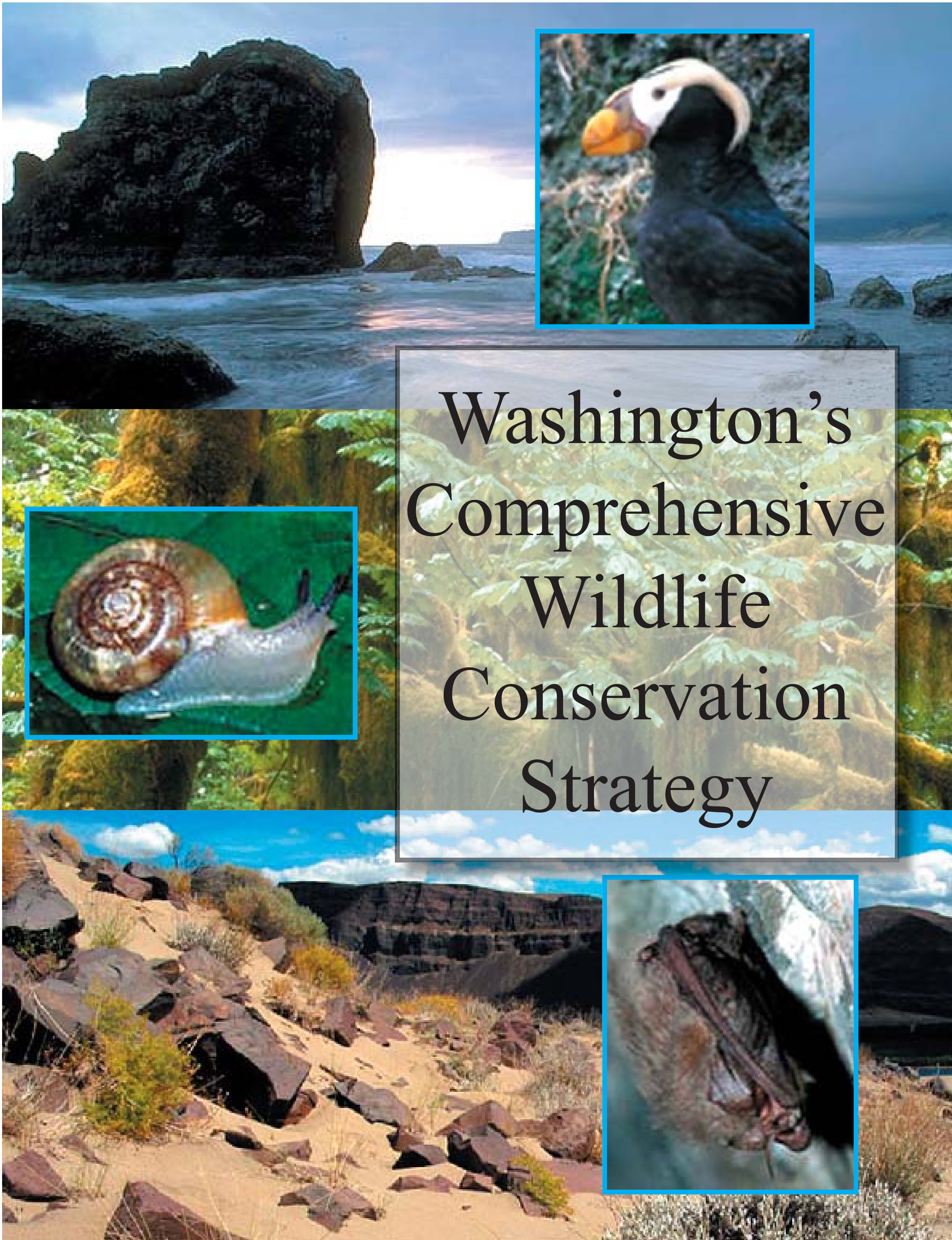

Washington's Comprehensive Wildlife Conservation Strategy

WASHINGTON'S COMPREHENSIVE WILDLIFE CONSERVATION STRATEGY

FINAL DRAFT

Submitted
September 19, 2005

Washington Department of FISH AND WILDLIFE

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ACKNOWLEDGMENTS

Development of the Washington Comprehensive Wildlife Conservation Strategy (CWCS) was a collaborative effort involving many policy advisors and technical experts from within the Department of Fish and Wildlife, as well as other public agencies and private conservation and business organizations. We want to acknowledge and thank the following organizations and individuals for their assistance in completing this large project:

<u>Washington Department of Fish and Wildlife (WDFW) Personnel</u>

Development of the CWCS was a high priority for WDFW, and many technical experts from the agency were enlisted to help with its development. Wildlife taxa experts from both Olympia headquarters staff and WDFW's six administrative regions participated in agency workshops to rank fish and wildlife species for the Species of Greatest Conservation Need list, as well as various other parts of the CWCS. Other technical staff, as well as fish, habitat and wildlife managers from around the state, were consulted in reviewing the discussions of species and habitats, problems and conservation actions, especially at the ecoregional scale. WDFW regional directors and regional wildlife staff also assisted in setting up and conducting public meetings around the state in June, 2005. Many of the WDFW staff who helped with developing the Species of Greatest Conservation Need list are included in Appendix 11; many of the regional meetings with WDFW staff are included in Appendix 15.

<u>Natural Heritage Program, Washington Department of Natural Resources</u>

Technical advice and hands-on assistance provided by managers and staff of the Washington Natural Heritage Program staff was invaluable in developing the CWCS. We consulted with WNHP staff throughout the CWCS process and they helped us in many ways, from participating in ranking wildlife species for the Species of Greatest Conservation Need list to helping us compare and crosswalk various habitat classification systems for the CWCS. We also want to acknowledge the importance of DNR documents as major sources of information for the CWCS, including the *Washington Natural Heritage Plan*, *Our Changing Nature* and *Changing Our Water Ways*. These documents were consulted early and continually throughout the development of the CWCS. Because the Washington Natural Heritage was Plan updated in 2003 and again in 2005, the plan provides an excellent summary of current problems affecting wildlife habitat, native plants, and other elements of biodiversity, at both statewide and ecoregional scales. Because it is beautifully designed and illustrated, the Natural Heritage Plan was also an inspiration to WDFW staff to try produce a CWCS document that is attractive and readable for the public.

<u>CWCS Advisory Committee</u>

This advisory committee was made up of representatives from other state and federal agencies, as well as business and stakeholder groups with an interest in helping WDFW develop the Washington CWCS. The committee met on an ad hoc basis in 2004 and 2005 and advised WDFW staff on various issues related to the CWCS. We especially want to thank The Nature Conservancy of Washington and Defenders of Wildlife for their intense level of involvement and their interest in helping us develop the best possible comprehensive wildlife strategy. We also appreciate the time spent by members of WDFW's standing Game, Wildlife Diversity, and Lands Management citizen advisory committees in meeting with WDFW staff and reviewing the draft CWCS. A list of these advisory committees is included as Appendix 11; a running account of our various meetings and planning workshops is included in Appendix 15.

I. INTRODUCTION AND BACKGROUND

A. Comprehensive Wildlife Conservation Strategy

Background

Since the 1970s, the Washington Department of Fish and Wildlife (WDFW) has gone through a significant evolution. Its overall mission has expanded from primarily managing the harvest of game and commercial fish and shellfish species, to the protection and management of all fish and wildlife species and their habitats. The regulation of hunting and fishing remains an important role of WDFW and the Fish and Wildlife Commission. Growing public interest in the protection and enjoyment of all wildlife species, plus the advent of laws such as the federal Endangered Species Act, has caused WDFW to become broader in its management scope and much more concerned with the protection and management of essential habitat and biodiversity than it was 30 years ago. Across the nation as well as in Washington, state wildlife agencies have shifted program emphasis and available funding to meet these new demands.

In 1980, WDFW published its first Nongame Wildlife (now Diversity) Plan and hired its first nongame wildlife biologists. In 1980, Congress also recognized this shift in public awareness and interest in broader wildlife programs by passing the Fish and Wildlife Conservation Act, also known as the "Nongame Act". This act authorized financial and technical assistance to the states for the development, revision and implementation of conservation plans and programs for nongame fish and wildlife. However, federal funding to assist with conservation of non-hunted wildlife lagged far behind resource needs and public demand, and it was not until 1994 that the states collectively approached Congress with a serious proposal to provide matching funds to conserve all those species and their habitats not covered by previous funding programs for game and commercial species.

In 1998, the International Association of Fish and Wildlife Agencies (IAFWA), in partnership with WDFW and other state wildlife agencies, initiated Teaming With Wildlife, a national campaign to document the need for additional wildlife funding and secure a reliable source of federal matching funds for species and habitat conservation. The original source of revenue investigated for the campaign was a new federal excise tax on outdoor equipment, similar to taxes imposed on fishing tackle and firearms and administered by the U.S. Fish and Wildlife Service. However, in 1999 the Teaming with Wildlife campaign became part of a much larger effort to restore and expand funding from offshore oil and gas revenues for a range of conservation, outdoor recreation and historic preservation programs. Although this expanded effort, the Conservation and Reinvestment Act of 1999 (CARA) was not passed by Congress as proposed, it did result in significant additional funds from the federal budget for certain programs such as a new State Wildlife Grant (SWG) program to assist state wildlife agencies with the conservation of species and habitats of greatest conservation need.

The first Congressional SWG appropriations were made in 2001, and both planning and implementation grants have been made to state wildlife agencies since that first appropriation. Funds are allocated according to a formula based on the size and population of each state.

All State Wildlife Grants funded by Congress are predicated on the completion and acceptance of state Comprehensive Wildlife Conservation Strategies (CWCS) by October 2005. Acceptance of the Washington CWCS by the U.S. Fish and Wildlife Service will satisfy the funding requirements of the current planning grants and establish eligibility for further funding of Washington wildlife conservation programs under the SWG program.

Eight Essential Elements

To meet the requirements for future State Wildlife Grants, state Comprehensive Wildlife Conservation Strategies must adequately address eight essential elements established by Congress. This Washington Comprehensive Wildlife Conservation Strategy meets or exceeds the requirements of these eight essential elements:

Element 1. Include information on the distribution and abundance of priority wildlife species that reflect the diversity and health of state wildlife.

Element 2. Identify the extent and condition of wildlife habitats and community types essential to the conservation of priority species.

Element 3. Identify problems that may adversely affect priority species or their habitats.

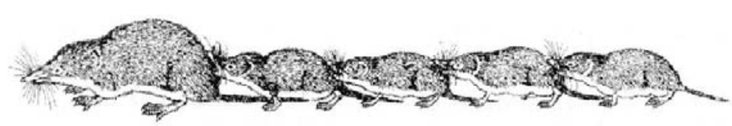
Element 4. Determine actions to be taken to conserve priority species and their habitats.

Element 5. Provide for periodic monitoring of priority species and habitats, as well as the effectiveness of conservation actions.

Element 6. Coordinate all stages of the CWCS with federal, state tribal and local agencies.

Element 7. Incorporate opportunities for public involvement into the development, revision and implementation of the CWCS.

Element 8. Provide for review of the CWCS and appropriate revision at intervals of not more than 10 years.



Guiding Principles

The State Wildlife Grants program and the Comprehensive Wildlife Conservation Strategy present the Washington Department of Fish and Wildlife with an opportunity to expand beyond traditional fish and wildlife management and consider other concepts such as biodiversity. Consequently, the following six Guiding Principles were adopted to direct the development of our Comprehensive Wildlife Conservation Strategy:

Guiding Principle 1: *"Leave no species behind." Address the conservation of wildlife species and associated habitats with identified greatest conservation need, while recognizing the importance of keeping common species common.*

The intent of Washington's CWCS is to build on current efforts to protect fish and wildlife species included on state and federal endangered and threatened species lists. This will include identifying species and their associated habitats for which we do not have adequate information, as well as protected species that could be in trouble in the future if steps are not taken now to conserve them. Washington's list of Species of Greatest Conservation Need is included as Appendices 1 and 2. The criteria used to evaluate over 700 fish and wildlife species is included as Appendix 3.

Guiding Principle 2: "Build a plan of plans." Construct the Washington CWCS from a large body of existing work, including nine ongoing ecoregional assessments.

WDFW and its public and private conservation partners are involved in a number of collaborative conservation planning efforts for species and habitats. These planning efforts are being conducted at many scales and levels of detail, from statewide to regional to county scales. The CWCS, for the most part, is not an original planning document but rather a summary of the goals and strategies articulated in other plans produced or influenced by WDFW. A more complete listing and description of these major planning efforts is included in Chapter III, State Overview.

Guiding Principle 3: "Strengthen conservation partnerships." Expand existing partnerships and create new opportunities to cooperate with other conservation agencies, local governments, Indian tribes, nongovernmental organizations and the private sector.

Development and implementation of the Washington CWCS provides a good opportunity for WDFW to engage with a range of public and private conservation partners and stakeholders. An active, three-phase outreach program was initiated in 2003 to inform partners about the CWCS and to later solicit their input on the draft CWCS. Implementation of many of the conservation actions included in the CWCS will require the involvement of conservation partners, including other state, federal and tribal agencies, colleges and universities, conservation and outdoor recreation groups, local governments and private landowners. WDFW's CWCS Outreach Plan is included as Appendix 4.

Guiding Principle 4. "Emphasize biodiversity conservation." Promote the long-term conservation of Washington's biodiversity and coordinate development and implementation of the CWCS with the Washington Biodiversity Council.

In 2002 Washington became one of the first states to articulate a state policy on biodiversity when the Washington State Legislature passed legislation calling for and partly funding the development of a state framework for biodiversity conservation. In 2004 the Washington Biodiversity Council was established by Governor's Executive Order to establish a 30-year vision for conserving the state's biodiversity, primarily through locally driven, nonregulatory, incentive-based programs on both private and public lands.

WDFW participates in the Washington Biodiversity Council and has joined with The Nature Conservancy and Washington Department of Natural Resources in a partnership to produce nine ecoregional assessments, which classify and prioritize biodiversity across Washington's landscapes. These assessments may serve as a landscape focus for an overall state biodiversity strategy. The ongoing ecoregional assessments (EAs) are discussed in more detail in Chapter VI, Washington's Ecoregional Conservation Strategy and in Volume Two, Approach and Methods.

Guiding Principle 5. "Inform the public." Create a document that is concise, readable, informative and available to a wide range of publics and stakeholders.

The CWCS has been organized and written so that the both the general public and the conservation and wildlife recreation community can gain a good understanding of the wildlife species, habitats and conservation actions that will guide fish, wildlife and biodiversity conservation in Washington for at least the next 10 years. The main report, Volume One, describes nine ecoregions and includes discussions of wildlife species and their habitats of greatest conservation need, as well as conservation problems, strategies and actions. The section documenting the Approach and Methods, which may not be important to the casual reader, is included as Volume Two. Detailed appendices have been included in a single CD-ROM. The Washington CWCS will be available on WDFW's website (www.wdfw.wa.gov/wlm/cwcs) with appropriate links to other plans and partners. The web-based strategy and appendices will be updated as often as appropriate and necessary.

Guiding Principle 6. "Inform decision makers." Use the CWCS to draw attention to important wildlife conservation issues—for Congress, the Washington Legislature, local decision makers, the media and the public.

The challenges of maintaining a healthy economy, accommodating growth, and conserving the state's wildlife, habitats and biodiversity can be met only through strong public awareness and support from a broad spectrum of publics and decision makers. Narrative and data in the CWCS will help meet that challenge.

WDFW and its conservation partners will use the CWCS, ecoregional assessments and other plans and assessments on which they are based to raise public awareness and gain support for conservation measures necessary to sustain fish and wildlife populations, habitat and biodiversity. Ecoregional assessments and other data sources will be used to develop county-level habitat assessments and other tools to better inform public and private landowners, and to help local decision makers and planners administer the Growth Management Act and other local conservation programs.

B. Washington Department of Fish and Wildlife

Washington Department of Fish and Wildlife
Mission Statement

Sound stewardship of fish and wildlife; protecting, restoring and enhancing fish and wildlife and their habitats, while providing sustainable fish and wildlife-related recreational and commercial opportunities.

Washington Department of Fish and Wildlife
Strategic Goals

- ❖ *Healthy and diverse fish and wildlife populations and habitats*
- ❖ *Sustainable fish and wildlife-related opportunities*
- ❖ *Operational excellence and professional service*

The Washington Department of Fish and Wildlife is one of the largest and most diverse state wildlife agencies in the country, with almost 1,800 employees working in six regional offices and the Olympia headquarters. The Washington State Legislature created WDFW in 1994 by merging the existing departments of Wildlife and Fisheries, both of which had been separate agencies since the 1930s. The WDFW Director is appointed by a nine-member Fish and Wildlife Commission. The Governor appoints commission members to six-year staggered terms.

WDFW is responsible for the protection and management of all marine, anadromous and freshwater fish; shellfish; and terrestrial wildlife—thousands of animal species statewide. WDFW regulates all legal harvest of commercial fish, sportfish and wildlife, enforces wildlife protection laws, and manages about 840,000 acres of land. More than half of these managed lands are owned by WDFW. The remainder is leased from other state and federal agencies, including the Washington Department of Natural Resources and the U.S. Bureau of Reclamation.

WDFW's conservation mission is administered through three resource management programs: Wildlife, Fish, and Habitat. On-the-ground implementation of these conservation programs is directed from the Olympia headquarters and accomplished through six Regional Offices, located in Spokane, Ephrata, Yakima, Mill Creek, Vancouver and Montesano (Figure 1).

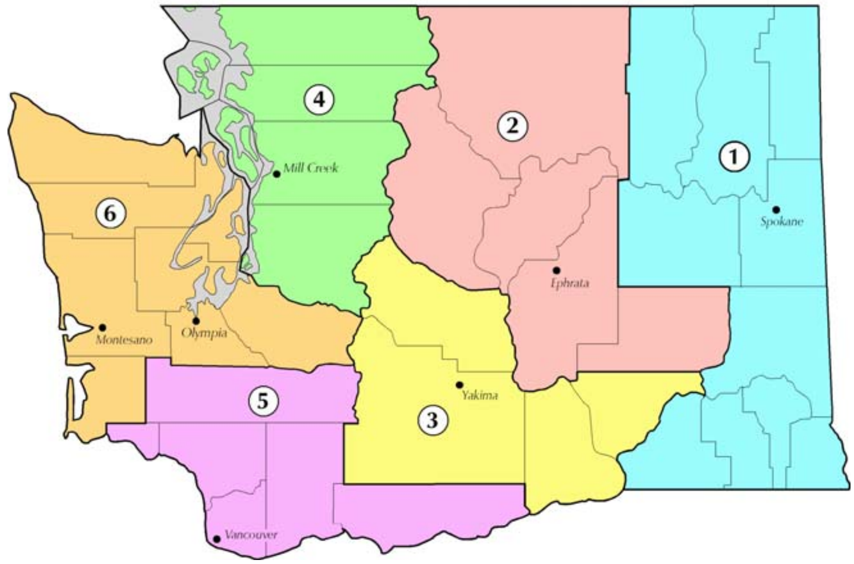


Figure. 1. Locations of WDFW Olympia headquarters and regional offices.

C. Major Conservation Partners and Programs

Conservation of fish and wildlife in Washington is primarily the responsibility of the Washington Department of Fish and Wildlife, although it requires the cooperation and active participation of many other public and private partners, including federal, state and tribal agencies, local governments, private landowners, commercial fish and shellfish harvesters, and nonprofit conservation and wildlife recreation organizations.

Many of WDFW's most important governmental conservation partners own and manage large blocks of public land and wildlife habitat, including the USDA Forest Service, U.S. Fish and Wildlife Service, Bureau of Land Management, Bureau of Reclamation, Department of Defense, National Park Service, Washington Department of Natural Resources, and the Washington State Parks and Recreation Commission. Others such as the National Marine Fisheries Service, Northwest Power and Conservation Council, Salmon Recovery Funding Board and Puget Sound Action Team do not directly manage wildlife or habitat, but establish policies, administer programs and regulations, or direct funding to conservation of the state's fish and wildlife resources. Washington's treaty Indian tribes, many of which have been designated as co-managers of the state's fish resources by the federal courts, also own and manage large blocks of reservation lands as habitat. The Tribes exercise considerable influence over the protection, management and harvest of fish and wildlife, both on and off their reservations. Much of Washington's forested land base is in private ownership and managed for timber and wood products; these landowners are also important partners of WDFW in protecting and managing the state's wildlife and other natural resources.

The potential role of many of WDFW's major conservation partners in implementing the Washington CWCS is discussed again in Chapter V, Implementation. Many of these major partners are listed in Appendix 5.

II. BIODIVERSITY CONSERVATION

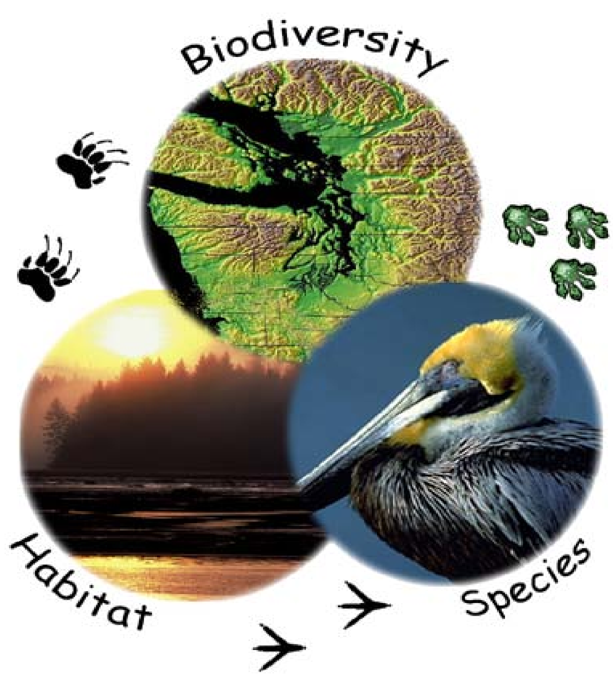
A. <u>The Challenge</u>

Species extinction is occurring at a rate of 100 to 1000 times greater than rates recorded through recent geologic time. The extinction crisis is not happening one species at a time; whole suites of species are placed in jeopardy as entire ecosystems and landscapes are being altered or lost.

The five main questions for wildlife and biodiversity conservation are: 1) what should be conserved, 2) how much should be conserved, 3) how can it be conserved, 4) where should it be conserved, and 5) how can it be measured and monitored? The state of the science and availability of information govern the extent to which these questions are addressed in the CWCS. While science can inform decision-makers, the answers to questions two and four are actually choices that society will make based on values, acceptable risk and opportunity. The CWCS is designed to be a "living" document that will be expanded in scope and updated on a biennial basis; so new information, strategies and priorities will be added with each iteration.

While conservation of Washington's biological diversity is one of the guiding principles of the CWCS, it is ultimately the responsibility of multiple agencies and private conservation organizations. In keeping with WDFW's mission, the CWCS focuses on animal and animal habitat diversity. It does not address rare flora, plant associations or abiotic features that are covered by the Washington Department of Natural Resource's (WDNR) Natural Heritage Plan, nor does it use the larger ecological systems of the ecoregional assessments discussed in Chapter VI and Appendix 12.

At some point in the future, all of these documents may be combined into a coordinated statewide biodiversity conservation strategy, perhaps through the Washington Biodiversity Council. In the meantime, WDFW is fulfilling its role in biodiversity conservation in several ways.



B. <u>What Should Be Conserved</u>?

Much of WDFW's traditional management has been single-species oriented. Statewide species recovery and management plans determine how and where fish and wildlife species should be conserved or managed for sustainable harvest. These plans are listed in Appendix 6 and Appendix 7.

While the single species approach is still needed to recover endangered species and maintain harvestable surplus of game or commercial fish and wildlife, it is impractical for managing thousands of species. Nor is the single species approach sufficient to prevent major losses in biodiversity. Biological diversity occurs at a variety of levels, from genes to species to ecosystems and at multiple spatial scales, from sites to landscapes to biomes. In the 1970s, conservation biologists at The Nature Conservancy realized that a systematic approach was needed and developed the "coarse filter/fine filter" approach that is used by NatureServe and the various state Natural Heritage Programs. Figure 2 below illustrates this coarse filter/fine filter approach:

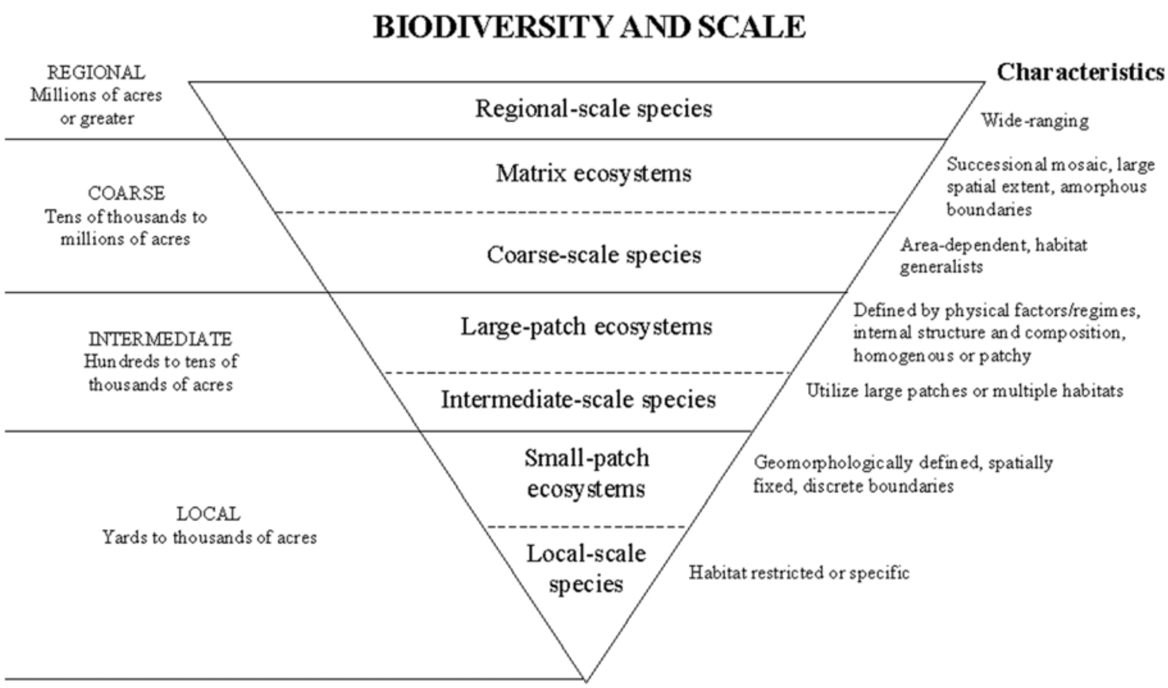


Figure 2. Coarse filter/fine filter assessment approach.

A brief explanation of the coarse filter concept is that by conserving large, representative examples of all of the ecological systems or habitat types in a region, the majority of common species will also be protected. However, a fine filter is needed to address the rare and imperiled species that might otherwise not adequately be protected by the coarse filter. The fine filter also includes wide-ranging species that have special needs for habitat connectivity over large expanses. The coarse filter/fine filter concept has evolved to a continuum approach that results in an assemblage of conservation targets spanning many spatial scales and multiple levels of biological organization. The four main categories of conservation targets are subspecies, species, communities, and ecological systems.

The CWCS uses the coarse/fine approach with respect to wildlife species by addressing both habitats and species of greatest conservation need.

C. How Much and Where Should Biodiversity Be Conserved?

A mix of science and societal values generally shape a conservation vision. Conservation goals or objectives determine where and how limited conservation resources are spent. There are crucial gaps in the science, including limited knowledge of species' distributions and large-scale, long-term dynamics of ecosystems, which must be addressed to improve conservation objectives. Because we cannot afford to wait for perfect knowledge, conservation biologists are exploring various ways to address this question. In 2001, WDFW and WDNR reviewed various biodiversity assessment methods and chose to join The Nature Conservancy in developing ecoregional assessments for the Pacific Northwest. The ecoregional assessment process is well documented, transparent with regard to limitations, and based on the best available science.

The ecoregional assessments attempt to address how much and the best places to conserve the full range of biological diversity. This is done through an iterative computer analysis that uses numeric goals for how much of each conservation target should be represented and a suitability index to select the least-impacted places to conserve biodiversity. Expert review of the computer-generated results is a crucial element to compensate for data errors and data gaps. The result of the process is an efficient portfolio of conservation sites. Alternative portfolios are developed by altering the goals. While the goals are somewhat subjective, they can be updated with new information and the analysis rerun. Regardless of the goal levels, the highest priority sites are always included in the portfolio, and thus part of the portfolio shows the best starting points for allocation of limited conservation resources.

