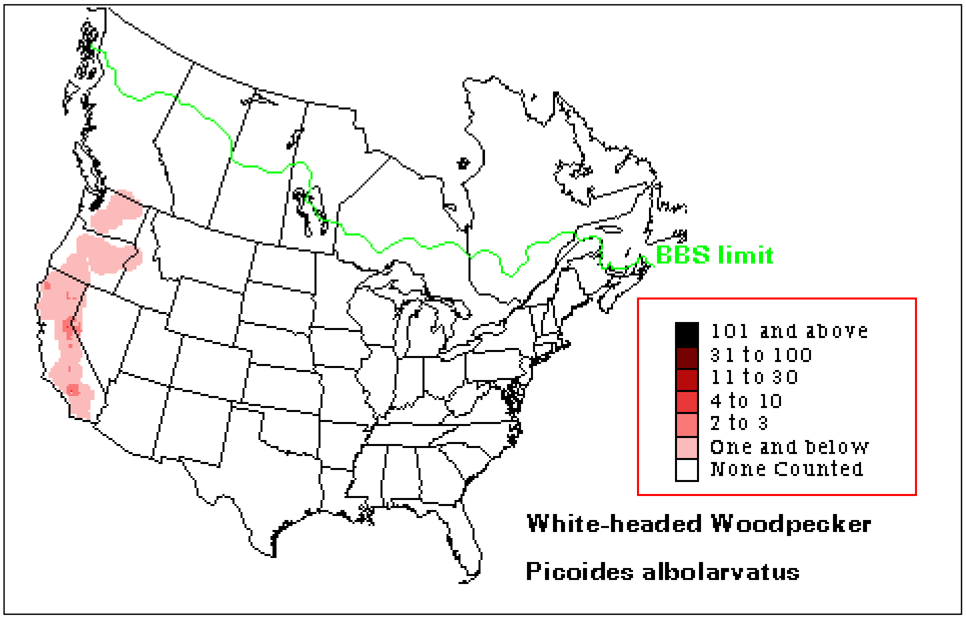

Figure 30. White-headed woodpecker year-round range (Sauer *et al*. 2003).

Woodpecker abundance appears to decrease north of California. They are uncommon in Washington and Idaho and rare in British Columbia. However, they are still common in most of their original range in the Sierra Nevada and mountains of southern California. The birds are non-migratory but do wander out of their range sometimes in search of food.

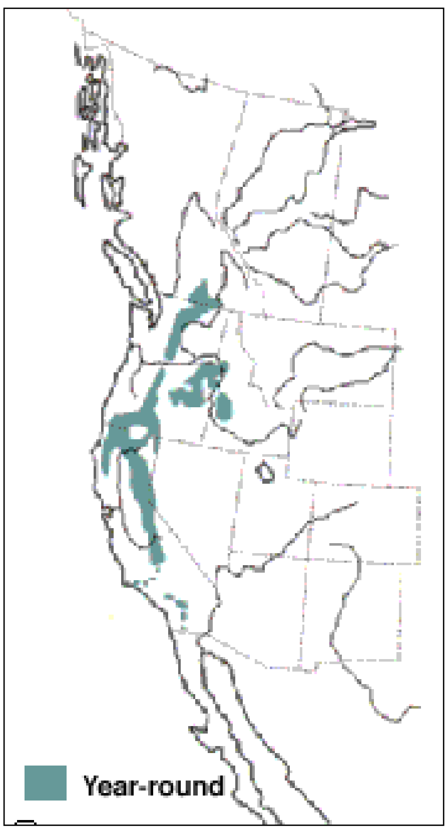

Figure 31 White-headed woodpecker breeding distribution (from BBS data) (Sauer *et al.* 2003).

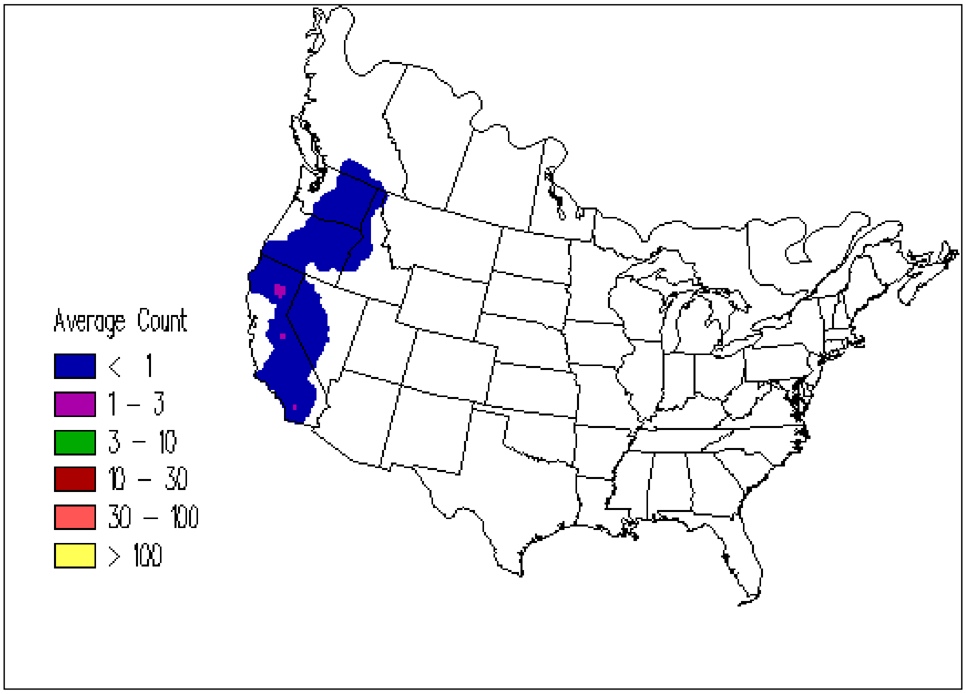

Figure 32. White-headed woodpecker winter distribution (from CBC data) (Sauer *et al.* 2003).

White-headed Woodpecker Status and Abundance Trends
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.

Trends

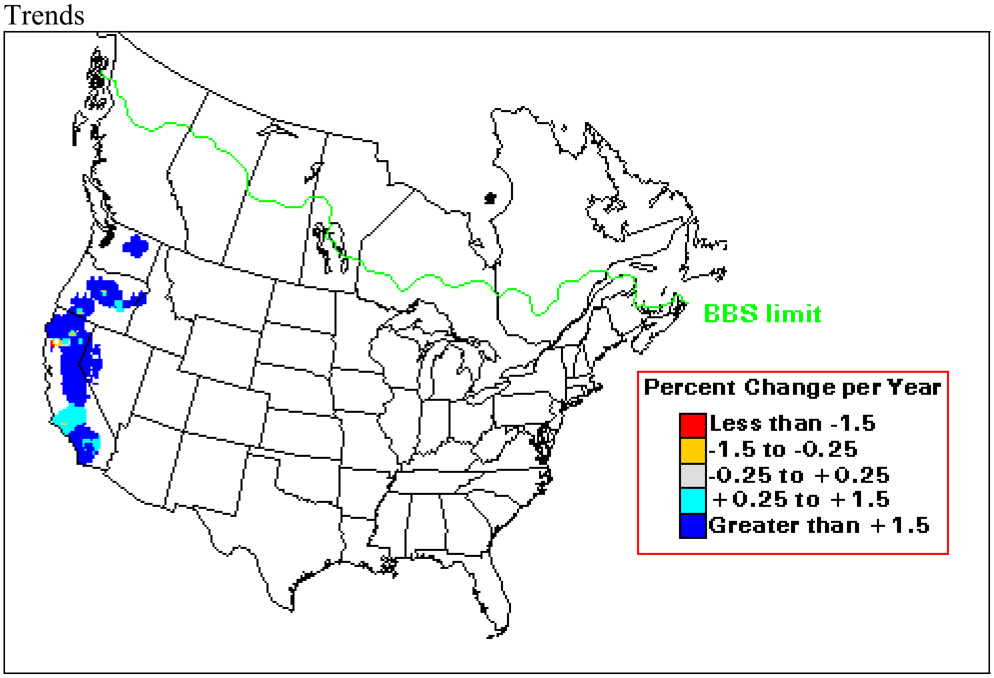

Figure 33. White-headed woodpecker Breeding Bird Survey (BBS) population trend: 1966-1996 (Sauer *et al.* 2003).

Factors Affecting White-headed Woodpecker Population Status

Key Factors Inhibiting Populations and Ecological Processes

Logging

Logging has removed much of the old cone producing pines throughout the South Okanagan. Approximately 27, 500 ha of ponderosa pine forest remain in the South Okanagan and 34.5 percent of this is classed as old growth forest (Ministry of Environment Lands and Parks 1998). This is a significant reduction from the estimated 75 percent in the mid 1800s (Cannings 2000). The 34.5 percent old growth estimate may in fact be even less since some of the forest cover information is incomplete and needs to be ground truthed to verify the age classes present. The impact from the decrease in old cone producing ponderosa pines is even more exaggerated in the South Okanagan because there are no alternate pine species for the white-headed woodpecker to utilize. This is especially true over the winter when other major food sources such as insects are not available. Suitable snags (DBH>60cm) are in short supply in the South Okanagan.

Fire Suppression

Fire suppression has altered the stand structure in many of the forests in the South Okanagan. 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.

Predation

There are a few threats to white-headed woodpeckers such as predation and the destruction of its habitat. Chipmunks are known to prey on the eggs and nestlings of white-headed woodpeckers. There is also predation by the great horned owl on adult white-headed woodpeckers. However, predation does not appreciably affect the woodpecker population.

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6.3.7 Mountain Goat

Rocky Mountain goat (*Oreamnos americanus*) Keith Paul, USFWS

Introduction

The Rocky Mountain goat (RMG) is stocky, with a slender neck, thin black horns, and a short tail. Its pelage consists of white wool and guard hairs, often with scattered dark brown hairs on back and rump (Seton, 1929), sometimes forming a "clearly defined dark brown line" (Grant 1905), and including a pointed beard approximately five inches (130 mm) in length. The winter coat often appears yellowish, especially shortly before it is shed in the spring. The feet are larger than those of mountain sheep, with oval hooves and prominent dew "claws." RMGs consequently are able to traverse weaker snow crusts than are mountain sheep (Geist 1971; Rideout and Hoffman 1975).

Most archaeological evidence of RMGs in Oregon occurs in northeastern Oregon (Randolph and Dahlstrom 1977, Leonhardy and Thompson 1991, Lyman 1995) and dates from 300 – 1,500 years old (Figure 4). One 2000 year old archaeological record was found in Rattlesnake Creek in the Owyhee drainage of southeast Oregon (Lyman, 1988) but it is not clear whether this record is from a resident animal or whether it was traded for by indigenous peoples. Lyman (1988) suggested RMGs were present throughout the Oregon Cascades in suitable habitat, including Mt. Hood, Mt. Jefferson, and the Three Sisters based on pre-historic evidence from Washington, Oregon, and California (Richardson et al. 1829, Rideout and Hoffmann 1975, ODFW 2003).

Lewis and Clark provide the first European reports of RMGs in Oregon in their journals ca. 1806 (Moulton 1990). Accounts from other early explorers, ca. 1799 – 1815, also suggest RMGs were plentiful along the Columbia River and in the Cascade and Coast Ranges of Oregon and Washington (Figure 4; Ord 1815, Richardson et al. 1829, Suckley and Gibbs 1860, Coues 1897, Grant 1905). All accounts indicate goats were readily used by local indigenous people of the area (ODFW 2003).

RMGs indigenous to northeastern Oregon likely disappeared prior to European settlement during the late 19th and early 20th century (Grant 1905). Matthews and Coggins (1995) theorize improved mobility resulting form horses and more efficient weapons (firearms) may have influenced tribal hunting impacts on RMGs. RMGs likely disappeared from the Oregon Cascades during the 19th century as a result of climatic fluctuation, impacts of severe weather on isolated populations, and impacts of Native American hunters (Lyman 1988). RMGs have since been reintroduced to Oregon and are currently increasing in numbers (ODFW 2003).

Life History, Key Environmental Correlates, and Habitat Requirements

Life History

<u>Diet</u>

RMGs have a broad food tolerance and eat almost any forage including species not normally used by other ungulates (ODFW 2003). However, they tend to select flower-heads, buds, or foliage parts that are presumably more nutritious (Casebeer et al. 1950). Grasses are preferred in most areas and are used year round if available (Saunders 1955, Chadwick 1973, Smith 1976). Frequent conifer consumption, particularly firs (Saunders 1955, Geist 1971, Smith 1976) seems to be associated with severe winter conditions (Geist 1962, Kerr 1965, Johnson 1983).

A generalized foraging strategy allows goats to take advantage of the limited forage choices available. Goats, particularly nursery groups, appear to select topographically secure habitats and eat whatever is available (Johnson 1983). Seasonal variation in forage and habitat selection suggests needs become less important as kids age and the need for abundant quality forage increases (ODFW 2003).

Water requirements are largely unknown. In some areas, goats left areas when water dried up (Anderson 1940, Johnson 1983), which may explain the absence of goats form otherwise suitable habitat in Oregon (Wigal and Coggins 1982). Brandborg (1955) saw no evidence of daily movements to reach water in Idaho or Montana. Goats frequently eat snow, which may fulfill much of their water requirement. Further, succulent vegetation may allow goats to obtain their water requirement from forage (ODFW 2003).

Like other ungulates, goats frequent available mineral licks, with most use in May, June, and July (Brandborg 1955, McCrory 1965, Hebert 1967, Stevens 1979). All sex and age groups use mineral licks, although timing varies (Singer and Doherty 1985). Mineral constituents and concentrations vary considerably and undoubtedly affect attractiveness and nutritional value of licks. In Oregon, mineral blocks are used in the Wallowa Mountains. Goats exhibit high use of mineral blocks and placement has been effective in managing goat distribution (ODFW 2003).

Reproduction

RMGs also are polygamous and breed between early November and Mid-December (Geist 1964). Dominant males are very active, moving between herds in search of estrous females, and tending such females throughout their 2-3 day receptive period (DeBock 1970, Chadwick 1983). Gestation lasts about 180 days with the peak of births near the 1st of June. As parturition approaches, pregnant nannies seek seclusion, often in the steepest roughest terrain in their range. A single kid is normally born, although twinning is not uncommon in low density populations on productive ranges (Holroyd 1967, Hibbs et al. 1969, Houston and Stevens 1988). Triplets have been reported on rare occasions (Lentfer 1955, Hayden 1984, Hoefs and Nowlan 1998). Birth weights average 12 pounds and kids gain approximately 0.44 pounds per day for the first five months (Smith et al. 1995) (ODFW 2003).

Kids are precocious; they are able to move on steep slopes within hours of birth. During the first few days, the nanny and kid remain close with frequent nursing bouts (Brandborg 1955, Chadwick 1983). Nursing becomes less frequent and of shorter duration within 10 days (Stevens 1980) and effectively terminates by late August. Kids begin eating forage and ruminating shortly after birth, and forage regularly by six weeks of age (Brandborg 1955, Chadwick 1983). One to two weeks after birth nannies and kids rejoin other females and young in small nursery herds on summer ranges. Yearlings also join these nursery herds, while two year old males gradually assume a more solitary existence typical of adult males. Kids remain with their mothers through winter, benefiting from their mother's social status and access to foraging sites. Although orphaned kids con survive the winter, survival is enhanced if their mothers are present to break trails and paw for forage through deep snow (Chadwick 1983). Nannies become less tolerant of kids in spring, eventually abandoning them as they prepare for another birth. Although yearlings are part of nursery herds and benefit from the association, they are rejected and kept apart from newborn kids. Yearlings dig for their own forage in winter or utilize craters abandoned by others. Nannies often defend locations and exclude subordinates from the forage during tough winters. As a result, yearling winter mortality can be high (Smith et al. 1999, ODFW).

Home Range

Studies of RMG home range are few, but Rideout (1977) reported annual home ranges of 48.3, 31.1, 24.0, and 21.5 km² for yearlings, two-year olds, adult females and adult males, respectively. Females use traditional summer and winter ranges (Rideout 1977, Smith 1976). Males appear to have less fidelity to seasonal ranges (ODFW 2003).

Habitat Requirements

RMG habitat varies throughout North America ranging from dense coastal forests at sea level in Alaska (Smith 1986) and British Columbia (Hebert and Turnbull 1977) to alpine basins in Colorado (Hibbs 1967) and Oregon (Matthews and Coggins 1994). Good goat habitat is dominated by cliffs or extremely steep rocky slopes (Kerr 1965, Holroyd 1967, Johnson 1983, Chadwick 1983). Cliffs and rock outcrops provide security cover. Nannies utilize the least accessible and most secure crannies for parturition and the first days with new born kids (von Elsner-Schack 1986). Nursery groups and even large adult males stay close to such cliffs most of the time. Cliff areas are often broken by narrow talus chutes, lush avalanche slopes, or are adjacent to less precipitous areas of quality forage. Sunny, wind-swept south to west facing slopes limit snow depth and provide greatest food availability during winter. North and east facing slopes often have greater snow and water accumulations that lead to succulent summer forage (ODFW 2003).

Cover

Cliffs are important for thermal regulation. Overhangs, caves, lee sides of rocks or ridges, and dense conifers near cliffs provide shelter from sever weather. These features also provide protection from cold soaking rains and excessive heat during summer. Lingering snow banks are used by goats for summer cooling (ODFW 2003).

Mortality

Brandborg (1955) reported a 13-year-old RMG, and Richardson (1971) reported an 11-year-old male and a 10-year-old female. The oldest individuals represented among 165 skulls examined by Cowan and McCrory (1970) were an 18-year-old female and a 14-year-old male (Rideout and Hoffman 1975).

Predators of the RMG include the cougar (*Felis concolor*), bobcat (*Lynx rufus*), coyote (*Canis latrans*), golden eagle (*Aquila chrysaetos*), and both black and grizzly bears (*Ursus americanus, U. arctos*). The cougar is probably the most serious of these, inasmuch as it can traverse rugged terrain and is large enough to attack and kill an adult mountain goat (Rideout and Hoffman 1975).

Harvest

RMG's were extirpated from Oregon prior to any formal regulatory or harvest management. Regulated RMG hunting began in 1965 in the Wallowa Mountains and continued through 1968. A total of 23 tags were issued and 20 animals (13 males and 7 females) were harvested. The population declined during this period, hunting was stopped following the 1968 season, and the season remained closed through 1996. The goat season reopened in 1997 for the Wallowa and Elkhorn Mountains with one tag in each area. As of October 2002, 38 goats have been legally harvested in Oregon (Table 1; ODFW 2003).