Two products of the ecoregional assessments were used in developing the CWCS. The conservation target lists were used in selecting the Species of Greatest Conservation Need (SGCN). The Conservation Utility Maps, initially displayed for three ecoregional chapters of the CWCS, display the relative conservation value of landscapes/watersheds across each ecoregion. WDFW is using the ecoregional assessments to guide activities that contribute to protecting the full range of biodiversity and to help keep common species common. The agency will also continue to develop species recovery and management plans to maintain viable populations of listed species and surplus population levels of harvested species. These plans include estimates of the amount of habitat and the management actions needed to achieve population goals.

D. How Can Biodiversity Be Conserved?

WDFW began cooperating with other state agencies on biodiversity conservation when the Washington Natural Heritage Advisory Council was formed in the early 1980s. Currently, several state agencies assist the Washington Department of Natural Resources (WDNR) with updating the Washington Natural Heritage Plan. The plan identifies, prioritizes and tracks the elements of biodiversity that are protected in the Washington Natural Area Preserves System. The plan can be accessed at http://www.dnr.wa.gov/nhp/refdesk/plan/index.html.

In 2001, WDFW joined with The Nature Conservancy, WDNR's Washington Natural Heritage Program, and other partners to conduct ecoregional assessments that identify and prioritize places for conserving biodiversity at the ecoregional scale. High priority places are identified based on factors such as species rarity, richness, and representation as well as site suitability and overall efficiency. The assessments use the fine/coarse filter concept described above. Information from these technical assessments is included in the CWCS, even though they will not be completed until 2006.

In 2002 the Washington State Legislature passed Engrossed Substitute Senate Bill 6400, which called for the development of a framework for state biodiversity conservation and directed the establishment of a temporary, broad-based, public/private Washington Biodiversity Conservation Committee to assess the state's current efforts at biodiversity conservation and make recommendations for a state biodiversity strategy. The Committee process was facilitated by The Nature Conservancy of Washington and their recommendations were provided to the Governor and Legislature on October 1, 2003. WDFW participated on, and provided major funding for, the Biodiversity Conservation Committee. The Committee's 2003 recommendations are available at: http://www.iac.wa.gov/Documents/IAC/Special_Projects/Biodiversity/BiodiversityStrategyReport.pdf).

In 2004, a new Washington Biodiversity Council was appointed by Governor's Executive Order. The Council was directed to review the recommendations of the earlier Biodiversity Committee and develop a 30-year strategy to protect the full range of Washington's biodiversity. The new Council, which will expire in 2007, is also a broad-based organization that includes participation by WDFW and other public agencies and private stakeholder groups. (http://www.iac.wa.gov/biodiversity/default.htm)

As mentioned above, biodiversity occurs at multiple scales and the CWCS attempts to address wildlife conservation at three scales: statewide, ecoregion and local. Chapter III, State Overview, discusses problems and strategies that are common throughout Washington. The preponderance of biological information and conservation problems and actions are presented in the ecoregional chapters. Ecoregions are defined through broad ecological patterns in the landscape and provide a useful framework for cooperating with neighboring states and provinces on conservation planning. Efficient conservation strategies should begin at a regional level, but conservation decisions and actions are increasingly occurring at the local level. Local conservation efforts can be most effective when made within the context of a broader, regional-scale strategy. WDFW staff participate in many local conservation projects, providing both expertise and a state and regional perspective. Descriptions of some local biodiversity conservation projects that attempt to address the questions of what, where and how much to conserve are discussed, with Internet links, in Chapter VII, Monitoring and Adaptive Management.

E. How Can Biodiversity Be Measured and Monitored?

Currently, there is no coordinated effort to monitor or measure changes in biodiversity over time; in fact, there is no agreement yet on how it would be done if we were monitoring biodiversity. However, WDFW is taking a lead role in proposing the development of a Biodiversity Index, which would be used to track and monitor long-term changes in Washington's biodiversity.

One of the ideas being proposed to the Washington Biodiversity Council and other partners, such as WDNR's Washington Natural Heritage Program, is the establishment of a Biodiversity Monitoring Committee to lead the design and implementation of the new Biodiversity Index. This committee, if established, would be responsible for designing scientific protocols and implementing strategies to guide the new biodiversity monitoring program. Measures of biodiversity will include species (plants and animals) and their habitats, and the protocols developed by the Committee will determine which species and habitats will be targeted for long-term biodiversity monitoring. The concept of a Biodiversity Index is discussed again in Chapter VII, Monitoring and Adaptive Management.

III. STATE OVERVIEW

A. Physiography and Climate

Although Washington is the smallest of the contiguous western states (less than half the size of Montana), it is geographically and ecologically diverse. Several natural features—the Olympic Peninsula, Cascade Range, Puget Sound and the Columbia River—determine and define the climate, economy, physiography and biodiversity of Washington.

The Cascade Mountains, which extend the length of the state from the Columbia River to the Canadian border, divide the state into wetter west and drier east regions. The western slopes of the Cascades drain to Puget Sound and the Pacific Ocean and eastern slopes drain primarily to the Columbia River. The Columbia River flows into Washington from Canada and courses 745 miles to the Pacific Ocean.

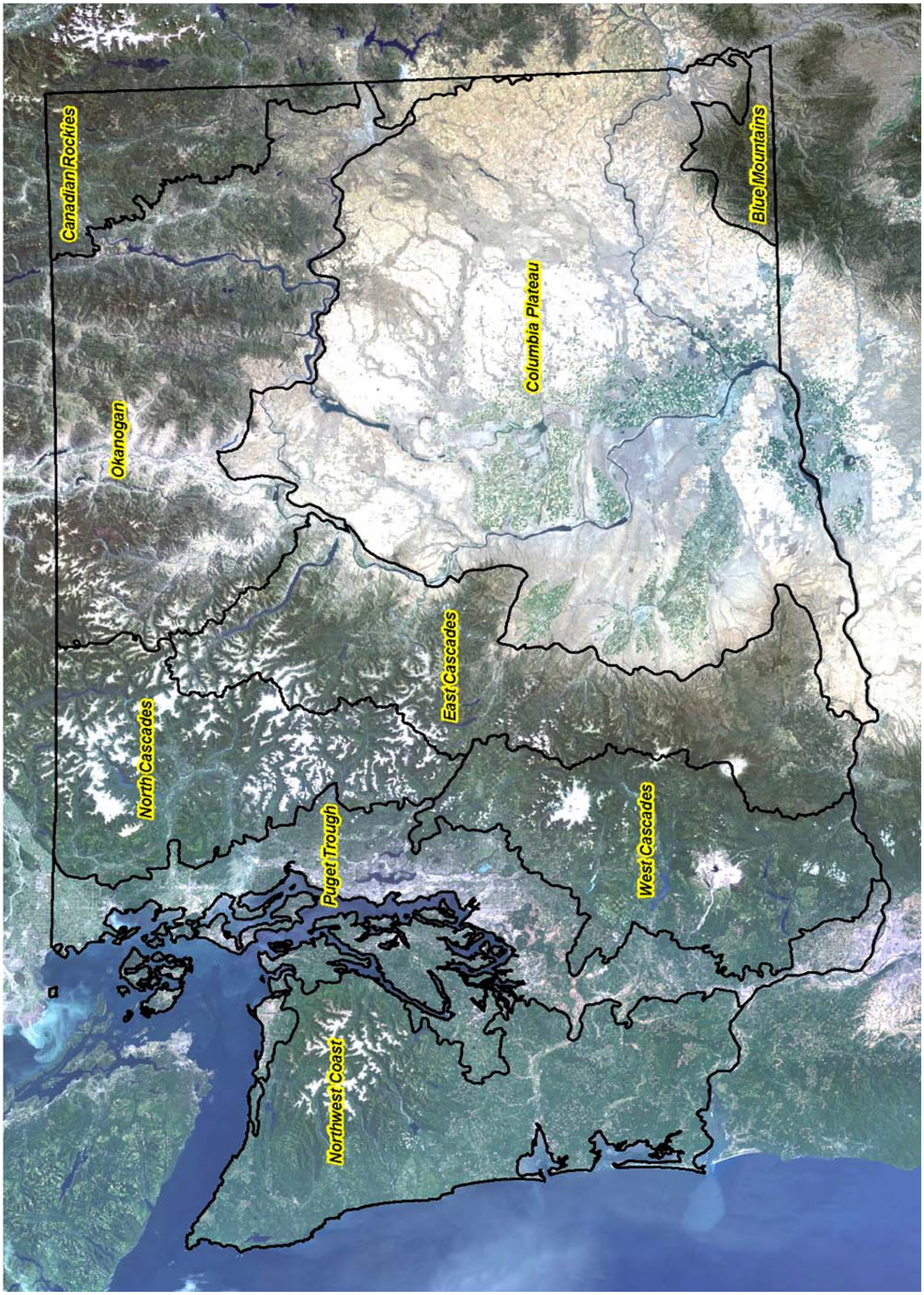
Washington's climate is heavily influenced by prevailing westerly winds, which travel up to 4,000 miles across the Pacific Ocean before reaching land. Ocean currents warm these moisture-laden winds; as they reach the coast, the air rises and cools, dropping heavy precipitation on the Cascades, the Olympic Mountains, and other coastal ranges. Annual rainfall on the western slopes of the Olympics exceeds 200 inches—the highest in the contiguous United States. The Cascades also intercept Pacific Ocean storms and experience both heavy rain and snowfall in winter.

The Cascade and Olympic mountain ranges work together to create rain shadow effects in both the Puget Sound basin and the Columbia Plateau by shielding them from the heaviest rains. Rainfall in the Puget Sound region ranges from 17 to 50 inches annually, depending on the "rain shadow" effect of the Olympics. The rain shadow effect of the Cascades extends east across the Columbia Plateau, where the rainfall rarely exceeds 14 inches and shrub-steppe, grasslands and dry ponderosa pine forests predominate.

Figure 3 depicts Washington's diverse range of topographic features and includes the ecoregional boundaries for orientation.

Figure 3.

Ecoregions within Washington State



B. Land Ownership and Human Population

Washington ranks 16th among all 50 states in population and is second only to California in both population size and population density in the West. The state's population increased from 4.1 million in 1980 to 5.8 million in 2000, and is projected to grow by another 2 million by 2020. Population density in 1990 was estimated at about 87 people per square mile, compared to 196 people per square mile in California and 42 people per square mile in Oregon.

Most (65%) of the state's population and rapid population growth is centered in the Puget Sound region, from Bellingham to Olympia, although rapid growth is also taking place in other metropolitan areas, especially Vancouver, Spokane, Yakima, Wenatchee, and the Tri-Cities (Richland, Pasco and Kennewick). According to the 2000 census, Clark County (Vancouver), across the Columbia River from Portland, Oregon, was the fastest-growing area of the state. Thurston County, where Washington's capitol city of Olympia is located, is expected to exceed all other counties in population growth in the next decade.

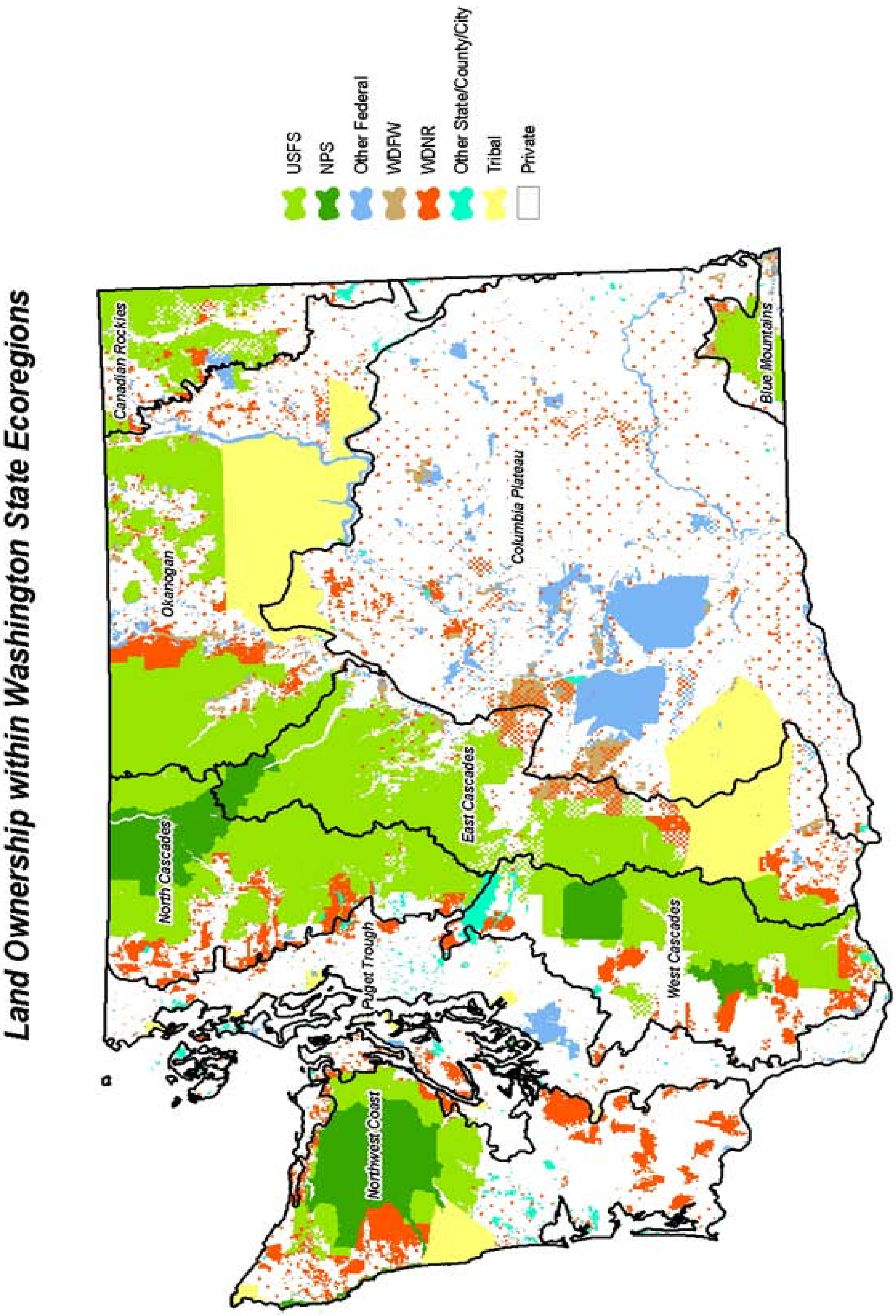
About 40% of Washington's land base (17,697,000 acres) is in public ownership, including military bases, the Hanford nuclear reservation, and state and federal parks, forests and wildlife refuges. This total does not include tribal lands, which account for another six percent. About 30% of the state's marine tidelands and 75% of freshwater shorelands are also owned by the State of Washington, the remainder having been sold into private ownership after statehood in 1889. Although parks and many wildlife areas are available to the public, not all public lands are open to public access.

Although Washington's percentage of public land is lower than other western states such as Nevada (84%) and Oregon (54%), much of the state's public land and protected wildlife habitat is located in high-elevation forests and managed as National Forests, National Parks, or State Trust Lands. The largest public land manager in the state is the USDA Forest Service, followed by the Washington Department of Natural Resources. Lower-elevation public lands (including wetlands, riparian corridors, prairies, shrub-steppe grasslands and forests below 3,000 feet) make up about 56 percent of the state's public land and habitat base. The table below shows the acreage of state, tribal and federal lands in Washington. The map (Fig. 4) on the following page also depicts public and private land ownership.

Public land ownership in Washington	
OWNERSHIP	ACRES
Federal	12,766,860
State	3,597,527
Tribal	3,091,998
City	156,047
County	79,496

Much of the private land in Washington outside metropolitan areas is in timber or agricultural production. Forests cover 40% of the state's total land area, and private corporate timberlands account for 8.7 million acres. Agriculture accounts for another 15.3 million acres, about one-third of the state, with half of that in crop production and the rest in range, pasture and other agricultural uses.

Figure 4.


Land Ownership within Washington State Ecoregions
USFS
NPS
Other Federal
WDFW
WDNR
Other State/County/City
Tribal
Private
Canadian Rockies
Okanogan
North Cascades
East Cascades
Columbia Plateau
Blue Mountains
Puget Trough
West Cascades
Northwest Coast

C. Washington's Biodiversity

Washington is one of the most ecologically diverse states in the United States. This diversity is due to a number of natural factors such as the state's varied topography, its exposure to Pacific Ocean currents and weather patterns, and its location on the migratory path of many wildlife species including birds, California gray whales and all seven species of Pacific Northwest salmon. Geographic diversity includes seacoast, shrub-steppe, native grasslands and prairies, river canyons, mountain ranges and the huge inland estuary known as Puget Sound. In fact, Washington contains most of the major ecosystem types found in the western United States, including two that are found nowhere else in the world—the channeled scablands of eastern Washington and the Olympic rainforest.

Biodiversity is partially defined or characterized by species richness—the number of plants and animals that spend all or part of their lifecycle in a particular area. Washington is permanent or temporary home to thousands of plant and animal species, including 140 mammals, 470 freshwater and saltwater fish species and 341 species of birds that either breed here or stop here on their annual migrations. Washington also hosts 150 other vertebrate species, 3,100 vascular plant species, and more than 20,000 classified invertebrates. More than 3,000 of the invertebrate species are butterflies and moths. While Washington's CWCS only focuses on fish and wildlife species and their associated habitats, it is important to try to frame the discussion in the larger context of the state's full biological diversity. Most of the state's native animal species fall within the legal definition of "wildlife" and are under the purview of WDFW. Responsibility for the conservation of native plants, including those designated as rare plant species, rests with the Natural Heritage Program of the Washington Department of Natural Resources.

Biodiversity is not a constant, even in a naturally evolving environment. Changes are accelerated by rapid human population growth and increased economic activity, and Washington's biodiversity is impacted every day by human disturbance to natural ecosystems. Much of the state is forested, and most of that has been harvested and reforested at some point in time. A small part of the forested landscape is unharvested. Estuarine (coastal) wetlands are extremely productive biologically, yet more than 90 percent of these wetlands in the greater Puget Sound area have been lost since the turn of the century. As Washington continues to grow and develop, fish and wildlife habitat is being altered and sometimes lost, resulting in a net loss of biodiversity. To be effective in stemming the loss of biodiversity, including important fish and wildlife resources, WDFW and its conservation partners must work together and improve efforts to identify and prioritize the most important places in Washington for biodiversity conservation. The ecoregional assessments described below are one effective method for addressing biodiversity conservation. The ecoregional assessments described below and participation in the Washington Biodiversity Council are two ways of addressing biodiversity conservation in Washington.

D. Washington's Ecoregions

Ecoregions are defined through broad ecological patterns in the landscape. Each ecoregion exhibits special physical and environmental characteristics, including unique combinations of soils, geology and climate, that give rise to a distinctive composition and distribution of plant communities and associated wildlife. These factors have encouraged WDFW and its conservation partners to conduct biological assessments and conservation planning at the ecoregional scale.

The ecoregional boundaries used in this CWCS are derived from boundaries originally developed by the U.S. Environmental Protection Agency and USDA Forest Service, and were used by the Washington Department of Natural Resources in their Washington Natural Heritage Plan (http://www.dnr.wa.gov/nhp/refdesk/plan/index.html) adopted in 2003. These boundaries are also used by The Nature Conservancy and its partners for developing ecoregional assessments and plans across North America. There are 63 ecoregions delineated in North America, and nine of these ecoregions occur partly within Washington. Figure 5 depicts the extent of these nine ecoregions within Washington.

Figure 5. Washington's ecoregions.

E. <u>Wildlife Species Distribution, Status and WDFW Management Priorities</u>

Washington is home to a wide array of vertebrate and invertebrate wildlife species. The distribution and richness of these species is largely a function of the habitat available to them, both within Washington and, in the case of migratory species, outside the state. For purposes of the Washington CWCS, the term "wildlife" includes all organisms in the animal kingdom, from sponges to mammals. However, only about 700 wildlife species were considered in the first-round evaluation for the Species of Greatest Conservation Need (SGCN) list, discussed below.

As Washington's habitat base has changed over the last hundred years, so has the distribution and status of the state's wildlife. Wild runs of Pacific salmon have diminished in both numbers and diversity with the construction of dams, water development projects and land use changes. Species such as the greater sage-grouse that are dependent on native shrub-steppe habitat have declined in numbers and distribution as shrub and grassland habitat has been converted to farms, orchards and other economic uses. On the other hand, water development in the Columbia Basin has created new areas of wetland habitat for migrating and wintering waterfowl, and the clearing of forests for agriculture in northeast Washington has facilitated the expansion of white-tailed deer into many areas where they did not occur prior to statehood. The 651 terrestrial vertebrate species cited in *Wildlife-Habitat Relationships in Oregon and Washington* (Johnson and O'Neil, 2001) might be more or fewer in number in 2005. Their abundance and distribution is almost certain to have changed over time with changes in the habitat base, as well as other factors such as competition, predation and hybridization.

The Washington Department of Fish and Wildlife (and its pre-merger parent agencies of Wildlife and Fisheries) has always classified fish and wildlife species for purposes of management and harvest regulation. Historically, the management emphasis was almost exclusively on commercially harvested species (salmon, shellfish and other food fish) and game species. This began to change in 1972 when the Department of Game established a Nongame Program funded from the sale of personalized license plates. The mission of the program was to identify and conserve species not identified as game species. In 1980 the Department of Game developed a state list of Endangered Species, which has since been expanded to include Candidate and Monitor species. In 1990, the Fish and Wildlife Commission adopted WAC 232.12.297, which defines procedures for state listing and delisting of species as Endangered, Threatened or Sensitive.

In 1989, WDFW created a statewide list of Priority Habitats and Species (PHS), which has been used to provide important fish, wildlife and habitat information to local governments, state and federal agencies, private landowners and consultants, and tribal biologists for land use planning and wildlife conservation purposes. For more information, go to http://wdfw.wa.gov/hab/phspage.htm. PHS is currently the agency's primary means of transferring fish and wildlife information from fish and wildlife resource experts to those who protect and manage habitat on both public and private land.

In 2001, WDFW was a major funding partner and participant in the production and publication of *Wildlife-Habitat Relationships in Oregon and Washington*. The document is an important bi-state, public-private effort that combines a number of state-level species lists into one Northwest regional list, with consistent scientific and common names and occurrence information. It includes a list of 753 terrestrial vertebrate species for Oregon and Washington in the following five occurrence categories: Occurs, Accidental, Non-native, Reintroduced, and Extirpated. Of these 753 species, 651 were determined to occur in Washington; the rest occur only in Oregon.

Species of Greatest Conservation Need (SGCN)

In 2004, WDFW began preparation of the Comprehensive Wildlife Conservation Strategy (CWCS) with the development of a statewide wildlife Species of Greatest Conservation Need (SGCN) list. Details of this list are included in Chapter IV, species of Greatest Conservation Need and in Volume Two: Approach and Methods.

Other Managed Species

In addition to adopting strategies to manage species on the statewide SGCN list, WDFW will continue to conserve and manage other fish and wildlife species and associated habitats for recreational use and/or commercial harvest. The term "other managed species" includes game species not on the SGCN list, including non-natives such as ring-necked pheasant, chukar partridge and largemouth bass, as well as commercially harvested marine fish, anadromous fish and shellfish. Many conservation actions undertaken for SGCN, especially actions that protect or restore habitat, will also benefit many game and commercially harvested species.

In 2003 WDFW published the *2003-2009 Game Management Plan*, which articulates management and research objectives, priorities and policies for all terrestrial game species managed by WDFW. Go to: http://wdfw.wa.gov/wlm/game/management/. Similar plans for sportfish, commercial fish and shellfish have also been adopted by WDFW. More complete lists of WDFW management plans are included as Appendix 6 and Appendix 7.

F. CWCS Habitats of Conservation Concern

The statewide Habitats of Conservation Concern list was determined using two sources, the official Priority Habitats and Species (PHS) list of 20 basic habitats maintained by WDFW since 1989 http://wdfw.wa.gov/hab/phshabs.htm, and the various priority habitats associated with identified Species of Greatest Conservation Need (SGCN) for each ecoregion, as discussed in Volume Two, Approach and Methods. For purposes of consistency, we have used the definitions for the basic habitats defined in *Wildlife-Habitat Relationships in Oregon and Washington* (WHROW). These habitats are listed below and fully described in Appendix 8.

The process that David Johnson and Tom O'Neil developed for defining these habitats in WHROW started with the definition of 287 plant alliances across the landscape of Washington and Oregon. Then, through a process of grouping and crosswalking (coordinating) these plant alliances, they were eventually able to isolate and describe 32 basic wildlife habitats—terrestrial, aquatic and marine—29 of which occur in Washington (see below) and three of which occur only in Oregon. WHROW also documented the degree of association of these 32 wildlife habitat types with 753 identified wildlife species considered by Johnson and O'Neil in their project. For purposes of the CWCS, specialized habitats such as cliffs, talus slopes, vernal ponds, and sand dunes are considered features within the 32 wildlife habitat types discussed in Appendix 8.

By associating the SGCN list with the 29 basic habitat types found in Washington, and by further coordinating this list with the official PHS habitat list described above, it was determined that the following 20 habitats, broken into Priority One and Priority Two categories, will be considered the highest priorities for current statewide conservation action in Washington. The designated Priority One habitats have a greater number of associated Species of Greatest Conservation Need (SGCN) than the Priority Two habitats.

WHROW HABITATS IN
THE STATE OF WASHINGTON
Listed by Priority

Priority One

Bays and Estuaries

Eastside (Interior) Grasslands

Shrub-steppe

Eastside (Interior) Riparian-Wetlands

Herbaceous Wetlands

Marine Nearshore

Ponderosa Pine Forest and Woodlands (includes Eastside Oak Woodlands)

Westside Grasslands

Westside Lowland Conifer-Hardwood (Mature) Forest

Westside Riparian-Wetlands

Priority Two

Coastal Dunes and Beaches

Coastal Headlands and Islets

Eastside (Interior) Mixed Conifer Forest

Inland Marine Deeper Water (Puget Sound)

Lodgepole Pine Forest and Woodlands

Montane Coniferous Wetlands

Montane Mixed Conifer Forest

Subalpine Parkland

Upland Aspen Forest

Westside Oak and Dry Douglas-fir Forest and Woodlands

Other

Agriculture, Pasture and Mixed Environs

Alpine Grassland and Shrublands

Desert Playa and Salt Scrub Shrublands

Dwarf Shrub-steppe

Eastside (Interior) Canyon Shrublands

Marine Shelf

Oceanic

Open Water: Lakes, Rivers and Streams

Urban and Mixed Environs

G. Major Statewide Conservation Problems and Issues

Most of the major statewide problems affecting Washington's wildlife and biodiversity are the direct or indirect result of human influence on the state's habitat base. Rapid, sustained population growth since the end of World War II has resulted in substantial losses of fish and wildlife habitat in urbanizing areas of the state, as well as a constant invasion of exotic plant and animal species across the landscape.

These habitat losses and changes are most profound in the Puget Sound region, where most of the state's population resides and where development pressure and urban runoff affect a host of terrestrial and aquatic habitats, and the greater Puget Sound estuary itself, as well as the Columbia Plateau, where much of the native shrub-steppe and grassland habitat has been converted to agriculture.

Washington's population is projected to double by the middle of the 21^{st} century. With this population growth will come more cars and roads, more demand for water, energy and developable land, and increased need for the treatment and disposal of solid waste, sewage and stormwater runoff—all of which will impact the state's wildlife and habitat resources. In the face of this projected growth, WDFW and its conservation partners find themselves in the difficult position of applying limited funds and staff resources to try to identify, conserve and manage what's left of the state's native habitat base, species and biodiversity.

The following major influences have the greatest impact on Washington's fish, wildlife and habitat base:

- Habitat loss through conversion, fragmentation and degradation
- Invasive alien plant and animal species
- Water quantity—allocation and diversion of surface water
- Water quality issues
- Salmon recovery
- Forest conservation and management practices
- Agricultural and livestock grazing practices
- Disease and pathogens
- Inadequate data on wildlife species, populations, and habitat

Habitat loss through conversion, fragmentation and degradation: Habitat conversion, fragmentation and degradation together pose the most serious statewide threat to Washington's native fish and wildlife resources. Since statehood in 1889, these combined problems have cost the state more than half of its highest priority functioning habitats, including an estimated 70 percent of estuarine wetlands, 50 to 90 percent of riparian habitat, 90 percent of old growth forest, 70 percent of arid grasslands and more than 50 percent of shrub-steppe. These four native habitat types alone are among the most diverse and productive for the state's native fish and wildlife. About 75 percent of Puget Sound's estuaries and their adjacent habitats, such as grasslands, mixed woodlands and floodplain forests, have been modified so significantly that they no longer provide their original functions.

Once native habitat is converted to other uses, the remaining habitat is often left as isolated fragments in a matrix of multiple land uses. Wildlife populations associated with these fragmented habitats are often blocked from their normal movement patterns and migration routes, and thus subjected to isolation from other breeding populations. Habitat loss and fragmentation also causes increased competition with other species, predation and increased conflicts with other land uses. In a fragmented landscape, animals have to move from one patch of habitat to another and when this happens, migrating wildlife populations become broken into smaller, isolated units that are more susceptible to population decline and possible extirpation.

It is estimated that functional habitat for wildlife continues to be altered at a rate of 30,000 to 80,000 acres per year, not counting impacts due to forest practices or hydroelectric projects. The following Washington habitat maps, as represented by Johnson and O'Neill in *Wildlife-Habitat Relationships in Oregon and Washington* (WHROW), illustrate general habitat changes in Washington from 1850 until the present time (Figures 6, 7 and 8).

Transportation systems such as major highways and roads are also a major cause of habitat loss and fragmentation, as well as direct barriers to wildlife movement and causes of direct mortality from roadkill. When wildlife populations are low, roadkill mortality is significant, especially for slow-moving animals such as turtles and salamanders, as well as wide-ranging carnivores that have to cross many roads.

Washington will continue to experience significant population growth into the foreseeable future. This growth and development will result in continued loss, conversion and fragmentation of fish and wildlife habitat. Steps are being taken by WDFW, other state and federal agencies, local governments and many private conservation organizations to identify and conserve the most important and productive habitats. Many different nonregulatory and regulatory strategies and tools, as varied as habitat acquisition and administration of the Growth Management Act (GMA), are discussed at both statewide and ecoregional scales in the CWCS.

Figure 6. Legend for Washington wildlife habitat maps.

Figure 7.

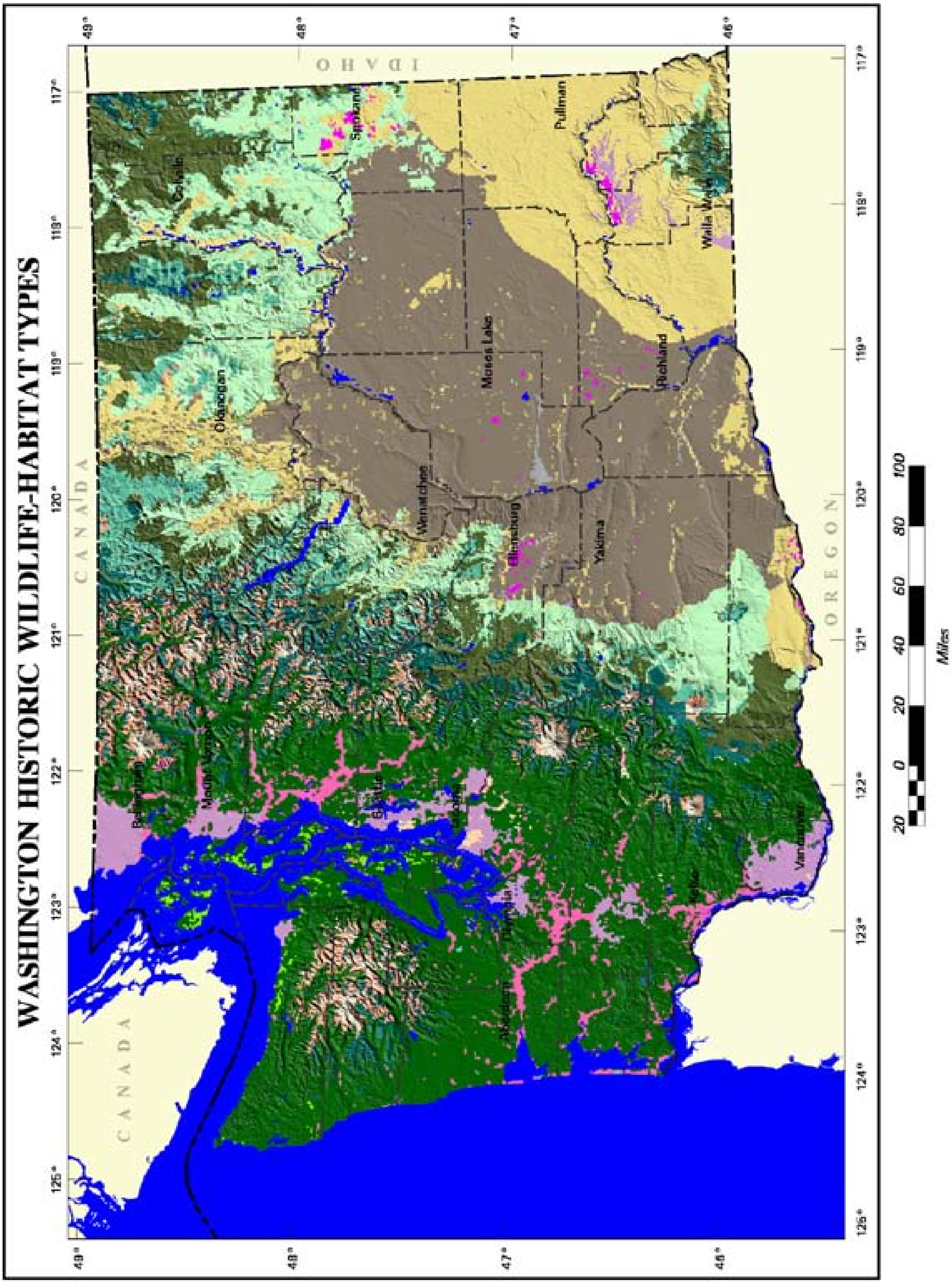
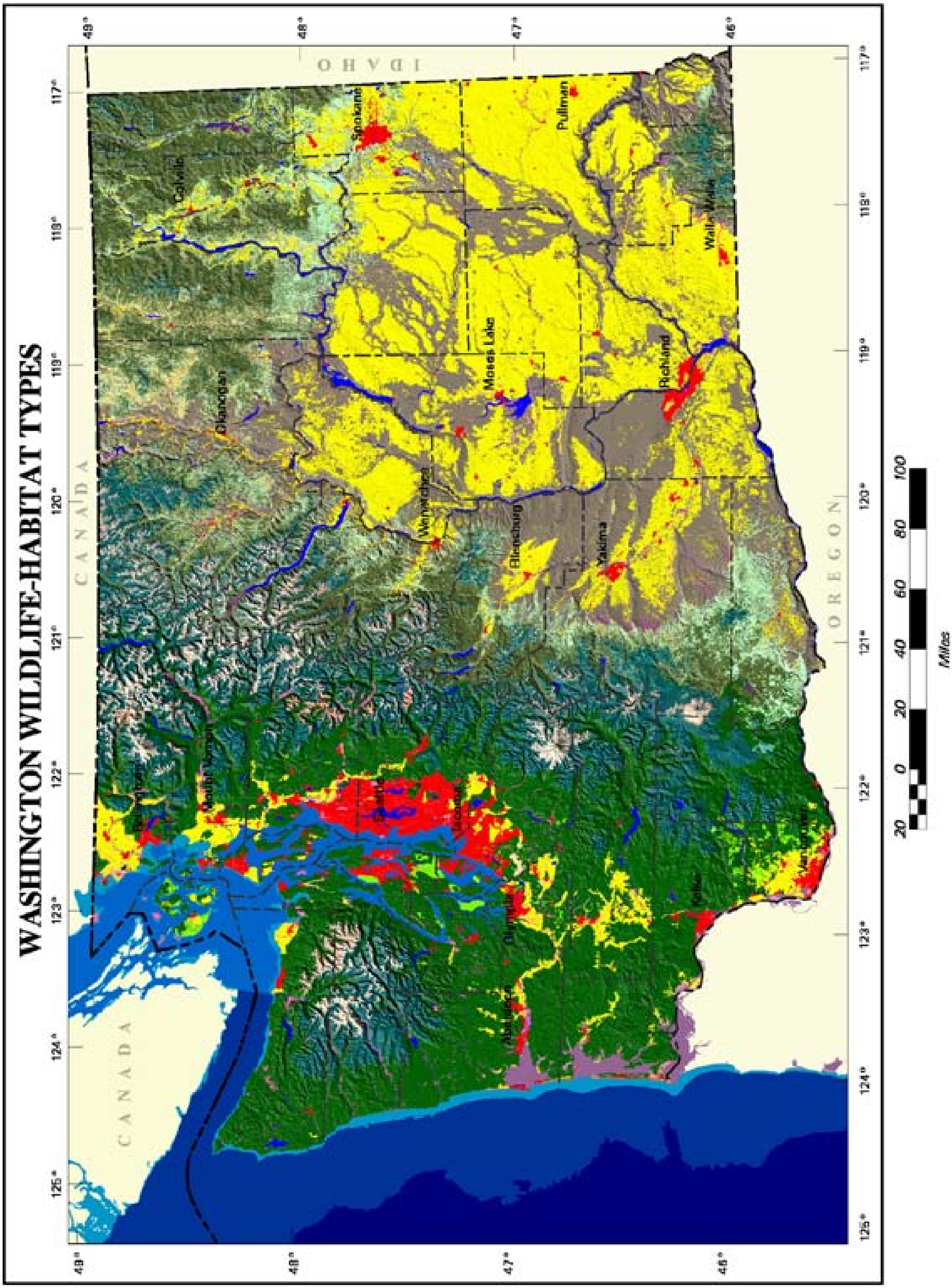

WASHINGTON HISTORIC WILDLIFE-HABITAT TYPES
CANADA
IDAHO
OREGON
Okanogan
Moses Lake
Pullman
Richland
Wenatchee
Ellensburg
Yakima
20 0 20 40 60 80 100
Miles

Figure 8.


WASHINGTON WILDLIFE-HABITAT TYPES
CANADA
IDAHO
OREGON
Colville
Spokane
Pullman
Walla Walla
Okanogan
Moses Lake
Richland
Wenatchee
Ellensburg
Yakima
Bellingham
Mount Vernon
Everett
Seattle
Tacoma
Olympia
Aberdeen
Kelso
Vancouver
Miles
20 0 20 40 60 80 100

Invasive alien plant and animal species: Invasive species constitute a severe and growing threat to Washington's native wildlife, habitat and biodiversity—second only, many believe, to habitat fragmentation. Everywhere in the state, aggressive non-native plants and animals are displacing native species, profoundly altering natural systems and affecting the state's economy and human health. These alien plants and animals have become introduced through both intentional and unintentional releases, including "hitchhiking" on horses and other livestock, trucks and boats; transport on ocean currents and in ballast water; importation in aquaculture and horticulture products, and the pet/aquarium trade; and accidental releases from research institutions and laboratories. Although many non-native species are unable to form self-sustaining populations and soon disappear, some become established and thrive, often outcompeting native species and adversely changing ecosystems in the process. They evolved in other parts of the world, and arrive in Washington without natural predators and diseases that would normally keep their growth in check in their native environment. The number and abundance of introduced species is an indicator of declining ecosystem health.

The effect of invasive species is especially severe in the shared inland marine waters of Puget Sound and the Georgia Basin to the north. Examples include cord grasses (*Spartina*), Japanese eelgrass, oyster drill, varnish or dark mahogany clam and the European green crab. Cordgrass outcompetes and eliminates native salt marsh vegetation and raises the level of the marsh substrate. Oyster drills prey upon young oysters. The green crab, first reported in Willapa Bay in 1998, is a voracious predator that feeds on many types of organisms, particularly bivalve mollusks (clams, oysters and mussels), polychaetes and small crustaceans. It also outcompetes Dungeness crab for habitat and food supply, and will eat juveniles. In freshwater habitats, the proliferation of non-native bullfrogs has had a severe impact on declining species such as western pond turtles, northern leopard frogs, and other native species. Alien zebra mussels have invaded the Great Lakes, and it is probably only a matter of time before they are found in other freshwater environments. Laws to regulate the introduction of invasive plant and animal species are inadequate now and, as the problem increases, more regulatory authority and enforcement resources will be sought at both the federal and state levels.

Some of the most destructive invasive plants are found in the shrub-steppe, grassland and forested communities of eastern Washington, where they thrive through the effects of agriculture, grazing, mining and certain natural disturbances such as catastrophic wildfire and floods. These invaders not only outcompete native plants, but also present a severe and growing problem for farmers, ranchers and forest managers. Perhaps the most widespread and problematic of the dryland invasive species is cheatgrass, originally from Eurasia, which has replaced native grassland communities all over the Intermountain West. Cheatgrass has limited or no food value for wildlife and livestock, and it presents a significant fire hazard in both shrub-steppe deserts and ponderosa pine forests, where it can add to the fire fuel load, resulting in hotter wildfires and more damage to native vegetation. Other examples of invasive, nuisance plant species include yellow starthistle, Japanese knotweed, knapweed species, Dalmatian toadflax and sulfur cinquefoil.

Many freshwater aquatic invasive plants found in Washington were originally brought here as ornamental plants for aquariums or water gardens. These ornamentals are usually hardy species and, when introduced to Washington's waters, often thrive and outcompete native plants. Eurasian water milfoil is one aquatic noxious weed that is a particular problem statewide. It reproduces by fragmentation and proliferates to form dense mats of vegetation in the littoral zone of lakes and reservoirs, where it crowds out native aquatic vegetation, reduces dissolved oxygen and can severely degrade the ecological integrity of a water body in just a few growing seasons.

The invasion of alien plant and animal species is recognized as a critical problem in Washington, not just for native fish, wildlife and biodiversity, but for the state's vital agricultural industry. The problem is currently being addressed at many different levels in Washington, within the constraints of budgets and staffing resources. Examples include Washington's Noxious Weed Control Board, which serves as the state's noxious weed coordination center for the activities of 48 county noxious weed control boards and districts. The Washington Department of Agriculture also has a lead role in coordinating an aggressive state/federal/private effort to eradicate or at least stop the spread of invasive cordgrass (*Spartina*), which has taken over much of Willapa Bay on Washington's Pacific coast and is spreading throughout Puget Sound. In 2000, the Washington Legislature passed a ballast water management law that requires oceangoing vessels and vessels involved in coastal trade to conduct any ballast water exchange at least 50 miles offshore and to report all ballast water discharges to the Coast Guard or the State.

Water quantity—allocation and diversion of surface water: The survival, distribution and diversity of Washington's fish and wildlife is determined by the availability of water, including water to support aquatic and marine species, water to drink, water to grow wildlife food plants and water to support the annual upstream and downstream migration of anadromous fish. Water is as important in the Olympic rainforests, which can receive more than 200 inches of moisture a year, as it is in the Juniper Dunes wilderness of eastern Washington, which averages only 8 to 14 inches of annual precipitation. Without adequate water to support fish and wildlife, other conservation issues become secondary.

The relative abundance of water has been a major factor in the growth and development of Washington's landscape and economy since the late 1800s. The seemingly unlimited supply of surface and groundwater encouraged the growth of cities and development of irrigated agriculture, not to mention the generation of hydroelectric power and production of aluminum, both of which require massive amounts of water. Until recent years, water was considered to be so plentiful in the

Northwest that plans were considered to divert water from the Columbia River and ship it south to California and other states.

The notion of surplus water is no longer a topic of serious discussion in Washington. Many of the state's rivers have already been developed for hydropower production and agriculture. Unfortunately, the water needs of fish and wildlife have often been overlooked until serous problems occurred, such as the decline and listing of certain stocks of Columbia River salmon under the federal Endangered Species Act.

Dams: There are currently 1,025 dams on Washington's rivers and tributary streams. Because they obstruct the natural flow of rivers, these dams can have many detrimental effects on the aquatic environment, including altering the natural flow cycles of rivers, interrupting the transport of nutrients and sediments normally deposited in deltas and estuaries, and hindering anadromous fish migration between the ocean and upstream spawning areas. Older dams without fish ladders, including Grand Coulee Dam on the Columbia River, block the upstream migration of fish. Even on newer dams, spinning turbines that generate electricity often disorient, injure or kill juvenile fish on their downstream migration to the sea.

Water diversions: Salmon and other aquatic wildlife depend on reliable water flows during critical periods in their lifecycles. Unless adequate minimum flows are established for fish and wildlife and enforced by Washington state agencies, water withdrawals may result in dewatering important mainstream habitats as well as pools and quiet backwater areas that provide essential habitat for juvenile fish-rearing, amphibians and aquatic invertebrates. Inadequate flows and water depth in these backwater areas deprive developing fish eggs of oxygen, make it easier for fish predators to find their prey, and generally interfere with the journey of migrating fish. Interrupting or delaying migration can cause adult fish to resort to spawning in unsuitable habitat.

There are many ongoing state and federal efforts to mitigate for the adverse impacts of past water diversions and dams, ranging from adding or improving fish ladders on hydroelectric dams, to screening fish out of irrigation culverts, to requiring adequate year-round instream flows for fish and wildlife. These efforts, many of which are addressed in the ecoregional chapters of this CWCS, have become more aggressive and better-funded since the listing of a number of Northwest salmon stocks under the federal Endangered Species Act. One important statewide effort is the Watershed Planning Act (ESHB 2514) passed by the Washington Legislature in 1998, which established a collaborative framework for developing solutions to water quantity and other watershed issues on a watershed scale. WDFW and 11 other state agencies signed a Memorandum of Understanding for implementation of ESHB 2514 and have actively participated in watershed planning to conserve fish and wildlife resources. Go to: www.ecy.wa.gov/watershed/background.html.

Water quality issues: Major water quality discussions in Washington usually revolve around preserving the quality of public drinking water supplies and the effects of non-point source contamination on ground and surface waters. However, the effect of surface water quality on the health of aquatic ecosystems and wildlife also is becoming increasingly important. The most common water quality problems affecting fish and wildlife in Washington's waters are: 1) fecal coliform bacteria contamination, which affects more than 44% of our polluted waters; 2) contaminated sediments, which are a particular problem in Puget Sound; 3) elevated water temperature, which can quickly alter or degrade an aquatic ecosystem; 4) increased sediment in streams, which can blanket important food sources and fish spawning areas; and 5) excess nutrients and pesticides washed into lakes from lawns, golf courses and agricultural fields, which can directly poison aquatic organisms or contaminate waterways. Water quality issues related to potential contamination of the Columbia River from the Hanford Nuclear Reservation are also of concern, particularly if long-buried radioactive waste reaches the river or its tributaries.

Although water quality is not a direct responsibility of the Washington Department of Fish and Wildlife, it is critical for the long-term health and survival of the state's fish and wildlife, including marine species in Puget Sound and adjacent waters. WDFW supports many other agencies to reduce water pollution from various sources listed above and maintain water quality standards that support healthy fish and wildlife populations. The federal Environmental Protection Agency and the Washington Departments of Ecology, Health and Natural Resources all have important responsibilities for water quality, as does the Puget Sound Action Team.

Salmon recovery: Washington's eleven species and subspecies of native salmonid fish have important biological, cultural, commercial and recreational values. As a keystone species, salmon are a critical component of the state's overall wildlife diversity and an important indicator of ecosystem health. Unfortunately, the state's salmon resource has been under heavy pressure from human population growth and development for many years. Urban and industrial land conversion, forest and agricultural practices, water diversion, municipal water demands, overfishing and hydropower development have all contributed to the decline of the number and health of salmon stocks in Puget Sound watersheds and the Columbia River system.

During the 1990s, this documented decline in populations of several salmon species resulted in numerous listings as Threatened or Endangered under the federal Endangered Species Act. A large ESA recovery effort at the local, state and federal levels is now underway in Washington and other Northwest states, as well as in Canada, to prevent further declines and improve the condition of imperiled salmon stocks.

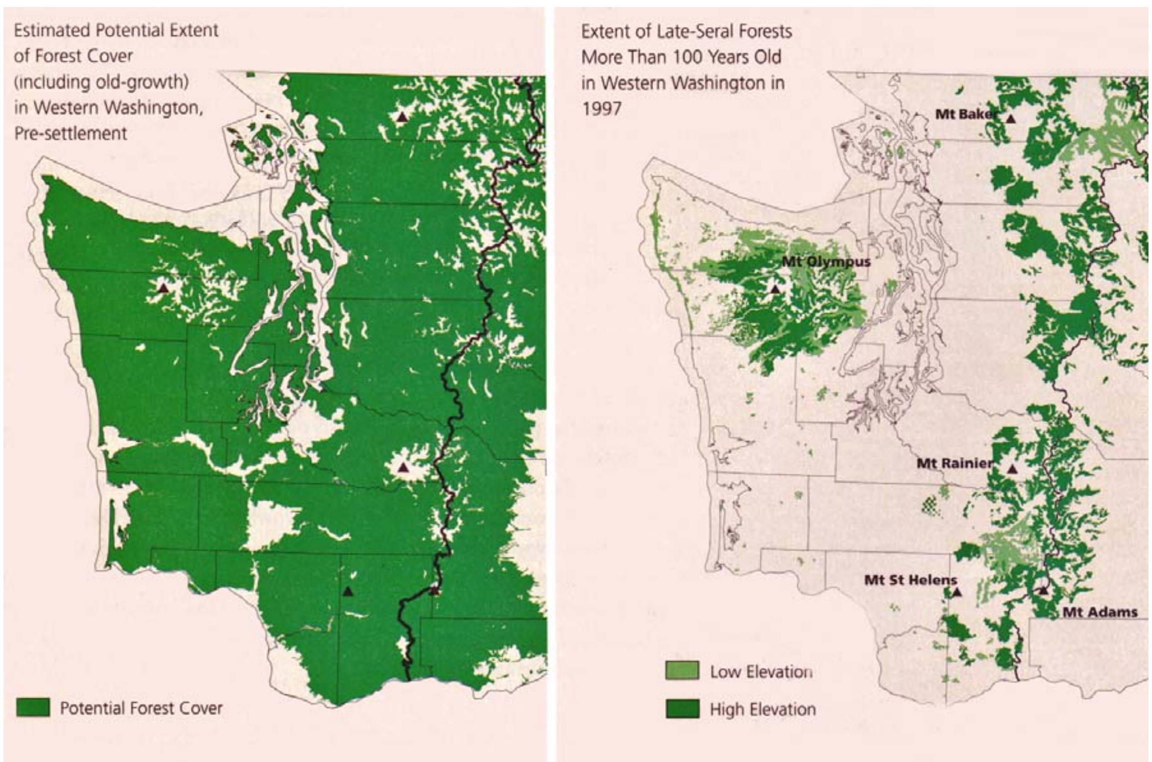
WDFW is heavily invested in coordinated salmon recovery at the regional, state and watershed levels. These coordinated efforts are discussed in more detail in this chapter under Major Conservation Strategies, and in the referenced salmon recovery plans, as well as in the nine ecoregional narratives in Chapter VI.

Forest conservation and management practices: Over half the land area of Washington is covered in forests, ranging from the temperate rain forest of the Olympic Peninsula to the Douglas-fir dominated lowland forests of the Puget Trough, and from the stunted, slow growing trees of the alpine forests to the dry, ponderosa pine dominated forests of eastern Washington. The management and commercial harvest of timber on both public and private lands has been and remains an important part of Washington's history, economy and culture.

Since the turn of the 20th century (1900), most of Washington's diverse forestlands have been affected by management practices and conversion to other uses, including the loss of most of the state's old growth forests and the resulting decline in biological diversity and habitat for old growth-dependent wildlife species. Since the

1970s more than 2.3 million acres of Washington's remaining forestlands have been converted to other uses or designations, especially west of the Cascade Mountains, although almost nine million acres, about 10 percent of the state, remains in privately owned forestland.

In western Washington, forests have been fragmented by urbanization, transportation corridors and other land development. In remaining forested areas, commercial harvest and replanting has changed the natural forest structure, resulting in simplified forest habitats and a reduction in overall biological diversity. Some commercial timberlands are also being sold to non-industrial owners and in many instances, the new owners choose to convert the land to non-forest uses. The overall loss and fragmentation of forest land in western Washington has resulted in a parallel loss of fish and wildlife habitat and wildlife movement corridors as well as diminished water quality in streams and rivers (Figure 9).



Courtesy of Washington Department of Natural Resources

Figure 9. Forest fragmentation in western Washington.

Eastern Washington forests have also been harvested for timber and timber products for many years. Although timber harvest activities have affected the long-term structure and diversity of eastern Washington forests, these forests are nearly as extensive today as they were in 1900. The pressures of urbanization and deforestation are not as great in eastern Washington as they are west of the Cascade Mountains. One of the most severe long-term problems for wildlife and habitat in eastern Washington forests is the suppression of natural fires on both public and private forestland. Frequent, low intensity ground fires were historically part of the forest ecosystem, including forest-associated wildlife, and the recent emphasis on fire suppression has eliminated an important natural means for removing fuels and thinning stands. The lack of fires often results in denser tree cover, particularly at low elevations, and changes in both species composition and structure of natural timber stands, leading to overcrowding and increased susceptibility of these stands to damage by bark beetles and defoliating insects.

Historically, the construction of logging roads near streams or across wetlands was often destructive to fish and wildlife habitat. Although modern forest practices under state and federal rules provide much more protection for wetlands and riparian zones, there are still potential adverse impacts from construction and operation of logging roads that do not meet modern forest practice standards. Improperly constructed or maintained logging roads may trigger or accelerate slope failure, erode stream channels, block fish migration and deposit sediment into streams and wetlands.

WDFW is heavily involved with the Department of Natural Resources and other agencies, organizations, and private forest landowners in promoting, developing and implementing forest practices that best protect the Washington's fish and wildlife resources. This coordinated effort is discussed in more detail in this chapter under Major Conservation Strategies, as well as in the nine ecoregional narratives in Chapter VI.

Agricultural and livestock grazing practices: Agriculture, like forestry, is an important part of Washington's landscape and economy. About one-third of the state's land area (15 million acres) is in agricultural production, including cropland, pastures and orchards. However, the conversion of native grassland, shrub-steppe and wetlands to agricultural purposes since the turn of the 20th century has resulted in extensive losses and fragmentation of habitat and associated wildlife. The statewide habitat maps shown earlier in this chapter illustrate the dramatic changes in eastern Washington's landscape due to agricultural development.

Agricultural development has tended to be concentrated in low elevation valleys all over the state, which has significantly reduced and fragmented valley bottom grasslands, shrublands and forested riparian habitats. Agricultural operations in valley bottoms and riparian zones have also increased sediment loads of rivers and tributary streams and unintentionally introduced herbicides and pesticides into aquatic ecosystems. The conversion of dry hillsides and benches to dryland wheat and other crops in eastern Washington has eliminated, altered and/or fragmented once-abundant shrub-steppe and native grassland habitats.

Livestock grazing throughout Washington over the last century has had widespread impacts on the structure and composition of native vegetation and wildlife habitat. Although properly managed grazing can be neutral or even beneficial to wildlife, improper management of grazing (overgrazing) can destroy native vegetation, change the balance of plant species, compact soil, accelerate soil erosion, and reduce the abundance and diversity of native wildlife. The severity of these impacts depends on the number and type of livestock (e.g. cattle, sheep, and horses) and their grazing pattern. Improper grazing practices also promote the spread of invasive plants and eventually reduce the productivity of native grasslands for both wildlife and livestock.

WDFW works at many different levels, including with many individual farmers and ranchers, to influence grazing and other agricultural practices to protect fish and wildlife habitat and biodiversity on private land. Many these nonregulatory efforts are addressed in the nine ecoregional narratives in Chapter VI. In 1993, the Washington State Legislature enacted House Bill 1309, which directs WDFW and WDNR to develop consistent grazing standards that preserve, protect and perpetuate fish, wildlife and habitat on state public lands. The Washington Biodiversity Council, referenced elsewhere in this CWCS, is looking at a whole range of new and expanded landowner incentives to encourage agricultural landowners to identify and protect important wildlife habitat and other elements of biodiversity on their lands.

Disease and pathogens: The rapid spread of new wildlife diseases in the United States and around the world since the beginning of the 21st century has created new challenges for both wildlife managers and public health officials. The social and economic impacts of wildlife diseases can be large, not only affecting wildlife populations and habitat but also human health, agriculture and food safety, and many nature-based industries.

A number of serious diseases currently affect Washington's wildlife populations and species at risk in every region of the state. These diseases include notoedric mange, which has become a serious risk to western gray squirrel populations; West Nile virus, a mosquito-borne virus that can cause encephalitis and/or meningitis in birds, horses and humans; avian botulism, which occurs principally in waterfowl and other birds living in an aquatic environment; and hair loss syndrome, which causes hair loss, emaciation and often death in Columbian white-tailed deer. Whirling disease, which has devastated wild rainbow trout in Montana, has now been found in wild steelhead juveniles in southeast Washington's Grande Ronde River. Chronic wasting disease, a contagious and fatal disease of deer and elk, was thought to be limited to relatively small areas in the Midwest and Rocky Mountain states, but has recently been found in several new areas of North America.

WDFW works closely with neighboring states and Canadian provinces, as well as federal wildlife and fisheries agencies and the veterinary medicine and academic communities, to identify and respond to outbreaks of wildlife disease such as West Nile Virus and Chronic Wasting Disease (CWD). Many of these wildlife disease problems are regional or local in nature and addressed in the nine ecoregional narratives in Chapter VI.