Table 1. Rocky Mountain goat harvest history in Oregon, 1965-2002 (ODFW 2003).

			Harvest	
Year	Hunt Area	Tags	Male	Female
1965	Hurricane Divide	5	4	1
1966	Hurricane Divide	5	3	2
1967	Hurricane Divide	5	3	2
1968	Hurricane Divide	8	3	2
1997	Hurricane Divide	1	1	0
1997	Elkhorn Mts.	1	1	0
1998	Hurricane Divide	1	1	0
1998	Elkhorn Mts.	2	2	0
1999	Hurricane Divide	1	0	1
1999	Elkhorn Mts.	2	2	0
2000	Hurricane Divide	1	1	0
2000	Elkhorn Mts.	2	2	0
2001	Hurricane Divide	2	2	0
2001	Elkhorn Mts.	2	2	0
2002	Hurricane Divide	2	1	0
2002	Elkhorn Mts.	2	2	0
Total		42	30	8

Annual hunting continues in both the Wallowa and Elkhorn Mountains with a limited number of tags. Similar to bighorn sheep, a person can hold only one controlled RMG tag in a lifetime. No tags are currently available to nonresidents. All tags are issued through a public drawing and the current bag limit is one goat. Currently, the goat season occurs during the mid September and runs 12 days (ODFW 2003).

In 2003, the Oregon Legislative Assembly adopted statute authorizing the Oregon Fish and Wildlife Commission to issue one special auction tag and one special raffle tag for hunting RMGs. Implementation will begin with a single raffle tag during the 2004 hunting season. Special auction and raffle tags will be valid for the months of September and October in all RMG hunting areas where the Commission authorizes controlled hunt tags (ODFW 2003).

Population and Distribution

Distribution

Rangewide Historic/Current

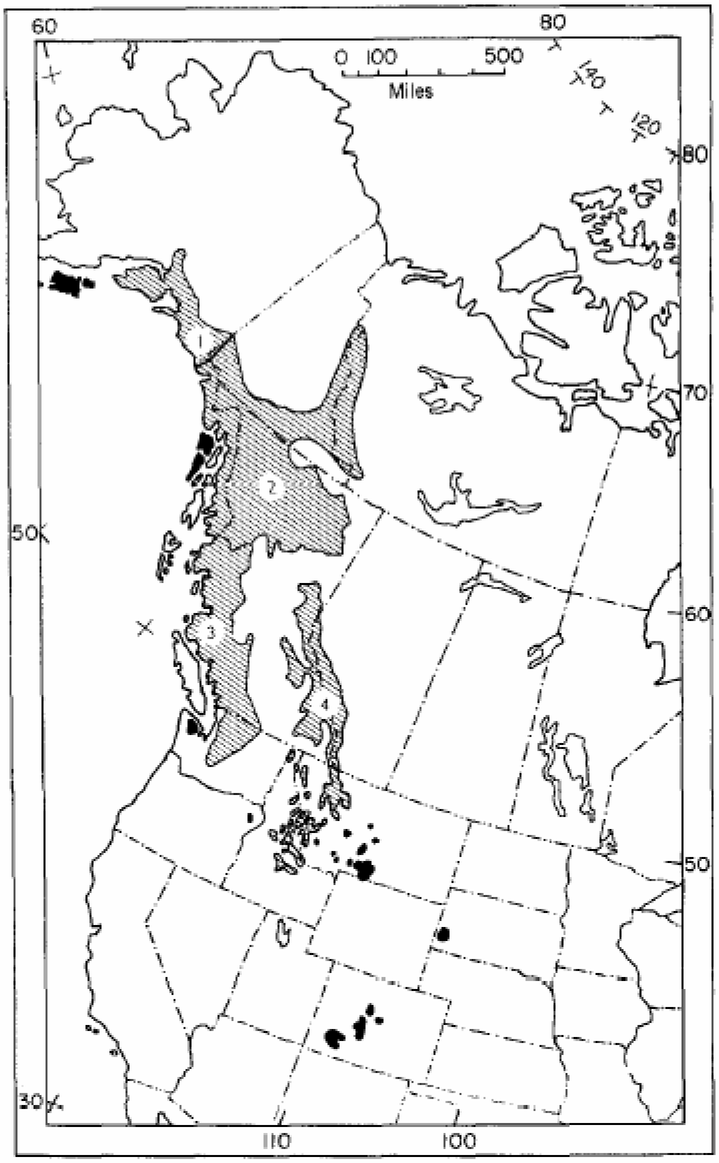

Figure 1. Distribution map of *Oreamnos americanus*. Shaded areas denote native ranges, which are still occupied; black areas show introduced herds. Ranges of subspecies formerly recognized are (1) *O. a. kennedyi*, (2) *O. a. Columbians*, (3) *O. a. americanus*, and (4) *O. a. missoulae*. Figure prepared by T. Swearingen (Rideout and Hoffman, 1975).

Oregon Historic/Current

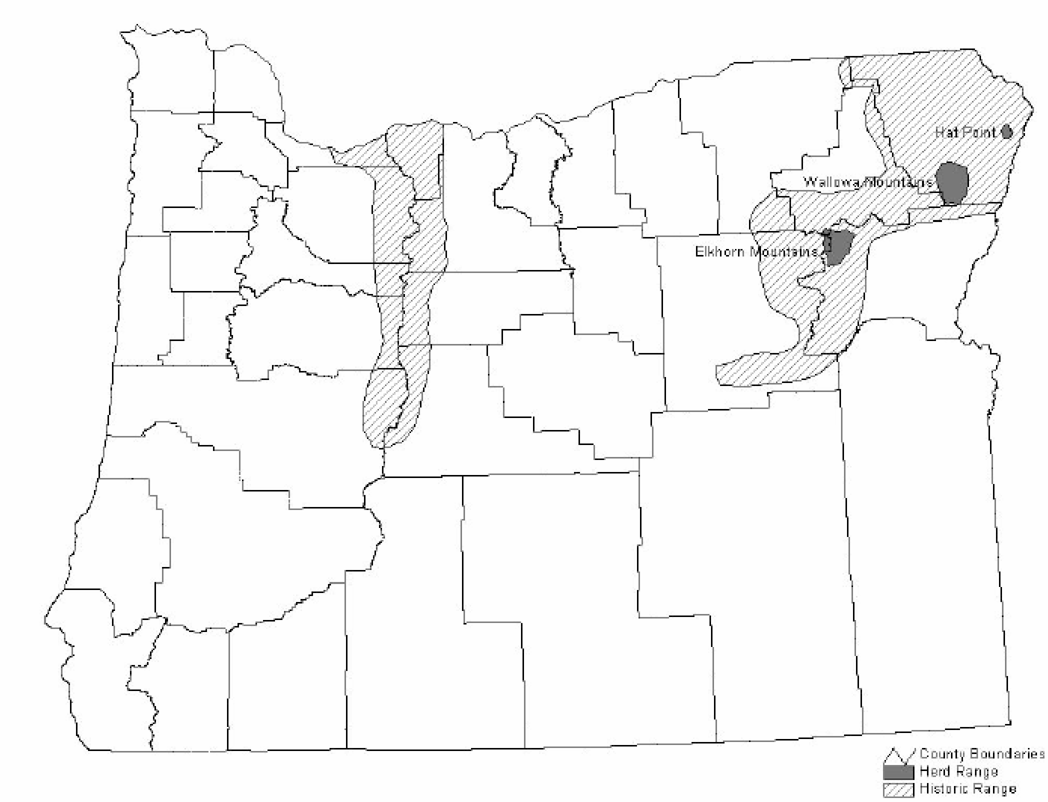

Figure 2. Historic and Current Distribution in Oregon (ODFW 2003).

RMGs were reintroduced to the Wallowa Mountains in 1950 when 5 animals from the Chopaka Mountains in Washington were released at the base of Joseph Mountain. Since 1950, 12 transplants from five sources have been made to four mountain ranges in Oregon. Thirty-three were released in the Wallowa's during the 1980's, and 20 were transplanted to the Wallowa's from the Elkhorn Mountains in 2002. From 1960-1976 three transplants totaling 15 goats were released in the Tanner Butte area of the Columbia River Gorge but none survived. A total of 21 goats from 3 sources were released in the Pine Creek drainage of the Elkhorn Mountains from 1983-1986. In July 2000, 16 goats were captured in the Elkhorn Mountains and transplanted to Sluice Creek in the Wallowa Mountains (ODFW 2003).

Population

Historic

There is no historic population data for RMG.

Current Population and Status

The Wallowa Mountains goat herd was established with five releases. The population remained static through the mid 1980's, never exceeding 45 animals. Kid recruitment has improved following additional releases and has remained moderately high (mean=39 kids:100 adults) since 1990. The 2002 population estimate for the Wallowa Mountains was 200 goats. Dispersal into vacant habitat adjacent to traditional core use areas is occurring throughout the Wallowa Mountains (ODFW 2003).

RMGs in the Elkhorn Mountains were established from 3 releases and annual surveys were initiated in 1987. Kid:adult ratios have been high and the population has increased rapidly with a 2002 population estimate of 150 goats. Individuals from this population continue to move into adjacent habitat including Vinegar Hill and the Strawberry Mountains (ODFW 2003).

RMGs transplanted to Hells Canyon in July 2000 continue to be monitored. Seven of the 16 individuals were radio collared and have remained near the release site. Reproduction has been good and the 2002 population estimate was 30 animals (ODFW 2003).

Table 2. Current status and 2002 population estimate for Rocky Mountain goats in Oregon (ODFW 2003).

Herd Name	# Releases (# Animals)	2002 Estimate	Status
Wallowa Mountains	4 (38)	200	Increasing
Elkhorn Mountains	3 (21)	150	Increasing
Hat Point	1 (16)	30	Increasing
Vinegar Hill	Dispersal	6	Unknown
Strawberry Mountains	Dispersal	4–6	Unknown
Wenaha River		2–3	Unknown
Cornucopia	1 (20)	6	No Data
Mt. Ireland		4–6	Unknown
Tanner Butte	3 (15)	0	Extirpated
Minimum Total		402	

Factors Affecting Population Status

Transplants

After RMGs were extirpated from Oregon, a reintroduction program was initiated in 1950. RMGs have been released on 12 separate occasions (Table 2). Early transplants in the Wallowa Mountains were successful. However, low productivity and overharvest limited population growth. Transplants during the 1980's stimulated population growth in the Wallowa Mountains herd and subsequent trapping was used to start the Elkhorn Mountains herd. By 2000, the Elkhorn herd had increased to a level that could support trapping and 36 goats have been moved to Hells Canyon since July 2000 (ODFW 2003).

Transplants to the Columbia Gorge in the 1980's likely failed because of small transplant size, scattering of individual goats, and too few males in the transplant (Matthews and Coggins, 1994). Observations of 1-4 individuals were occasionally reported from 1973-1990; however, no goats have been observed since 1990 (ODFW 2003)

Table 3. Rocky Mountain goat transplant history in Oregon, 1950-2002 (ODFW 2003).

Year	Origin of Stock	Male	Female	Total Released	Release Site	Range
1950	Chopaka Mt., WA	3	2	5	Joseph Mt.	Wallowa Mts.
1969-70	Olympic N.P., WA	2	6	8	Tanner Butte	Columbia Gor.
1975	Olympic N.P., WA	2	4	6	Tanner Butte	Columbia Gor.
1976	Olympic N.P., WA	1	0	1	Tanner Butte	Columbia Gor.
1983	NF Clearwater, ID	3	3	6	Pine Creek	Elkhorn Mts.
1985	Olympic N.P., WA	2	6	8	Hurricane Cr.	Wallowa Mts.
1985	Olympic N.P., WA	4	4	8	Pine Creek	Elkhorn Mts.
1986	Misty Fjord, AK	3	5	8	Hurricane Cr.	Wallowa Mts.
1986	Misty Fjord, AK	2	5	7	Pine Creek	Elkhorn Mts.
1989	Olympic N.P., WA	8	9	17	Hurricane Cr.	Wallowa Mts.
2000	Elkhorn Mts., OR	3	13	16	Sluice Creek	Hells Canyon
2002	Elkhorn Mts., OR	7	13	20	Summit Pt.	Wallowa Mts.
	Total	40	70	110		

Key Factors Inhibiting Populations and Ecological Processes

Because of the habitats that goats prefer, very little landscape manipulation is possible. Therefore, habitat that is available for RMG should be protected (if not already) and human access to that habitat should be limited by discouraging trails and roads that allow motorized vehicles. In areas where monitoring indicates overuse of forage species, goat management may include density reduction, use of techniques to discourage goat use or redistribute animals, or protection of specific plant communities (ODFW).

Research in Oregon by Vaughan (1975), found that low productivity was more likely responsible for lack of population growth rather than high mortality. Research also indicates that RMG populations are very sensitive to over-harvest, and goats cannot sustain harvest rates typical of other ungulate species (Haywood et al. 1980, Adams and Bailey 1982, Gonzalez-Voyer et al. in press). Harvest should be directed at the males because survival of nanny-kid groups is dependent on the dominant nanny leading the group between summer and winter ranges. Harvest of the nanny can compromise survival of the entire group (ODFW 2003).

Future Management and Research

ODFW realizes that RMG behavior has significant application to management. Therefore, ODFW believes that additional information is needed and/or refinement of technique to determine more accurate sex-ratio data, productivity, distribution, and seasonal range locations.

Population goals need to be established for specific goat herds. A population goal is defined as the optimal number sustainable in a particular area over time. Established goals will provide direct5ion for future population and human use management. Population goals may be difficult to establish without historical data for vacant or under-stocked ranges (ODFW 2003).

Primary management emphasis for the future will be to establish viable goat populations in all suitable habitat in Oregon (Table 4). Transplants will require landowner (private and/or government agency) cooperation (ODFW 2003).

Table 4. Proposed transplant sites for Rocky Mountain goats in Oregon (ODFW 2003).

Priority	Site Name	District	Limitations
1	Saulsberry Saddle	Wallowa	None
1	Eagle Creek[a]	Baker	None
1	Mt. Jefferson	Deschutes	Winter Range
1	Three Sisters	Deschutes	Winter Range
1	Upper Whitewater	CTWIR	None
1	Three-Fingered Jack	Deschutes	Winter Range
1	Wenaha River	Wallowa	None
1	Strawberry Wildnerness	Grant	None
1	Tanner Butte	Mid Col.	None
1	Herman Creek	Mid Col.	None

[a] Supplemental Release

RMGs are particularly vulnerable to hunting, and harvest should be strictly controlled and monitored. The following criteria will be used to determine hunt areas and tag numbers (ODFW 2003):

1. Herd population survey data should be indicative of a stable or growing population 3-5 years prior to initiation of harvest.

2. The population should be ≥ 50 animals comprised of at least 15% males.

3. Harvest should be no greater than 5% of the total population and no more than 50% of the harvest should be adult females. If more than 50% of the annual harvest is adult females, the following year's tag quota may be reduced.

Where goat numbers exceed established management goals or other social problems areas, additional removal of goats may be necessary. Trapping and transplanting, an increase in tags, salting to draw goats out of the area or other options may be employed (ODFW 2003).

RMG research should focus on management needs of local populations. Data on seasonal movements, habitat use, diet, and factors effecting reproduction or recruitment is needed to improve management of established populations. Herd health information from blood assays, identification of parasites and disease exposure are needed. Research designed to examine human impacts may be necessary in the future (ODFW 2003).

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6.3.8 Bald Eagle

Bald Eagle (*Haliaeetus leucocephalus*). Keith Paul, USFWS, La Grande, Oregon.

Introduction

Bald eagles in the lower 48 states were first protected in 1940 by the Bald Eagle Protection Act and then were federally listed as endangered in 1967. In 1995, the bald eagle was reclassified as threatened in all of the lower 48 States. The bald eagle was proposed for delisting on July 6, 1999; a decision on whether to delist the bald eagle is pending (64 FR 36453). No critical habitat has been designated for the bald eagle (USFWS 2003).

The bald eagle is one of eight species of sea-eagle (genus *Haliaeetus*) worldwide (Brown 1977), and the only sea eagle found throughout North America (Stalmaster 1987). Large size, wingspan of 6.6-8.0 ft (200-243 cm) (Stalmaster 1987), and the contrast of white head and tail, and yellow eyes, beak, and legs, to dark brown body and wings make the adult bald eagle one of our most distinctive raptors (Isaacs and Anthony 2003a).

Bald Eagle Life History, Key Environmental Correlates, and Habitat Requirements

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).

Diet

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 habitats are unknown for nesting eagles over much of the state (Isaacs and Anthony 2003a).

Reproduction

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), but “divorce” has been documented (Frenzel 1985, Garrett et al 1993). Cooperative nesting by three adults was reported (Garcelon et al. 1995). 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).

Bald eagles lay one to four eggs in late March or early April and both adults incubate the eggs for about 35 days until hatching. 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. The first year is particularly difficult for young eagles. Only half may survive the first year due to disease, lack of food, bad weather, or human interference (USFWS 2003).

Migration

Bald eagles can be resident year-round where food is available; otherwise they will migrate or wander to find food. When not breeding, 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).

Mortality

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).

Habitat Requirements

General

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

Nesting Habitat

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). A nest in the Fort Rock Valley was the most distant from water at 18 mi (29 km) from the nearest shoreline (Isaacs and Anthony unpublished data). 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. Nest trees are usually large and prominent (Anthony et al. 1982). Large old trees have large limbs and open structure required for eagle access and nest territory. Some use has been made of artificial platforms placed in trees modified for Osprey (Witt 1996, Isaacs and Anthony unpublished data, R. Opp p.c.). Cliff nesting is thus for unknown, but possible, especially in sparsely forested areas of southeast Oregon (Isaacs and Anthony 2003a).

Wintering Habitat

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). Favored perch trees are invariably located near feeding areas, and eagles consistently use preferred branches (Stalmaster 1976). 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). Close proximity to a feeding area is not the only requirement for night roosting sites, as there are minimum requirements for forest stand structure. In open areas, bald eagles also use cottonwoods and willows for night roosting (Isaacs and Anthony 1983). Most communal winter roosts used by bald eagles offer considerably more protection from the weather than diurnal habitat. 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).

Bald Eagle Population and Distribution
Distribution

The bald eagle is a resident of North America, and can be found throughout Alaska, Canada, the contiguous U.S. (AOU 1998) as far south as Baja California Sur, Mexico (Henny et al. 1978), and as far west as the Aleutian Is., Alaska (Anthony et al. 1999) (Isaacs and Anthony 2003a).