Inadequate data on wildlife species, populations and habitat: Although many of the wildlife species under WDFW's purview, including game species, commercially harvested fish and shellfish species, and most of the species on the SGCN list, are fairly well understood in terms of life history, populations and habitat requirements, the ecology of many others is poorly known. Some species may play an important but as yet unknown role in the ecological web; but without more research we will never know, and in some cases it might be too late. The ecoregional assessments and other surveys and plans have also identified certain habitats for which additional research is needed, including eastern Washington wetlands, cave habitats in the Columbia Plateau, and deepwater habitats of Puget Sound. WDFW and its conservation partners, including the Washington Natural Heritage Program, need to design, implement and monitor additional applied research and surveys for many of the identified Species of Greatest Conservation Need and associated habitats identified in Washington's CWCS.

During the development of the Species of Greatest Conservation Need discussed in Chapter IV, many species were identified and added to the list because there was a lack of information about their status, distribution, and life history. The CWCS also references in many places the lack or shortage of good information on habitat trends. Development of the SGCN and list of associated habitats will help direct and focus the efforts of WDFW and its conservation partners to collect more and better information in the future on wildlife species, populations and habitats. The general problem of inadequate data collection for species and habitat is also addressed in Chapter V, Implementation and Chapter VII, Monitoring and Adaptive Management, as well as the nine ecoregional narratives in Chapter VI.

H. Major Conservation Strategies

Many tools and strategies are available to WDFW and its partners to address the conservation of fish and wildlife habitat and biodiversity in Washington, on both public and private lands. These range from direct conservation efforts such as law enforcement and habitat protection, as well as indirect but equally important programs such as environmental education, habitat assessment and research.

Many Washington residents and decision makers care deeply about their quality of life, including their fish and wildlife resources, and they have consistently been willing to pass laws and fund programs to help identify and protect important wildlife, habitat and biodiversity. It may or may not be necessary to pass new laws or create new programs, but it is important to effectively administer and enforce existing laws and to coordinate the various federal, state and private programs that are already in place—all of which require adequate funding, staffing and support from the public and decision makers at all levels.

Some of the most effective programs, strategies and tools used by WDFW and its public and private conservation partners are briefly discussed below.

Species conservation strategies: WDFW works closely with other conservation agencies and organizations to identify wildlife species in need of special conservation measures. The U.S. Fish and Wildlife Service and National Marine Fisheries Service classify and protect fish and wildlife species under the federal Endangered Species Act, and the Washington Department of Natural Resources uses the NatureServe methodology for listing state and globally ranked plant and animal species (see Volume Two, Approach and Methods). For purposes of implementing the CWCS, WDFW will focus attention on those wildlife species that are included on the Species of Greatest Conservation Need (SGCN) list (Appendices 1 and 2), which include many classified by Washington as endangered, threatened, candidate or monitor species. It also includes a number of species that are not included in one of those classifications but which have been identified as needing additional research or funding attention. A range of conservation actions are recommended for identified Species of Greatest Conservation Need, from the development of recovery plans for Endangered or Threatened species to baseline population surveys for other species. A series of additional species matrices have been developed that display life history, population status, distribution, problems and conservation and monitoring actions recommended for all designated Species of Greatest Conservation Need, except for the salmon GDUs mentioned above. These matrices, grouped by taxon, are provided as Appendices 9, 10 and 11a-f.

Coordinated salmon recovery: In 1999, after salmon listings were made under the Endangered Species Act, Washington developed the *Statewide Strategy to Recover Salmon: Extinction is Not an Option* to outline the vision, goals and objectives necessary to keep salmon from becoming extinct in Washington. The Strategy identified four main areas of recovery emphasis, referred to as the "four Hs"—habitat, harvest, hatcheries and hydropower—and stressed that recovery efforts need to be appropriately integrated and coordinated at the federal, state, regional and watershed levels. Since then, large-scale, coordinated salmon recovery efforts have been underway in Washington, involving many federal, state, tribal and local agencies, as well as organized conservation groups and the public. Go to: http://www.governor.wa.gov/gsro/strategy/strategy.htm

Salmon recovery is a complex and expensive proposition in the Pacific Northwest. WDFW and many of its conservation partners are committed to assuring that these various efforts are successful in recovering salmonid populations. Salmon recovery is being coordinated in seven regions of the state (Figure 10).

Figure 10. Salmon recovery regions in Washington.

A number of salmon populations (classified as genetically distinct units or GDUs) were ranked and included as a component of the overall Species of Greatest Conservation Need list (see Appendix 2). Recovery plans have been written for many of these species by regional recovery groups, which include participation from local governments, tribes, state and federal natural resource agencies, and other interested parties. There are six regional groups in Washington that have been actively engaged in salmon recovery planning for four or more years.

Each region is completing a draft plan and submitting it to the Governor's Salmon Recovery Office (http://www.governor.wa.gov/gsro/regions/recovery.htm). Many other plans, assessments and databases were used in developing these regional plans, including the Salmon and Steelhead Habitat Inventory and Assessment Program (SSHIAP) and the Salmonid Stock Inventory Database (SaSI). These databases are described and linked to their respective websites in Section J below. The regional plans are too large to include within the CWCS, but those that are completed can be viewed at the following web links:

The Upper Columbia Salmon Recovery Region
http://okanogancounty.org/water/Documents%20on%20Site/UCSRP%206-30-05%20Draft.pdf

The Lower Columbia Salmon Recovery Region
http://www.nwr.noaa.gov/1srd/Recovery/domains/willow/WMU_Plan/pdfs/RegionalPlan/RPOverview.pdf

The Snake River Salmon Recovery Region
http://www.snakeriverboard.org/pdf_files/DraftPubSummary06005.pdf

The Hood Canal Summer Chum Recovery Region
http://www.hccc.wa.gov/SalmonRecovery/SalmonRecoveryTOC/default.aspx

The Puget Sound Chinook Recovery Region
http://www.sharedsalmonstrategy.org/plan/docs/Draft%20Salmon%20Recovery%20Plan,%20Executive%20Summary.pdf

The Middle Columbia Recovery Region
http://www.co.yakima.wa.us/yaksubbasin/Library/ExecutiveSummary.pdf

The National Marine Fisheries Service and U.S. Fish and Wildlife Service are currently reviewing the regional plans and working with regional organizations to make revisions. Following this review and revision cycle, the plans will be published in the Federal Register as draft plans and a formal public review process will begin. Implementation of the plans is expected to commence in January 2006, while the plans are still undergoing formal public review.

In 1999, the Legislature also created the Salmon Recovery Funding Board (SRFB), composed of five citizens appointed by the Governor and five state agency directors, which provides grant funds to protect or restore salmon habitat and assist related activities. It works closely with local watershed groups known as lead entities. SRFB has helped finance over 500 salmon recovery projects since its creation. Go to: http://www.iac.wa.gov/srfb/default.asp.

Habitat conservation on public lands and waterways: Approximately 40 percent of Washington's land base is in public ownership, and conservation of wildlife and habitat may be easier to accomplish on these public lands and waterways than on private property, depending on the legal mission of these public lands. Most of Washington's public lands and water resources are either managed specifically for fish and wildlife or managed under a multiple-use concept that addresses the conservation of important habitat in the context of other uses. All public land and water management agencies have some responsibility for protecting fish, wildlife and habitat on their lands. The Department of Defense and Department of Energy operate or fund active fish and wildlife programs on their lands, including Fort Lewis, the Yakima Training Center and the Hanford Nuclear Reservation.

WDFW manages a statewide network of more than 840,000 acres of land and water that provide important habitat for wildlife while offering a range of fishing, hunting and other wildlife-related recreational opportunities. Most of these lands are designated as state Wildlife Areas or Wildlife Access Points, and are found in almost every county in Washington. Washington Department of Natural Resources (WDNR) manages almost 3 million acres of public lands and trust lands, not counting aquatic lands, which include lands managed for timber, agriculture, recreation and conservation.

Protecting wildlife habitat and biodiversity on other public lands, including state and federal lands, depends on each agency's mission, management priorities, funding, knowledge of natural resources, and their willingness to actually identify and conserve areas important for fish, wildlife and biodiversity. WDFW has many cooperative conservation agreements with other agencies and provides fish and wildlife information and habitat management recommendations to other public land management agencies on request. Through individual species recovery and management plans, wildlife area management plans, and the potential future development of a habitat conservation plan (HCP) for WDFW lands through 2005, WDFW will give priority consideration to identified Species of Greatest Conservation Need, associated habitats and biodiversity in the future management of its publicly owned land base.

Implementation of HB 1309, enacted by the Washington Legislature in 1993, has resulted in the development and application of consistent standards for grazing and other agricultural practices on public lands to protect fish, wildlife and habitat.

Habitat conservation on tribal lands: About 16% of the land area of Washington is within tribal reservations. Reservations are not really public land, although some are administered by the federal Bureau of Indian Affairs, nor are they private land, although there is private land within many reservations. Conservation of fish, wildlife and habitat within tribal reservations is the responsibility of the governing tribal councils. WDFW, as well as other state, federal and private conservation partners, work closely with the various tribal councils to identify and conserve important fish and wildlife resources on tribal lands. The largest Indian reservations in Washington are the Yakama, Colville, and Quinault reservations.

Habitat conservation on private lands: Because about 60% of Washington's land base is in private ownership, WDFW and its conservation partners have had to devise many different approaches or tools for identifying and protecting important wildlife species, habitats and biodiversity on these private lands. Conservation tools include direct and indirect regulation, habitat acquisition and landowner incentives.

All conservation tools are important, but no single approach is ever going to be enough to adequately identify, protect, restore and properly manage the state's wildlife resources and biodiversity, especially on private lands. State and federal regulations only go so far in protecting habitat on private land. Regulations currently in place often focus narrowly on endangered species rather than areas important for biodiversity. Land acquisition programs are very effective in permanently protecting important habitats that cannot be saved in any other way; but not all land is for sale, and funds available for acquiring habit, including conservation easements, are very limited.

One of the most cost effective ways to ensure the protection of important wildlife and habitat on private lands is through the application of financial and non-financial landowner incentive programs. These landowner incentives include direct local property tax reductions by counties; acquisition of conservation easements by agencies and land trusts; and programs such as WDFW's voluntary Upland Wildlife

Restoration program, which provide direct incentives to willing agricultural landowners to protect and restore wetlands and other important habitat on their land. WDFW will continue to work with landowners, private conservation organizations, county extension agents, and conservation districts to provide technical assistance and encouragement to landowners to implement land and water management practices, including grazing practices that benefit fish and wildlife on private land. WDFW will also work closely with the Washington Biodiversity Council to develop and expand various conservation incentives available to private landowners.

The Washington Growth Management Act (GMA) and other local conservation efforts require that local governments have access to reliable landscape-scale data and the best available science to protect important wildlife habitat and other critical areas. WDFW is assisting with a number of collaborative projects around Washington that address wildlife habitat conservation at the local scale. These pilot efforts are led by a variety of county governments and conservation organizations working together. They include King County Greenprint (http://www.tpl.org), Kitsap County Alternative Futures (www.psat.wa.gov/Programs/growth/LID_futures.htm), Pierce County Biodiversity Network (http://www.co.pierce.wa.us/pc/services/home/property/pals/other/biodiversity/htm) and Spokane County Landscape Linkages and Wildlife Corridors (no active web link at this time).

Habitat acquisition: For WDFW and conservation partners like the Washington Department of Natural Resources, U.S. Fish and Wildlife Service, The Nature Conservancy, the Trust for Public Land and local land trusts, acquisition of land from willing landowners is an important nonregulatory tool for protecting areas with high habitat or biodiversity values. Although the cost of acquiring land can be significant compared to other alternatives, in some cases it is the best or only alternative for long-term protection and stewardship of critical habitats. The term "acquisition" is usually associated with the outright purchase of land, but may also include conservation easements, land donations or land trades.

WDFW has a long and successful history of identifying important habitat areas and protecting them through fee-title acquisition. The State's habitat acquisition program began in 1939, shortly after the Department of Game was established by the legislature. It tapered off in the 1970s after about 340,000 acres of habitat had been purchased, but continues today, although in a much more targeted and collaborative fashion.

In 2004, the Washington State Legislature passed Substitute Senate Bill 6242, which directed the Interagency Committee for Outdoor Recreation (IAC) to develop a study report by June 30, 2005 that would include a statewide strategy for future coordination of acquisition, exchange or disposal of state habitat and recreation lands.
http://www.iac.wa.gov/Documents/IAC/Special_Projects/6242/senate_bill_6242.pdf

In 2005, WDFW completed a new policy plan to guide its future acquisition and management of habitat and wildlife recreation lands. This plan, entitled *Lands 20/20: A Clear Vision for the Future* is available for review at http://wdfw.wa.gov/lands/lands2020/. In addition to the Lands 20/20 plan, WDFW will use the CWCS, ecoregional assessments, species recovery and management plans and other tolls to set priorities for future habitat acquisition.

A number of state and federal funding programs have been established over the last twenty years to address habitat acquisition, and these programs are administered in Washington by a mix of federal, state and local agencies, partnerships and conservation organizations including the Pacific Coast and Intermountain West joint ventures and an expanding system of regional and local land trusts. Below is a list of state and federal programs and web links.

Washington Wildlife and Recreation Program
http://www.iuac.wa.gov/iac/grants/wwrp.htm

Salmon Recovery Funding Board (Washington)
http://iac.wa.gov/srfb

Trust Land Transfer Program (Washington)
http://www.dnr.wa.gov/htdocs/adm/comm/qafiles/tlt2.htm

Aquatic Lands Enhancement Account (ALEA) (Washington)
http://www.iac.wa.gov/iac/grants/alea.htm

Land and Water Conservation Fund (federal)
http://www.nps.gov/lwcf/

Cooperative Endangered Species Conservation Fund (federal)
http://www.fws.gov/endangered/grants

North American Wetlands Conservation Act (federal)
http://www.fws.gov/birdhabitat/NAWCA

National Fish and Wildlife Foundation
http://www.nfwf.org

National Coastal Wetland Conservation Grant Program (federal)
http://www.fws.gov/coastal/CoatalGrants

Cooperative Endangered Species Conservation Fund grants alone have provided more than $20 million to habitat conservation in Washington since 2000.

The WWRP is an especially successful statewide program established by the Washington Legislature in 1989. More than $402 million has been appropriated since 1989 for state and local agencies to acquire habitat and outdoor recreation lands. In 2005 the Legislature recommitted, restructured and refunded the program with a $50 million biennial appropriation.

Research, monitoring and surveys of fish, wildlife and habitat: Scientific research has long provided the foundation for fish and wildlife management in Washington, and WDFW conducts ongoing research and field investigations into the ecological requirements, population status, migrations and habitat relationships of many fish and wildlife species. WDFW also conducts genetic research on terrestrial wildlife and fisheries, performs DNA forensic analysis to support WDFW enforcement investigations, and provides technical support and expertise in wildlife veterinary medicine, including training on humane and safe handling and immobilization of wildlife species. WDFW also develops, analyzes and maintains computerized wildlife and fisheries survey databases. To ensure that conservation priorities always reflect the current conservation needs of wildlife species and habitats, research and surveys will continue to be a high priority for WDFW. Monitoring of species, habitats and biodiversity is addressed in Chapter VII, Monitoring and Adaptive Management. Also go to: http://wdfw.wa.gov/wildlife.htm, http://wdfw.wa.gov/habitat.htm, and http://wdfw.wa.gov/fish-sh.htm.

Direct enforcement of state laws to protect fish, wildlife and habitat: WDFW's direct authority for the protection of wildlife habitat is limited, although the agency does enforce state laws to protect bald eagle habitat, fish habitat (Hydraulic Project Approval), bald eagle habitat, and fish passage and diversion standards. Through the Washington Fish and Wildlife Commission, WDFW also establishes regulations for the legal harvest of game and commercially harvested fish and wildlife, and WDFW officers enforce those harvest regulations statewide in cooperation with other state, federal and tribal enforcement personnel. Harvest regulations are generally conservative and designed to allow sustainable harvest that has no adverse impact on fish and wildlife populations. However, the illegal overharvest of wildlife or the destruction of critical protected habitats can have a profound impact on fish and wildlife populations that are rare, depressed or threatened with extinction. WDFW Enforcement officers are fully commissioned. They ensure compliance with licensing and habitat requirements and enforce prohibitions against the illegal taking or poaching of fish and wildlife. The Fish and Wildlife Enforcement Program is primarily responsible for enforcing **Title 77**, the Fish and Wildlife Code.

Indirect enforcement of local, state and federal laws to protect fish, wildlife and habitat: WDFW works closely with other agencies including local and tribal police agencies, the Washington Department of Natural Resources, U.S. Fish and Wildlife Service (USFWS), and the National Marine Fisheries Service (NMFS) to enforce laws and regulations that are both within and outside WDFW's jurisdiction. For example, migratory birds and marine mammals are protected and regulated under both state and federal law and jointly enforced by WDFW, U.S. Fish and Wildlife Service and National Marine Fisheries Service. WDFW also works closely with other agencies in publicizing, implementing and sometimes enforcing laws, regulations and permit conditions that prevent the destruction or degradation of important habitat, including the federal Endangered Species Act, Northwest Power Planning Act and Clean Water Act, the Washington Forest Practices Act, Shoreline Management Act and the locally administered Washington Growth Management Act. WDFW also works with the Washington Departments of Transportation and Ecology in developing and implementing mitigation measures for projects with potential adverse impacts on fish and wildlife.

Because much of Washington's authority to protect fish and wildlife habitat is shared with cities and counties, WDFW puts a high priority on providing good biological information to local planners and decision makers to improve their ability to administer the Growth Management Act and other locally administered land use laws. The Priority Habitats and Species (PHS) program has provided good site-based information to local governments since 1989. With the completion of statewide ecoregional assessments in 2006, WDFW will be able to provide even better assessment data to local governments on the location of critical habitats and biodiversity for land use planning.

Wildlife information and conservation education: Effective conservation of habitat and biodiversity can only be accomplished if the public and policymakers understand the biological needs of fish and wildlife, the importance of biodiversity to our overall quality of life, and how citizens can be involved and contribute to conservation efforts. It is also critical that the public have opportunities to observe and enjoy wildlife in its natural surroundings. As Washington's population grows, so does public demand for wildlife information and wildlife-related recreation opportunities on both public and private lands, including hunting, sportfishing and wildlife viewing.

WDFW's Public Affairs Office communicates with the news media, the public and various government agencies and conservation groups about wildlife conservation and recreation. Information is disseminated in a variety of ways, including "Wild About Washington," a monthly television program aired on about 30 public TV stations around the state. In its 2005-07 Strategic Plan (http://wdfw.wa.gov/depinfo/strategic_plan05-07.pdf), WDFW committed to developing effective communication strategies to increase the public understanding of the health of the state's fish, wildlife and habitats and the opportunities to enjoy, protect and recover them. One of the most successful and popular has been the development of web-based wildlife viewing cameras (WildWatchCams) http://wdfw.wa.gov/wildwatch/index.html, showing rarely seen life history footage and educating the public about the species' needs and challenges.

In 2003, WDFW joined with other agencies, educators and businesses to develop and promote a new public-private Pacific Education Institute (PEI). PEI will integrate environmental education with the public school curriculum and state learning standards by providing K-20 educators with the training and materials to offer academically rigorous education activities focused on natural resources and the surrounding environment. In 2004, the Governor's Council on Environmental Education and other partners released a *Report Card on the Status of Environmental Education in Washington State*, which provides a roadmap for expanding environmental education. This plan may be viewed at http://www.eeaw.org/EE%20Report/2004_WAEE_Report_Card.pdf. The Washington Biodiversity Council is also considering recommendations to better integrate biodiversity education into the public school curriculum.

"In the end we will conserve only what we love; We will love only what we understand; We will understand only what we have been taught."

--Baba Dioum, Senegalese ecologist

Wildlife recreation programs: Demand for traditional hunting and fishing activities remains steady in Washington. The 2001 National Survey of Fishing, Hunting and Wildlife-Associated Recreation indicated that the state of Washington is eighth in the nation in spending by recreational fishers, generating an estimated $1.14 billion in annual revenues to the state. A major focus of both recreational and commercial fishing is Washington's salmon resource, which includes healthy stocks as well as depressed populations, and ESA listing of certain salmon populations. The same survey showed that recreational hunting generates another $350 million in annual revenue to the state each year.

The fastest growing sector of wildlife recreation demand, however, is watchable wildlife. An estimated 47 percent of Washington's residents participated in some form of wildlife watching in 2001. WDFW has embraced the national Watchable Wildlife movement and is working with the Washington Division of Tourism, Department of Transportation, Washington State Parks and Recreation Commission, Audubon Washington, and other partners to develop programs such as the Washington State Birding Trail program to both meet this growing demand for non-consumptive wildlife recreation and to increase public awareness of the need for conservation of wildlife and wildlife habitat. In 2004 a new statewide strategic plan for watchable wildlife was provided to the Governor and Washington Legislature. This plan, titled *Wildlife Viewing Activities in Washington: A Strategic Plan* is available at http://wdfw.wa.gov/viewing/wildview.htm.

As the state's population grows, so does the demand for wildlife-related recreation opportunities and public access to wildlife on both public and private lands. WDFW will continue to work with public and private conservation organizations and landowners to try to meet this growing public demand for wildlife recreation.

Harvest management: The sustainable management of game and commercially harvested species and the allocation of harvest for licensed hunters, sport anglers and commercial fishers will continue to be an important management focus for WDFW. WDFW works closely with the U.S. Fish and Wildlife Service and National Marine Fisheries Service to establish and enforce rules for harvesting migratory species, including salmon and waterfowl, and with Washington's Treaty Indian Tribes for harvesting fish and wildlife for which the Tribes have co-management responsibilities. A number of recent plans have been adopted which shape the future of WDFW's game and commercial harvest program, including the *2003-2009 Game Management Plan,* nine elk herd management plans, *Outline for Salmon Recovery Plans* (2003), *Bull Trout and Dolly Varden Management Plan* (2000), *Forage Fish Management Plan* (1998), and the Puget *Sound Groundfish Management Plan* (1998). A more complete list of these plans is included as Appendix 6 and Appendix 7.

Forest practices management: Over half the land area of Washington is forested, and most of the state's forested landscapes continue to be managed for timber and timber products. Because of the influence of commercial forestry on the state's forest lands and wildlife habitat, it is imperative that WDFW and its conservation partners continue to put a heavy emphasis on influencing the forest practices used in managing and harvesting these public and private timberlands. In the last 20 to 25 years, however, Washington's forest practices regulations have been dramatically improved and are now considered by some to be the best in the nation.

Timber management and harvest on federal land, including National Forests, is regulated by the Northwest Forest Plan, adopted by the federal government in 1994 to provide for maintenance and restoration of a functional and interconnected late-successional forest ecosystem. The management and harvest of timber on non-federal land in Washington, both public and private, is regulated by the state Forest Practices Act. Since the federal listing of the northern spotted owl as a Threatened species in 1990 and the passage of the Northwest Forest Plan in 1994, there have been a number of proactive efforts and agreements among public agencies, Indian tribes, conservation groups and forest landowners. These agreements work to protect listed species and their habitat, and to avoid further listings of forest species under the Endangered Species Act, while protecting the economic viability of the timber industry in Washington.

One of the most recent and successful of these public-private efforts is the Washington Forests and Fish Agreement initiated in 1997 by state and federal agencies, Indian tribes, conservation groups and private forest landowners. The rules that resulted from this agreement were developed in concert by all parties and are a good example of how a high degree of habitat protection can be achieved through collaboration. This agreement sets high standards for logging practices and road maintenance, while ensuring that forest landowners receive the technical support they need in order to comply with the new rules. (http://www.dnr.wa.gov/forestpractices/rules/forestsandfish.pdf)

In addition to the Forests and Fish Agreement, WDFW and many of its conservation partners are heavily involved in other efforts to influence and ensure sound forest practices on the state's public and private forest lands, including active participation on the Washington Forest Practices Board and implementation of current forest practices rules and regulations. Washington's Forest Practices rules apply to some eight million acres of private forestlands and protect about 60,000 miles of streams.

The development of Habitat Conservation Plans (HCPs) with private forest landowners, and most recently, public land management agencies, is a good alternative to additional federal regulation to protect ESA-listed wildlife species and habitats. In 1997, the Washington Department of Natural Resources and federal fish and wildlife agencies signed a multi-species Habitat Conservation Plan that covers 1.6 million acres of state-owned trust forestlands. WDFW is contemplating a similar federally funded HCP that would apply to the management of lands owned and managed by WDFW.

Biological assessments, local planning and information services: Land use planning and conservation of land and water resources are largely the responsibility of local governments in Washington. While both cities and counties are required to plan under the state Growth Management Act, counties have a special responsibility to administer the optional local conservation futures and open space property tax incentive programs, and to support local conservation districts, land trusts and watershed councils that provide assistance to private landowners. WDFW is constantly working to provide better, up-to-date fish, wildlife and habitat information in formats and scales that are most useful for local planners.

WDFW currently maintains the Priority Habitats and Species (PHS) program, which gives counties data on the location of priority fish and wildlife habitats as well as habitat management recommendations. But the current PHS approach does not address larger landscape issues such as habitat connectivity, regional or local species viability, prioritization of habitat areas, cumulative effects of development, or multi-county habitat management. WDFW and its partners are developing other tools to help counties address these needs, including new landowner incentives being investigated by the Washington Biodiversity Council.

The ecoregional assessments described in Chapter VI, Washington's Ecoregional Conservation Strategy, are another important tool being developed by WDFW and the Washington Department of Natural Resources to identify areas of ecoregional significance. Finer scale assessments such as the local habitat assessments are yet another tool that will help connect sites of ecoregional biodiversity importance with habitats of local significance. By incorporating existing data, including that from PHS and the Washington Natural Heritage Program, the local habitat assessments produce digital "conservation utility maps" that portray the relative importance of wildlife habitat and biodiversity across the landscape. Both the ecoregional and local assessments should be useful to local governments in understanding where habitat is likely to be lost or gained under various land use plan alternatives, as well as informing funding and incentive programs. Finally, guidance documents that address the needs of specific native fish and wildlife species are being developed to improve technical assistance for landowners and land use planners.

Several Washington counties have begun incorporating fish and wildlife or biodiversity assessments into their local growth management plans. These efforts are briefly discussed below.

I. Major Statewide Conservation Planning and Assessment Initiatives

WDFW, working with many public, tribal and private conservation partners, is involved in a number of large conservation planning and assessment efforts for fish and wildlife species, habitats and biodiversity. These collaborative efforts are conducted at various levels of detail, concluding statewide, regional and county scales. WDFW also develops and implements management and recovery plans for many species, management recommendations for priority habitats, and strategic planning for administration of the agency. One of the primary opportunities for cooperation between WDFW and other public and private partners has been and will continue to be participation in the collaborative development of statewide and regional conservation plans and habitat assessments, as well as initiatives such as the Washington Biodiversity Council.

Some of the most important of these collaborative planning and assessment efforts are described below. Many of these plans and assessments were consulted and incorporated into the discussion of wildlife species, habitats and conservation strategies in the Washington CWCS. Many of the same planning and assessment efforts, as well as others not mentioned, will provide opportunities for WDFW and other conservation partners to work together to implement the various wildlife species and habitat recommendations in the Washington CWCS.

State of Washington Natural Heritage Program: The Washington State Legislature established the Washington Natural Heritage Program (WNHP) in 1982, through an amendment to the Natural Area Preserves Act (RCW 79.70), placing the program within the Department of Natural Resources. One of the requirements of the amended Natural Area Preserves Act is that the NHP must prepare and/or update a Natural Heritage Plan each biennium. The S*tate of Washington Natural Heritage Plan*, updated in 2003 by ecoregion, provides the framework for a statewide system of natural areas by 1) identifying the criteria and process by which natural areas are selected, 2) identifying priority ecosystems and species for protection, 3) outlining methods of protection, and 4) identifying the roles of agencies/organizations in natural area protection. The statewide natural areas system is meant to provide habitats for rare and/or declining species and places for healthy functioning ecosystems, as well as opportunities for scientific research and education. The statewide system includes natural areas managed by state agencies (including DNR's Natural Areas Program, WDFW and State Parks), federal agencies (including the USDA Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service, National Park Service and the U.S. Department of Defense) and private conservation organizations (http://www.dnr.wa.gov/nhp/).