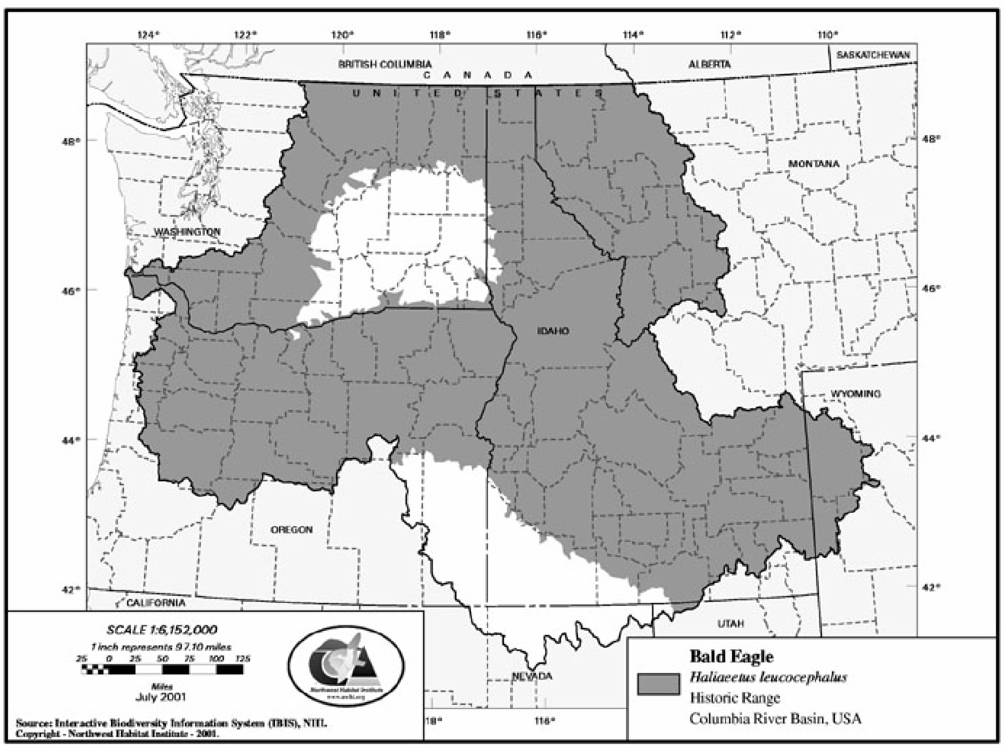

Figure 34. Bald eagle historic range in the Columbia River subbasin (IBIS 2003).

<u>Historic</u>

The status and distribution of bald eagle populations in the decades before World War II are poorly understood. Declines probably begin in some populations in the 19th century; other declines were probably not underway until the 1940's. Between 1947 and 1970, reproduction in most bald eagle populations declined drastically (Broley 1958, Sprunt et al. 1973), and the species disappeared form many parts of its breeding range (USFWS 1986).

Historical records provide evidence for the decline of bald eagles in the Pacific Northwest. Accounts by Baird (1858), Evermann (1886), Merrill (1888, 1897), Belding (1890), Bendire (1892), Woodcock (1902), Hall (1933a, 1933b), and Buechner (1953) document the abundance of bald eagles in the region during the late 19th century. Later records suggest that a population decline may have occurred at the beginning of the twentieth century (Bowles 1906, Dawson and Bowles 1909, Kitchin 1939). These suspected declines are difficult to quantify, however, because no intensive surveys were conducted until the latter part of the twentieth century. In some cases, historical records have confirmed the disappearance of breeding eagles form parts of their former range. Breeding populations of bald eagles in Oregon and Washington are still widely distributed, but historical information suggests significant declines and changes in distribution (USFWS 1986).

Current

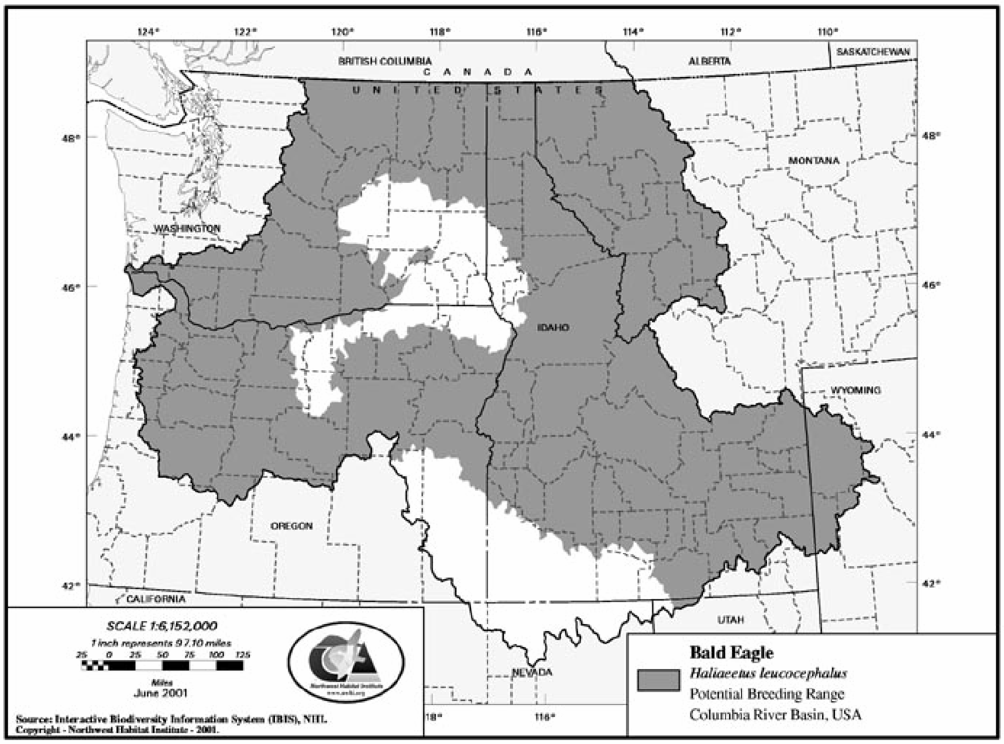

Figure 35. Bald eagle current breeding range in the Columbia River subbasin (IBIS 2003)

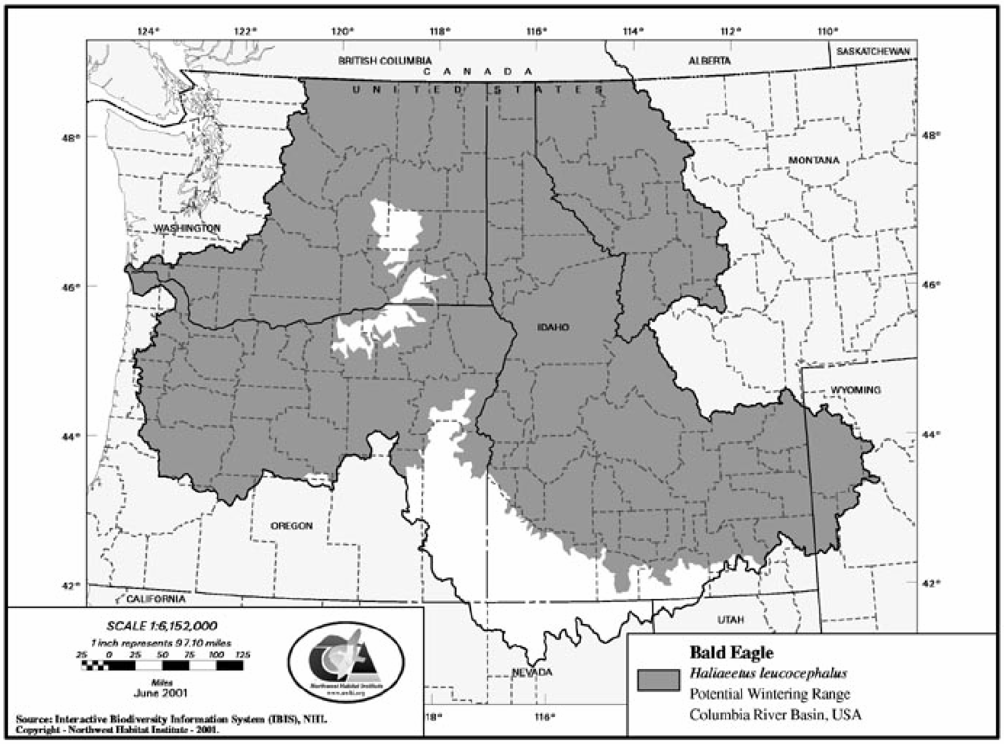

Figure 36. Bald Eagle Current Wintering Range (IBIS 2003)

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). Bald eagles can be found throughout the state during non-breeding. Variation locally in number of eagles and timing of peak abundance is due to weather and food supply. Eagles are very common in winter and early spring in the Klamath (Keister et al. 1987) and Harney (Garrett et al. 1988) basins, Columbia River estuary (Garrett et al. 1988), and L. Billy Chinook (Concannon 1998); 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), the Crooked River Valley above Prineville Reservoir (Isaacs et al. 1993), the south end of the Willamette Valley (Isaacs unpublished data), the John Day River above Service Creek (Isaacs et al. 1996), the Columbia River in Lower Valley (Isaacs unpublished data), the Columbia River in the Umatilla National Wildlife Refuge area (Isaacs unpublished data), Goose Lower Valley (Isaacs unpublished data), Summer Lake and Chewaucan River downstream of Paisley (R.L. Madigan p.c.), and at Sauvie I. (Isaacs unpublished data); common in fall at Wickiup Reservoir (Isaacs unpublished data, G.J. Niehuser p.c.) and Odell Lake (Crescent Ranger District 1998) (Isaacs and Anthony 2003a).

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).

Bald Eagle Population, Status, and Abundance Trends

Population Status and Conservation

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). Habitat loss (cutting of nest trees) and direct persecution (shooting, trapping, poisoning), probably caused a gradual decline prior to 1940. Between 1945 and 1974 over 4.5 million acres (1.8 million ha) of National Forest in Oregon were sprayed with DDT (Henny and Nelson 1981). Undocumented quantities were also applied on private forests and agricultural crops, and for mosquito control around municipalities. Consequently, the deleterious effects of DDT on reproduction (Stalmaster 1987) joined habitat loss and direct persecution as causes of decline through the early 1970's when the population may have reached its historical low. By then, nesting pairs were extirpated in northeastern Oregon (Isaacs and Anthony 2001), where applications of DDT on National Forest land were common and widespread (Henny and Nelson 1981) (Isaacs and Anthony 2003a).

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). The recovery plan for the Pacific states was completed in 1986 (USFWS 1986b). The bald eagle was listed as threatened under the Oregon ESA in 1987 (Marshall et al. 1996). Listing resulted in protection of eagle habitat and restriction on human activities near nest and roost sites. Site-specific planning was recommended for nest and roost protection (USFWS 1986). Forest management in nesting (Arnett et al. 2001) and roosting (DellaSala et al. 1998) habitat proved useful when declining forest health or fire danger threatened nest and roost trees. 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. Contaminants have been implicated in reduced productivity of nesting pairs on the Columbia River downstream of Portland (Anthony et al. 1993, Buck 1999) and warrant continued monitoring (Isaacs and Anthony 2003a).

Midwinter Bald Eagle Count

Each January, the U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center's Snake River Field Station (SRFS) coordinates the Midwinter Bald Eagle Survey, in which several hundred individuals count eagles along standard, non-overlapping survey routes.

Nationwide counts of eagles were coordinated by the National Wildlife Federation from 1979 until 1992, when the Raptor Research and Technical Assistance Center (now SRFS) assumed responsibility for overseeing the count. Initial objectives of the survey were to establish an index to the total wintering Bald Eagle population in the lower 48 states, to determine eagle distribution during a standardized survey period, and to identify previously unrecognized areas of important winter habitat. In 1986, Millsap (Wildl. Soc. Bull. 14:433-440) reported results of the midwinter survey from 1979 through 1986.

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).

*For more specific data (by route), see: http://ocid.nacse.org/qml/nbii/eagles/

Bald Eagle Nest Locations and History of Use in Oregon and the Washington portion of the Columbia River Recovery Zone, 1971 through 2003

Compiled by Frank B. Isaacs and Robert G. Anthony, 2003b

Highlights

- The 2003 survey year was the 26th year of bald eagle nest site surveys in Oregon (OR) and the Washington (WA) portion of the Columbia River Recovery Zone (CRRZ).

- History of bald eagle use has been compiled for a total of 1,303 nest trees (1,173 in OR, 130 in WA) at 502 nest sites (456 in OR, 46 in WA). Bald eagle nests have been discovered in 33 of 36 (92%) counties in OR, and 6 of 7 counties in the WA portion of the CRRZ. Counties in OR with no reported nests are Sherman, Gilliam, and Morrow. The first nest tree for Malheur County, Oregon was discovered this year. There are no nests known in the Benton County, WA portion of the study area.

- 77 previously unknown nest trees were documented (68 in OR, 9 in WA); 25 were at 23 previously unknown breeding territories (21 at 19 in OR, 4 at 4 in WA), and 52 (47 in OR, 5 in WA) were at previously known territories.

- 458 of 490 (416 of 444 in OR, 42 of 46 in WA) sites surveyed (93%) were occupied by bald eagles. 466 nestlings (430 in OR, 36 in WA) were observed at 445 occupied sites (405 in OR, 40 in WA) where nesting outcome was determined. 5,199 eaglets have been counted at nests in OR since 1971.

- Nesting outcome was 1.06 young per occupied site in OR and 0.90 in WA, resulting in 5-year productivity of 1.03 young per occupied site for OR and 0.94 for WA. This is the second year in a row that the 5-year productivity for OR has been greater than the recovery goal of 1.00.

- 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, and was lowest in Recovery Zone 22 (Klamath Basin) with 0.94 young per occupied site. 1.0 young per occupied site in the CRRZ in 2003 was $\geq$1.0 for the second year in a row.

- 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. Population growth may be slowing, or survey effort has not been sufficient to document eagles nesting in new areas. Data gathered during the next two nesting seasons should help determine the trend.

- Six nest trees at six nest sites burned in wildfires in July and August.

Additional information on nest locations is available.

Factors Affecting Bald Eagle Population Status
Key Factors Inhibiting Populations and Ecological Processes

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.

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6.3.9 Yellow Warbler

Yellow Warbler (*Dendroica petechia*), P. Ashley and S. Stovall, WDFW

Introduction

The yellow warbler (*Dendroica petechia*) is a common species strongly associated with riparian and wet deciduous habitats throughout its North American range. In Washington it is found in many areas, generally at lower elevations. It occurs along most riverine systems, including the Columbia River, where appropriate riparian habitats have been protected. The yellow warbler is a good indicator of functional subcanopy/shrub habitats in riparian areas.

Yellow Warbler Life History, Key Environmental Correlates, and Habitat Requirements

Life History

Diet

Yellow warblers capture and consume a variety of insect and arthropod species. The species taken vary geographically. Yellow warblers consume insects and occasionally wild berries (Lowther *et al.* 1999). Food is obtained by gleaning from subcanopy vegetation; the species also sallies and hovers to a much lesser extent (Lowther *et al.* 1999) capturing a variety of flying insects.

Reproduction

Although little is known about yellow warbler breeding behavior in Washington, substantial information is available from other parts of its range. Pair formation and nest construction may begin within a few days of arrival at the breeding site (Lowther *et al.* 1999). The reproductive process begins with a fairly elaborate courtship performed by the male who may sing up to 3,240 songs in a day to attract a mate. The responsibility of incubation, construction of the nest and most feeding of the young lies with the female, while the male contributes more as the young develop. In most cases only one clutch of eggs is laid; renesting may occur, however, following nest failure or nest parasitism by brown-headed cowbirds (Lowther *et al.* 1999). The typical clutch size ranges between 4 and 5 eggs in most research studies of the species (Lowther *et al.* 1999). Egg dates have been reported from British Columbia, and range between 10 May and 16 August; the peak period of activity there was between 7 and 23 June (Campbell *et al.* in press). The incubation period lasts about 11 days and young birds fledge 8-10 days after hatching (Lowther *et al.* 1999). Young of the year may associate with the parents for up to 3 weeks following fledging (Lowther *et al.* 1999).

Nesting

Results of research on breeding activities indicate variable rates of hatching and fledging. Two studies cited by Lowther *et al.* (1999) had hatching rates of 56 percent and 67 percent. Of the eggs that hatched, 62 percent and 81 percent fledged; this represented 35 percent and 54 percent, respectively, of all eggs laid. Two other studies found that 42 percent and 72 percent of nests fledged at least one young (Lowther *et al.* 1999); the latter study was from British Columbia (Campbell *et al.* in press).

Migration

The yellow warbler is a long-distance neotropical migrant. Spring migrants begin to arrive in the region in April. Early dates of 2 April and 10 April have been reported from Oregon and British Columbia, respectively (Gilligan *et al.* 1994, Campbell *et al.* in press). Average arrival dates are somewhat later, the average for south-central British Columbia being 11 May (Campbell *et al.* in press). The peak of spring migration in the region is in late May (Gilligan *et al.* 1994). Southward migration begins in late July, and peaks in late August to early September; very few migrants remain in the region in October (Lowther *et al.* 1999).

Mortality

Little has been published on annual survival rates. Roberts (1971) estimated annual survival rates of adults at 0.526 ±0.077 SE, although Lowther *et al.* (1999) felt this value underestimated survival because it did not account for dispersal. The oldest yellow warbler on record lived to be nearly 9 years old (Klimkiewicz *et al.* 1983).

Yellow warblers have developed effective responses to nest parasitism by the brown-headed cowbird (*Molothrus ater*). The brown-headed cowbird is an obligate nest brood parasite that does not build a nest and instead lays eggs in the nests of other species. When cowbird eggs are recognized in the nest the yellow warbler female will often build a new nest directly on top of the original. In some cases, particularly early in the incubation phase, the female yellow warbler will bury the cowbird egg within the nest. Some nests are completely abandoned after a cowbird egg is laid (Lowther *et al.* 1999). Up to 40 percent of yellow warbler nests in some studies have been parasitized (Lowther *et al.* 1999).

Habitat Requirements

The yellow warbler is a riparian obligate species most strongly associated with wetland habitats and deciduous tree cover. Yellow warbler abundance is positively associated with deciduous tree basal area, and bare ground; abundance is negatively associated with mean canopy cover, and cover of Douglas-fir (*Pseudotsuga menziesii*), Oregon grape (*Berberis nervosa*), mosses, swordfern (*Polystuchum munitum*), blackberry (*Rubus discolor*), hazel (*Corylus cornuta*), and oceanspray (*Holodiscus discolor*) (Rolph 1998).

Partners in Flight have established biological objectives for this species in the lowlands of western Oregon and western Washington. These include providing habitats that meet the following definition: >70 percent cover in shrub layer (<3 m) and subcanopy layer (>3 m and below the canopy foliage) with subcanopy layer contributing >40 percent of the total; shrub layer cover 30-60 percent (includes shrubs and small saplings); and a shrub layer height >2 m. At the landscape level, the biological objectives for habitat included high degree of deciduous riparian heterogeneity within or among wetland, shrub, and woodland patches; and a low percentage of agricultural land use (Altman 2001).

Nesting

Radke (1984) found that nesting yellow warblers occurred more in isolated patches or small areas of willows adjacent to open habitats or large, dense thickets (i.e., scattered cover) rather than in the dense thickets themselves. At Malheur National Wildlife Refuge, in the northern Great Basin, nest success 44 percent (n = 27), however, cowbird eggs and young removed; cowbird parasitism 33 percent (n = 9) (Radke 1984).

Breeding

Breeding yellow warblers are closely associated with riparian hardwood trees, specifically willows, alders, or cottonwood. They are most abundant in riparian areas in the lowlands of eastern Washington, but also occur in west-side riparian zones, in the lowlands of the western Olympic Peninsula, where high rainfall limits hardwood riparian habitat. Yellow warblers are less common (Sharpe 1993). There are no BBA records at the probable or confirmed level from subalpine habitats in the Cascades, but Sharpe (1993) reports them nesting at 4000 feet in the Olympics. Numbers decline in the center of the Columbia Basin, but this species can be found commonly along most rivers and creeks at the margins of the Basin. A local breeding population exists in the Potholes area.

Non-breeding

Fall migration is somewhat inconspicuous for the yellow warbler. It most probably begins to migrate the first of August and is generally finished by the end of September. The yellow warbler winters south to the Bahamas, northern Mexico, south to Peru, Bolivia and the Brazilian Amazon.

Yellow Warbler Population and Distribution

Population

Historic

No historic data could be found for this species.

Current

No current data could be found for this species.

Distribution

Historic

Jewett *et al.* (1953) described the distribution of the yellow warbler as a common migrant and summer resident from April 30 to September 20 in the deciduous growth of Upper Sonoran and Transition Zones in eastern Washington and in the prairies and along streams in southwestern Washington. They describe its summer range as north to Neah Bay, Blaine, San Juan Islands, Monument 83; east to Conconully, Swan Lake, Sprague, Dalkena, and Pullman; south to Cathlamet, Vancouver and Bly, Blue Mts., Prescott, Richland, and Rogersburg; and west to Neah Bay, Grays Harbor, and Long Beach. Jewett *et al. (*1953) also note that the yellow warbler was common in the willows and alders along the streamsof southeastern Washington and occurs also in brushy thickets. They state that its breeding range follows the deciduous timber into the mountains, where it porbably nests in suitable habitat to 3,500 or perhaps even to 4,000 feet – being common at Hart Lake in the Chelan region around 4,000 feet. They noted it was a common nester along the Grande Ronde River, around the vicinity of Spokane, around Sylvan Lake, and along the shade trees along the streets of Walla Walla.

Current

The yellow warbler breeds across much of the North American continent, from Alaska to Newfoundland, south to western South Carolina and northern Georgia, and west through parts of the southwest to the Pacific coast (AOU 1998). Browning (1994) recognized 43 subspecies; two of these occur in Washington, and one of them, *D.p. brewsteri*, is found in western Washington. This species is a long-distance migrant and has a winter range extending from western Mexico south to the Amazon lowlands in Brazil (AOU 1998). Neither the breeding nor winter ranges appear to have changed (Lowther *et al.* 1999).

The yellow warbler is a common breeder in riparian habitats with hardwood trees throughout the state at lower elevations. It is a locally common breeder along rivers and creeks in the Columbia Basin, where it is declining in some areas. Core zones of distribution in Washington are the forested zones below the subalpine fir and mountain hemlock zones, plus steppe zones other than the central arid steppe and canyon grassland zones, which are peripheral.

Figure 37. Breeding bird atlas data (1987-1995) and species distribution for yellow warbler (Washington GAP Analysis Project 1997).

Breeding

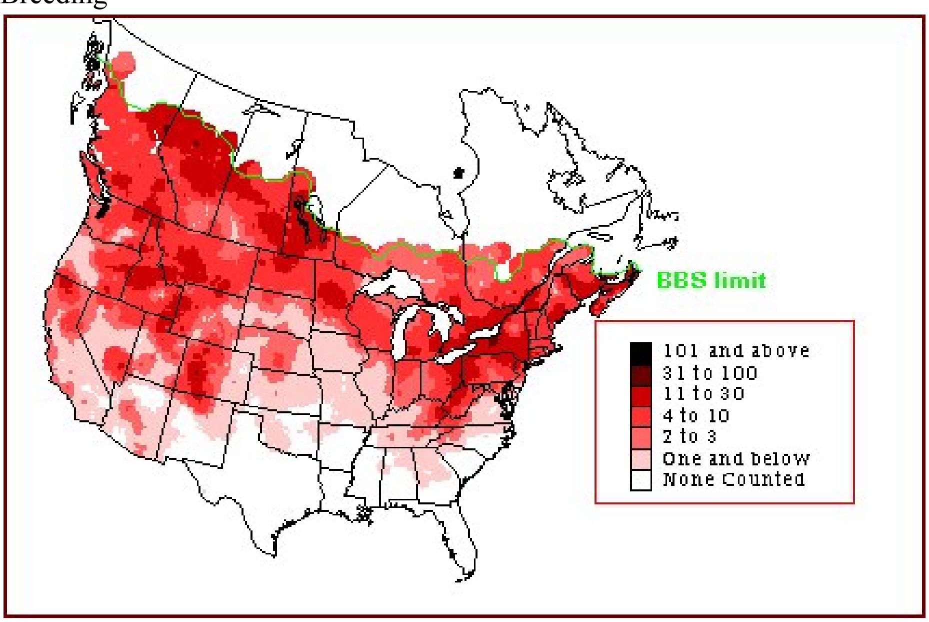

Figure 38 Yellow warbler breeding season abundance (from BBS data) (Sauer *et al.* 2003).

The yellow warbler breeds across much of the North American continent, from Alaska to Newfoundland, south to western South Carolina and northern Georgia, and west through parts of the southwest to the Pacific coast (AOU 1998).

Non-Breeding

This data is not readily available; however, the yellow warbler is a long-range neotropical migrant. Its winter range is from Northern Mexico south to Northern Peru.

Yellow Warbler Status and Abundance Trends

Status

Yellow warblers are demonstrably secure globally. Within the state of Washington, yellow warblers are apparently secure and are not of conservation concern (Altman 1999).

Trends

Yellow warbler is one of the more common warblers in North America (Lowther *et al.* 1999). Information from Breeding Bird Surveys indicates that the population is stable in most areas. Some subspecies, particularly in southwestern North America, have been impacted by degradation or destruction of riparian habitats (Lowther *et al.* 1999). Because the Breeding Bird Survey dates back only about 30 years, population declines in Washington resulting from habitat loss dating prior to the survey would not be accounted for by that effort.

Factors Affecting Yellow Warbler Population Status

Key Factors Inhibiting Populations and Ecological Processes

Habitat loss due to hydrological diversions and control of natural flooding regimes (e.g., dams) resulting in reduction of overall area of riparian habitat, conversion of riparian habitats, inundation from impoundments, cutting and spraying for ease of access to water courses, gravel mining, etc.

Habitat degradation from: loss of vertical stratification in riparian vegetation, lack of recruitment of young cottonwoods, ash, willows, and other subcanopy species; stream bank stabilization (e.g., riprap) which narrows stream channel, reduces the flood zone, and reduces extent of riparian vegetation; invasion of exotic species such as reed canary grass and blackberry; overgrazing which can reduce understory cover; reductions in riparian corridor widths which may decrease suitability of the habitat and may increase encroachment of nest predators and nest parasites to the interior of the stand.

Hostile landscapes, particularly those in proximity to agricultural and residential areas, may have high density of nest parasites (brown-headed cowbird) and domestic predators (cats), and be subject to high levels of human disturbance.

Recreational disturbances, particularly during nesting season, and particularly in high-use recreation areas.

Increased use of pesticide and herbicides associated with agricultural practices may reduce insect food base.

Out-of-Subbasin Effects and Assumptions

No data could be found on the migration and wintering grounds of the yellow warbler. It is a long-distance migrant and as a result faces a complex set of potential effects during it annual cycle. Habitat loss or conversions is likely happening along its entire migration route (H. Ferguson, WDFW, pers. comm. 2003). Riparian management requires the protection of riparian shrubs and understory and the elimination of noxious weeds. Migration routes, corridors and wintering grounds need to be identified and protected just as its breeding areas. In addition to loss of habitat, the yellow warbler, like many wetland or riparian associated birds, faces increased pesticide use in the metropolitan areas, especially with the outbreak of mosquito born viruses like West Nile Virus.

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6.3.10 American Beaver

American Beaver (Castor Canadensis) K. Paul, USFWS.

Distribution

In Oregon, the American beaver can be found in suitable habitats throughout the state (Verts and Carraway 1998).

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). Streams with rocky bottoms through steep terrain and more subject to wide fluctuations in water levels are less suitable to beavers. In large lakes with broad expanses subject to extensive wave action, beavers usually are restricted to protected inlets (Verts and Carraway 1998).

Harvest

Harvest of beavers in Oregon between 1969 and 1992 per 1,000 hectares in Union and Wallowa Counties were <1 and 1-10 respectively (ODFW, annual reports, cited in Verts and Carraway 1998).

Diet

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). Bulbous roots of aquatic species also may be eaten in winter (Beer 1942, cited in Verts and Carraway 1998). Beavers cut mostly deciduous trees such as cottonwood, will, alder, maple, and birch, but in some regions, coniferous species may be used (Jenkins 1979, cited in Verts and Carraway 1998).

In southeastern Oregon, riparian-zone trees have been reduced or eliminated in many areas by browsing herbivores. However, comparison of growth of red willow (*Salix lasiandra*) in an area inaccessible to cattle but occupied by beavers with that in an area inaccessible to both cattle and beavers, indicated that beavers were not responsible for the deterioration. Although beavers harvested 82% of available stems annually, they cut them at a season after growth was completed and reserves were translocated to roots. Subsequent growth of cut willows increase exponentially in relation to the proportion of the stems cut by beavers (Kindschy 1985, cited in Verts and Carraway 1998).

Habits

Beavers, because of their ability to fell trees, dam streams (and irrigation ditches), 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).

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6.3.11 Columbia Spotted Frog

Columbia Spotted Frog (*Rana luteiventris*). Keith Paul, USFWS, La Grande, Oregon.

Introduction

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). The hind legs are relatively short relative to body length and there is extensive webbing between the toes on the hind feet. The eyes are upturned (Amphibia Web 2004). Tadpoles are black when small, changing to a dark then light brown as they increase in size. 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).

Columbia Spotted Frog Life History, Key Environmental Correlates, and Habitat Requirements

Life History

Diet

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).

In a study by Whitaker et al. (1982) in Grant County, OR (Blue Mountains) CSFs 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.

Reproduction

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).

Adults exhibit a strong fidelity to breeding sites, with oviposition typically occurring in the same areas in successive years. Males arrive first, congregating around breeding sites, periodically vocalizing "advertisement calls" in a rapid series of 3-12 "tapping" notes that have little carrying power (Davidson 1995; Leonard et al. 1996). As a female enters the breeding area, she is approached by and subsequently pairs with a male in a nuptial embrace referred to as amplexus. From several hours to possibly days later, the female releases her complement of eggs into the water while the male, still clinging to the female, releases sperm upon the ova (Amphibia Web 2004). Breeding is explosive (as opposed to season-long), occurring only in the first few weeks following emergence (USFWS 2002a). After breeding is completed, adults often disperse into adjacent wetland, riverine and lacustrine habitats (Amphibia Web 2004).

CSF's have a strong tendency to lay their eggs communally and it is not uncommon to find 25 or more egg masses piled atop one another in the shallows (Amphibia Web 2004). Softball-sized egg masses are usually found in groups, typically along northeast edges of slack water amongst emergent vegetation (USFWS 2002a). After a few weeks thousands of small tadpoles emerge and cling to the remains of the gelatinous egg masses. Newly-hatched larvae remain clustered for several days before moving throughout their natal site (USFWS 2002a). In the Columbia Basin tadpoles may grow to 100 mm (4 in) total length prior to metamorphosing into froglets in their first summer or fall. At high-elevation montane sites, however, tadpoles barely reach 45 mm (1.77 in) in total length prior to the onset of metamorphosis in late fall (Amphibia Web 2004). As young-of-the-year transform, many leave their natal sites and can be found in nearby riparian corridors (USFWS 2002a).

Females may lay only one egg mass per year; yearly fluctuations in the sizes of egg masses are extreme (Utah Division of Wildlife Resources 1998). Successful egg production and the viability and metamorphosis of CSF's are susceptible to habitat variables such as temperature, depth, and pH of water, cover, and the presence/absence of predators (e.g., fishes and bullfrogs) (Morris and Tanner 1969; Munger et al. 1996; Reaser 1996).

Migration

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).

In a three-year study of R. luteiventris movement within the Owyhee Mountain subpopulation of the Great Basin population in southwestern Idaho, Engle (2000) PIT-tagged over 1800 individuals but documented only five (of 468) recaptures over 1,000 m (3,281 ft) from their original capture point. All recaptures were along riparian corridors and the longest distance between capture points was 1,765 m (5,791). Although gender differences were observed, 88 percent of all movement documented was less than 300 m (984 ft) from the original capture point (NatureServe 2003).

Though movements exceeding 1 km (0.62 mi) and up to 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).

In the Toiyabe Range in Nevada, Reaser (2000) captured 887 individuals over three years, with average mid-season density ranging from 2 to 24 frogs per 150 m (492 ft) of habitat (NatureServe 2003).

Mortality

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).

Habitat Requirements
General

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).

Breeding

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 (Cares spp.) and rushes (Juncus spp.) (Amphibia Web 2004).

Columbia Spotted Frog Population and Distribution

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 (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.

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 and the southeastern Washington 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. Their habitat in the Blue and Wallowa Mountains is more like that of the Northern population (montane) than the Great Basin (high desert). Until more genetic work is completed, this account will refer to the Blue and Wallowa Mountain populations as part of the Northern DPS.

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 eastern Oregon, Owyhee, and the Jarbidge-Independence occur in the Columbia River subbasin.

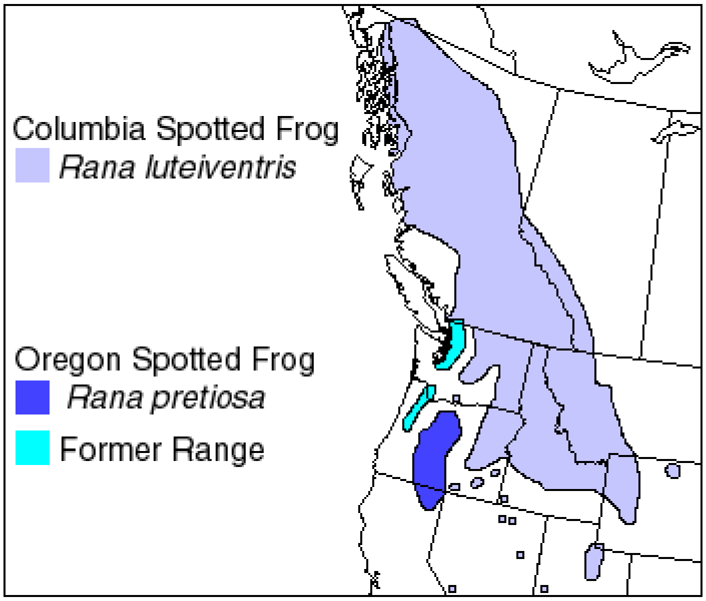
Historic

The historic range of the spotted frog includes Alaska, California, Idaho, Montana, Nevada, Oregon, Utah, Washington, Wyoming, and Alberta and British Columbia, Canada (Turner and Dumas 1972, Nussbaum et al. 1983, Hovingh 1986).

In Alaska, the historic distribution was restricted to southeast Alaska (Hodge 1976). Historic distributions in California include the Warner Mountains in Modoc County and a few locations in Lassen and Siskiyou County (Storer 1925). In Idaho, the historic range primarily occurred in the northern and central part of the state, where it is still considered common (Dumas 1964, 1966; Nussbaum et al. 1983), with scattered populations in the southwestern portion of the state. In Montana, the historical distribution occurred in the intermountain region of western Montana and extended east to the Rocky Mountain Front (Black 1969). The historical distribution in Nevada consisted of the north-central region of the state. In Oregon, spotted frogs were reported to have occurred throughout much of the state (Dumas 1966, Shay 1973, Marshall 1992). In Utah between 1930 and 1977, spotted frogs where recorded from 25 locations in Sanpete, Juab, Utah, Salt Lake, Wasatch, and Summit Counties and various locations along the western Utah/Nevada border (Utah Department of Natural Resources 1991). In Washington, spotted frogs were historically abundant throughout western Washington, including the Cascades and portions of eastern Washington. In Wyoming, the historical range included the northwest part of the state. In Canada, the spotted frog was historically found throughout British Columbia and the western edge of Alberta (USFWS 1992).

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.

Current



USGS, Northern Prairie Wildlife Research Center; range acquired from Green et al. 1997.

Wasatch Front DPS

Spotted frog populations in Utah represent the southern extent of the species range (Stebbins 1985). The Wasatch Front population occurs in isolated springs or riparian wetlands in Juab, Sanpete, Summit, Utah, and Wasatch counties in Utah. These counties are located within the Bonneville Basin of Utah. The Bonneville Basin encompasses the area that was covered by ancient Lake Bonneville and which, today, lies within the Great Basin province. The largest known concentration is currently in the Heber Valley; the remaining six locations are Jordanelle/Francis, Springville Hatchery, Holladay Springs, Mona Springs Complex/Burraston Ponds, Fairview, and Vernon (USFWS 2002b).