Washington Biodiversity Council: The Washington Biodiversity Council was created in 2004 to develop and promote more effective ways of conserving Washington's biodiversity. Comprised of 23 members, the Council is directed to develop a proactive blueprint for biodiversity protection that is comprehensive, enables policymakers to target limited funds, and goes beyond the crisis-driven policies that currently dictate many of our conservation efforts. In short, it is an opportunity to shape Washington's first-ever biodiversity strategy.
http://www.iac.wa.gov/biodiversity/default.htm

Northwest Forest Plan (NWFP): The Northwest Forest Plan (NWFP) presents a vision for a sustainable future for federal natural resources (lands managed by the USDA Forest Service and the U.S. Bureau of Land Management) and for local timber-dependent communities within the range of the northern spotted owl, which encompasses all or portions of 17 National Forests in Washington, Oregon and California. The NWFP, adopted in 1994, amended individual Land and Forest Management Plans for each of seven National Forests in Washington and established new management approaches such as Late Successional Reserves (LSR), which are designed to promote the long-term conservation of late successional-dependent wildlife species such as the northern spotted owl. Within the area covered by the Northwest Forest Plan, over 85% of the USDA Forest Service and Bureau of Land Management land base is now within a "reserve" classification designed to protect either old growth- or riparian-dependent wildlife species. The NWFP also includes Aquatic Conservation Strategies designed to further protect habitat for salmonids and other aquatic species. http://www.fs.fed.us/r6/nwfp.htm

Northwest Power and Conservation Council Fish and Wildlife Program: The Northwest Power Act of 1980 directs the Council to develop a program to protect, mitigate and enhance fish and wildlife of the Columbia River basin that have been impacted by hydropower dams. This program is being implemented through a partnership of federal and state agencies. Coordinated fish and wildlife plans have been developed for 58 subbasins in Washington and other Northwest states. http://www.nwcouncil.org/fw/program/Default.htm

Ecoregional Assessments (EAs): To provide an ecoregional perspective for multi-species conservation and ecosystem-level habitat protection, WDFW and the Washington Department of Natural Resources joined a public-private partnership in 2001 with The Nature Conservancy to conduct nine ecoregional assessments for the state's nine ecoregions. These assessments will guide the state's future actions by identifying high priority areas for the conservation of biological diversity in each ecoregion, and they will provide usable, comprehensive information for planning and decision making at both regional and statewide scales. The EAs are discussed in more detail in Chapter VI, Washington's Ecoregional Conservation Strategy and in Volume 2, Approach and Methods.

Puget Sound Water Quality Management Plan: The Puget Sound Water Quality Management Plan is Washington's long-term strategy for protecting and restoring Puget Sound. The management plan provides the framework for managing and protecting the Sound and coordinating the roles and responsibilities of federal, state, tribal and local governments. The management plans also serves as the federally approved Comprehensive Conservation and Management Plan (CCMP) for Puget Sound under Section 320 of the federal Clean Water Act, which established the National Estuary Program.
http://www.psat.wa.gov/Publications/manplan00/mp_index.htm

Puget Sound Nearshore Restoration Project: The Puget Sound Nearshore is defined as that area of marine and estuarine shoreline extending from the Canadian border throughout Puget Sound and out the Strait of Juan de Fuca to the Pacific Ocean (approximately 2,500 miles). The Puget Sound Restoration Project was initiated in 2003 to identify significant ecosystem problems, evaluate potential solutions, and restore and preserve critical nearshore habitat. The project represents a partnership between the state and federal government organizations, Indian tribes, industries and environmental organizations.
http://www.pugetsoundnearshore.org/

Salmon Recovery Plans and Assessments: WDFW is either leading or heavily involved in all statewide and regional assessments and plans that specifically address salmon recovery in Washington. Included are the Salmon & Steelhead Habitat Inventory & Assessment Project (SSHIAP), Puget Sound Shared Salmon Strategy, Salmon Recovery Funding Board and the Puget Sound Comprehensive Chinook Management Plan. Other statewide or regional conservation plans such as the Puget Sound Action Plan, while not specific to salmon, do address the protection and management of important salmon habitat and migration corridors. The National Marine Fisheries Service has the lead federal role in recovering ESA-listed salmon stocks in Washington and other states. As co-managers of the salmon resource, Washington's Treaty Indian tribes also play a major role in developing and implementing salmon recovery efforts in Washington. A more complete list of salmon recovery plans and assessments is included as Appendix 7. http://wdfw.wa.gov/recovery.htm or http://www.governor.wa.gov/gsro/regions/recovery.htm.

U.S. Fish and Wildlife Service Comprehensive Refuge Management Plans: Under the National Wildlife Refuge System Improvement Act of 1997 (Refuge Improvement Act), all national wildlife refuges are required to develop a Comprehensive Conservation Plan (CCP), a document that provides a framework for guiding refuge management decisions. All refuges are required by law to complete their CCP by 2012. The CCP process complies with standards outlined in the National Environmental Policy Act (NEPA). NEPA requires CCPs to examine a full range of alternative approaches to refuge management and also to involve the public in selecting the alternative best suited to the refuge's purposes. Of Washington's 20 National Wildlife Refuges (NWR), only Little Pend Oreille and Nisqually NWRs have completed a CCP. Comprehensive conservation planning is currently underway for 12 more refuges, and the remaining seven refuges will have completed CCPs by 2011. http://pacific.fws.gov/planning/

Intermountain West Joint Venture Coordinated All-Bird Conservation Plan for Eastern Washington: The Intermountain West Joint Venture (IWJV) was established in 1994 as the eleventh public-private partnership to implement the habitat goals of the North American Waterfowl Management Plan. The IWJV encompasses parts of eleven Western states, including all of eastern Washington. Western Washington is covered within the Pacific Coast Joint Venture. IWJV partners work to identify, protect, restore and enhance wetlands and other important habitats for waterfowl and other migratory birds, as well as native resident birds such as sage-grouse and sharp-tail grouse. In 2005, the IWJV adopted "all-bird" conservation plans for all eleven states within the IWJV. These plans reflect a multi-year, collaborative effort among many federal, state and private conservation partners who collectively identified and ranked priority bird species, priority habitats, and hundreds of landscape-level Bird Habitat Conservation Areas (BHCA). The coordinated all-bird plan for eastern Washington includes 43 such BHCAs. http://www.iwjv.org

Interior Columbia Basin Ecosystem Management Project: In July 1993, the USDA Forest Service was directed to "develop a scientifically sound and ecosystem-based strategy for management of eastside forests." Over 170 different GIS data layers or themes were developed, focusing on the upper Columbia River basin east of the Cascades. Much of the information is derived from other data providers, including the USDA Forest Service, Bureau of Land Management, Environmental Protection Agency, National Marine Fisheries Service, U.S. Fish and Wildlife Service and U.S. Geological Survey. In 2003 these federal agencies signed a memorandum of understanding to implement the Interior Columbia Basin Ecosystem Management Strategy. http://www.icbemp.gov/

Washington GAP Project: The Gap Analysis Program: A Geographical Approach to Planning (GAP) data are based on an interpretation of vegetation types and habitat associations. The GAP program is funded by the Biological Resources Division of the U.S. Geological Survey and located within the Washington Cooperative Fish and

Wildlife Research Unit at the University of Washington.
http://www.fish.washington.edu/naturemapping/wagap/public_html/

Important Bird Areas (IBA) Programs: The IBA Program is an international, site-based approach to bird conservation that began in Europe in the mid-1980s. The Washington IBA Program was initiated in 1997 as a joint effort of Audubon Washington and WDFW. Between 1998 and 2000, 75 sites were formally nominated and evaluated, and 56 of these sites were described in *Important Bird Areas of Washington*, published in 2001 by Audubon Washington. The IBA Program is currently being updated and expanded by Audubon Washington, which is also developing a statewide Washington Birding Trail system that will reflect and be compatible with the Washington IBA Program. For more information, go to http://wa.audubon.org/new/audubon.

Partners in Flight (PIF): The national Partners in Flight (PIF) program began in 1989 as a coordinated effort to document and reverse apparent declines in the populations of neotropical migratory birds, those birds that breed north of Mexico and then migrate to Mexico, Central and South America, and the Caribbean in the winter months. The development of a conservation strategy for Partners in Flight in Washington has been accomplished by the Oregon-Washington Partners in Flight Working Group that released five provincial plans for landbird conservation in both states in 2000. Three of these provincial plans together provide a landbird conservation strategy for eastern Washington: Conservation Strategy for Landbirds in the Columbia Plateau of Eastern Oregon and Washington, Conservation Strategy for Landbirds of the East Slope of the Cascade Mountains of Eastern Oregon and Washington, and Conservation Strategy for Landbirds in the Northern Rocky Mountains of Eastern Oregon and Washington. For more information on the national and Washington PIF efforts, go to: http://www.partnersinflight.org.

Pacific Marine Fisheries Council Groundfish Strategic Plan: This strategic plan is intended to provide guidance for groundfish management in 2001 and beyond. It is intended to be a resource for efforts to rebuild depleted stocks and maintain healthy stocks and to guide efforts to reduce the size of the fishing fleet to a level that is both biologically sustainable for the resource and economically sustainable for the fishing fleet. http://www.pcouncil.org/groundfish/gfother/stratplan.pdf

Washington Forest Practices Rules: The Washington Forest Practices Board has the authority and responsibility to regulate forest practices on both state and private lands. Current rules and regulations address wildlife resource issues such as snag and leave tree requirements, wetland and riparian buffers, and establishment of critical habitat for the bald eagle, gray wolf, grizzly bear, mountain caribou, Oregon silverspot butterfly, peregrine falcon, greater Sandhill crane, northern spotted owl, western pond turtle, and marbled murrelet. The Forest Practices Board is currently engaged in implementation issues related to the new Forests and Fish regulations designed to protect forested habitat for salmonids and a select group of amphibian species. In addition, the Board has adopted a comprehensive wildlife work plan that includes three primary elements: 1) an assessment of species-specific rules (e.g. bald eagle, northern spotted owl), 2) a landscape-level wildlife habitat assessment, and 3) development of incentives to promote habitat protection and landscape planning. Adaptive management will be incorporated into the three elements as needed. http://www.dnr.wa.gov/forestpractices/board, http://www.forestsandfish.com.

WDFW Wildlife Area Plans: These plans define the goals and objectives for priority habitat and species management and protection on WDFW lands. The plans address issues to achieve sustainable wildlife populations and to provide compatible fish and wildlife-related recreational opportunities on Wildlife Areas. Each plan will provide management direction for individual Wildlife Areas. The plans will be updated annually to maintain their value as flexible working documents. Each plan will identify needs and guide activities on the area based on the Washington Department of Fish and Wildlife Agency Mission of "Sound Stewardship of Fish and Wildlife" and its underlying statewide goals and objectives as they apply to local conditions. http://wdfw.wa.gov/viewing/wildarea/wildarea.htm.

J. Major Fish and Wildlife Species and Habitat Databases

A number of major fish, wildlife and habitat databases and information sources are available to WDFW and its conservation partners to help design fish and wildlife conservation programs and implement the Washington CWCS. These databases and information sources are summarized with appropriate web links in Section J below.

Washington Priority Habitats and Species (PHS) List

The Priority Habitats and Species (PHS) List is a catalog of those species and habitat types identified by the Washington Department of Fish and Wildlife as priorities for management and preservation. Because information on fish, wildlife, and their habitats is dynamic, the PHS List is updated periodically.

Priority species require protective measures for their perpetuation due to their population status, sensitivity to habitat alteration, and/or recreational, commercial, or tribal importance. Priority species include State Endangered, Threatened, Sensitive, and Candidate species; animal aggregations considered vulnerable; and those species of recreational, commercial, or tribal importance that are vulnerable. Priority habitats are those habitat types or elements with unique or significant value to a diverse assemblage of species. A Priority habitat may consist of a unique vegetation type or dominant plant species, a described successional stage, or a specific structural element.

There are 18 habitat types, 140 vertebrate species, 28 invertebrate species, and 14 species groups currently on the PHS List. These constitute about 16 percent of Washington's approximately 1,000 vertebrate species and a fraction of the state's invertebrate fauna. Mapping of priority habitats and species was initiated in 1990 and includes about two-thirds of Washington's 43 million acres. The remaining third generally involves federal and tribal lands. Mapping consists of recording locational and descriptive data in a Geographic Information System (GIS). These GIS databases represent WDFW's best knowledge of fish and wildlife resources and occurrences. It is important to note, however, that priority species or priority habitats may occur in areas not currently known to WDFW biologists or in areas for which comprehensive surveys have not been conducted. Site-specific surveys may be necessary to rule out the presence of priority habitats or species on individual sites.

Included in the PHS system of databases are WDFW's PHS Points and Polygon Databases, StreamNet, and the Wildlife Heritage Database. Other information sources include the Department of Natural Resources Aquatic Lands Division database on kelp beds and the U.S. Fish and Wildlife Service's information on the National Wetlands Inventory (NWI).

The PHS Internet home page can be accessed via the World Wide Web at: www.wa.gov/wdfw/hab/phspage.htm

Washington Natural Heritage Information System

The Washington Natural Heritage Program (WNHP) was established by the State Legislature and placed within the Washington Department of Natural Resources (WDNR) in 1982. The main objectives of establishing the program were 1) to develop and maintain an objective classification of the state's species and ecosystems, 2) to develop an inventory of the locations of priority species and ecosystems, 3) to use the information to help guide the development of a statewide system of natural areas, and 4) to share the information with agencies, organizations and individuals for environmental assessment and land management purposes.

Since its establishment, the WNHP has been gathering information on rare species and both rare and common ecosystems. The WNHP maintains the primary statewide information system on rare plant species, managing information on more than 350 species of rare plants and more than 5,000 locations of those species statewide. The WNHP also has information and expertise on select groups of rare animal species. The WNHP zoologists work cooperatively with WDFW zoologists on individual projects and on setting species priorities. The WNHP's vegetation ecologists are responsible for the development and maintenance of the statewide ecosystems classification used in ecoregional assessments and other conservation planning purposes.

The Washington Natural Heritage Information System is a major source of information for individuals, agencies and organizations engaged in land use planning and decision making. During the two-year period 2003-2005, the WNHP provided information to more than 1,000 private companies, local governments, state and federal agencies, conservation organizations and educational institutions.

The WNHP is a member of a network of similar programs throughout the western hemisphere. The network, NatureServe, has member programs in all 50 states, all Canadian provinces, and several Latin American and Caribbean nations. All programs use the same basic methodology and data management tools to assess rarity and set conservation priorities. This allows for improved sharing of information and consistency of conservation efforts across political boundaries.

The WNHP home page can be accessed via the Internet at:
http://www.dnr.wa.gov/inhp/index.html
Additional information about NatureServe is available via the Internet at:
http://www.natureserve.org

Interactive Biodiversity Information System (IBIS)

IBIS is an informational resource developed by the Northwest Habitat Institute (NHI) to promote the conservation of Northwest fish, wildlife, and their habitats through education and the distribution of timely, peer-reviewed scientific data.

The IBIS web site is in the early stages of development; however, NHI staff, with the support of many project partners, has been developing the data for over five years. The IBIS database was initially developed by NHI for Oregon and Washington during the Wildlife-Habitat Types in Oregon and Washington project. IBIS data is currently being refined and extended to include all of Idaho, Oregon, Washington, and the Columbia River Basin portions of Montana, Nevada, Utah and Wyoming. IBIS will eventually include species range maps, wildlife-habitat maps, extensive species-habitat data queries, and interactive wildlife-habitat mapping applications allowing dynamic spatial queries for the entire Pacific Northwest as previously defined.

The IBIS Internet Home Page can be accessed via the World Wide Web at: http://www.nwhi.org/ibis/home/ibis.asp

Washington GAP Database

The Washington GAP Analysis Program (GAP) is a nation-wide program currently administered by the Biological Resources Division of the US Geological Survey (BRD-USGS; formerly the National Biological Service [NBS]). The overall goal of GAP Analysis is to identify elements of biodiversity that lack adequate representation in the nation's network of reserves (i.e., areas managed primarily for the protection of biodiversity). GAP Analysis is a coarse-filter approach to biodiversity protection. It provides an overview of the distribution and conservation status of several components of biodiversity, with particular emphasis on vegetation and terrestrial vertebrates. Digital map overlays in a Geographic Information System (GIS) are used to identify vegetation types, individual species, and species-rich areas that are unrepresented or underrepresented in existing biodiversity management areas. GAP Analysis functions as a preliminary step to more detailed studies needed to establish actual boundaries for potential additions to the existing network of reserves.

The network of Conservation Data Centers (CDC) and Natural Heritage Programs established cooperatively by The Nature Conservancy and various state agencies maintain detailed databases on the locations of rare elements of biodiversity. Conservation of such elements is best accomplished through the fine-filter approach of the above organizations. It is not the role of GAP to duplicate or disseminate Natural Heritage Program or CDC Element Occurrence Records. Users interested in more specific information about the location, status, and ecology of populations of such species are directed to their state Natural Heritage Program or CDC.

The Washington GAP Analysis Internet Home Page can be accessed via the World Wide Web at: http://www.fish.washington.edu/naturemapping/waGAP/public_html/index.html

National Wetland Inventory (NWI)

The National Wetlands Inventory (NWI) of the U.S. Fish and Wildlife Service produces information on the characteristics, extent, and status of the Nation's wetlands and deepwater habitats. The National Wetlands Inventory Center information is used by federal, state, and local agencies, academic institutions, U.S. Congress, and the private sector. The NWIC has mapped 90 percent of the lower 48 states, and 34 percent of Alaska. About 44 percent of the lower 48 states and 13 percent of Alaska are digitized. Congressional mandates require the NWIC to produce status and trends reports to Congress at ten-year intervals. In addition to status and trends reports, the NWIC has produced over 130 publications, including manuals, plant and hydric soils lists, field guides, posters, wall size resource maps, atlases, state reports, and numerous articles published in professional journals.

The NWI National Center in St. Petersburg, Florida, includes a state-of-the-art computer operation, which is responsible for constructing the wetlands layer of the National Spatial Data Infrastructure. Digitized wetlands data can be integrated with other layers of the NSDI such as natural resources and cultural and physical features, leading to production of selected color and customized maps of the information from wetland maps, and the transfer of digital data to users and researchers world-wide. Dozens of organizations, including federal, state, county agencies, and private sector organizations such as Ducks Unlimited, have supported conversion of wetland maps into digital data for computer use. Digitized wetland data are also available for portions of 37 other States. Once a digital database is constructed, users can obtain the data at no cost over the Internet, or through the U.S. Geological Survey for the cost of reproduction.

The National Wetlands Inventory Internet Home Page can be accessed via the World Wide Web at: http://wetlands.fws.gov/

Salmonid Stock Inventory Database (SaSI)

WDFW developed SaSI in 1992 to identify changes in salmonid stock health and to prioritize recovery efforts. SaSI is a standardized, uniform approach to identifying and monitoring the status of Washington's salmonid fish stocks. The inventory is a compilation of data on all wild stocks and a scientific determination of each stock's status as healthy, depressed, critical, unknown or extinct. SaSI is a cooperative product of WDFW and tribal co-managers. (http://wdfw.wa.gov/fish/sassi/intro.htm).

A total of 515 stocks have been identified. Of these, 201 stocks (39%) were rated as healthy, 124 stocks (24%) were rated as depressed, 18 (3%) were rated as critical, and 171(33%) were of unknown status. The percentage of stocks of unknown status varies considerably, from 11% in sockeye to 72% in bull trout/Dolly Varden.

Salmon and Steelhead Habitat Inventory and Assessment Program Database (SSHIAP)

The Salmon and Steelhead Habitat Inventory and Assessment Program (SSHIAP) supports a spatial data system that characterizes salmonid habitat conditions and distribution of salmonid stocks in Washington at the scale of 1:24,000. SSHIAP is co-managed by the Washington Department of Fish and Wildlife (WDFW) and the Northwest Indian Fisheries Commission (NWIFC); NWIFC has primary stewardship in

Water Resource Inventory Areas (WRIAs) 1 – 23; WDFW is the primary data steward in WRIAs 24 – 62. The foundation of the SSHIAP data system is a 1:24,000-scale cleaned and routed hydrography layer. This hydrolayer provides a consistent spatial data foundation for integrating a wide variety of habitat information and for subsequent analyses. The SSHIAP data system quantitatively characterizes habitat conditions, incorporates a wide variety of information sources, and links habitat conditions and stock distribution with productivity modeling efforts. SSHIAP is designed to support regulatory, conservation, and analysis efforts such as Washington State Watershed Analysis, State Salmon Recovery, Habitat Conservation Planning, Ecosystem Diagnosis and Treatment (EDT), and others.

SSHIAP data may be viewed on SalmonScape, an interactive, user-friendly, map-based web application. Data layers include hydrography, fish distribution, Salmonid Stock Inventory (SaSI), barriers to fish passage, habitat characteristics such as stream gradient, and Ecosystem Diagnosis and Treatment model output. Data can be displayed over shaded relief or orthographic photos. Users can query by stream or spatial location and can make limited queries of data content.

IV. SPECIES OF GREATEST CONSERVATION NEED

Washington's Species of Greatest Conservation Need (SGCN) list is the driving force behind Washington's CWCS. It builds on current efforts to protect fish and wildlife species, including those listed on state and federal endangered, threatened and sensitive species lists, as well as species not yet listed but for which conservation actions or additional information is needed.

Construction of the SGCN list began by ranking a source list of almost 700 fish and wildlife species derived from previously evaluated lists, including the Property Habitats and Species (PHS) list, and ended with an initial statewide SGCN list of approximately 200 species. The full list of 600 fish and wildlife species, including the SGCN, is shown as Appendix 1. A separate Appendix 2 lists the anadromous salmonids included on the full SGCN list. The salmonids were ranked by genetically distinct unit (GDU) rather than by species. The criteria used to evaluate over 700 fish and wildlife species is included as Appendix 3.

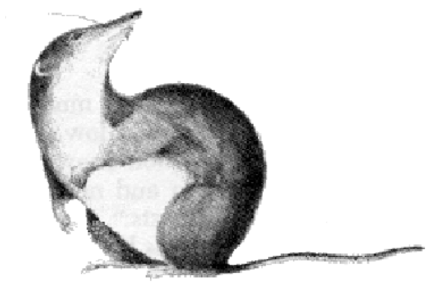
In Appendices 1 and 2, the Species of Greatest Conservation Need are those wildlife species listed above the heavy blue line. In appendix 1, the blue line is on page 623.

On the following pages of this chapter, we have included a large table with current information on population, distribution, problems, strategies and actions for all 200 Species of Greatest Conservation Need. Appendices 9 and 10 provide additional information on SGCN. A regional subset of SGCN and Associated Priority Habitats is also provided within each of the ecoregional chapters in Chapter VI.

Many of the wildlife species on this SGCN list ranked high because of biological concerns such as threat and vulnerability. Some were targeted for the list because it was determined that their recovery or conservation efforts were not adequately funded. Others were included because their life histories and habitat relationships are not well understood and need more research, surveys and/or management dollars directed to them. Only native animal species were considered in developing this list; however, no major groups of wildlife (taxa) were excluded from consideration. Game and commercially harvested species were included if they met other ranking criteria such as inclusion on WDFW's PHS list or the list of global or state ranked species of concern developed by the Washington Natural Heritage Program. Guidelines for the Natural Heritage Program can be accessed at: http://www.natureserve.org/explorer/aboutd.htm or http://www.dnr.wa.gov/nhp.

The process and criteria for developing the SGCN list and Associated Habitats of Conservation Concern list is provided in Volume Two: Approach and Methods.

MAMMALS

Preble's shrew *Sorex preblei*	**Biology and Life History**	**Population**	**Distribution**
 from Ingles 1965	Forest floor insectivore	Species status in Washington is unknown	Only recorded from limited area of the Blue Mountains in Garfield County in habitat atypical for species
Monitoring Activities ➔	No formal surveys/protocol; information gained from research projects and scientific collection permits, and museum specimen collections.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Limited distribution	small, isolated population vulnerable to extinction	Determine status	Conduct trapping surveys at historical sites

Merriam's shrew *Sorex merriami*	**Biology and Life History**	**Population**	**Distribution**
 from Ingles 1965	Steppe insectivore	Low, unknown	Found in the Columbia Basin and Blue Mountains.
Monitoring Activities ➔	No formal surveys/protocol; information gained from research projects and scientific collection permits, and museum specimen collections.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat loss	Loss, degradation and fragmentation due to agriculture, grazing, pesticides and altered fire regimes	Conserve suitable habitat	Conserve and protect habitat through landowner cooperation, land acquisition, and management of land use practices. Survey for potential sites.
Lack of information	Few surveys of shrews associated with arid habitats have been conducted.	Determine status	Conduct surveys to determine abundance and status and habitat requirements. Research and monitor life history and limiting factors.

Keen's myotis *Myotis keeni*	**Biology and Life History**	**Population**	**Distribution**
 Bat Conservation International	Coastal forest insectivore, roosts in tree cavities, rock crevices and small caves.	Unknown	Olympic Peninsula and along shore of northern Puget Sound
Monitoring Activities →	USDA Forest Service-initiated survey on multiple long-eared bat species on the Olympic Peninsula will collect opportunistic data on this species' distribution. Limited information has been gained from research projects, scientific collection permits, and museum specimen collections.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Lack of information	Little is known about behavior and population status.	Assess life history and behavior, limiting factors and habitat requirements.	Conduct research and surveys to determine abundance, status and habitat requirements. Research and monitor life history and limiting factors.
Limited distribution	One of the smallest distributional ranges of any North American bat.	Determine status.	Conduct coordinated surveys throughout known range to determine population and distribution.
Habitat loss	Loss and fragmentation due to logging and human disturbance	Conserve and protect existing habitat.	Conserve and protect existing habitat, identify suitable habitat.

Pallid Townsend's big-eared bat *Corynorhinus townsendii pallascens*	**Biology and Life History**	**Population**	**Distribution**
 Arizona Department of Game & Fish	Sagebrush steppe, grasslands, riparian. Roosts in caves and tunnels.	Low, unknown	Low to mid-elevation areas throughout Washington east of the Cascades.
Monitoring Activities ➔	Periodic surveys conducted of known colonies statewide by multiple partners. Implement standard survey protocols developed by the Western Bat working Group to determine distribution and abundance.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Disturbance	Reclamation of abandoned mines, vandalism and disturbance of critical maternity roosts and hibernacula	Conserve and protect roosting habitat, particularly identified maternity roosts.	Identify roosting sites and limit access to these areas. Protect and conserve preferred roost and hibernacula sites.
Habitat loss	Possible degradation of habitat through conversion to agriculture.	Determine suitability of agricultural land as habitat.	Conduct distribution and abundance surveys in agricultural areas.

Pacific Townsend's big-eared bat *Corynorhinus townsendii townsendii*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. of Fish & Wildlife	Low-elevation deciduous and conifer forests, riparian. Roosts in caves and tunnels; tree cavities at night.	Low, unknown	Low to mid-elevation areas throughout Washington west of the Cascades.
Monitoring Activities ➔	Periodic surveys conducted of known colonies statewide by multiple partners. Implement standard survey protocols developed by the Western Bat working Group to determine distribution and abundance.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Disturbance	Reclamation of abandoned mines, vandalism and disturbance of maternity roosts and hibernacula	Conserve and protect roosting habitat, particularly identified maternity roosts.	Identify roosting sites and limit access to these areas. Protect and conserve preferred roost and hibernacula sites.
Habitat loss	Possible degradation of habitat through conversion to agriculture.	Determine suitability of agricultural land as habitat.	Conduct distribution and abundance surveys in agricultural areas.

White-tailed jackrabbit *Lepus townsendii*	**Biology and Life History**	**Population**	**Distribution**
 S. McDonald, Cal Photos	Herbivore inhabiting open shrub-steppe	declining	Limited to Columbia Plateau and Okanogan ecoregions in WA
Monitoring Activities ➔	Survey protocol may be developed by University of Washington genetics research project partially funded by the Washington Falconers Association in coordination with Washington Falconers Association.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Limited Habitat, Habitat loss	Conversion of shrub steppe to cropland; overgrazing	Conserve suitable habitat	Conserve suitable habitat
Disease; Limited distribution	disease may be responsible for recent decline	Test and monitor for disease, Population monitoring and research,	assess need of reintroductions
Lack of information	jackrabbits have undergone mysterious declines	determine status	Determine and map distribution; investigate cause of declines

Black-tailed jackrabbit *Lepus californicus*	**Biology and Life History**	**Population**	**Distribution**
 Alison M. Sheehey, Cal Photos	Herbivore inhabiting shrub steppe	declining	Limited to Columbia Plateau in WA
Monitoring Activities →	Survey protocol may be developed by University of Washington genetics research project partially funded by the Washington Falconers Association in coordination with Washington Falconers Association.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Lack of information	jackrabbits have undergone mysterious declines	Determine status	Determine and map distribution; investigate cause of declines
Habitat Loss	Conversion of shrub steppe to agriculture	Conserve suitable habitat,	Management agreements,
Disease; Limited distribution	disease may be responsible for recent decline	Test and monitor for disease, Population monitoring and research,	Assess need of reintroductions

Pygmy rabbit *Brachylagus idahoensis*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. of Fish & Wildlife	Herbivore inhabiting sagebrush habitat with deep soils	critically low population; remaining individuals captured for captive breeding recovery project.	Was limited to small area in Douglas Co., before being placed in captivity. No known individuals occurring in the wild.
Monitoring Activities ➔	Intensive surveys conducted WDFW and Washington State University for occurrence of remnant populations; will resume set protocol annual surveys once captive animals are returned to the wild.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Severe population decline	Small population size	Increase distribution	Reintroduce sufficient numbers through captive breeding
Loss of deep soil sagebrush habitat	Loss of genetic diversity	Restore degraded habitats	Increase amount and connectivity of suitable habitat

Olympic marmot *Marmota olympus*	**Biology and Life History**	**Population**	**Distribution**
 Sunny Walter, WWW Photography	*Marmota olympus*	Herbivore inhabiting alpine parklands with rock slide, boulder piles, herbaceous vegetation, and few to no trees	Exists largely in protected areas of Olympic National park and National forest
Monitoring Activities ➔	Surveys conducted annually by Olympic National Park, U.S. Geological Survey Biological Resources Division, and universities as part of long-term ongoing research projects.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Disturbance	Human disturbance and potentially increased rate of predation caused by visitors feeding coyotes at visitor areas near marmot colonies	Education and enforcement	Control and monitor human disturbance; enforce park rules regarding interactions with wildlife.
Limited habitat and distribution	demographic and genetic effects of small population size and metapopulation structure.	Determine Status; Monitor and research populations and habitat.	Develop survey protocols in cooperation with other agencies.