West Desert DPS

The West Desert spotted frog population occurs mainly in four large spring complexes. One new population, Vernon, was recently discovered in the eastern-most portion of the West Desert geographic management unit (GMU). CSFs in the West Desert DPS can be found along the eastern border of White Pine County, NV and Toole County, Utah. Populations have been extirpated from the northern portions of the West Desert range (USFWS 2002b).

Northern DPS

The Northern DPS includes northeastern Oregon, eastern Washington, central and northern parts of Idaho, western Montana, northwestern Wyoming, British Columbia and Alaska (J. Engle, C. Mellison, pers. comm., 2004). Populations within the Blue and Wallowa Mountains are found within this DPS.

Great Basin DPS

Nevada

The Great Basin population of Columbia spotted frogs in Nevada is geographically separated into three distinct subpopulations; the Jarbidge-Independence Range, Ruby Mountains, and Toiyabe Mountains subpopulations (USFWS 2002c).

The largest of Nevada's three subpopulation areas is the Jarbidge-Independence Range in Elko and Eureka counties. This subpopulation area is formed by the headwaters of streams in two major hydrographic basins. The South Fork Owyhee, Owyhee, Bruneau, and Salmon Falls drainages flow north into the Snake River basin. Mary's River, North Fork of the Humboldt, and Maggie Creek drain into the interior Humboldt River basin. The Jarbidge-Independence Range subpopulation is considered to be genetically and geographically most closely associated with Columbia spotted frogs in southern Idaho (Reaser 1997)(USFWS 2002c).

Columbia spotted frogs occur in the Ruby Mountains in the areas of Green Mountain, Smith, and Rattlesnake creeks on lands in Elko County managed by the U.S. Forest Service (Forest Service). Although geographically, Ruby Mountains spotted frogs are close to the Jarbidge-Independence Range subpopulation, preliminary allozyme evidence suggests they are genotypically different (J. Reaser, pers. comm., 1998). The Ruby Mountains subpopulation is considered discrete because of this difference (J. Reaser, pers. comm., 1998) and because it is geographically isolated from the Jarbidge-Independence Range subpopulation area to the north by an undetermined barrier (e.g., lack of suitable habitat, connectivity, and/or predators), and from the Toiyabe Mountains subpopulation area to the southwest by a large gap in suitable Humboldt River drainage habitat (USFWS 2002c).

In the Toiyabe Range, spotted frogs are found in seven drainages in Nye County, Nevada; the Reese River (Upper and Lower), Cow and Ledbetter Canyons, and Cloverdale, Stewart, Illinois, and Indian Valley Creeks. Although historically they also occurred in Lander County, preliminary surveys have found them absent from this area (J. Tull, Forest Service, pers. comm., 1998). Toiyabe Range spotted frogs are geographically isolated from the Ruby Mountains and Jarbidge-Independence Range subpopulations by a large gap in suitable habitat and they represent R. luteiventris in the southern-most extremity of its range. Genetic analyses of Great Basin Columbia spotted frogs from the Toiyabe Range suggest that these frogs are distinctive in comparison to frogs from the Ruby Mountains and Jarbidge-Independence Range subpopulation areas (Green et al. 1996, 1997; J. Reaser, pers. comm., 1998). Genetic (mtDNA) differences between the Toiyabe Range frogs and the Ruby Mountains frogs are less than those between the Toiyabe Range frogs and the Jarbidge-Independence Range frogs, but this may be because of similar temporal and spatial isolation (J. Reaser, pers. comm., 1998) (USFWS 2002c).

<u>Idaho and Oregon</u>

Surveys conducted in the Raft River and Goose Creek drainages in Idaho failed to relocate spotted frogs (Reaser 1997; Shipman and Anderson 1997; Turner 1962). In 1994 and 1995, the Bureau of Land Management (BLM) conducted surveys in the Jarbidge and Snake River Resource Areas in Twin Falls County, Idaho. These efforts were also unsuccessful in locating spotted frogs (McDonald 1996). Only six historical sites were known in the Owyhee Mountain range in Idaho, and only 11 sites were known in southeastern Oregon in Malheur County prior to 1995 (Munger et al. 1996) (USFWS 2002c).

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).

Columbia Spotted Frog Population, Status, and Abundance Trends

Nevada

Declines of Columbia spotted frog populations in Nevada have been recorded since 1962 when it was observed that in many Elko County localities where spotted frogs were once numerous, the species was nearly extirpated (Turner 1962). Extensive loss of habitat was found to have occurred from conversion of wetland habitats to irrigated pasture and spring and stream dewatering by mining and irrigation practices. In addition, there was evidence of extensive impacts on riparian habitats due to intensive livestock grazing. Recent work by researchers in Nevada have documented the loss of historically known sites, reduced numbers of individuals within local populations, and declines in the reproduction of those individuals (Hovingh 1990; Reaser 1996a, 1996b, 1997). Surveys in Nevada between 1994 and 1996 indicated that 54 percent of surveyed sites known to have frogs before 1993 no longer supported individuals (Reaser 1997) (USFWS 2002c).

Little historical or recent data are available for the largest subpopulation area in Nevada, the Jarbidge-Independence Range. Presence/absence surveys have been conducted by Stanford University researchers and the Forest Service, but dependable information on numbers of breeding adults and trends is unavailable. Between 1993 and 1998, 976 sites were surveyed for the presence of spotted frogs in northeastern Nevada, including the Ruby Mountains subpopulation area (Shipman and Anderson 1997; Reaser 2000). Of these, 746 sites (76 percent) that were believed to have characteristics suitable for frogs were unoccupied. For these particular sites there is no information on historical presence of spotted frogs. Of 212 sites that were known to support frogs before 1992, 107 (50 percent) sites no longer had frogs, while 105 sites did support frogs. At the occupied sites, surveyors observed more than 10 adults at only 13 sites (12 percent). Frogs in this area appear widely distributed (Reaser 1997). No monitoring or surveying has taken place in northeastern Nevada since 1998. The Forest Service is planning on surveying the area during the summer of 2002 (USFWS 2002c).

Between 1993 and 1998, 339 sites were surveyed for the presence of Columbia spotted frogs in the Toiyabe Range. Surveyors visited 118 sites (35 percent) with suitable habitat characteristics where no frogs were present. Ten historical frog sites no longer had frogs when surveyed by Reaser between 1993 and 1996 (Reaser 1997). However, at 211 other historical sites, frogs were still present during this survey period. Of these 211 sites, surveyors reported greater than 10 adult frogs at 133 sites (63 percent) (Reaser 1997). In 2000, frog mark-recapture surveys of the Toiyabe Range subpopulation was conducted by the University of Nevada, Reno. Preliminary estimates of frog numbers in the Indian Valley Creek drainage were around 5,000 breeding individuals, which is greater than previously believed (K. Hatch, pers. comm., 2001). However, during the 2000-2001 winter, Hatch (2002) noted a large population decrease, ranging between 66 and 86.5 percent at several sites. Research is currently being conducted to help understand this apparent winterkill. Lack of standardized or extensive monitoring and routine surveying has prevented dependable determinations of frog population numbers or trends in Nevada (USFWS 2002c).

Idaho and Oregon

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).

Legal Status

In 1989, the U.S. Fish and Wildlife Service (USFWS) was petitioned to list the spotted frog (referred to as *Rana pretiosa*) under ESA (Federal Register 54[1989]:42529). The USFWS ruled on April 23, 1993, that the listing of the spotted frog was warranted and designated it a candidate for listing with a priority 3 for the Great Basin population, but was precluded from listing due to higher priority species (Federal Register 58[87]:27260). The major impetus behind the petition was the reduction in distribution apparently associated with impacts from water developments and the introduction of nonnative species.

On September 19, 1997 (Federal Register 62[182]:49401), the USFWS downgraded the priority status for the Great Basin population of Columbia spotted frogs to a priority 9, thus relieving the pressure to list the population while efforts to develop and implement specific conservation measures were ongoing. As of January 8, 2001 (Federal Register 66[5]:1295-1300), however, the priority ranking has been raised back to a priority 3 due to increased threats to the species. This includes the Great Basin DPS Columbia spotted frog populations

Factors Affecting Columbia Spotted Frog Population Status
Key Factors Inhibiting Populations and Ecological Processes

<u>The present or threatened destruction, modification, or curtailment of its habitat or range</u>

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). Beaver trapping is still common in Idaho and harvest is unregulated in most areas (IDFG et al. 1995). 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. Efforts to protect spotted frog habitat on state lands in Idaho have been largely unsuccessful because of lack of cooperation from the State. In northeast Nevada, the

Forest Service has completed three riparian area protection projects in areas where spotted frogs occur. These projects include altering stocking rates or changing the grazing season in two allotments known to have frogs and constructing riparian fencing on one allotment. However, these three sites have not been monitored to determine whether efforts to protect riparian habitat and spotted frogs have been successful. In the Toiyabe Range, a proposal to fence 3.2 kilometers (km) (2 miles (mi)) of damaged riparian area along Cloverdale Creek to protect it from grazing is scheduled to occur in the summer of 2002. In addition to the riparian exclosure, BLM biologists located a diversion dam in 1998 on Cloverdale Creek which was completely de- watering approximately 1.6 km (1 mi) of stream. During the summer of 2000, this area was reclaimed and water was put back into the stream. This area of the stream is not currently occupied by spotted frogs but it is historical habitat (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 or 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 Nevada Division of Wildlife (NDOW) has committed to conducting stomach sampling of stocked nonnative and native species to determine the effects of predation on spotted frogs. However, this commitment will not be fulfilled until the spotted frog conservation agreements are signed. To date, NDOW has not altered fish stocking rates or locations in order to benefit spotted frogs (USFWS 2002c).

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).

Chytrid was confirmed in the Circle Pond site, Idaho, where long term monitoring since 1998 has indicated a general decline in the population (Engle 2002). It is unclear whether the presence of this disease will eventually result in the loss of this subpopulation. Two additional sites may have chytrid, but this has yet to be determined (J. Engle, pers. comm., 2001). Protocols to prevent further spread of the disease by researchers were instituted in 2001. Chytrid has also been found in the Wasatch Columbia spotted frog distinct population segment (K. Wilson, pers comm., 2002). Chytrid has not been found in Nevada populations of spotted frogs (USFWS 2002c).

The inadequacy of 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).

In the fall of 2000, 250 head of cattle were allowed to graze for 45 days on one pasture in the Indian Valley Creek drainage of the Humboldt-Toiyabe National Forest in central Nevada for the first time in 6 years (M. Croxen, pers. comm., 2002). Grazing was not allowed in this allotment in 2001. Recent mark-recapture data indicated that this drainage supports more frogs than previously presumed, potentially around 5,000 individuals (K. Hatch, pers. comm., 2000). Perceived improvements in the status of frog populations in the Indian Valley Creek area may be a result of past removal of livestock grazing. The reintroduction of grazing disturbance into this relatively dense area of frogs has yet to be determined (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).

The southernmost known population of spotted frogs can be found on the BLM San Antone Allotment south of Indian Valley Creek in the Toiyabe Range. Grazing is allowed in this area from November until June (L. Brown, pers. comm., 2002). The season of use is a very sensitive portion of the spotted frog annual life cycle which includes migration from winter hibernacula to breeding ponds, breeding, egg laying and hatching, and metamorphosing of young. Additionally, the riparian Standards and Guidelines were not met in 1996, the last time the allotment was evaluated (USFWS 2002c).

The status of local populations of spotted frogs on Yomba-Shoshone or Duck Valley Tribal lands is unknown. Tribal governments do not have regulatory or protective mechanisms in place to protect spotted frogs (USFWS 2002c).

The Nevada Division of Wildlife classifies the spotted frog as a protected species, but they are not afforded official protection and populations are not monitored. Though the spotted frog is on the sensitive species list for the State of Idaho, this species is not given any special protection by the State. 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 manmade factors affecting its continued existence
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 (see Factor A for additional information). 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).

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6.3.12 Great Blue Heron

Great Blue Heron (*Ardea herodias*). Paul Ashley and Stacey Stovall. 2004. Southeast Washington Subbasin Planning Ecoregion Wildlife Assessment.

Introduction

The great blue heron (*Ardea herodias*) is the largest, most widely distributed, and best known of the American herons (Henny 1972). Great blue herons occur in a variety of habitats from freshwater lakes and rivers to brackish marshes, lagoons, mangrove areas, and coastal wetlands (Spendelow and Patton in prep.).

Great Blue Heron Life History, Key Environmental Correlates, and Habitat Requirements

Life History

Diet

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). Fish up to about 20 cm in length dominated the diet of herons foraging in southwestern Lake Erie (Hoffman 1978). Ninety-five percent of the fish eaten in a Wisconsin study were 25 cm in length (Kirkpatrick 1940).

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 southeast Washington, blue herons are often seen hunting along rivers and streams. In the winter months they are often seen hunting rodents in alfalfa fields (P. Fowler, WDFW, pers. comm.. 2003).

Reproduction

The great blue heron typically breeds during the months of March - May in its northern range and November through April in the southern hemisphere. The nest usually consists of an egg clutch between 3-7 eggs, with clutch size increasing from south to north. Chicks fledge at about two months.

Nesting

Great blue herons normally nest near the tree tops. Usually, nests are about 1 m in diameter and have a central cavity 10 cm deep with a radius of 15 cm. This internal cavity is sometimes lined with twigs, moss, lichens, or conifer needles. Great blue herons are inclined to renest in the same area year after year. Old nests may be enlarged and reused (Eckert 1981).

The male gathers nest-building materials around the nest site, from live or dead trees, from neighboring nests, or along the ground, and the female works them into the nest. Ordinarily, a pair takes less than a week to build a nest solid enough for eggs to be laid and incubated. Construction continues during almost the entire nesting period. Twigs are added mostly when the eggs are being laid or when they hatch. Incubation, which is shared by both partners, starts with the laying of the first egg and lasts about 28 days. Males incubate during the days and females at night.

Herons are particularly sensitive to disturbance while nesting. Scientists suggest as a general rule that there should be no development within 300 m of the edge of a heron colony and no disturbance in or near colonies from March to August.

Mortality

The great blue heron lives as long as 17 years. The adult birds have few natural enemies. Birds of prey occasionally attack them, but these predators are not an important limiting factor on the heron population. Draining of marshes and destruction of wetland habitat is the most serious threat. The number of herons breeding in a local area is directly related to the amount of feeding habitat.

Mortality of the young is high: both the eggs and young are preyed upon by crows, ravens, gulls, birds of prey, and raccoons. Heavy rains and cold weather at the time of hatching also take a heavy toll. Pesticides are suspected of causing reproductive failures and deaths, although data obtained up to this time suggest that toxic chemicals have not caused any decline in overall population levels.

Habitat Requirements

Minimum Habitat Area

Minimum habitat area is defined as the minimum amount of contiguous habitat that is required before a species will live and reproduce in an area. 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).

Foraging

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 potential foraging area needs to be free from human disturbances several hours a day while the herons are feeding. Suitable great blue heron foraging areas are those in which there is no human disturbance near the foraging zone during the four hours following sunrise or preceding sunset or the foraging zone is generally about 100m from human activities and habitation or about 50m from roads with occasional, slow-moving traffic.

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 average distance from heronries to inlets was 7.0 to 8.0 km. The average distance of heronries to possible feeding areas (lakes 140 ha in area) varied from 0 to 4.2 km and averaged 1.8 km on the Chippewa National Forest in Minnesota (Mathisen and Richards 1978). Collazo (1981) reported the distance from the nearest feeding grounds to a heronry site as 0.4 and 0.7 km. 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, usually 150m deep (Bent 1926; Meyerriecks 1960; Bayer 1978).

Thompson (1979b) reported that great blue herons along the Mississippi River commonly foraged in water containing emergent or submergent vegetation, in scattered marshy ponds, sloughs, and forested wetlands away from the main channel. He noted that river banks, jetties, levees, rip-rapped banks, mudflats, sandbars, and open ponds were used to a lesser extent. Herons near southwestern Lake Erie fed intensively in densely vegetated areas (Hoffman 1978).

Other studies, however, have emphasized foraging activities in open water (Longley 1960; Edison Electric Institute 1980). Exposed mud flats and sandbars are particularly desirable foraging sites at low tides in coastal areas in Oregon (Bayer 1978), North Carolina (Custer and Osborn 1978), and elsewhere (Kushlan 1978). Cooling ponds (Edison Electric Institute 1980) and dredge spoil settling ponds (Cooper *et al.* in prep.) also are used extensively by foraging great blue herons.

Water

The great blue heron routinely feeds on soft animal tissues from an aquatic environment, which provides ample opportunity for the bird to satisfy its physiological requirements for water.

Cover

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.

Reproduction

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. The suitability of potential heronries diminishes as their distance from current or former heronry sites increases because herons develop new heronries in suitable vegetation close to old heronries.

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). Most great blue heron colonies along the Atlantic coast are located in riparian swamps (Ogden 1978). Most colonies along the northern Gulf coast are in cypress - tupelo (*Taxodium Nyssa*) swamps (Portnoy 1977). Spendelow and Patton (in prep.) state that many birds in coastal Maine nest on spruce (*Picea spp*.) trees on islands. Spruce trees also are used on the Pacific coast (Bayer 1978), and black cottonwood (*Populus trichocarpa*) trees frequently are used as nest sites along the Willamette River in Oregon (English 1978). Miller (1943) stated that the type of tree was not as important as its height and distance from human activity. Dead trees are commonly used as nest sites (McAloney 1973). Nests usually consist of a platform of sticks, sometimes lined with smaller twigs (Bent 1926; McAloney 1973), reed stems (Roberts 1936), and grasses (Cottrille and Cottrille 1958).

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).

Great Blue Heron Population and Distribution

Population

Historic

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. 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.

In southeast Washington, few historical colonies have been reported. The Foundation Island colony is the oldest, but has been taken over by cormorants. It appears blue herons numbers in the colony have declined significantly.

One colony was observed from a helicopter in 1995 on the Touchet River just upriver from Harsha, but that colony appears to have been destroyed by a wind storm (trees blown down), and no current nesting has been observed in the area (Fowler per. com.)

Current

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

In southeast Washington, three new colonies have been discovered over the last few years. One colony on the Walla Walla River contains approximately 24 nests. This colony has been active for approximately 12 years. Two new colonies were discovered in 2003, one on a railroad bridge over the Snake River at Lyons Ferry, and one near Chief Timothy Park on the Snake River. The Lyons Ferry colony contained approximately 11 nests, and the Chief Timothy colony 5 nests (P. Fowler, WDFW, personal communication, 2003).

Distribution

Two known heron rookeries occur within the Walla Walla subbasin, one on the Walla Walla and one on the Touchet River (NPPC 2001). The Walla Walla River rookery contains approximately 13 active nests. The Touchet River rookery contains approximately 8-10 active nests. Blue herons are observed throughout the lowlands of southeast Washington near rivers or streams (P. Fowler, WDFW, personal communication, 2003).

Historic

No data are available.

Current

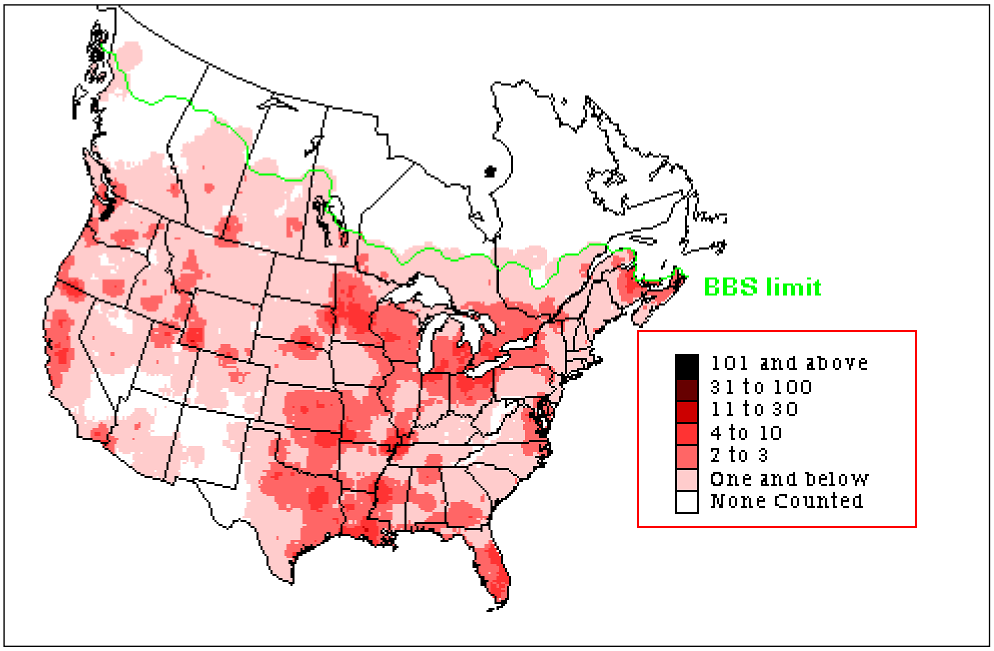

Figure 39. Great blue heron summer distribution from Breeding Bird Survey (BBS) data (Sauer *et al.* 2003).

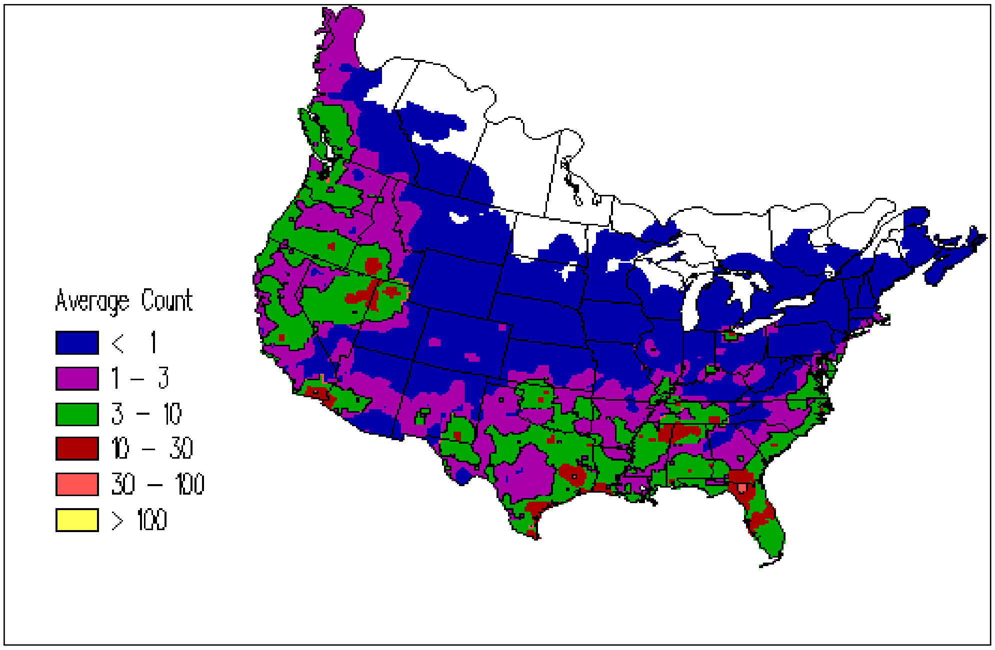

Figure 40Great blue heron breeding distribution from Breeding Bird Survey (BBS) data (Sauer *et al.* 2003).

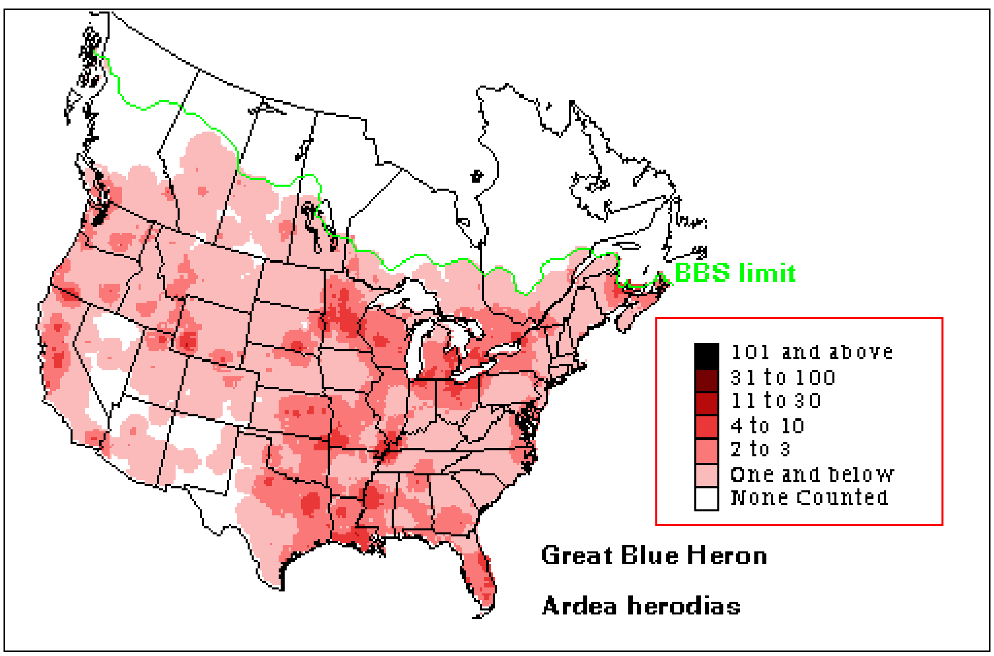

Figure 41. Great blue heron winter distribution from Christmas Bird Count (CBC) data (Sauer *et al.* 2003).

Great Blue Heron Status and Abundance Trends

Status

Surveys of blue heron populations are not conducted. However, populations appear to be stable and possibly expanding in some areas. Two new nesting colonies have been found in on the Lower Snake River (P. Fowler, WDFW, personal communication, 2003).

Trends

Populations in southeast Washington appear to be stable, and may actually be increasing.

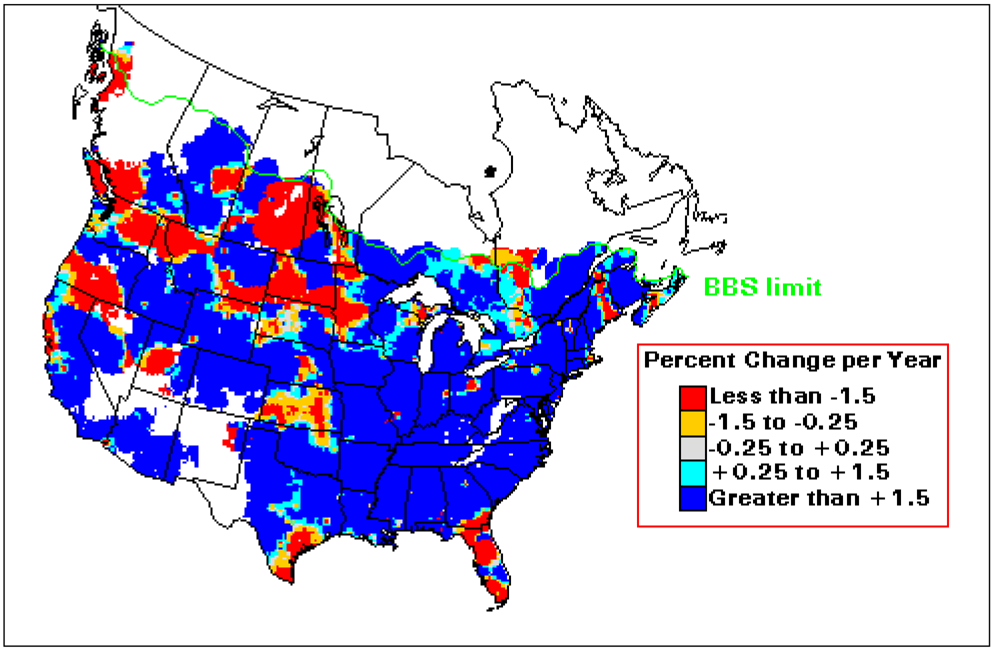

Figure 42. Great blue heron Breeding Bird Survey (BBS) trend results: 1966-1996 (Sauer *et al.* 2003).

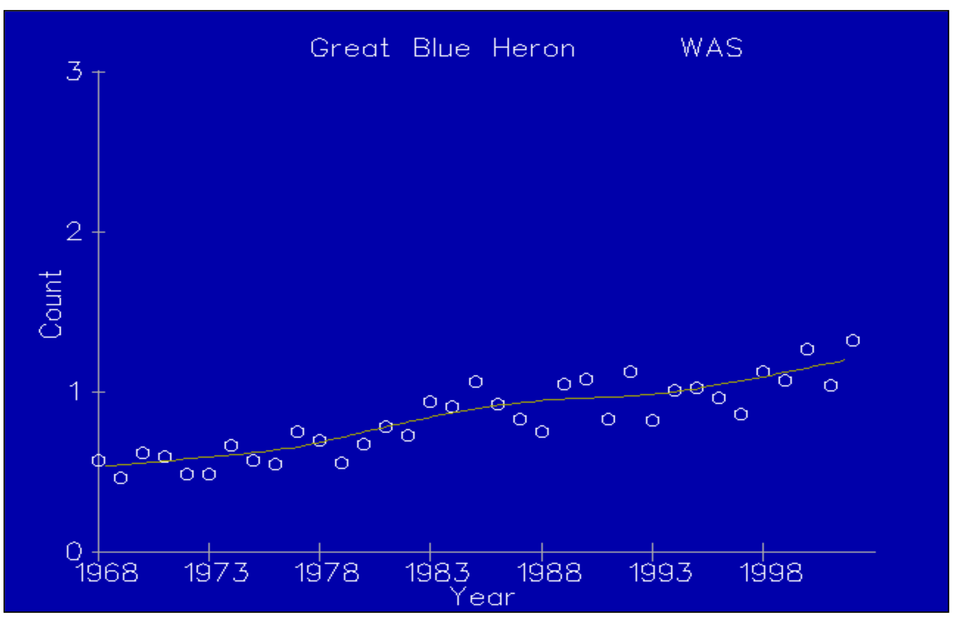

Figure 43. Great blue heron Breeding Bird Survey (BBS) Washington trend results: 1966-2002 (Sauer *et al.* 2003).

Factors Affecting Great Blue Heron Population Status

Key Factors Inhibiting Populations and Ecological Processes

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).

Habitat Loss

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 o f 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.

Water Quality

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.

Human Disturbance

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.

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6.3.13 Ruffed Grouse

Ruffed Grouse (*Bonasa umbellus*). Keith Paul, USFWS, La Grande, Oregon.

Introduction

The ruffed grouse (RG) is distributed throughout deciduous and coniferous forest of North America but is most abundant in early-successional forests dominated by aspens and poplars (*Populus spp.*) (Rusch et al 2000). The distinctive RG is found singly in woods (Sibley 2000).

The RG is named for a series of black iridescent feathers on the sides of the neck called the ruff, which is erected by males to form an umbel-shaped ring around the neck during courtship displays (Pelren 2003). Both sexes are mottled in rich brown, black, and white (Pelren 2003). Two color morphs occur, with some intermediates (Pelren 2003, Rusch et al. 2000). Gray birds have tails barred with alternating banks of black and gray, whereas red birds have tails banded with black and rust (Pelren 2003, Rusch et al. 2000). Most RG in western Oregon are red, while most in eastern Oregon are gray although both morphs can exist in mixed broods on both sides of the state (Pelren 2003).

The male RG's display consists of a series of accelerating, muffed thumps, produced by beating wings rapidly while standing, that sound like a distant motor starting. This low-pitched "drumming" is often felt rather than heard. Both sexes give clucking notes and higher squeal when alarmed (Sibley 2000).

Life History, Key Environmental Correlates, and Habitat Requirements

Life History

Diet

RG 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 are a major winter food in Oregon, but where aspen is limited RG may also feed on alder, willow, birch, dogwood, hawthorn, and others (Pelren 2003). Ferns and other ground-level evergreen plants are also utilized during winter (Durbin 1979). Newly hatched young are feed primarily insects and spiders (Csuti et al. 1997).

Reproduction

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). A single drumming log is often used throughout the life of a RG, and many have been used by numerous successive generations (Pelren 2003). Visual displays may include upright strutting, a "bowing" movement, and a rush sequence (Hjorth 1970). Sullivan (1992) described an observation of a display in the Wallowa Mountains as "rattlesnake" behavior due to the rattle-like sound of the tail following the rush sequence (Pelren 2003).

RG are polygamous. After copulation, the female seeks a nest site (Pelren 2003), typically at the base of a tree, stump, or boulder (Rusch et al. 2000). Nests can also be found in deadfalls and brushpiles, in the base of hollowed, partially opened stump, or at the base of multiple-stem shrubs; sometimes nest may be by itself without any object nearby (Johnsgard and Maxson 1989, Rusch et al. 2000). RG prefer nest sites in hardwood stands and stands that are fairly open at ground level (Johnsgard and Maxson 1989). Nests are rarely found in dense vegetation. Some nests are found in wet and brushy habitat (Maxson 1977, Rusch et al. 2000). Nests are shallow depressions lined with feathers (Pelren 2003).

Eggs are laid at a rate of two per three days with an average clutch size of 11. Incubation begins after the last egg is laid and usually lasts 23-24 days. Chicks usually hatch in early to mid-June, and gain flight in approximately two weeks. During the summer RG, and particularly broods, frequent habitat with dense invertebrate populations, such as logging roads or other disturbed locations with herbaceous growth (Pelren 2003).

Breeding Territory/Home Range

On average, male RG 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. Females tend to have a smaller home range when they have eggs or chicks.

Survivorship

Average annual survival rates of adult males rangewide is about 34% but varies by age class, region, habitat, and phase of population cycle (Rusch et al. 2000). A study conducted in the Appalachians by Haulton (1999), showed that survival was lowest in the first week after hatching with a high incidence of total brood loss (38%). Survival was 13.5% five weeks after hatching and 7% ten weeks after hatching.

Mortality

RG are rarely found dead from exposure, disease, or starvation (Rusch et al. 2000). Predation, including hunting by humans, is the largest source of mortality (Rusch et al. 2000). In Wisconsin, out of 563 radio-tagged grouse, 29.8% were killed by hunters, 46.2% were killed by hawks and owls, and 20.4% were killed by small mammals (Rusch et al. 2000).

Habitat Requirements

RG 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).

Spring habitat for males include their "drumming" log or elevated surface, frequently located in mid-successional deciduous stands, often with conifer and dense understory components (Johnsgard 1983, Pelren 2003).

Nesting habitat is often found in mid-aged deciduous or mixed deciduous-conifer habitat (Johnsgard 1983).

Population and Distribution

Distribution

In the western United States, the RG is a resident of the coastal and Cascade mountains of western Washington, Oregon, and northwest California, and the Rocky Mountains of eastern Washington and Oregon, northern Idaho, western Montana, and Wyoming, and northeast Utah (Pelren 2003). There are small populations in northeast Nevada and western North Dakota and South Dakota (Pelren 2003).

In Oregon, RG 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). The RG is not known to inhabit the riparian or aspen stands of southeast Oregon desert regions (Pelren 2003).

Population

Historic

There is no historic population data for RG.

Current Population 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). Populations in some states exhibit 10-year cycles of alternating abundance and relative scarcity (Johnsgard 1983); insufficient data exist on cyclic fluctuations in Oregon (Pelren 2003).

Factors Affecting Population Status

Timber harvest can actually help improve RG 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). Currently, the outlook for RG in Oregon is positive (Pelren 2003).

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6.4 Appendix 4: QHA Output Tables

Table 32. Current Habitat Ratings for Bull Trout and Redband trout in the Powder River subbasin, Oregon.