Townsend's ground squirrel ssp. *Spermophilus townsendii townsendii*	**Biology and Life History**	**Population**	**Distribution**
 Herbert Clarke, Burke Museum, U of WA	Shrub-steppe species, found in small to large colonies, hibernates up to 8 mo./year	Believed to be declining; extirpation of some historical populations	Endemic to south-central Washington
Monitoring Activities ➔	Ongoing research/surveys to detect colony occurrence and numbers, survey protocol to be developed. Current survey activity ongoing by WDFW, U.S. Army, universities.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Lack of information	Data on population and habitat trend lacking, but suspect both are declining	Determine status; test and monitor for disease	Undertake field surveys for presence and abundance
Harvest	target shooting (plinking)	Education and outreach;	Add to list of protected wildlife
Development; Habitat loss	urban and rural sprawl, conversion and degradation of sagebrush habitats	Monitoring and research on habitat	Gather basic information on habitat use/selection, habitat condition.

Townsend's ground squirrel ssp. *Spermophilus townsendii nancyae*	**Biology and Life History**	**Population**	**Distribution**
SEE ABOVE PHOTO	Shrub-steppe species, found in small to large colonies, hibernates up to 8 mo./year	Size unknown but probably declining.	Endemic to south-central Washington
Monitoring Activities ➔	Ongoing research/surveys to detect colony occurrence and numbers, survey protocol to be developed. Current survey activity ongoing by WDFW, U.S. Army, universities.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Lack of information	Data on population and habitat trend lacking, but suspect both are declining	Determine status, test and monitor for disease	Undertake field surveys for presence and abundance
Harvest	target shooting (plinking)	Education and outreach;	Add to list of protected wildlife
Development; Habitat loss	urban and rural sprawl, conversion and degradation of sagebrush habitats	Monitoring and research on habitat	Gather basic information on habitat use/selection, habitat condition.

Washington ground squirrel *Spermophilus washingtoni*	**Biology and Life History**	**Population**	**Distribution**
 U.S. Fish & Wildlife Service	Shrub-steppe species, found in small to large colonies, hibernates up to 8 mo./year	Size unknown but declining.	Endemic to southeastern Washington and north-central Oregon.

Monitoring Activities ➔	Ongoing research/surveys to detect colony occurrence and numbers, survey protocol to be developed. Current survey and research activity ongoing by WDFW, universities and U.S. Fish & Wildlife.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat loss	Conversion to agriculture and development, and fragmentation of habitat may isolate remaining populations	Monitoring and research of habitat	Use land acquisitions, conservation easements, and landowner agreements to protect significant colonies, and increase habitat connectivity. Buy vacuum truck for relocations.
Invasive plant species	Cheatgrass invasion and fires	Restore degraded habitats	Manage degraded habitat at colonies.
Harvest; illegal target shooting (plinking)	Illegal target shooting continues despite legal protection	Education and outreach; Control and monitor disturbance; enforce existing protective regulations	Efforts are needed to reduce the amount of illegal shooting.
Lack of information	Causes of recent declines uncertain; range not well known.	Determine Status; Research into causes of recent declines, test and monitor for disease	Conduct research on current status and causes of decline, continue surveys for range.

Western gray squirrel *Sciurus griseus*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. of Fish & Wildlife	Habitat specialist tree squirrel, strongly associated with oak/ponderosa pine or oak/Douglas fir forests	Historical declines; occurs in 3 isolated subpopulations;	Limited to 3 subpopulations: Klickitat County, southern Okanogan-eastern Chelan Cos., and Fort Lewis in Pierce County.
Monitoring Activities ➔	Intensive surveys conducted by WDFW through research projects in Klickitat and Okanogan Counties and Fort Lewis in Thurston County. Survey and monitoring partners have included WDFW, The Nature Conservancy, University of Washington, and timber industry. Need future survey protocols for long-term management.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat loss	Timber harvest, fire, residential development	Conserve suitable habitat, Habitat and population monitoring and research	Protect areas with concentrations of squirrel nests from timber harvest; provide protective buffers around trees with nests; develop critical habitat rule; work with counties to conserve habitat
Invasive animals	Competition from non-native eastern gray and fox squirrels	Monitor and control invasive animal	Conduct limited control of eastern gray and fox squirrels

Limited distribution	At risk from loss of genetic diversity, disease and demographic factors	Increase distribution	Monitoring and research of population and habitat; assess feasibility of population augmentations, and implement where feasible

Brush Prairie pocket gopher *Thomomys talpoides douglasi*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. of Fish & Wildlife	Fossorial herbivore; occurs in open areas with low herbaceous vegetation.	Isolated subspecies of the northern pocket gopher; trend unknown	Limited in distribution to south-central Clark County.
Monitoring Activities ➔	No routine surveys, occurrence information from museum collections, historic research and survey projects, and scientific collection permit information.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Development	loss and fragmentation of habitat	Conserve suitable habitat	Protection of prairies, meadows, grasslands; grassland restoration through voluntary and legal means
Harvest and persecution	trapping by landowners and mortality by pets	Outreach and education;	Inform local residents of gopher colonies, prohibit trapping; promote non-lethal methods of damage control
Limited distribution	genetic and demographic effects of small population size, catastrophic events	Population monitoring and research	Determine status and conduct surveys to monitor presence and relative abundance

Invasive plant species	Degradation of suitable habitat	Restore degraded habitats	Remove invasive trees, scotch broom from prairie/grassland areas.

Mazama pocket gopher *Thomomys mazama*	**Biology and Life History**	**Population**	**Distribution**
 Burke Museum, University of Washington	Fossorial herbivore; occurs in prairies, grasslands and alpine meadows; require herbs and loose, dry soil for burrowing.	Declining; several populations extinct	Occurs in the southern Puget Sound area the alpine meadows in northern Olympic Mountains.
Monitoring Activities →	No routine surveys, periodic spot surveys by WDFW, limited historic by University of Puget Sound, University of Washington as part of research projects, recent local surveys by The Evergreen State College. Occurrence information from museum specimen collections, research projects, and scientific collection permits.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Development	loss and fragmentation of habitat	Conserve suitable habitat	Protection of prairies; prairie/grassland restoration through voluntary and legal means
Harvest and persecution	trapping by landowners and mortality by pets	Outreach and education; enforcement of existing laws	Inform local residents of gopher colonies, prohibit trapping; promote non-lethal methods of damage control

Limited distribution	genetic and demographic effects of small population size, catastrophic events	Population monitoring and research	Determine status and conduct surveys to monitor presence and relative abundance
Invasive plant species	Degradation of suitable habitat	Restore degraded habitats	Remove invasive trees, scotch broom from prairie/grassland areas.

Kincaid meadow vole *Microtus pennsylvanicus kincaidi*	**Biology and Life History**	**Population**	**Distribution**
 Michael R. Fryda, Cal Photos	Large vole	Poorly known.	Columbia Plateau, Grand Coulee area
Monitoring Activities ➔	No formal surveys. Occurrence information from museum specimen collections, research projects, and scientific collection permits.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Lack of information	Unknown	Determine Status;	Survey for presence in suitable habitat

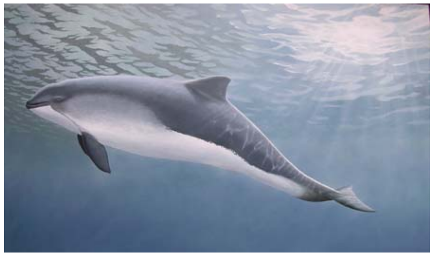
Shaw Island Townsend's vole *Microtus townsendii pugeti*	**Biology and Life History**	**Population**	**Distribution**
 Burke Museum, U of Washington	Shaw Island vole is smaller than other forms of Townsend's which is a larger, longer-furred vole; found in open meadow and marsh areas; feeds on succulents and herbaceous vegetation.	Poorly known	Neck Point on Shaw Island, San Juan County
Monitoring Activities ➔	No formal surveys. Occurrence information from museum specimen collections, research projects, and scientific collection permits.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Lack of information	isolated, small population size; genetic and demographic effects of small, isolated populations	Determine Status	Survey for presence in potentially suitable habitat

Gray-tailed vole *Microtus canicaudus*	**Biology and Life History**	**Population**	**Distribution**
 Oregon State University	Medium sized vole, limited distribution, occurs in hayfields, pastures, fallow grassy areas, and grain fields.	Common in limited area	Limited in distribution to the Willamette Valley of Oregon and Clark County, WA.

Monitoring Activities ➔	No formal surveys. Occurrence information from museum specimen collections, research projects, and scientific collection permits.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Lack of information	Unknown status; lack of survey effort.	Determine status; population monitoring and research	Small mammals surveys to detect presence and define small mammal community composition in range of the gray-tailed vole.
Development	Loss and fragmentation	Conserve habitat	Protect and restore habitat through voluntary and legal means
Limited habitat, habitat loss, development, and lack of information	Demographic and genetic effects of small population size and disjunct	Habitat monitoring and research	Evaluate/model habitat based on surveys of potentially suitable areas.

Killer whale *Orcinus orca*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. of Fish & Wildlife	Cetacean that feeds on salmon and other fish (residents and offshore ecotypes), or marine mammals (transients)	Southern resident population is 88 in May 2005; transients 300-400, trend unknown; offshore population is >350, trend unknown.	Marine waters throughout Washington: Pacific coast, Strait of Juan de Fuca, San Juan Islands, Haro Strait, Strait of Georgia and Puget Sound

Monitoring Activities ➔	Intensive population, productivity and behavioral surveys conducted through NOAA Fisheries, Fisheries & Oceans Canada, and NGO partners and cooperators.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Lower prey abundance	Reduction in salmon abundance	Restore prey populations	Rebuild depleted populations of salmon and other prey through multiple restoration activities, including management of harvest, habitat, and hatcheries.
Environmental Contamination	Known to contain high conc. of PCBs, PBDEs	Restore degraded habitats	Control and Monitor pollution in aquatic habitat; minimize risk of oil spills.
Human disturbance	Disturbance by whale-watching vessels	Education and outreach	Minimize disturbance of whales through adherence to voluntary guidelines for whale watching.

Pacific harbor porpoise *Phocoena phocoena*	**Biology and Life History**	**Population**	**Distribution**
 Rob Van Assen, Cal Photos	Small cetacean of shallow coastal and inland marine waters (typically <200m); prey on squid, herring and hake.	About 3,500 in inland marine waters; declined in southern Puget Sound	Occur along Pacific coast, Strait of Juan de Fuca, Strait of Georgia, San Juan Islands and Puget Sound.
Monitoring Activities ➔	Biennial occurrence and population surveys conducted in conjunction with NOAA Fisheries.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**

Harvest	Gill netting, salmon trolls, hake trawls incidentally capture and kill porpoises	Monitor and Research population; Determine status	Continue efforts to reduce gill entanglement with tribal fisheries
Human disturbance	Vessel disturbance, noise and acoustic deterrent devices, and highly developed areas can displace porpoises	Monitor and Research population; Determine status	Periodic surveys conducted to assess presence and abundance
Environmental contamination	Accumulation of persistent toxins: dioxins, furans, organochlorines and heavy metals. Steady shipping traffic and associated oil spills.	Restore degraded habitats	Control and Monitor pollution in aquatic habitat; minimize risk of oil spills.

Gray wolf *Canis lupus*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. of Fish & Wildlife	Wide ranging social carnivore, habitat generalist, relies on ungulate populations for prey, avoids humans and development.	Believed extirpated as a breeder, but occasional transients occur; may become re-established by expanding from Idaho	Limited to remote areas of North Cascades and Selkirks.
Monitoring Activities ➔	No formal surveys. Informal howling surveys done by NGOs and volunteers. Occurrence data collected in conjunction with U.S. Fish & Wildlife, USDA Forest Service, NGOs and other cooperators. Protocols being developed.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**

Human disturbance	Persecution through being shot or shot at, or being poisoned	Control and monitor disturbance	Enforce existing protection; outreach and education
Reduced prey resources	Reduction in important ungulate winter range	Conserve suitable habitat; habitat monitoring and research	Develop conservation protection (acquisitions, easements, agreements) for important ungulate winter range.
Habitat loss	Large highway corridors and development (including HWYs 20, 2, 12, and I-90) fragment suitable habitat and create barriers or impediments to movement	Restore degraded habitat	develop highway overpasses/underpasses to facilitate access to suitable habitats in central and southern Cascades. Promote forest management that improves habitat connectivity and facilitates dispersal of wolves from BC.
Limited distribution	Habitat fragmentation, and loss of important ungulate winter range.	Education and outreach	Conservation target species for ecoregional assessments which identify important areas for conservation

Grizzly bear *Ursus arctos*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. of Fish & Wildlife	Wide ranging carnivore, avoids humans and development, low reproductive capacity.	Population is small, 0-20 bears, and is likely the periphery or periodic expansion of the BC population.	Largely restricted to remote areas of the North Cascades and Selkirks as these areas support the best habitat.

Monitoring Activities ➔	No structured ongoing surveys. Occurrence data collected in conjunction with U.S. Fish & Wildlife, USDA Forest Service, NGOs and other cooperators. Prior WDFW and university research projects conducted surveys in conjunction with trapping attempts, and follow-up verification of observations, tracks and hair. Protocols being developed.

General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Limited distribution	Demographic and genetic effects of small population size	Enforce protected status	Population monitoring; Request reports of incidental observations.
Habitat loss	Large highway corridors and development (including HWYs 20, 2, 12, and I-90) fragment habitat and create barriers or impediments to movement	Restore degraded habitat	Develop highway overpasses/underpasses to facilitate access to suitable habitats. Promote forest management that improves habitat connectivity and facilitates dispersal of bears from BC.
Human disturbance	Back-country recreation (e.g., hiking, biking, motorized vehicles can disturb or displace grizzlies.	Control and monitor disturbance	Limit or restrict disturbance/access to important areas for grizzlies.

Steller's sea lion *Eumetopias jubatus*	**Biology and Life History**	**Population**	**Distribution**
 Gerald & Buff Corsi, Cal Photos	Large pinniped, feeds on a variety of fish, occurs in coastal and inland marine waters; does not breed in WA.	Rangewide declines	Coastal and inland marine waters of WA. Distribution is focused at <10 haul outs along the coast.

Monitoring Activities ➔	Set protocol for annual surveys of haul-out sites.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Limited habitat	Vulnerable because of limited number of haul outs used/available	Monitoring and research population	Tracking movements and foraging ecology of tagged sea lions
Reduced prey resources; competition for prey resources with fisheries	Commercial fisheries may reduce important prey species	Monitoring and research of prey base	Tracking movements and foraging ecology of tagged sea lions
Incidental mortality through commercial fisheries	entanglement in gill nets and other fishery gear	Monitoring and research population	assess impact of incidental mortality
Oil spills	Limited distribution makes oil spills particularly significant	Prevention and preparation for oil spills	maintain oil spill response capabilities

Marten (coastal population) *Martes americana*	**Biology and Life History**	**Population**	**Distribution**
 L.L.C. Jones	Small to mid-sized terrestrial/arboreal carnivore, associated with older conifer forests, prey generalist, occupied lower elevation forests than Cascades populations	Possibly extirpated from the Olympic Peninsula and southwest Washington. No verifiable detections since 1991.	Historically, the distribution included the Olympic Peninsula and southwest Washington. May now be extirpated.

Monitoring Activities ➔	Population and occurrence inferred through harvest management reports and standardized camera-set surveys. Occurrence information from museum specimen collections, research projects and scientific collection permit information.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Limited distribution	Demographic and genetic effects of small population size	Determine Status	Determine and map distribution of any remaining population
Lack of information and lack of protected status.	Possible extirpation	Increase distribution	Consider future reintroduction

Fisher *Martes pennanti*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. of Fish & Wildlife	Wide ranging, mid-sized forest carnivore, associated with older coniferous forest, prey generalist.	Extirpated	Historically found in forested areas of Western WA, northeastern WA, and the Blue Mountains. Now extirpated. However, in 1996, there were two sightings at Lake Quinault within one week.
Monitoring Activities ➔	Intensive camera and track plate surveys conducted in the past determined no viable population exists in the state. Survey protocols being developed to monitor fishers post-reintroduction. Occurrence information from museum specimen collections, trapping reports and incidental observations.		

General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Limited distribution	Historical commercial trapping,	Increase distribution; Population monitoring and research	Reintroduce fishers; Monitoring release animals to evaluate reintroduction success and to determine feasibility of additional reintroductions within the historical range
Habitat loss	Loss and fragmentation of late-successional coniferous forests	Habitat monitoring and research	Evaluate habitat use and selection for reintroduced fishers at multiple scales.
Lack of information	No state-specific information on habitat associations, demography, or food habits	Population monitoring and research	Conduct research on habitat use, demography, and food habits, and methods of habitat protection.

Wolverine *Gulo gulo*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. of Fish & Wildlife	Wide ranging mid-sized carnivore, avoids humans and developed areas, occurs in remote habitats, prey generalist, very large area requirement in relation to body size, low reproduction capacity.	Small, probably <25. Approximately 5 verifiable detections in WA since 1990.	Limited in distribution to high-elevation, remote areas of North Cascades and northeastern WA. Central Cascades may support individuals as suggested by verifiable wolverine detections in that area since 1990.

Monitoring Activities ➔	Population and occurrence surveys conducted intermittently by WDFW with additional funding from U.S. Fish & Wildlife and USDA Forest Service. Surveys have been conducted using camera sets and aerial post denning track surveys. Occurrence information from museum specimen collections and observations.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Limited Distribution	Effects of small population size; dependence on recruitment of dispersers from BC	Population monitoring and research; determine status; Conserve suitable habitat	protect habitat from recreational development
Habitat loss	Large highways and associated corridors (including HWYs 20, 2, 12, and I-90) fragment habitat and create barriers or impediments to movement	Restore degraded habitat	improve highway overpasses/underpasses to promote effective movement across highway corridors to facilitate access to suitable habitats in central and southern Cascades.
Human disturbance	Backcountry skiers, heli-skiers, snowmobiles, motorized vehicles can disturb or displace wolverines.	Control and monitor disturbance	Limit access to roadless, wilderness and primitive areas; prevent disturbance of known denning areas for wolverines.

American Badger *Taxidea taxus*	**Biology and Life History**	**Population**	**Distribution**
 Sunny Walter, WWW Photography	Fossorial carnivore; predator of other fossorial mammals, especially ground squirrels; large area requirements; inhabits shrub-steppe and other open habitats.	Very few reported caught by trappers since 1995. Apparently declining.	Historical distribution likely included most of eastern Washington from eastern Cascade foothills to Idaho. Current distribution unknown, but is limited to portions of eastern Washington.
Monitoring Activities ➔	Current occurrence data from WDFW research project in shrub-steppe, occurrence and relative abundance data from trapper harvest reports. Occurrence information from museum collection specimen records, observations and incidental information from research projects.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Lack of information	Lack information on distribution, abundance, Problems, and habitat associations.	Determine status; Population monitoring and research	Study recently initiated to investigate ecology of badgers by Spokane BLM. Need to conduct badger surveys in large landscapes capable of supporting badger populations

Habitat loss	The badger's association with shrub steppe and other more open habitats places at risk to habitat loss and fragmentation via agriculture and development.	Habitat monitoring and research.	Conduct research/modeling of habitat using findings of habitat associations from the BLM study and badger surveys.

Sea otter *Enhydra lutris*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. of Fish & Wildlife	Near shore marine carnivore; feed on urchins, crab, clams, and mussels; associated with rocky substrates and kelp; keystone species	Small but increasing; Population is the result of a reintroduction of 59 sea otters in 1969-1970	Limited in distribution to the marine waters from just south of Destruction Island north and east to Pillar Point in the Strait of Juan de Fuca.
Monitoring Activities ➔	Annual surveys with rigorous protocols conducted in conjunction with U.S. Fish & Wildlife.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Limited Distribution	Small population and limited distribution make them vulnerable to catastrophic events, disease outbreaks, and could have demographic and genetic effects.	Implement existing recovery plan	Annual surveys for populations trends

Environmental contaminants	Oil spills are the most threatening catastrophic event. Shipping commerce is an ongoing occurrence within the limited Washington range	Prevention and preparation for oil spills	Maintain oil spill response capabilities
Incidental mortality through commercial fisheries	Entanglement in gill nets results in mortality.	Population monitoring and research	Annual surveys for populations trends
Persecution/harvest	Considered competitors of fishermen for shellfish, creating fisheries management issues. Incidental mortality from gillnet fishery.	Outreach and education; cooperative management approaches	Outreach and education to reduce misperceptions of otters as competition for fishermen. Monitor mortalities from gillnet entanglement and develop strategies to reduce mortalities.

Lynx *Lynx canadensis*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. of Fish & Wildlife	Mid-sized felid. Prey specialist on snowshoe hares; physically adapted for foraging in deep snow. Strongly associated with subalpine and boreal forests.	Small population, probably <100; apparently stable. Maintenance of the WA population is likely dependent upon the demographic support from populations in BC and AB.	Eastern slope of north Cascades; Okanogan, Chelan, Ferry, Stevens and Pend Oreille Counties. Historically the species may have occurred throughout the WA Cascades.
Monitoring Activities ➔	Annual snow track surveys by WDFW in Cascades and northeastern Washington to detect occurrence. Prior years' surveys and radio telemetry by cooperative research projects of WDFW, University of Idaho, Washington State University, USDA Forest Service PNW Research Station, and NGOs.		

General Problems	Specific Problems	Conservation Strategies	Specific Conservation Actions
Limited distribution	Demographic effects of small population size; catastrophic events such as large scale fires	Population monitoring and research	Continued surveys to determine occupancy and relative abundance in recovery zones.
Habitat loss	Habitat degraded by some silvicultural practices; roads, snowmobile trails, and natural succession, grazing; roads may facilitate winter competition with coyotes	Habitat monitoring and research; Conserve suitable habitat	Provide input on timber harvest and fire mgt activities on state, private, and federal lands to perpetuate adequate amounts and distribution of denning and foraging habitats.
Limited habitat	naturally limited to high elevation boreal forest types	Conserve suitable habitat	Work with landowners to maintain sufficient foraging habitat, travel corridors and denning sites

Elk – Nooksack herd, mixed *Cervus elaphus nelsoni, roosevelti*	Biology and Life History	Population	Distribution
 Washington Dept. of Fish & Wildlife	Large social ungulate; occurs in herds of various sizes; herds have large area requirements and have distinct summer and winter ranges.	Population is a combination of reintroduced *C. nelsoni* and possibly remnant *C. roosevelti*; herd mix is not conclusive. Smallest elk herd in Washington. Currently protected from hunting. Declined to 300 animals and has rebounded to 450 animals.	Occurs in the west slope and western foothills of the north Cascades.

Monitoring Activities ➔	Currently developing more rigorous population surveys, including population estimates, bull/cow ratios and productivity. Monitoring conducted to document thresholds required to restore a population able to sustain hunting.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Limited habitat	Crucial winter range is limited; overlaps with private land holdings where elk may cause damage and create management conflicts.	Permanent conservation of habitat; habitat monitoring and research.	Acquisition of important winter range on private lands. Habitat quality enhancements. Minimize elk damage on private lands through compensation, special hunts and permits, fencing and other approaches.
Limited Distribution	Effects of small population size, and proximity of elk to humans and roads.	Population monitoring and research; herd augmentation.	Habitat acquisitions and enhancements are expected to result in expanded elk distributions and increased numbers. Augmentation from the Mt. St. Helens herd has been conducted in the past and should continue as necessary.
Mortality	Illegal harvest, predation and winter mortality limit population growth and recovery.	Monitor and control mortality.	Habitat acquisitions may reduce or limit access thereby reducing illegal harvest. Increase enforcement could also limit illegal harvests. Control predator population.

Columbian white-tailed deer *Odocoileus virginianus leucurus*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. of Fish & Wildlife	Pacific northwest coastal subspecies of White-tail; restricted in range; occupies mosaics of lowland marshes, woodlands and grasslands.	An estimated 600-700 animals WA population.	Limited to the Julia Butler Hansen National Wildlife Refuge in Wahkiakum and Cowlitz Counties: 5 islands in the lower Columbia River, and 2000 acres of uplands near Skamokawa in Pacific County.
Monitoring Activities →	Rigorous protocol population surveys conducted in conjunction with U.S. Fish and Wildlife Refuge System in lower Columbia River area.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Limited distribution based on historical harvest and habitat loss	Genetic and demographic effects of small population size, catastrophic events (floods) and proximity of deer to humans and roads.	Increase distribution; population monitoring and research; Test and monitor disease;	Refuge has acquired Crimms Island and population augmentation is currently in progress. Conduct predator control to reduce coyote predation of fawns.

Limited habitat	Competition with elk for food; flooding	Conserve suitable habitat; reduce competition with elk; control water levels to prevent flooding	Extensive fencing is used to exclude and reduce elk numbers on the refuge. Allow limited entry, special permit hunt for elk. Use water control structures on refuge to manage water levels in sloughs and marshes. Manage vegetation to maintain/expand a mosaic of marshes, woodlands and grasslands.

Woodland caribou *Rangifer tarandus*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. of Fish & Wildlife	mid-sized social ungulate; associated with mature forests; depend on lichens for food especially during the winter; occur in lowland cedar and hemlock forests and higher elevation spruce and subalpine fir forests.	<50 individuals; translocations have occurred with minimal success at maintaining a population.	Limited to a small portion of northeastern Pend Oreille County.
Monitoring Activities ➔	Annual herd counts conducted in conjunction with U.S. Fish and Wildlife, Idaho Fish & Game and Canada.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Limited Distribution	genetic and demographic effects of small population size; inability of reintroduced animals to adapt to conditions in WA.	Increase distribution	A number of reintroductions have been undertaken to increase the number and distribution with little success. Source populations for further reintroductions are now unavailable.

Limited habitat	Suitable habitat may be limited by elevation and by timber management activities	Conserve suitable habitat	Protect mature forest from harvest and important calving areas.
Vulnerability to predation	Caribou appear excessively vulnerable to predation, especially by cougars	Enhanced predator management	Increase harvest of cougars in recovery areas.

Pronghorn antelope *Antilocapra americana*	**Biology and Life History**	**Population**	**Distribution**
 Gerald & Buff Corsi, Cal Photos	Small social ungulate of open, arid areas; occurs in shrub-steppe and steppe habitats;	Pronghorns were reintroduced in the 40s, 50s and 60s. No populations are thought to remain in the state. Status as an historical resident has been questioned.	
Monitoring Activities ➔	No surveys conducted. Survey protocols to be developed if pronghorns are reintroduced.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**

Limited distribution	lack of a viable population	Increase distribution	Feasibility study is underway which may lead to a reintroduction
Limited Habitat	Amounts and configuration of suitable habitat may not support a viable population	Conduct a reintroduction feasibility study; develop a recovery/mgt plan	Feasibility study should evaluate habitat quality, quantity and distribution.

BIRDS

Common loon *Gavia immer*	**Biology and Life History**	**Population**	**Distribution**
 Peter La Tourrette	Inhabits lowland lakes and reservoirs and nearshore marine waters	Rare	Breeding in north counties. Non-breeders concentrated in marine waters, but also inland freshwater bodies.
Monitoring Activities ➔	Annual productivity surveys conducted on known nesting lakes by WDFW in conjunction with USDA Forest Service Loon Lake NGO loon conservationists Daniel Poleeschook and Ginger Gum.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Development	Residential development of lakeshores	Conserve Suitable Habitat	Protection and education programs targeting suitable breeding lakes to curtail development and recreational pressure.
Habitat Loss	Loss and degradation of suitable shoreline nesting habitat	Conserve Suitable Habitat	Protection and education programs targeting suitable breeding lakes to curtail development and recreational pressure.
Human Disturbance	Recreational boating	Education and Outreach	Education programs targeting suitable breeding lakes to curtail recreational pressure.