Reach Name	Description	Not Rated	Riparian Condition	Channel stability	Habitat Diversity	Fine sediment	High Flow	Low Flow	Oxygen	Low Temperature	High Temperature	Pollutants	Obstructions	Reach Confidence
Powder-1	From mouth at Snak		0.0	0.0	1.0	0.0	1.0	0.0	1.0	4.0	1.0	1.0	0.0	2
Daly Cr	Entire Daly Cr water		3.0	3.0	3.5	3.0	3.0	2.0	4.0	4.0	2.5	3.5	3.0	1.5
Eagle Cr-1	From mouth of Eagl		2.0	2.0	2.5	3.0	2.0	1.5	2.5	4.0	2.5	3.0	2.0	1.5
Eagle Cr 2	Bernard Creek to Lit		2.5	3.0	3.0	3.0	3.0	1.5	3.0	4.0	3.0	3.5	2.0	1.5
Little Eagle Cr	Entire Little Eagle C		3.5	3.0	3.5	3.0	3.5	2.5	4.0	4.0	3.5	4.0	3.0	1.5
Eagle Cr-3	From Little Eagle to		3.5	3.0	4.0	3.0	4.0	3.0	4.0	4.0	4.0	4.0	3.0	1.5
Eagle Cr EF	Entire Eagle Cr EF v		3.5	3.5	3.5	3.0	3.5	3.0	4.0	4.0	4.0	4.0	3.0	1.5
Eagle Cr WF	Entire Eagle Cr WF		3.5	3.0	4.0	3.0	4.0	3.0	4.0	4.0	4.0	4.0	3.0	1.5
Eagle Cr-4	Entire Eagle Cr wate		3.0	3.0	3.5	3.0	4.0	3.5	4.0	4.0	4.0	4.0	3.0	1.5
Powder-2	From Eagle Cr to Go		2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.0	2.0	2.0	3.5	1.5
Love Cr	Entire Love Cr water		2.0	2.5	2.5	2.5	2.5	2.0	4.0	4.0	2.0	3.5	2.5	1.5
Goose Cr-1	Goose Creek to Cot		2.5	2.0	2.5	2.0	2.0	1.5	3.0	4.0	1.5	3.5	1.5	1.5
Goose Cr-2	Cottonwood Creek U		3.0	3.0	3.0	2.0	3.5	1.5	4.0	4.0	2.5	3.5	2.0	1.5
Powder-3	From Goose Cr to H		1.5	2.0	1.5	2.0	3.0	1.5	2.0	4.0	1.5	1.5	2.0	1.5
Ritter Cr	Entire Ritter Cr wate		1.5	1.5	1.5	1.5	1.5	1.5	2.0	4.0	1.5	1.5	1.5	1.5
Balm-1	To Slide Creek, inclu		3.0	2.5	3.0	2.0	3.0	2.0	3.0	4.0	2.0	2.0	2.0	1.5
Balm-2	Above Slide Creek		3.5	3.5	3.5	3.5	4.0	2.5	4.0	4.0	3.0	4.0	1.0	1.5
Clover Cr	Entire Clover Cr wat		2.5	2.0	2.5	2.0	2.0	1.0	3.0	4.0	1.5	3.5	1.5	1.5
Ruckles Cr	Entire Ruckles Cr wa		1.5	1.5	1.5	1.5	1.5	1.5	2.0	4.0	1.5	1.5	1.5	1.5
Tucker Cr	Entire Tucker Cr wa		2.5	2.0	2.5	2.0	2.0	1.0	3.0	4.0	1.5	3.5	1.5	1.5
Powder-4	From Highway 203 t		3.5	3.5	3.5	2.5	3.5	2.0	3.5	4.0	2.0	3.5	1.5	1.5
Big Cr-1	From mouth to Beag		3.5	3.5	3.5	3.0	3.5	2.5	4.0	4.0	2.0	4.0	2.5	1.5
Beagle Cr	Entire Beagle Cr wa		2.5	2.5	2.5	2.5	2.5	2.5	2.5	4.0	3.0	2.5	2.5	0.5
Big Cr-2	From Beagle Cr to L		2.5	2.5	2.5	2.5	2.5	2.0	2.5	4.0	3.0	4.0	2.0	1
Big Cr-3	Big Cr watershed ab		3.5	3.5	3.5	3.0	3.5	3.0	4.0	4.0	3.5	4.0	3.0	1
Powder-5	Thief Valley Reservo		3.5	3.5	3.5	2.5	3.5	2.0	3.5	4.0	2.0	3.5	1.5	1.5
Powder-6	End of Thief Valley R		1.5	0.0	0.0	0.0	3.0	3.0	2.0	4.0	2.5	2.5	0.0	2
Antelope Cr	Entire Antelope Cr w		2.5	2.5	2.5	2.5	2.5	2.0	3.0	4.0	2.0	2.5	2.0	0.25
Jimmy Cr-1	From mouth of Jimm		1.5	2.0	2.5	2.0	2.5	2.0	3.0	4.0	2.0	2.5	0.0	0.5
Jimmy Cr-2	Entire Jimmy Cr wat		2.0	2.0	2.5	2.5	2.5	2.0	3.0	4.0	2.0	3.0	2.5	0.5
Wolf Cr-1	From mouth Wolf Cr		1.5	3.0	2.0	2.5	3.0	2.0	2.0	4.0	2.0	4.0	2.0	1
Wolf Cr-2	Entire Wolf Cr water		3.5	3.5	3.5	3.0	3.5	3.0	4.0	4.0	3.5	4.0	3.0	1.25
Powder NF-1	From mouth of NF to		3.0	3.0	3.0	2.5	3.0	1.0	4.0	4.0	1.5	4.0	1.0	1.5
Hot Cr (Warm Spr	Entire Hot Cr waters		1.0	2.0	2.0	2.0	3.0	2.0	4.0	4.0	2.0	3.5	1.5	1.25
Anthony Cr-1	From mouth Anthon		3.0	3.5	3.5	3.0	3.5	1.5	4.0	4.0	3.0	4.0	1.5	1.5
Anthony Cr-2 inclu	Entire Anthony Cr wa		3.5	3.0	3.5	3.0	3.5	3.0	4.0	4.0	3.0	4.0	1.5	1.5
Powder NF-2	From Anthony Cr to		3.0	3.0	2.0	3.0	3.5	1.5	4.0	4.0	2.0	4.0	1.5	1.5
Powder NF-3	Entire Powder NF w		3.5	3.5	3.5	3.5	3.5	3.0	4.0	4.0	3.5	4.0	4.0	1.5
Powder-7	From Powder NF to		1.0	1.5	2.0	1.5	3.0	2.0	4.0	4.0	2.0	2.0	2.5	1.5
Muddy Creek-1	Big and little muddy creek below		1.0	1.5	1.0	1.0	2.5	2.0	1.0	4.0	2.0	1.0	1.0	1.5
Muddy Creek-2	Big and little muddy creek above		3.0	3.0	3.5	3.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	1.5
Rock Cr-1	Mouth to town of Ro		2.0	2.5	2.0	2.5	3.0	2.5	4.0	4.0	2.0	4.0	2.0	1.25
Rock Cr-2	Above town of Rock		4.0	3.5	3.5	3.5	3.5	3.5	4.0	4.0	3.5	4.0	4.0	1.5
Willow Cr-1	Willow and Tribs bel		2.0	2.5	2.0	2.0	3.0	0.0	1.0	4.0	1.0	4.0	0.0	1.5
Willow Cr-2	Willow and Tribs ab		3.0	3.0	2.5	3.5	3.5	3.5	4.0	4.0	3.0	4.0	4.0	1.5
Salmon Cr-1	From mouth of Salm		1.0	1.0	1.0	1.0	2.0	0.0	1.0	3.0	1.0	1.0	0.0	1.5
Pine Creek-1	In Salmon Cr Below		1.0	1.0	1.0	1.0	2.0	0.0	1.0	3.0	1.0	1.0	0.0	1.5
Pine Creek-2	Above Williams Ditc		3.0	3.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	1.5
Gee Creek-1 (Pin	Below Nelson Ditch		1.0	1.0	1.0	1.0	2.0	0.0	1.0	3.0	1.0	1.0	0.0	1.5
Gee Creek-2 (Pin	Above Nelson Ditch		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	1.5
Salmon Cr-2	Pine to Goodrich		1.0	1.0	1.0	1.0	2.0	0.0	1.0	3.0	1.0	1.0	0.0	1.5
Goodrich-1	Downstream of Nels		1.0	1.0	1.0	1.0	2.0	0.0	1.0	3.0	1.0	1.0	0.0	1.5
Goodrich-2	Upstream of Nelson		2.0	2.5	2.5	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	1.5
Salmon Cr-3	Goodrich to Pond at		1.0	1.0	1.0	1.0	2.0	0.0	1.0	3.0	1.0	1.0	0.0	1.5

Current Habitat Ratings Continued.

Mill Creek-1	Below Nelson Ditch		1.0	1.0	1.0	1.0	2.0	0.0	1.0	3.0	1.0	1.0	0.0	1.5
Mill Creek-2 (abov	Above Nelson Ditch		4.0	4.0	4.0	4.0	4.0	2.5	4.0	4.0	4.0	4.0	3.0	1.5
Marble Creek Sys	Below 5400' level (Baker City wat		1.0	1.0	1.0	1.0	2.0	0.0	1.0	3.0	1.0	1.0	0.0	1.5
Marble Creek Sys	Above 5400' level (Baker City wat		2.5	2.5	4.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	1.5
Salmon Cr-4	Upstream of Pond a		2.5	2.5	4.0	2.5	4.0	4.0	4.0	4.0	4.0	4.0	4.0	1.5
Old Settlers Sloug	From mouth of Settl		1.0	3.0	2.0	1.0	2.0	1.0	1.0	4.0	1.0	1.0	1.0	1.25
Baldock Slough	From mouth of Bald		2.0	3.0	2.0	1.0	3.0	2.5	2.0	4.0	1.0	2.0	2.0	1.25
Sutton Cr/Ebell Cr	Entire Sutton Cr wat		2.0	1.5	1.8	1.5	2.0	2.0	4.0	4.0	2.0	4.0	1.5	1.5
Powder-8	Sutton Creek to Stic		2.5	3.0	3.0	3.0	3.0	2.5	4.0	4.0	2.5	4.0	1.3	1.5
Beaver Cr	Entire Beaver Cr wa		3.0	2.5	2.5	3.0	3.5	1.5	4.0	4.0	2.0	4.0	1.5	1.5
Powder-9	From Stices Gulch t		2.0	3.0	2.5	3.0	3.5	2.0	2.5	4.0	3.0	4.0	3.5	1.5
Powder-10	From Mason Dam to		1.5	0.0	1.0	0.0	3.0	3.0	4.0	4.0	2.5	3.5	0.0	1.5
Deer Creek-1	Deer Creek to Babo		2.5	2.5	3.0	3.0	2.0	2.0	4.0	4.0	2.5	4.0	2.0	1.5
Deer Creek-2	From and including Baboon Cree		3.0	3.5	3.5	2.0	3.0	2.5	4.0	4.0	3.0	4.0	3.0	1.5
Denny, Dean, Litt	Southern Tribs of Mason Reser		3.0	3.0	3.0	2.0	2.5	3.0	4.0	4.0	2.0	4.0	4.0	1.5
Miners-Smith-Br	North tribs of Mason Reservoir		3.0	3.0	3.0	2.0	3.0	2.5	4.0	4.0	3.0	4.0	3.0	1.5
Powder-11	From dredge tailings		1.0	1.0	1.5	2.5	3.0	1.0	4.0	4.0	2.5	4.0	1.5	1.5
Sawmill, Huckleb	Sawmill, Huckleberry Gulch in u		3.0	3.0	3.0	3.0	3.0	0.0	4.0	4.0	2.5	4.0	0.0	1.5
Cracker Cr-1	To confluence with L		2.0	2.0	2.0	2.5	2.0	3.5	4.0	4.0	3.5	4.0	4.0	1.5
Cracker Cr-2	Above confluence with Little Crac		3.5	3.0	3.5	3.0	3.5	2.0	4.0	4.0	4.0	4.0	2.0	1.5
McCully Cr	Entire McCully Cr wa		3.0	3.0	3.0	3.5	3.5	3.5	4.0	4.0	4.0	4.0	4.0	1.5

Table 33. Reference Habitat Ratings for bull trout and redband trout in the Powder River subbasin, Oregon.

Powder-1	ead of Brownlee reservoir.	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	2.5	4.0	4.0	1.0
Daly Cr	t 1.66 mile of Howell Ditch.	4.0	4.0	4.0	3.5	4.0	3.5	4.0	4.0	3.0	4.0	4.0	1.0
Eagle Cr-1	ek, including Bernard Creek	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	3.5	4.0	4.0	1.0
Eagle Cr 2	rnard Creek to Little Eagle	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	1.0
Little Eagle Cr	Little Eagle Cr watershed.	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	1.0
Eagle Cr-3	Eagle Cr WF including tribs.	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0
Eagle Cr EF	ire Eagle Cr EF watershed.	4.0	4.0	4.0	3.5	4.0	4.0	4.0	4.0	4.0	4.0	3.0	1.0
Eagle Cr WF	t 1.25 mile of Phillips Ditch.	4.0	4.0	4.0	3.5	4.0	4.0	4.0	4.0	4.0	4.0	3.0	1.0
Eagle Cr-4	ershed above WF Eagle Cr.	4.0	4.0	4.0	3.5	4.0	4.0	4.0	4.0	4.0	4.0	3.0	1.0
Powder-2	From Eagle Cr to Goose Cr	3.0	4.0	4.0	3.5	4.0	3.0	4.0	4.0	3.0	4.0	4.0	1.0
Love Cr	Entire Love Cr watershed.	3.5	3.0	3.5	3.5	3.5	3.0	4.0	4.0	3.0	4.0	4.0	1.0
Goose Cr-1	onwood, include Cottonwood	4.0	4.0	4.0	3.5	4.0	3.5	4.0	4.0	3.5	4.0	4.0	1.0
Goose Cr-2	ottonwood Creek Upstream	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	3.5	4.0	4.0	1.0
Powder-3	Cr to Highway 203 crossing	4.0	4.0	4.0	3.5	4.0	3.5	4.0	4.0	3.5	4.0	4.0	1.0
Ritter Cr	Basche, and Perkins Ditch).	4.0	3.0	4.0	3.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	1.0
Balm-1	Creek, including Slide creek	4.0	3.5	4.0	3.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	1.0
Balm-2	Above Slide Creek	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	3.5	4.0	4.0	1.0
Clover Cr	Entire Clover Cr watershed.	4.0	4.0	4.0	3.5	4.0	3.5	4.0	4.0	3.5	4.0	4.0	1.0
Ruckles Cr	(Duncan and Basche Ditch).	4.0	3.0	4.0	3.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	1.0
Tucker Cr	st 0.25 mile of Erwin Ditch.	4.0	4.0	4.0	3.5	4.0	3.5	4.0	4.0	3.5	4.0	4.0	1.0
Powder-4	lley Dam including all tribs.	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	1.0
Big Cr-1	rom mouth to Beagle Creek	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	3.5	4.0	4.0	1.0
Beagle Cr	Entire Beagle Cr watershed.	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	1.0
Big Cr-2	From Beagle Cr to Lick Cr	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0
Big Cr-3	1.0 mile of Trout Cr Ditch.	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0
Powder-5	Thief Valley Reservoir	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	1.0
Powder-6	Reservoir to North Powder	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	1.0
Antelope Cr	ire Antelope Cr watershed.	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	0.5
Jimmy Cr-1	Jimmy Cr to Jimmy Cr Rsv.	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	0.5
Jimmy Cr-2	upstream of Jimmy Cr Rsv.	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	0.5
Wolf Cr-1	hat cross HUC6 boundaries.	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	1.0
Wolf Cr-2	nes and Shaw Brant Ditch).	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0
Powder NF-1	hat cross HUC6 boundaries.	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0
Hot Cr (Warm Springs	hat cross HUC6 boundaries.	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	3.5	4.0	4.0	1.0
Anthony Cr-1	at cross HUC6 boundaries .	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0
Anthony Cr-2 includes N	Cr NF includes North Fork.	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0
Powder NF-2	immy Creek including tribs.	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0
Powder NF-3	ershed above Jimmy Creek	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0
Powder-7	Sutton Creek (Baker City)	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	3.5	4.0	4.0	1.0
Muddy Creek-1	y creek below foothill road	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	3.5	4.0	4.0	1.0
Muddy Creek-2	y creek above foothill road	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	3.5	4.0	4.0	1.0
Rock Cr-1	outh to town of Rock Creek	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	3.5	4.0	4.0	1.0
Rock Cr-2	Above town of Rock Creek	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0
Willow Cr-1	d Tribs below Wilcox Ditch	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	3.5	4.0	4.0	1.0
Willow Cr-2	d Tribs above Wilcox Ditch	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0
Salmon Cr-1	uth of Salmon Cr to Pine Cr	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	3.5	4.0	4.0	1.0
Pine Creek-1	non Cr Below Williams Ditch	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	3.5	4.0	4.0	1.0
Pine Creek-2	Above Williams Ditch	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0
Gee Creek-1 (Pine syste	Below Nelson Ditch	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	3.5	4.0	4.0	1.0
Gee Creek-2 (Pine syste	Above Nelson Ditch	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0
Salmon Cr-2	Pine to Goodrich	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	3.5	4.0	4.0	1.0
Goodrich-1	ownstream of Nelson Ditch	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	3.5	4.0	4.0	1.0
Goodrich-2	Upstream of Nelson Ditch	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0
Salmon Cr-3	h to Pond at 3800' contour	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	3.5	4.0	4.0	1.0

Reference Habitat Ratings Continued.

Mill Creek-1	200 ft) includes Little Mill	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	3.5	4.0	4.0	1.0
Mill Creek-2 (above Ne	n Ditch includes Little Mill	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0
Marble Creek System-1	l (Baker City water intake)	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	3.5	4.0	4.0	1.0
Marble Creek System-2	l (Baker City water intake)	2.5	2.5	4.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0
Salmon Cr-4	n of Pond at 3800' contour	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0
Old Settlers Slough	to Powder R including tribs.	4.0	4.0	4.0	3.0	4.0	3.5	4.0	4.0	3.5	4.0	4.0	1.0
Baldock Slough	hat cross HUC6 boundaries.	4.0	4.0	3.0	3.0	4.0	3.5	4.0	4.0	3.5	3.0	4.0	1.0
Sutton Cr/Ebell Cr	Does not include Ebell Cr.	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	3.5	4.0	4.0	1.0
Powder-8	utton Creek to Stices Gulch	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	3.5	4.0	4.0	1.0
Beaver Cr	ntire Beaver Cr watershed.	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	3.5	4.0	4.0	1.0
Powder-9	Stices Gulch to Mason Dam	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	3.5	4.0	4.0	1.0
Powder-10	and McEwen Valley Ditch).	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	3.5	4.0	4.0	1.0
Deer Creek-1	aboon Creek, includes Alder	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	4.0	4.0	4.0	1.0
Deer Creek-2	d including Baboon Creek up	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	1.0
Denny, Dean, Little Dea	n Tribs of Mason Reservoir	4.0	4.0	4.0	3.0	4.0	3.0	4.0	4.0	3.5	4.0	4.0	1.0
Miners-Smith-Bridge-U	h tribs of Mason Reservoir	4.0	4.0	4.0	3.5	4.0	3.0	4.0	4.0	3.5	4.0	4.0	1.0
Powder-11	hat cross HUC6 boundaries.	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	3.5	4.0	4.0	1.0
Sawmill, Huckleberry G	erry Gulch in upper Powder	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0
Cracker Cr-1	fluence with Little Cracker	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0
Cracker Cr-2	Little Cracker, includes LC	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0
McCully Cr	ntire McCully Cr watershed.	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0

Table 34. Protection and Restoration habitat rankings for redband trout in the Powder River subbasin, Oregon.

NPC= Not present currently

NPR = Not present in reference condition

	Protection Habitat Ranking											Restoration Habitat Ranking											
Reach Name	Reach Rank	Riparian Condition	Channel stability	Habitat Diversity	Fine sediment	High Flow	Low Flow	Oxygen	Low Temperature	High Temperature	Pollutants	Obstructions	Reach Rank	Riparian Condition	Channel form	Channel complexity	Fine sediment	High Flow	Low Flow	Oxygen	Low Temperature	High Temperature	Pollutants	Obstructions
Powder-1	75	6	6	5	6	2	6	2	1	6	2	6	17	7	4	6	9	1	8	1	10	10	1	5
Daly Cr	15	5	4	3	6	8	9	1	7	10	2	11	42	4	2	6	7	3	1	10	10	9	5	8
Eagle Cr-1	52	8	7	4	3	6	9	2	5	11	1	10	16	5	1	6	9	3	4	2	11	10	7	8
Eagle Cr 2	46	8	5	5	7	3	10	2	4	9	1	11	25	3	5	5	7	4	1	2	11	10	9	8
Little Eagle Cr	7	4	5	3	8	6	9	1	10	7	1	11	55	5	2	4	3	6	1	8	8	8	8	7
Eagle Cr-3	10	4	5	3	9	7	8	1	10	6	1	11	48	4	1	6	2	6	3	6	6	6	6	5
Eagle Cr EF	20	5	3	3	9	6	8	1	10	7	1	11	63	4	2	2	5	6	1	7	7	7	7	7
Eagle Cr WF	32	4	5	3	9	5	7	1	10	8	1	11	70	3	1	5	4	5	2	5	5	5	5	5
Eagle Cr-4	13	7	5	3	9	8	4	1	10	6	1	11	49	2	1	3	4	6	5	6	6	6	6	6
Powder-2	72	8	4	4	7	1	9	1	10	11	1	4	19	7	4	4	6	3	8	1	9	10	1	11
Love Cr	54	7	3	3	6	8	9	1	5	10	2	11	66	1	8	2	4	3	5	10	10	7	6	9
Goose Cr-1	44	6	7	4	8	5	9	2	3	10	1	11	22	6	1	3	4	2	5	7	11	8	9	10
Goose Cr-2	30	6	3	3	9	5	10	1	7	8	2	11	43	5	3	3	2	9	1	10	10	6	7	8
Powder-3	53	8	4	7	6	1	9	2	3	11	5	10	11	4	5	3	7	8	6	2	11	10	1	9
Ritter Cr	67	6	4	4	7	8	9	2	1	10	3	11	38	4	6	2	7	5	8	3	11	9	1	10
Balm-1	40	6	7	3	8	2	9	1	4	10	5	11	28	7	3	3	6	5	8	2	11	9	1	10
Balm-2	22	5	3	3	7	6	8	1	9	10	1	11	68	5	3	3	6	8	1	8	8	7	8	2
Clover Cr	45	6	7	4	8	5	9	2	3	10	1	11	21	6	1	4	5	2	3	7	11	8	9	10
Ruckles Cr	67	6	4	4	7	8	9	2	1	10	3	11	38	4	6	2	7	5	8	3	11	9	1	10
Tucker Cr	57	6	7	4	8	5	9	2	3	10	1	11	31	5	1	4	6	3	2	7	11	8	10	9
Powder-4	26	7	4	4	8	3	9	1	6	10	1	11	36	10	8	8	2	7	1	4	11	6	4	3
Big Cr-1	29	6	4	4	8	3	9	1	7	10	1	11	57	7	4	4	1	6	3	9	9	2	9	8
Beagle Cr	38	5	3	3	10	9	6	1	7	8	1	11	26	5	3	3	8	7	6	1	11	10	1	9
Big Cr-2	34	5	3	3	9	8	10	2	6	7	1	11	33	5	3	3	7	6	2	1	10	8	10	9
Big Cr-3	36	5	3	3	9	7	6	1	10	8	1	11	67	5	3	3	2	6	1	9	9	7	9	8
Powder-5	26	7	4	4	8	3	9	1	6	10	1	11	36	10	8	8	2	7	1	4	11	6	4	3
Powder-6	70	6	8	8	8	1	5	3	4	7	2	8	15	7	1	1	3	8	9	4	11	10	6	5
Antelope Cr	48	8	5	5	4	7	9	1	2	10	3	11	45	6	3	3	2	5	8	7	11	9	1	10
Jimmy Cr-1	50	9	7	4	6	5	8	1	2	10	3	11	35	1	3	6	4	5	9	8	11	10	2	7
Jimmy Cr-2	51	8	7	5	4	6	9	2	1	10	2	11	44	2	1	4	3	5	8	6	11	9	6	10
Wolf Cr-1	56	9	3	7	6	2	8	5	4	10	1	11	32	2	5	3	4	6	7	1	10	9	10	8
Wolf Cr-2	19	5	3	3	6	7	10	1	8	9	1	11	64	5	3	3	1	6	2	9	9	7	9	8
Powder NF-1	39	8	5	5	7	3	9	1	4	10	1	11	20	7	4	4	3	8	1	9	9	2	9	6
t Cr (Warm Springs Creek)	58	9	5	5	5	3	8	1	4	10	2	11	61	1	2	2	2	5	6	10	10	9	8	7
Anthony Cr-1	33	8	4	4	7	3	9	1	6	10	1	11	41	2	6	6	3	8	1	9	9	4	9	5
y Cr-2 includes North Fork	23	4	5	3	7	6	8	1	9	10	1	11	60	6	1	5	2	7	3	9	9	4	9	8
Powder NF-2	35	7	6	8	5	4	9	1	3	10	1	11	27	5	4	1	6	8	2	9	9	3	9	7
Powder NF-3	1	5	3	3	6	7	8	1	10	9	1	11	59	4	2	2	5	6	1	8	8	7	8	8
Powder-7	47	10	6	5	7	3	8	1	2	9	4	11	12	2	3	5	4	7	6	10	10	8	1	9
Muddy Creek-1	55	9	3	8	7	2	6	4	1	10	4	11	9	5	6	3	4	7	8	1	11	10	1	9
Muddy Creek-2	9	7	6	3	8	4	5	1	9	10	1	11	69	2	1	4	3	6	11	6	6	5	6	6
Rock Cr-1	42	8	6	7	5	4	9	1	3	10	1	11	29	2	3	1	4	5	6	9	9	7	9	8
Rock Cr-2	4	3	4	4	6	7	9	1	8	10	1	11	72	7	1	1	5	4	3	7	7	6	7	7
Willow Cr-1	49	7	4	6	5	3	10	8	2	9	1	10	13	5	6	3	4	9	2	1	10	8	10	7
Willow Cr-2	14	5	4	9	3	6	8	1	7	10	1	11	56	3	2	1	7	6	5	8	8	4	8	8
Salmon Cr-1	59	8	6	6	5	2	10	3	1	9	3	10	1	7	3	3	5	8	6	1	11	10	1	9
Pine Creek-1	59	8	6	6	5	2	10	3	1	9	3	10	1	7	3	3	5	8	6	1	11	10	1	9

Protection and Restoration Rankings – redband trout, Continued.

Pine Creek-2	6	7	6	3	8	4	5	1	9	10	1	11	71	2	1	5	3	5	5	5	5	5	5	4
Gee Creek-1 (Pine system)	59	8	6	6	5	2	10	3	1	9	3	10	1	7	3	3	5	8	6	1	11	10	1	9
Gee Creek-2 (Pine system)	2	5	3	3	6	7	8	1	9	10	1	11	74	1	1	1	1	1	1	1	1	1	1	1
Salmon Cr-2	59	8	6	6	5	2	10	3	1	9	3	10	1	7	3	3	5	8	6	1	11	10	1	9
Goodrich-1	59	8	6	6	5	2	10	3	1	9	3	10	1	7	3	3	5	8	6	1	11	10	1	9
Goodrich-2	16	10	8	8	5	3	4	1	6	7	1	11	54	1	2	2	4	5	5	5	5	5	5	5
Salmon Cr-3	59	8	6	6	5	2	10	3	1	9	3	10	1	7	3	3	5	8	6	1	11	10	1	9
Mill Creek-1	59	8	6	6	5	2	10	3	1	9	3	10	1	7	3	3	5	8	6	1	11	10	1	9
above Nelson Ditch 4200')	3	5	3	3	6	7	10	1	8	9	1	11	73	3	3	3	3	3	1	3	3	3	3	2
Marble Creek System-1	59	8	6	6	5	2	10	3	1	9	3	10	1	7	3	3	5	8	6	1	11	10	1	9
Marble Creek System-2	8	10	9	3	6	4	5	1	7	8	1	11	74	1	1	1	1	1	1	1	1	1	1	1
Salmon Cr-4	11	9	8	3	10	4	5	1	6	7	1	11	65	2	1	4	3	4	4	4	4	4	4	4
Old Settlers Slough	73	8	1	3	7	2	9	5	4	11	5	10	23	3	8	4	7	5	6	1	11	10	1	9
Baldock Slough	74	8	2	5	10	1	6	3	7	11	3	9	47	2	5	5	3	7	10	1	11	8	4	9
Sutton Cr/Ebell Cr	31	6	8	5	7	4	9	1	3	10	1	11	18	5	1	3	2	4	6	9	9	8	9	7
Powder-8	24	7	3	3	6	5	9	1	8	10	1	11	40	1	3	3	6	2	7	9	9	8	9	5
Beaver Cr	43	6	7	7	5	3	9	1	4	10	1	11	50	4	2	2	5	8	1	9	9	6	9	7
Powder-9	71	7	2	5	4	3	9	5	8	10	1	11	24	2	5	3	6	7	4	1	10	8	10	9
Powder-10	41	7	9	8	9	4	3	1	5	6	2	9	10	4	1	3	2	6	9	10	10	8	7	5
Deer Creek-1	18	7	6	3	5	8	9	1	4	10	1	11	34	3	2	5	7	1	4	9	9	6	9	8
Deer Creek-2	12	5	3	3	10	7	8	1	6	9	1	11	46	3	6	6	1	4	2	8	8	5	8	8
, Little Dean, Clear Creeks	28	5	3	3	8	9	7	1	6	10	1	11	52	4	2	2	5	1	7	7	7	5	7	7
ers-Smith-Bridge-Union Cr	25	5	3	3	8	7	10	1	6	8	1	11	51	4	2	2	1	5	6	9	9	7	9	8
Powder-11	37	9	8	7	5	3	10	1	4	6	1	11	14	2	1	3	5	6	4	9	9	8	9	7
erry Gulch in upper Powder	69	7	5	5	4	8	10	1	3	9	1	10	62	6	3	3	8	7	1	9	9	2	9	3
Cracker Cr-1	17	8	5	5	7	10	3	1	9	4	1	11	30	3	1	1	5	4	6	8	8	7	8	8
Cracker Cr-2	21	4	5	3	8	7	9	1	10	6	1	11	53	5	2	4	3	7	1	8	8	8	8	6
McCully Cr	5	6	4	4	8	9	3	1	10	7	1	11	58	3	1	1	5	6	4	7	7	7	7	7
	NPC												NPR											

Table 35. . Protection and Restoration habitat rankings for bull trout in the Powder River subbasin, Oregon.

NPC= Not present currently

NPR = Not present in reference condition

	Protection Habitat Ranking												Restoration Habitat Ranking											
Reach Name	Reach Rank	Riparian Condition	Channel stability	Habitat Diversity	Fine sediment	High Flow	Low Flow	Oxygen	Low Temperature	High Temperature	Pollutants	Obstructions	Reach Rank	Riparian Condition	Channel form	Channel complexity	Fine sediment	High Flow	Low Flow	Oxygen	Low Temperature	High Temperature	Pollutants	Obstructions
Powder-1	NPC												14	7	5	9	8	2	6	2	10	10	2	1
Daly Cr	NPC												NPR											
Eagle Cr-1	NPC												30	7	5	8	9	1	2	4	10	10	6	3
Eagle Cr 2	NPC												19	2	5	8	7	4	1	3	11	10	9	6
Little Eagle Cr	NPC												47	4	2	6	3	5	1	8	8	8	8	7
Eagle Cr-3	NPC												27	4	1	6	2	6	3	6	6	6	6	5
Eagle Cr EF	NPC												44	2	3	4	5	6	1	7	7	7	7	7
Eagle Cr WF	NPC												48	3	1	5	4	5	2	5	5	5	5	5
Eagle Cr-4	NPC												54	1	2	5	4	6	3	6	6	6	6	6
Powder-2	NPC												32	7	4	6	9	1	5	1	10	11	1	8
Love Cr	NPC												NPR											
Goose Cr-1	NPC												43	6	4	7	7	1	3	5	10	10	9	2
Goose Cr-2	NPC												35	3	3	6	2	9	1	10	10	8	7	5
Powder-3	NPC												22	5	4	8	9	7	3	2	10	10	1	6
Ritter Cr	NPC												NPR											
Balm-1	NPC												NPR											
Balm-2	NPC												NPR											
Clover Cr	NPC												NPR											
Ruckles Cr	NPC												NPR											
Tucker Cr	NPC												NPR											
Powder-4	NPC												39	8	7	9	3	4	2	4	10	10	4	1
Big Cr-1	NPC												53	6	5	7	3	4	2	8	8	8	8	1
Beagle Cr	NPC												33	3	4	8	5	6	7	1	11	9	1	10
Big Cr-2	NPC												21	2	4	6	5	7	3	1	10	8	10	9
Big Cr-3	NPC												56	3	4	5	1	7	2	8	8	5	8	8
Powder-5	NPC												13	7	1	4	5	8	9	3	11	10	6	2
Powder-6	NPC												25	7	5	8	6	4	2	1	11	10	3	9
Antelope Cr	NPC												NPR											
Jimmy Cr-1	NPC												NPR											
Jimmy Cr-2	NPC												NPR											
Wolf Cr-1	NPC												37	2	7	3	6	4	8	1	9	9	9	5
Wolf Cr-2	3	3	4	5	8	7	10	1	6	9	1	11	40	3	4	6	1	5	2	9	9	7	9	8
Powder NF-1	NPC												16	6	6	8	4	5	1	9	9	2	9	3
t Cr (Warm Springs Creek)	NPC												51	1	2	3	3	5	6	9	9	9	8	7
Anthony Cr-1	NPC												28	2	6	7	4	8	1	9	9	3	9	5
y Cr-2 includes North Fork	7	3	5	6	7	4	9	1	7	10	1	11	36	5	1	7	2	6	3	9	9	4	9	8
Powder NF-2	9	5	5	8	5	4	9	1	1	10	1	10	17	4	5	2	6	7	1	9	9	3	9	8
Powder NF-3	1	3	4	7	6	5	9	1	8	10	1	11	45	2	3	6	5	4	1	8	8	7	8	8
Powder-7	NPC												15	1	3	5	4	7	6	10	10	9	2	8
Muddy Creek-1	NPC												7	3	5	6	4	7	8	1	11	10	1	9
Muddy Creek-2	8	3	6	5	8	4	9	1	7	10	1	11	52	2	1	4	3	6	11	6	6	5	6	6
Rock Cr-1	NPC												26	1	2	3	4	5	6	9	9	7	9	8
Rock Cr-2	NPC												50	7	1	4	5	3	2	7	7	6	7	7
Willow Cr-1	NPC												10	3	5	6	4	7	2	1	10	9	10	8
Willow Cr-2	NPC												41	2	2	1	7	6	5	8	8	4	8	8
Salmon Cr-1	NPC												11	5	3	6	8	7	4	1	10	11	1	9
Pine Creek-1	NPC												1	3	4	8	5	7	6	1	10	9	1	11

Protection and Restoration Rankings – bull trout, Continued.

Pine Creek-2	2	4	6	3	8	5	9	1	7	10	1	11		49	1	1	5	3	5	5	5	5	5	5	4
Gee Creek-1 (Pine system)	NPC													NPR											
Gee Creek-2 (Pine system)	NPC													NPR											
Salmon Cr-2	NPC													11	5	3	6	8	7	4	1	10	11	1	9
Goodrich-1	NPC													2	3	4	8	5	7	6	1	11	10	1	9
Goodrich-2	NPC													38	1	2	3	4	5	5	5	5	5	5	5
Salmon Cr-3	NPC													2	3	4	8	5	7	6	1	11	10	1	9
Mill Creek-1	NPC													2	3	4	8	5	7	6	1	11	10	1	9
above Nelson Ditch 4200')	NPC													55	3	3	3	3	3	1	3	3	3	3	2
Marble Creek System-1	NPC													2	3	4	8	5	7	6	1	11	10	1	9
Marble Creek System-2	NPC													57	1	1	1	1	1	1	1	1	1	1	1
Salmon Cr-4	5	6	8	3	10	4	7	1	5	9	1	11		46	1	1	4	3	4	4	4	4	4	4	4
Old Settlers Slough	NPC													8	3	9	5	7	6	4	1	11	8	1	10
Baldock Slough	NPC													18	2	6	7	3	8	9	1	11	5	4	10
Sutton Cr/Ebell Cr	NPC													NPR											
Powder-8	NPC													29	2	4	6	7	3	5	9	9	8	9	1
Beaver Cr	NPC													NPR											
Powder-9	NPC													23	2	5	4	6	7	3	1	10	9	10	8
Powder-10	NPC													6	3	1	4	2	6	9	10	10	8	7	5
Deer Creek-1	NPC													20	2	3	7	6	1	4	9	9	5	9	8
Deer Creek-2	6	4	3	5	8	7	10	1	6	8	1	11		31	3	6	7	1	4	2	8	8	5	8	8
ı, Little Dean, Clear Creeks	NPC													NPR											
ers-Smith-Bridge-Union Cr	NPC													NPR											
Powder-11	NPC													9	1	1	4	5	6	3	9	9	8	9	7
erry Gulch in upper Powder	NPC													NPR											
Cracker Cr-1	NPC													24	1	2	4	5	3	6	8	8	7	8	8
Cracker Cr-2	4	3	5	8	4	7	10	1	6	9	1	11		42	1	2	3	6	5	4	7	7	7	7	7
McCully Cr	NPC													34	4	2	7	3	6	1	8	8	8	8	5
	NPC													NPR											