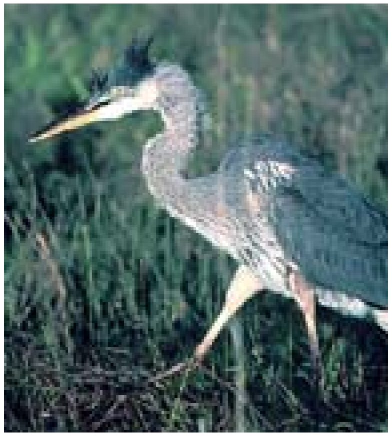
Water Development	Water level manipulations from hydroelectric dams	Conserve Suitable Habitat	Cooperate with Hydroelectric companies to provide floating platform nest structures where water levels fluctuate dramatically.
Environmental Contamination	Lead poisoning from lead sinkers and oil spills	Control Contaminants	Advocate use of non-toxic alternatives to lead fishing sinkers in loon areas.

Western grebe *Aechmophorus occidentalis*	**Biology and Life History**	**Population**	**Distribution**
 Peter La Tourrette	Inhabits lowland lakes and reservoirs and nearshore marine waters.	Common to locally abundant winter visitor in saltwater, uncommon to locally common on freshwater; locally common summer breeder and migrant.	Concentrations in protected marine waters of Puget Sound during winter. Breeds in eastern Washington, primarily in the Columbia Basin.
Monitoring Activities ➔	Intensive protocol-driven wintering population survey conducted by WDFW through Puget Sound Ambient Monitoring Program (PSAMP). Distribution, nesting and productivity surveys need to be developed for lakes.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Environmental Contamination	Oil spills	Determine and Map Distribution	Identify winter concentration areas and incorporate into oil spill plans.
Loss of Prey Base	Prey base may be declining in marine waters.	Determine causes of wintering population declines.	Monitor prey base populations.
Harvest	Incidental harvest in gillnet fishery	Protect Significant Areas	Determine extent of mortality from gillnet fishery

Human Disturbance	Recreational boating near colonies may cause abandonment or gull predation	Control and Monitor Disturbance, Conserve Suitable Habitats	Identify wake-free zones near breeding colonies to minimize human disturbance.

American white pelican *Pelecanus erythrorhynchos*	**Biology and Life History**	**Population**	**Distribution**
 Sunny Walter, WWW Photography	Inhabits deltas and sandbars of slow-flowing rivers, and breeds on lakes and impoundments.	Locally uncommon to common visitor and migrant, very local breeder in eastern part of state. Rare visitor in western Washington.	Local breeder in Columbia Basin
Monitoring Activities ➔	Annual nesting, productivity surveys conducted in conjunction with US Fish & Wildlife. Research on distribution along the Columbia being conducted by WDFW, Oregon State University, Bonneville Power Administration, and Yakama Indian Nation. WDFW conducts surveys on selected lakes. Sprague Lake currently being monitored for nesting evidence.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat Loss	Water draw-down for irrigation, hydroelectricity	Conserve Suitable Habitat	Work with stakeholders on amount and timing of water level manipulations
Human Disturbance	Human proximity and entry into breeding colonies	Control and Monitor Disturbance	Post no disturbance signs around colonies and establish colony stewardship program where needed
Harvest	Shooting because of perceived salmon predation	Population Monitoring & Research, Education and Outreach	Inter-governmental agreements

Environmental Contamination	Pesticides and mercury	Monitor Contaminants	Reproductive success not currently impaired, but warrants periodic monitoring

Great blue heron *Ardea herodias*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. of Fish & Wildlife	Forages in low elevation wetlands and nests in nearby woodlots	Common resident statewide, especially in Puget Sound and lower Columbia R. Uncommon to rare in mountains and in arid uplands of eastern Washington	Breeding birds concentrated near shorelines of Puget Sound in western Washington, and along Yakima R. and Columbia R. in eastern part of state.
Monitoring Activities ➔	Periodic surveys of adults at breeding colonies. Currently developing standard survey protocol with provincial and federal wildlife agencies in Canada.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Development	Construction of buildings, subdivisions, roads and other structures near breeding colonies	Conserve Suitable Habitat, Permanent Conservation of Habitat, Education and Outreach	Protect land around large colonies through fee title or conservation easement. Inform public on minimizing disturbance during breeding period
Habitat Loss	Continued clearing of woodlands adjacent to high value foraging areas reduces heron populations	Conserve Suitable Habitat, Determine and Map Distribution, Habitat Monitoring, Permanent Conservation of Habitat	Protect land around large colonies through fee title or conservation easement. Inform public on minimizing disturbance during breeding period

Lack of Information	Forms vulnerable aggregations during breeding period	Research and Conservation	Develop standard survey protocol to monitor populations statewide
Human Disturbance	Human proximity and entry into breeding colonies	Education and Outreach	Inform public on minimizing disturbance during breeding period

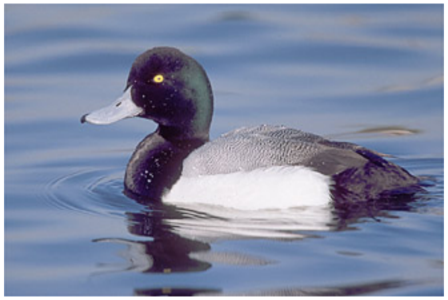
Trumpeter swan *Cygnus buccinator*	**Biology and Life History**	**Population**	**Distribution**
 Dr. Lloyd Glenn Ingles, Cal Photo	Winters in protected marine waters of northern Puget Sound and adjacent agricultural lands. Delayed maturation and low reproductive rate.	Historic decline and rebound; Up to 3,000 winter; large segment of Alaska breeding population winters around north Puget Sound; attempts to establish breeding population unsuccessful	winters around northern Puget Sound, Hood Canal, and southwestern Washington river valleys; summer at l or more isolated lakes in Spokane County
Monitoring Activities ➔	Annual protocol-driven midwinter surveys conducted in conjunction with U.S. Fish & Wildlife and the Trumpeter Swan Society in portions of western Washington. Current research project on lead shot poisoning is providing detailed information on locations and numbers in northern Puget Sound.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Environmental Contamination	Lead shot poisoning from ingestion on wintering grounds	Habitat Research	Identify and remediate sources of lead poisoning
Habitat Loss	Conversion of agricultural lands	Conserve Suitable Habitat	Conservation easements on agricultural lands and wetlands

Tule greater white-fronted goose *Anser albifrons gambelli*	**Biology and Life History**	**Population**	**Distribution**
 Peter La Tourrette	Feeds on grasses and grains in agricultural fields and on tubers in wetlands, uses open water for roosting at night; nests in Arctic	Uncommon	Migrant to coastal and adjacent areas of Puget Sound, Washington's outer coast, and the lower Columbia River
Monitoring Activities ➔	Annual protocol-driven winter waterfowl survey conducted by WDFW in conjunction with U.S. Fish & Wildlife.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat loss	Decline in suitable habitat due to degradation and loss of marshes, and loss of upland habitat from development and changing land use practices	Permanent conservation of habitat, conserve suitable habitat, restore degraded habitats	Purchase and manage wetlands used for roosting and uplands used for foraging
Lack of information	Better information needed on population size	Determine status	Improved monitoring of this subspecies is needed in wintering areas
Environmental contamination	Use of agricultural chemicals may contaminate foraging areas	Control and monitor contamination	Monitor contamination loads in birds

Brant *Branta bernicla*	**Biology and Life History**	**Population**	**Distribution**
 Peter La Tourrette	Forages heavily on eelgrass in intertidal estuaries; nests in Arctic	Fairly common to locally abundant. Declining trend	Migrant to western Washington
Monitoring Activities →	Intensive winter survey in Puget Sound, midwinter waterfowl population surveys in the remainder of the state by WDFW in conjunction with U.S. Fish & Wildlife.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat loss	Local declines in eelgrass reduce foraging habitat	Conserve suitable habitat	Protect eelgrass beds from human activity, pollution, invasive species, and other disturbance
Human disturbance	Disturbance from increased development and greater amounts of human activity (e.g., boating) along shorelines	Protect significant areas	Restrict public use of critical wintering areas through acquisitions and easements
Environmental contamination	Chemical contamination and heavy metal accumulation of winter food supplies may affect reproductive success, oil spills represent another threat	Control and monitor contamination, restore degraded habitats	Minimize sources of ongoing pollution, clean up contaminated sites, prevent oil spills

Northern pintail *Anas acuta*	**Biology and Life History**	**Population**	**Distribution**
 Peter La Tourrette	Inhabits estuaries, freshwater wetlands, and agricultural fields; feeds on grains, aquatic plants, and invertebrates	Common to locally abundant in western Washington, common in eastern Washington	Migrants and wintering birds found throughout state, nests only in eastern Washington
Monitoring Activities ➔	Annual protocol-driven winter waterfowl surveys conducted by WDFW in conjunction with U.S. Fish & Wildlife.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat loss	Decline in suitable habitat due to degradation and loss of marshes and intertidal areas, and loss of upland habitat from development and changing land use practices	Permanent conservation of habitat. Conserve suitable habitat. Restore degraded habitats	Preserve wintering habitat through land purchase and management programs
Harvest	Vulnerable to overhunting	Manage hunting	Maintain conservative hunting regulations

Redhead *Aythya americana*	**Biology and Life History**	**Population**	**Distribution**
 Kay Boulter, Cal Photos	Breeds in lakes, ponds, permanent wetlands. Winters on lakes and large rivers and westside sewage treatment ponds.	Fairly common, wintering population low.	Year-round in eastern Washington; rarely winter in western Washington; most wintering populations further south.
Monitoring Activities ➔	Annual protocol-driven winter population and spring productivity surveys conducted by WDFW in conjunction with U.S. Fish & Wildlife and other NGOs and conservation partners.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat Loss	Continued loss and degradation of easily drained shallow wetlands. Problems in winter range include loss of aquatic vegetation for feeding.	Conserve Suitable Habitat	Protection and education programs targeting suitable breeding wetlands to curtail development and recreational pressure. Restoration of degraded habitats.
Harvest	Species can be overharvested if not regulated.	Control and Monitor Harvest	Establish and monitor hunting regulations, continue conservation regulations.
Human Disturbance	Increased recreational and industrial use of preferred habitats, recreational boating and fishing.	Education and Outreach	Education programs targeting suitable wetlands to curtail recreational pressure.

Greater scaup *Aythya manila*	**Biology and Life History**	**Population**	**Distribution**
 Peter La Tourrette	Winters in shallow nearshore waters, particularly with soft substrate and eelgrass, in open to protected embayments.	Wintering population only in WA. Fairly common, but declining statewide.	Winters in nearshore and inland waters in western Washington, some in eastern Washington. Largest densities in bays and estuaries.
Monitoring Activities ➔	Annual protocol-driven winter surveys by WDFW in conjunction with U.S. Fish & Wildlife and the PSAMP program.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Environmental Contamination	Poor water quality affecting food sources, poor reproduction due to contaminants. Oil spills, DDE and PCBs.	Control and Monitor Contaminants	Tighten shipping contaminant regulations and industrial waste regulations. Monitor and regulate contaminant levels in cooperation with state and federal agencies.
Habitat Loss	Preferred migration stopover sites and winter habitats place species within heavily urbanized zones (degraded habitat due to contaminants and industrial and recreational activity).	Control and Monitor Disturbance and Restore Degraded Habitats	Control disturbance through regulation and enforcement, and restore degraded habitats.
Human Disturbance	Species is sensitive to nearby human activity, particularly recreational boating of all kinds.	Education and Outreach	Education programs targeting species sensitivity and suitable wintering spots in bays and estuaries.

Harvest	Species can be overharvested if not regulated.	Control and Monitor Harvest	Establish and monitor hunting regulations, continue conservation regulations.

Lesser scaup *Aythya affinis*	**Biology and Life History**	**Population**	**Distribution**
 Peter La Tourrette	Usually nests near small ponds and lakes, sedge meadows, creeks. During migration and when not breeding, found along coast in sheltered bays, estuaries, and marshes or inland on lakes, ponds, and rivers	Fairly common, historically low breeding population in state.	Breeding resident in northeastern Washington; wintering resident in western and central Washington.
Monitoring Activities ➔	Annual protocol-driven winter surveys by WDFW in conjunction with U.S. Fish & Wildlife and the PSAMP program.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Human Disturbance	Mortality from fishing nets and lines may be substantial.	Education and Outreach	Develop educational materials and programs targeted to fishermen.
Habitat Loss	Drainage of wetlands and conversion to agriculture have decreased quality and quantity of breeding and wintering habitat.	Conserve Suitable Habitat, Permanent Conservation of Habitat	Preserve wetlands through land purchase and management programs
Harvest	Species can be overharvested if not regulated.	Control and Monitor Harvest	Establish and monitor hunting regulations, continue conservation regulations.

Long-tailed duck *Clangula hyemalis*	**Biology and Life History**	**Population**	**Distribution**
 Peter La Tourrette	Occurs in marine waters, diet consists of bottom-dwelling invertebrates and small fish, breeds in Arctic	Uncommon, declining	Marine waters of western Washington
Monitoring Activities ➔	Annual protocol-driven winter surveys by WDFW in conjunction with U.S. Fish & Wildlife and the PSAMP program.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat loss, development, declining prey populations	Urbanization and industrialization of coastal shorelines have degraded some winter habitat and reduced food abundance	Conserve suitable habitats, restore degraded habitats, habitat monitoring and research	Manage marine areas to reduce impacts of urbanization and industrialization, monitor prey populations
Environmental contamination	Chemical contamination and heavy metal accumulation of winter food supplies may affect reproductive success, oil spills represent another threat	Control and monitor contamination, restore degraded habitats	Minimize sources of ongoing pollution, clean up contaminated sites, prevent oil spills
Harvest	Vulnerable to overhunting	Manage hunting	Monitor harvest levels and reduce take as necessary

Black scoter *Melanitta nigra*	**Biology and Life History**	**Population**	**Distribution**
 Ole Krogh, Cal Photos	Inhabits marine waters, feeds mainly on mollusks, nests in Canada and Alaska	Uncommon, declining	Marine waters of western Washington
Monitoring Activities ➔	Annual protocol-driven winter surveys by WDFW in conjunction with U.S. Fish & Wildlife and the PSAMP program.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat loss, development, declining prey populations	Urbanization and industrialization of coastal bays and estuaries have degraded some winter habitat and reduced food abundance	Conserve suitable habitats, restore degraded habitats, habitat monitoring and research	Manage marine areas to reduce impacts of urbanization and industrialization, monitor prey populations
Environmental contamination	Chemical contamination and heavy metal accumulation of winter food supplies may affect reproductive success, oil spills represent another threat	Control and monitor contamination, restore degraded habitats	Minimize sources of ongoing pollution, clean up contaminated sites, prevent oil spills
Harvest	Vulnerable to overhunting	Manage hunting	Monitor harvest levels and reduce take as necessary

Surf scoter *Melanitta perspicillata*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. of Fish & Wildlife	Occurs in shallow marine waters and less frequently on rivers and lakes, feeds on mollusks and herring eggs, nests in Canada and Alaska	Common to abundant, declining	Widespread, especially in western marine waters
Monitoring Activities →	Annual protocol-driven winter surveys by WDFW PSAMP program in conjunction with U.S. Fish & Wildlife.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat loss, development, declining prey populations	Urbanization and industrialization of coastal bays and estuaries have degraded some winter habitat and reduced food abundance, commercial shellfish production has reduced access to some productive foraging areas	Conserve suitable habitats, restore degraded habitats, habitat monitoring and research	Manage marine areas to reduce impacts of urbanization and industrialization, maintain access to important feeding areas through acquisitions or easements, restore herring stocks, monitor prey populations
Environmental contamination	Chemical contamination and heavy metal accumulation of winter food supplies may affect reproductive success, oil spills represent another threat	Control and monitor contamination, restore degraded habitats	Minimize sources of ongoing pollution, clean up contaminated sites, prevent oil spills
Harvest	Vulnerable to overhunting	Manage hunting	Monitor harvest levels and reduce take as necessary

White-winged scoter *Melanitta fusca*	**Biology and Life History**	**Population**	**Distribution**
 Peter La Tourrette	Occurs in shallow marine waters, feeds on mollusks and herring eggs, nests in Canada and Alaska	Common, declining	Widespread, especially in western marine waters
Monitoring Activities ➔	Annual protocol-driven winter surveys by WDFW PSAMP program in conjunction with U.S. Fish & Wildlife.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat loss, development, declining prey populations	Urbanization and industrialization of coastal bays and estuaries have degraded some winter habitat and reduced food abundance, commercial shellfish production has reduced access to some productive foraging areas	Conserve suitable habitats, restore degraded habitats, habitat monitoring and research	Manage marine areas to reduce impacts of urbanization and industrialization, maintain access to important feeding areas through acquisitions or easements, restore herring stocks, monitor prey populations
Environmental contamination	Chemical contamination and heavy metal accumulation of winter food supplies may affect reproductive success, oil spills represent another threat	Control and monitor contamination, restore degraded habitats	Minimize sources of ongoing pollution, clean up contaminated sites, prevent oil spills
Harvest	Vulnerable to overhunting	Manage hunting	Monitor harvest levels and reduce take as necessary

Bald eagle *Haliaeetus leucocephalus*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. of Fish & Wildlife	Nests in large trees, territory is usually near marine shore, large lake or river. Prey on fish, waterfowl, and small mammals, or scavenge. Many birds that nest in Canada and Alaska migrate south to winter in Washington concentrating on rivers with spawned out salmon, especially chum.	Resident population of about 700 breeding pairs; up to 4,000 winter in Washington	Nests primarily along marine shorelines and major rivers of western and northeastern Washington. Nests are rare or absent from the Columbia Basin and southeastern Washington, but wintering birds can be locally common.
Monitoring Activities ➔	Intensive statewide nest occupancy and productivity monitoring surveys conducted by WDFW, USFWS, Weyerhaeuser, utility companies, Oregon State University, Indian tribes, National Park Service, other cooperators, and citizen volunteers since the late 1970's to the present. In recent years comprehensive statewide monitoring efforts, especially productivity, have been reduced, or conducted on a periodic and regional basis due to the reduced need to closely monitor the species as it has shown a spectacular recovery. In 2005, the USFWS selected the WDFW as 1 of the 4 sites in the nation to conduct an experimental post delisting pilot project to develop a monitoring protocol that would survey sample blocks of bald eagle habitat on a 5 year rotation for 25 years subsequent to final delisting. WDFW continues to conduct I localized management oriented bald eagle surveys in conjunction with monitoring bald eagle site management plan needs.		
General Problems	**Specific Problems**	**General Problems**	**Specific Problems**
Human development	Loss of shoreline trees for nesting, perching	Protect large trees in nesting territories,	Continue to require bald eagle habitat plans that require retention of trees; enforce/strengthen Shoreline Management Act
Forest practices	Clearcutting of communal roost sites	Protect known locations	Maintain and enforce Forest Practice rules protecting bald eagle roost sites, and nests

Environmental contaminants	Concentration of DDE, PCBs, dioxins from prey causes reduced reproduction of birds on Columbia River, possibly Hood Canal; lead poisoning acquired from scavenging waterfowl; oil from oil spills	Control and monitor contaminants	Work with other agencies to decrease and remediate sources of contamination; enforce nontoxic shot requirements; maintain and improve oil spill response capabilities; monitor eagle population for declines that might indicate new contaminant problems
Loss of prey	Declines in scoters, scaup, some salmon stocks, and other prey	Protect or manage prey base	Implement salmon recovery strategies; investigate declines in waterfowl and seabirds
Human disturbance	Many eagles are still sensitive to disturbance while nesting; and by boaters while foraging; eagles often avoid foraging in water around stationary boats;	Control disturbance	Disseminate education materials to minimize disturbance of nests from construction, logging activities; educate boaters about disturbance
Harvest, persecution	Illegal killing for black market in eagle parts.	Enforcement	Enforce prohibitions on killing and illegal possession of body parts.

Northern goshawk *Accipiter gentilis*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. of Fish & Wildlife	Nests in mature to old timber; territory contains several nests; eat variety of birds, mammals; non-migratory in Washington	338 known territories in 2003; declined in Puget Trough and southwest Washington	All forested regions of Washington
Monitoring Activities →	Periodic management driven protocol nesting, territory and productivity surveys. Periodic analysis of little-known nest areas for habitat change and occupancy status.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat loss	excessive logging of mature/old timber; conversion of forest for residential development; wildfire	Protect significant areas; Conserve suitable habitat	Protect nests, and nesting and pre-fledge stands from logging; thin to reduce fire hazard in pine forest; encourage longer rotations
Lack of information	status and trend in population unknown	Population monitoring and research	Assess status and trend in populations with surveys

Ferruginous hawk *Buteo regalis*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. of Fish & Wildlife	Nests on rock outcrops, cliffs, isolated trees; needs uncultivated lands for hunting and nesting; eats pocket gophers, ground squirrels, snakes, etc.;	Uncommon breeder; recent decline; populations decline when cultivated land exceeds 30% of area.	Columbia Basin
Monitoring Activities ➔	Periodic protocol-driven nest/productivity surveys. Research project on wintering distribution using telemetry.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat loss, limited habitat	Conversion of steppe to agriculture; residential development; habitat degradation by wildfire	Conserve suitable habitat;	Protect shrub-steppe habitat
Human disturbance	causes nesting failure, nest abandonment	Protect significant sites	Protect nest sites from disturbance;
Reduced prey populations	poisoning of ground squirrels, low prey prevents reproduction	Outreach and education; restore habitat	Facilitate restoration projects; consider reclassifying some ground squirrels as Protected Wildlife

Golden eagle *Aquila chrysaetos*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. of Fish & Wildlife	Occurs primarily in dry open forests, shrub-steppe, canyons, and alpine areas. Nests mostly on cliffs. Feeds largely on marmots, jackrabbits, ground squirrels, and carrion	Locally fairly common	Breeds widely in mountainous areas of the state, especially in eastern Washington
Monitoring Activities ➔	Periodic protocol-driven nesting/productivity surveys.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat loss	Habitat loss, degradation, and fragmentation may directly impact golden eagles and cause declines in major prey species, especially jackrabbits and ground squirrels. Control programs for prey have contributed to decreases in food availability	Restore degraded habitats, conserve suitable habitat, conserve prey populations, control and monitor invasive species	Habitat and prey populations should be protected and increased through restoration of grasslands and shrub-steppe via reduced grazing, removal of trees and exotic vegetation, and reseeding with native grasses. Large blocks of suitable habitat should be retained. Prey populations should be conserved by reducing control programs.
Energy development	Electrocution on power lines	Eliminate human-related sources of mortality	Power lines near breeding and foraging areas should be constructed or modified to reduce electrocutions
Human disturbance	Development and activities such as rock climbing may disturb nesting birds	Control and monitor disturbance	Maintain buffer zones of no activity during nesting

Environmental contamination	Lead poisoning from ingestion of lead shot	Control and monitor contaminants	Advocate use of steel shot

Peregrine falcon *Falco peregrinus*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. of Fish & Wildlife	Territorial predator of pigeons, doves, shorebirds, waterfowl, seabirds, and other birds; nests on high cliffs, and occasionally tall buildings, bridges.	About 120 nesting pairs	Throughout the state, but with major concentrations on the northwest coast, San Juan Islands, Cascade foothills and along the Columbia River

Monitoring Activities ➔	Prior to 1978, baseline search type surveys to locate peregrine falcon nest sites (eyries) were conducted on an ad hoc basis in localized regions of the state by raptor researchers and falconers. Some opportunistic observational data was recorded incidental to other species surveys. In 1978 the newly created Nongame Program of the Department of Game initiated comprehensive surveys statewide to survey historic and potentially occupied habitat. Intensive annual statewide baseline surveys and monitoring for occupancy and productivity expanded as the population grew and were conducted by the WDFW, the Falcon Research Group (FRG), Washington Department of Transportation (WSDOT), cooperators, and independent citizens. In 2003 in addition to statewide monitoring surveys of all known eyries and potential sites, the WDFW participated in the first nationwide post – delisting monitoring survey organized by the USFWS, that involved sampling a number of randomly chosen eyries for each state. After 2003 the WDFW reduced the statewide survey emphasis, but along with other cooperators including the FRG Group, and WSDOT, continued region specific surveys of selected eyries and potential sites. In 2006 the WDFW and cooperators will participate in the second periodic (4 year interval) nationwide post – delisting monitoring survey organized by the USFWS. Was part of the statistical verification, the WDFW and cooperators will conduct statewide comprehensive monitoring and search surveys.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Environmental contaminants	Concentrate persistent chemicals (DDE, PCB) that can cause eggshell thinning; vulnerable to any persistent chemical	Control and monitor contaminants	Monitor peregrine population for signs of decline; work with other agencies to reduce and remediate sources of contaminants that contribute to prey contamination
Human disturbance	Nesting peregrines vulnerable to disturbance from blasting, beach walkers, rock climbers.	Control and monitor disturbance	Use access restrictions on public lands as needed; work with permitting agencies to prevent blasting or construction disturbance; Inform rock climbers of sensitive periods and locations to reduce disturbance of nesting pairs

Prairie falcon *Falco mexicanus*	**Biology and Life History**	**Population**	**Distribution**
 Peter La Tourrette	Nest on cliffs; depend on abundant prey in steppe and shrub-steppe; prey on horned larks, meadowlarks, other birds, small mammals.	Low density; likely declining with uncultivated habitat	Columbia Basin and surrounding foothills
Monitoring Activities →	No current surveys. Falconry capture reports provide limited information on an annual basis. Historic distribution surveys in 1970s and early 1980s.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat loss, limited habitat	Conversion of steppe to agriculture; residential development;	Conserve suitable habitat;	Protect shrub-steppe habitat
Reduced prey populations	poisoning of ground squirrels; habitat degradation by wildfire; reduced prey prevents successful reproduction	Conserve suitable habitat;	Discourage widespread control of rodents; protect shrub-steppe from fire
Human disturbance	causes nesting failure, nest abandonment;	Protect significant sites, Control and monitor disturbance	Protect nest sites from disturbance;

Greater sage-grouse *Centrocercus urophasianus*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. of Fish & Wildlife	Inhabits shrub-steppe; mating occurs at leks	Total population holds about 1,000 birds; declining trend	Two remnant populations occur in Douglas, Grant, Yakima, and Kittitas counties
Monitoring Activities ➔	Annual lek surveys, WDFW, U.S. Army, and BLM using Western States Sage Grouse Working Group protocols. Monitoring of reintroduced birds using telemetry.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat loss	Habitat loss and degradation results from large-scale fires, conversion of shrub-steppe to cropland, overgrazing, encroachment by invasive weeds, and inappropriate use of herbicides	Conserve suitable habitat, protect significant areas, restore degraded habitats	Protection and enhancement of habitat is needed, including fire prevention, continuation of Conservation Reserve Program lands, and management of grazing practices and military training activities
Limited distribution	Only small isolated populations remain	Increase distribution	Improve habitat and conduct transplants to increase population sizes
Energy development	Development of wind energy projects may be harmful	Control and monitor disturbance, protect significant areas	Prevent construction of wind energy projects in areas important for sage grouse recovery

Disease	Expansion of West Nile Virus into Washington poses a threat	Test and monitor disease	Monitor the expansion of West Nile Virus into areas occupied by the species

Sharp-tailed grouse Tympanuchus phasianellus	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. of Fish & Wildlife	Inhabits meadow-steppe and riparian/deciduous habitats; mating occurs at leks	Total population numbers fewer than 1,000 birds; declining trend	Eight remnant populations remain in Douglas, Lincoln, and Okanogan counties
Monitoring Activities ➔	Annual lek surveys using Western States Sage Grouse Working Group. Monitoring of reintroduced birds using telemetry.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat loss	Overgrazing and conversion of habitat to agriculture and pastureland	Conserve suitable habitat, protect significant areas, restore degraded habitats	Protection and enhancement of high quality habitat is needed, including restoration of low elevation winter sites
Limited distribution	Only small isolated populations remain	Increase distribution	Conduct transplants to increase population sizes
Energy development	Development of wind energy projects may be harmful	Control and monitor disturbance, protect significant areas	Prevent construction of wind energy projects in areas important for the species

Disease	Expansion of West Nile Virus into Washington poses a threat	Test and monitor disease	Monitor the expansion of West Nile Virus into areas occupied by sharp-tailed grouse

Mountain quail *Oreortyx pictus*	**Biology and Life History**	**Population**	**Distribution**
 Peter La Tourrette	Require tall, dense cover; brushy, riparian habitat in dry areas; brushy slopes; eat seeds, berries, mast	Modest populations in scattered localities; some result from introductions; declined in recent years	Primarily Kitsap, Mason, Grays Harbor, Klickitat Counties; Also Asotin, Garfield, and Columbia counties.
Monitoring Activities ➔	Annual occurrence and productivity survey, monitoring of reintroduced birds by WDFW and University of Idaho.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat loss, Limited habitat	habitat degraded by overgrazing, herbicides, development	Restore degraded habitat; conserve suitable habitat	prevent grazing riparian habitat; discourage harmful forest practices

Sandhill crane (greater) *Grus canadensis tabida*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. of Fish & Wildlife	Breeding territories contain wetlands, grassy uplands, partially forested uplands, and wet meadows. Reproductive rates are low and birds often mate for life. The Washington population winters in the Central Valley of California	Breeding population in Washington numbers only about 50 birds and is increasing. Larger numbers nest in Oregon and British Columbia	Formerly nested at a small number of sites throughout eastern Washington, but now breeds only at four locations in Yakima and Klickitat counties
Monitoring Activities ➔	Annual nesting/productivity surveys conducted by WDFW in conjunction with U.S. Fish & Wildlife and the Yakama Indian Nation.		

General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat loss	Wetlands and meadows may be harmed by grazing and haying practices and various water projects. Maintenance of water levels needed during breeding season	Conserve suitable habitat, restore degraded habitats, implement existing conservation plan	Protect important areas from habitat loss and degradation through acquisitions, easements, conservation agreements, and management plans. Restore wetlands and protect from harmful livestock grazing.
Water development	Drainage and damming projects in or near territories may impact breeding success	Conserve suitable habitat	Discourage water projects that impact breeding habitat

Human disturbance	Mowing may accidentally destroy nests and chicks. New road and building construction near territories may cause excessive disturbance.	Control and monitor disturbance	Prevent construction of roads and buildings within 0.5 mile of territories, discourage detrimental mowing practices during sensitive periods

Snowy plover *Charadrius alexandrinus nivosus*	**Biology and Life History**	**Population**	**Distribution**
 Peter La Tourrette	Inhabits sandy beaches and coastal dunes, some Washington birds are probably migratory	Less than 100 birds, stable	Pacific and Grays Harbor counties
Monitoring Activities ➔	Intensive, annual protocol-driven nesting/productivity surveys by WDFW in conjunction with U.S. Fish & Wildlife Service.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Invasive plant species	Dense growth of European beachgrass reduces nesting and foraging habitat	Control and monitor invasive species	Reduce the occurrence of European beachgrass in coastal areas
Human disturbance	Beach walkers, pets, and cars disturb and kill birds and destroy nests	Control and monitor disturbance	Expand efforts to reduce disturbance by limiting human access to areas used by plovers, restrict pets from breeding areas

Habitat loss	Cars compact beach soils, thereby reducing prey availability	Protect significant areas	Limit vehicle traffic along beaches used by birds
Environmental contamination	Oil spills may kill birds, or damage or destroy foraging and nesting habitat	Control and monitor contamination	Prevent oil spills, clean up to spills rapidly

Black oystercatcher *Haematopus bachmani*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. of Fish & Wildlife	Feeds on rocky marine intertidal shorelines; nests on rocks of islands, non-migratory	Small population of several hundred birds is limited by habitat	Rocky shores of outer coast, San Juan Islands, and eastern Strait of Juan de Fuca
Monitoring Activities ➔	Intermittent population surveys conducted in conjunction with U.S. Fish & Wildlife, NGOs and other conservation partners. WDFW initiated intensive San Juan surveys in 2005.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Environmental contamination	Oil spills may kill birds, or damage or destroy foraging and nesting habitat	Control and monitor contamination	Prevent oil spills, clean up to spills rapidly
Lack of information	Need information on population status and trends	Gather data on populations	Conduct population monitoring surveys
Human disturbance	Fishing, kayaking, and other activity may disturb nesting birds	Control and monitor disturbance	Consider limitations on human activity near nesting sites during breeding season

Willet *Catoptrophorus semipalmatus*	**Biology and Life History**	**Population**	**Distribution**
 Peter La Tourrette	Occupies estuaries and sandy beaches, migratory	Rare, stable	Primarily northern Willapa Bay
Monitoring Activities ➔	Is not formally monitored. Specific site on Willapa Bay is observed annually by bird watchers. Intensive shorebird surveys were conducted by The Evergreen State College in 1980s.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Environmental contamination	Oil spills may kill birds, or damage or destroy foraging habitat	Control and monitor contamination	Prevent oil spills, clean up to spills rapidly
Development	Modifications of the Tokeland marina could eliminate an important roost site	Conserve suitable habitat	Work with local authorities to protect roosting areas in Tokeland

Upland sandpiper *Bartramia longicauda*	**Biology and Life History**	**Population**	**Distribution**
 Peter S. Weber, Cal Photos	Nests in grasslands, but uses various open habitats during migration, migratory	Very rare, no longer breeds in state	Scattered sites in eastern Washington
Monitoring Activities →	No surveys except for gathering data on occasional occurrences. Regular annual surveys of the Spokane County breeding site ceased when species became extirpated there. Future surveys should follow up recent reports, and survey suitable habitat in eastern and southeastern Washington.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat loss	Residential development, wetland drainage, and overgrazing have reduced or degraded habitat	Conserve suitable habitat, protect significant areas	Work with private landowners to manage and restore grassland habitats
Invasive plant species	Spread of spotted knapweed has reduced habitat quality	Control and monitor invasive species	Work with private landowners to reduce spotted knapweed

Marbled godwit *Limosa fedoa*	**Biology and Life History**	**Population**	**Distribution**
 Peter La Tourrette	Forages on tidal mud flats, migratory	Probably numbers fewer than 1,000 birds, increasing	Primarily northern Willapa Bay and Grays Harbor County
Monitoring Activities ➔	No formal ongoing surveys. Shorebird survey strategies under discussion and development. Implementation date uncertain.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Environmental contamination	Oil spills may kill birds, or damage or destroy foraging habitat	Control and monitor contamination	Prevent oil spills, clean up to spills rapidly
Development	Modifications of the Tokeland marina could eliminate a major roost site	Conserve suitable habitat	Work with local authorities to protect roosting areas in Tokeland

Red knot *Calidris canutus*	**Biology and Life History**	**Population**	**Distribution**
 Peter La Tourrette	Mainly forages on intertidal flats and roosts in sandy coastal habitats;	Relatively common, rangewide declines reported	Outer coast, primarily in Pacific and Grays Harbor counties; Willapa Bay and Grays Harbor are major stopover sites along the Pacific Flyway
Monitoring Activities ➔	No formal ongoing surveys. Shorebird survey strategies under discussion and development. Implementation date uncertain.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Invasive plant species	Spread of *Spartina* spp. threatens habitat quality in Willapa Bay	Control and monitor invasive species	Continue programs to control and eradicate *Spartina* spp.
Environmental contamination	Oil spills may kill birds, or damage or destroy foraging habitat	Control and monitor contamination	Prevent oil spills, clean up to spills rapidly

Rock sandpiper *Calidris ptilocnemis*	**Biology and Life History**	**Population**	**Distribution**
 Peter La Tourrette	Occupies rocky shoreline habitats, migratory	Rare, with perhaps fewer than 100 birds overwintering, numbers have declined slightly in recent decades	Primarily outer coast
Monitoring Activities ➔	No formal ongoing surveys. Shorebird survey strategies under discussion and development. Implementation date uncertain.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Environmental contamination	Oil spills may kill birds, or damage or destroy foraging habitat	Control and monitor contamination	Prevent oil spills, clean up to spills rapidly

Arctic tern *Sterna paradisaea*	**Biology and Life History**	**Population**	**Distribution**
 Peter La Tourrette	Marine waters, especially along the continental shelf; breeds on dredge-spoil and waterfront open space, mainly a passage migrant in Washington, with a tiny breeding population.	Fairly common migrant, rare breeder.	Marine waters, especially along the outer coast; a few pairs nests at Everett, Snohomish County.

Monitoring Activities ➔	No population surveys conducted other than occurrence or potential nesting shorebird areas.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Human disturbance	Any changes in management of Jetty Island, Everett, may affect nesting birds; human activity on the island and at waterfront nest locations may impact nest success	Control and monitor disturbance	Work with community officials and private businesses to manage Jetty Island for benefit of terns and to reduce disturbance during the nesting season
Environmental contamination	Oil spills may kill birds, or damage or destroy foraging and nesting habitat	Control and monitor contamination	Prevent oil spills, clean up to spills rapidly

Common murre *Uria aalge*	**Biology and Life History**	**Population**	**Distribution**
 Peter La Tourrette	Colonial breeder on rocks, islands, and coastal cliffs, forages in nearshore continental shelf waters and deeper inland waters	Varies between years from about 50,000-200,000 birds during winter and from about 4,000-10,000 birds during breeding season; stable	Marine waters throughout the state; breeding colonies distributed along outer coast from Clallam to Grays Harbor counties

Monitoring Activities ➔	Periodic colony surveys by U.S. Fish & Wildlife and University of Washington. WDFW conducts pelagic breeding season surveys of all seabird species on outer coast and winter in Puget Sound.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Environmental contamination	Oil spills and chronic oil pollution can kill large numbers of murres; toxic pollutants (e.g., DDTs and PCBs) may affect survival and reproduction	Control and monitor contamination	Prevent oil spills and chronic oil pollution, clean up to spills rapidly; reduce sources of ongoing toxic pollution
Harvest	Gill net fisheries result in the accidental bycatch of sizable numbers of birds	Address harvest concerns, education and outreach	Continue requirements on net design and daily and seasonal fishing activity
Human disturbance	Birds at breeding colonies are sensitive to the close approach of people, boats, and aircraft	Control and monitor human disturbance, education and outreach	Restrict human activity in and around breeding colonies
Declines in prey abundance	Commercial fisheries harvests may reduce food availability	Address harvest concerns	Manage fisheries harvests to reduce competitive impacts on seabirds
Excessive nest predation	Predation from gulls and introduced mammals at breeding colonies may impact populations	Control and monitor predators	Conduct predator control programs as necessary

Marbled murrelet *Brachyramphus marmoratus*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. of Fish & Wildlife	Seabird that nests in mature or old-growth forests, and younger forests with old-growth tree components within 50 miles of marine waters; depends on availability of large platforms. Breeds solitarily and attends nests during periods of low light.	Uncommon to fairly common resident in marine waters, rare in freshwater	Nests in low to mid-elevation coniferous forests w. of Cascade crest
Monitoring Activities ➔	Forest Practices Rules for Washington provide requirements for protocol surveys for landowners with >500 acres. Use current Pacific Seabird Group (PSG) protocol, as modified by WDFW guidance document, to survey potential nesting habitat prior to timber harvest and follow existing federal and state statutes regarding occupied site management. Regular monitoring of selected sites with history of murrelet detections. WDFW and DNR conduct surveys on state-managed lands.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat Loss	Logging of old-growth forests and forests with old components removes nesting habitat; fragmentation of old growth may enhance nest predation in remnant stands.	Conserve Suitable Habitat, Determine and Map Distribution, Habitat Monitoring and Research, Permanent Conservation of Habitat, Protect Significant Areas	Finalize and implement federal recovery plan. Use fee title and conservation easements to protect habitat. Identify at-sea foraging habitat as well as nearby nesting habitat and include in conservation strategy. Conduct research needed to fill gaps for developing delisting criteria.
Harvest	Gill-net fishery accidental bycatch is a source of mortality, but limited data for Washington. Reduced mortality primarily due to Fisheries modification since mid-1990s.	Determine and Address Limiting Factors	Update and evaluate potential impact of gill-net mortality in state.

Lack of Knowledge	Standard survey protocols to determine status and trends of at-sea populations	Research, natural history and Conservation	Develop standard survey protocols for determining status and trends based on at-sea counts of murrelets with other agencies.
Environmental Contamination	Very vulnerable to periodic and chronic oil spills because most time is spent at sea; lethal and may have sublethal, physiological and reproductive consequences that affect local populations.	Control and Monitor Contaminants	Identify important nearshore foraging areas along coast and include in oil spill response team databases for boom placement.

Ancient murrelet *Synthliboramphus antiquus*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. of Fish & Wildlife	Winter migrant to continental shelf and inland marine waters; breeds in Alaska and British Columbia, but a handful of breeding season records in Washington suggest that very small numbers may nest in the state	Fairly rare during the breeding season but common to abundant migrant and during the winter, trend unknown	Outer coast, Strait of Juan de Fuca, and northern Puget Sound
Monitoring Activities ➔	No ongoing surveys except for gathering incidental data on occurrences by WDFW and U.S. Fish & Wildlife Service.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Environmental contamination	Oil spills and chronic oil pollution can kill large numbers of murrelets	Control and monitor contamination	Prevent oil spills and chronic oil pollution, clean up to spills rapidly
Harvest	Gill net fisheries result in the accidental bycatch of sizable numbers of birds	Address harvest concerns, education and outreach	Continue requirements on net design and daily and seasonal fishing activity

Cassin's auklet *Ptychoramphus aleuticus*	**Biology and Life History**	**Population**	**Distribution**
 Alaska Dept. of Fish & Game	Forages along the outer continental shelf and slope and in deeper inland marine waters, nests on forested offshore rocks	Common to abundant; 90,000 estimate to nest in Washington, possibly declining	Outer coast, Strait of Juan de Fuca, and some adjacent inland marine waters
Monitoring Activities ➔	Periodic historic burrow surveys by U.S. Fish & Wildlife and other researches on selected colonies.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Environmental contamination	Oil spills and chronic oil pollution can kill large numbers of auklets	Control and monitor contamination	Prevent oil spills and chronic oil pollution, clean up to spills rapidly
Harvest	Gill net fisheries result in the accidental bycatch of sizable numbers of birds	Address harvest concerns, education and outreach	Continue requirements on net design and daily and seasonal fishing activity
Human disturbance	Birds at breeding colonies are sensitive to the close approach of people, boats, and aircraft	Control and monitor human disturbance, education and outreach	Restrict human activity in and around breeding colonies
Excessive nest predation	Predation from gulls, eagles, and other avian and mammalian predators at breeding colonies can impact populations	Control and monitor predators	Conduct predator control programs as necessary

Tufted puffin *Fratercula cirrhata*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. of Fish & Wildlife	Breeds over vast geographic range and extreme climatic conditions; pelagic; diet mainly of squid, euphausiids, and pelagic fishes. Breeds colonially.	Locally common breeder on n. outer coast, uncommon elsewhere in marine waters, rare s. of Admiralty Inlet. Very rare in winter.	Occurs on offshore islands along the outer coast and inland waterways from grays harbor to western Skagit and Island Counties
Monitoring Activities ➔	Periodic nesting colony and current pelagic surveys conducted by WDFW in conjunction with U.S. Fish & Wildlife.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Harvest	Gill-net fishery (both high seas drift net fisheries and coastal gill-net fisheries) kills individuals. Coastal gill-net fishery may be a significant source of mortality on Washington coastline.	Determine and Address Limiting Factors	Evaluate potential impact of gill-net mortality in state.
Lack of Information	Unknown why populations in Washington are declining	Research, Natural History and Conservation	Conduct demographic studies along coast to determine causes of 20 yr decline in populations
Environmental Contamination	Oil spills kill individuals and breeding population most at risk. Plastic pollution and ingestion at sea widespread, but detrimental affects not documented.	Control and Monitor Contaminants	Identify important nearshore foraging areas along coast and include in oil spill response team databases for boom placement.

Yellow-billed cuckoo *Coccyzus americanus*	**Biology and Life History**	**Population**	**Distribution**
 Peter La Tourrette	Onset of breeding is correlated with abundant food supply and once initiated requires only 17 days from egg-laying to fledging of young	Formerly an uncommon westside breeder, now very rare visitor statewide and may be extirpated.	Primarily riparian woodlands
Monitoring Activities ➔	No monitoring or surveys conducted except collect information on occurrences from all sources.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat Loss	Loss of suitable riparian habitat	Determine and Map Distribution; restore degraded habitat	Survey former breeding locations for occupancy to determine if extant population occurs in the state.

Flammulated owl *Otus flammeolus*	**Biology and Life History**	**Population**	**Distribution**
 Judd Patterson, Cal Photos	Occupies open forests with brushy understory with high nocturnal arthropod density, low reproductive rate among owls	Uncommon to fairly common summer resident in ponderosa pine zone on e. slope Cascades, Kettle Range, Selkirk Mtns., and Blue Mtns.	Mature ponderosa pine and Douglas-fir forests in eastern Washington
Monitoring Activities ➔	No forma surveys conducted. Incidental observations during spotted owl monitoring and surveys.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat Loss, Limited Habitat	Loss of nest cavities and lack of snag recruitment; degradation of foraging habitat by application of forest pesticides that kill non-target moths	Conserve Suitable Habitat, Restore Degraded Habitats	Conserve existing old-growth ponderosa pine and Douglas-fir forests, restore function to managed forests by providing functional nest cavities and foraging habitat
Lack of Information	Population status	Research, Natural History and Conservation; assess population status	Conduct habitat selection studies at multiple spatial scales and evaluate demography. Conduct population surveys.

Burrowing owl *Athene cunicularia*	**Biology and Life History**	**Population**	**Distribution**
 Paul Bannick, Cal Photos	Inhabitant of shrub-steppe and steppe; uses abandoned mammal burrows for nesting; diet of small mammals and insects; largely migratory, wintering in the southwest and Mexico	Locally fairly common to uncommon breeder in shrub-steppe in e. Washington. Rare in winter in eastern Washington.	Shrub-steppe and grassland habitats in eastern Washington
Monitoring Activities ➔	Periodic surveys for nests/productivity by WDFW, BLM, U.S. Fish & Wildlife refuges and universities. Intensive research project on populations and life history conducted through Washington State University and University of Arizona Cooperative Wildlife Unit.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Limited Habitat	Cultivation of grasslands and native prairies destroys nesting burrows and foraging habitat, degrades habitat quality, and may increase vulnerability to predators.	Conserve Suitable Habitat, Restore Degraded Habitats, permanent Conservation of Habitat, Education and Outreach	Work with land owners to restore native vegetation and conserve local populations of burrowing mammals around breeding colonies of owls. Implement voluntary agreements and conservation easements to conserve habitat for long-term.
Habitat Loss	Decline in burrowing mammals due to poisoning, trapping, shooting.	Education and outreach, enforcement	Reduce persecution of burrowing mammals through regulation, outreach and education.

Lack of information	Lack of information about local populations and population trends	Complete status assessments	Conduct systematic surveys periodically to monitor population trends.

Northern spotted owl *Strix occidentalis caurina*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. of Fish & Wildlife	Inhabits late seral coniferous forests at mid- to low-elevations; majority of pairs do not breed every year	Widespread, uncommon resident on Olympic Peninsula and in Cascade Mtns.; rare in SW Washington, and rare elsewhere away from Cascade foothills.	Mid and late-seral closed canopy forests in western Washington and eastern Cascade slope

Monitoring Activities ➔	No statewide comprehensive surveys have been done for many years. Intensive monitoring as part of demographic studies on the Olympic Peninsula, Cle Elum, and the Rainier North and I-90 SOSEA'S, Eastern Cascades by NCASI. Timber industry conducts limited surveys to selected sites. WADNR conducts site-specific surveys for site-specific management needs. WDFW conducts site-specific surveys for site-specific HCP management needs and compliance monitoring. Habitat-change analysis and remote sensing of habitat monitoring project, funded by WADNR, was conducted by WDFW in 2004 and 2005. USFWS will write new owl rescue "blueprint". WFPA may rewrite state rules governing logging of private forests designated to supplement federal efforts.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat Loss	Short-rotation even-aged silviculture, threat of fire eliminating isolated habitats	Conserve Suitable Habitat, Restore Degraded Habitat, Develop Recovery Plan	Preserve existing old-growth forests at landscape scale and restore habitat. Manage for and retain snags, large trees with cavities, and coarse woody debris in selectively logged forests.
Pathogens	Advent of West Nile virus into the state; possible threat to owls	Monitor spread of virus in the state.	Monitor spread and occurrence of virus in all bird species
Invasive species	Potential competition for habitat with barred owl	Population monitoring and research	Evaluate effect of timber harvest at landscape scale on occupancy of spotted owl habitat by barred owls

Great gray owl *Strix nebulosa*	**Biology and Life History**	**Population**	**Distribution**
 Paul Bannick, Cal Photos	Can be resident or nomadic with stable and irruptive populations. Delayed maturity (commonly breeds at 3 yr)	Rare local breeder in north-central. Washington, very rare winter visitor in n. counties.	Occupies mid-seral to mature forests adjacent to meadows in eastern Okanogan and western Ferry Counties
Monitoring Activities →	No formal surveys conducted. Incidental observations during spotted owl monitoring and surveys. Winter observations in lowlands reported by NGOs and bird watchers.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat Loss	Timber harvest; intensive forestry simplifies forest structure degrading habitat.	Conserve Suitable Habitat	Develop management guidelines to protect nesting structures, restrict harvest unit size, maintain hunting perches in cutover areas.
Lack of Information	Lack of knowledge of nesting and foraging habitats and their juxtaposition	Research, Natural History and Conservation	Conduct habitat studies in occupied range and map habitat across larger area to focus additional survey work.

Vaux's swift *Chaetura vauxi*	**Biology and Life History**	**Population**	**Distribution**
 Richard B. Forbes, Cal Photos	Nests and roosts in large diameter hollow trees in stands of high canopy closure, attaches nest to inside wall of tree cavity	Fairly common summer resident and migrant in w., uncommon in e. Widespread spring and fall migrant, locally abundant during migration.	Occurs in forests throughout the state below Alpine/Parkland and above steppe where suitable cavity trees are available
Monitoring Activities ➔	No formal surveys conducted. Incidental observations and data from BBS routes and other neotropical migrant surveys.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat Loss	Loss of hollow old-growth trees used as nesting and roosting sites	Conserve Habitat, Protect Significant Areas, Habitat Research	Maintain old growth forests
Lack of Information	Poor knowledge of population status	Research, Natural History and Conservation, assess population status	Evaluate habitat selection at forest stand and landscape scales. Conduct periodic population surveys/monitoring.

Lewis' woodpecker *Melanerpes lewisi*	**Biology and Life History**	**Population**	**Distribution**
 Peter La Tourrette	Requires snags of advanced decay for nesting, switches diet from insects in summer to acorns in winter; catches insects by fly catching and gleaning, rarely drills bark.	Locally common to uncommon summer resident, rare to locally common winter resident in e. Washington. Rare migrant and very rare winter visitor.	Open forests and woody riparian corridors of eastern Washington in the ponderosa pine zone and below. In the Columbia Basin, occupies transition zone between ponderosa pine and sagebrush.
Monitoring Activities ➔	No formal surveys conducted. Incidental observations and data from BBS routes and other neotropical migrant surveys.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat Loss	Fire suppression, grazing, selective timber harvesting and replanting with high densities of seedlings have degraded open ponderosa pine forests. Extent of cottonwood forests has also declined. Loss of large snags for nest sites.	Conserve Suitable Habitat	Restore open ponderosa pine forest conditions; restore natural fire regimes; maintain and recruit large diameter snags Preserve mature cottonwood riparian forests, restore natural hydrology regimes, and exclude cattle from riparian areas.

Lack of Information	Information on habitat selection at nest site, stand and landscape scales and population demography	Research, Natural History and Conservation	Conduct habitat selection studies and estimate vital rates to determine source habitats/landscapes.
Invasive Animal Species	Potential competition for nest cavities with starlings	Control and Monitor Invasive Species	Determine extent of competition for cavities and if necessary control
Development	Urbanization and residential development in breeding and overwintering habitat may result in habitat loss	Conserve Suitable Habitat	Work with county planners in establishing reserve areas of suitable habitat

Acorn woodpecker *Melanerpes formicivorus*	**Biology and Life History**	**Population**	**Distribution**
 Peter La Tourrette	Dependent on snags for nesting and roosting, cooperative breeder, acquires prey items by gleaning and fly-catching	Very localized, uncommon resident in Klickitat Co.	Confirmed nesting only from Klickitat County.

Monitoring Activities ➔	No formal surveys conducted. Incidental observations and general data reported from multiple sources that visit the known site.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Lack of Information	Extent of occurrence in pine-oak woodlands in Klickitat Co.	Determine and Map Distribution	Survey oak and pine-oak woodlands in Klickitat and other counties where potentially suitable habitat occurs to determine extent of distribution in the state at northern part of its range.

White-headed woodpecker *Picoides albolarvatus*	**Biology and Life History**	**Population**	**Distribution**
 Peter La Tourrette	Pine seeds dominate diet during most of year, flakes bark and gleans prey items, rarely drills into bark	Uncommon to locally fairly common resident in ponderosa pine forest on e. slope of cascades, NE. mountains and Blue Mtns. Very rare in w. Washington.	Occupies ponderosa pine forests in eastern Cascades and east of Okanogan River, local in Blue Mountains

Monitoring Activities ➔	No formal surveys conducted. Incidental observations and general data reported from multiple sources. Recent survey and habitat relationships project of known and historical nest areas completed by WDFW in 2003 (Rogers and Buchanan) and intensive research by R. Dixon, University of Idaho.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat Loss	Loss of and degradation of large diameter pine forests that are needed to provide abundant and reliable seed sources and nest cavities.	Conserve Suitable Habitat, Restore Degraded Habitat	Develop conservation strategy that addresses management of pine forest types. Maintain and recruit suitable snag as nesting structures to maintain populations.
Lack of Information	Limited data on distribution	Determine and Map Distribution, Habitat Monitoring and Research, Population Monitoring and Research	research habitat needs at stand and landscape scales incorporating measures of population demography; develop methods to monitor extent of suitable source habitats using landscape imagery, assess population status.

Black-backed woodpecker *Picoides arcticus*	**Biology and Life History**	**Population**	**Distribution**
 Peter La Tourrette	Irruptive species dependent on fire landscapes.	Rare to locally uncommon resident in mid to high-elevation coniferous forests e. of Cascade crest, rare w. of crest.	Primarily inhabits forests above ponderosa pine, but peripherally within ponderosa pine on east slope of Cascades. On w. side of the crest occurs in western hemlock, subalpine fir, and alpine/parkland forest types. Also occurs in Blue Mtns.
Monitoring Activities ➔	No formal surveys conducted. Incidental observations and data from BBS routes and other neotropical migrant surveys.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat Loss	Degradation of habitat by fire suppression and loss of snags for nest sites.	Conserve Suitable Habitat, Habitat Monitoring & Research, Restore Degraded Habitats	Establish management areas where mature and old stands develop and natural processes of disease and decay occur without logging. Monitor populations to evaluate effectiveness of management areas. Allow wildfires to burn in some forests to create suitable habitat.

Lack of Information	Knowledge of population status	Research, Natural History and Conservation	Evaluate habitat selection at forest stand and landscape scales and method of tracking habitat using remote sensing techniques, assess population status.

Pileated woodpecker *Dryocopus pileatus*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. of Fish & Wildlife	Dependent on large diameter snags typically in mature forest for nest and roost sites, forages in mature forest stands	Fairly common resident in coniferous forest, deciduous, and mixed forests over wide range statewide.	Below western hemlock zone in w. Washington, and below alpine/parkland zone in e. Washington.
Monitoring Activities →	No formal surveys conducted. Incidental observations and data from BBS routes and other neotropical migrant surveys.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat Loss	Timber harvest; removal of large diameter live and dead trees, downed woody material.	Conserve Suitable Habitat, Protect Significant Areas, Restore Degraded Habitats;	Evaluate whether existing management prescriptions are adequate to maintain populations.

Lack of Information	Data on population dynamics is needed to determine sustainable populations	Population monitoring and research; Research natural history and conservation	Study populations in landscapes of different forest age class distributions and amounts, and evaluate demographic parameters (vital rates, juvenile dispersal) to assess habitat conditions needed for sustainable populations.

Streaked horned lark *Eremophila alpestris strigata*	**Biology and Life History**	**Population**	**Distribution**
 Ruth Sullivan	Breeds on remnant prairie and grassland of south Puget Sound, coastal beaches and islands in the lower Columbia; winters in Oregon and on lower Columbia sites	Entire population about 330 birds in Washington, and 450 in Oregon	Local breeder in remnant grasslands in prairies and beaches of western Washington endemic subspecies of Washington and Oregon; likely extirpated in BC.
Monitoring Activities ➔	Current intensive monitoring and research by Scott Pearson, WDFW, formerly WADNR. Previous rangewide surveys by Russell Rogers (1999 and 2000), WDFW and formerly The Evergreen State College and WDFW P. MacLaren (2000).		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat Loss	Loss of habitat to development, fire suppression, and introduction of exotic plants all have been or continue to be factors in decline of populations.	Conserve Suitable Habitat, Restore Degraded Habitats; Protect significant areas. Manage spoil disposition to maintain open habitat.	Conserve and restore function to remaining prairie habitat. Develop conservation strategies with Fort Lewis, McChord Air Force Base, and area airports; Protect and manage dredge spoil islands in Columbia River as nesting habitat.

Invasive plant species	Dense growth of European beachgrass reduces nesting and foraging beach habitat	Control and monitor invasive species	Reduce the occurrence of European beachgrass in coastal areas
Human disturbance	Disturbance of nesting beaches by recreational activity	Enforcement, outreach	Protect nesting sites on public beaches.
Predation	Crow predation on nests	Control and monitor predators	Conduct predator control programs as necessary
Limited Distribution	Populations have been extirpated from San Juan Islands and most of Puget Trough	Determine and Address factors Limiting Recovery, Increase Distribution	Where habitat is restored, reintroduce populations to formerly occupied sites.

Purple martin *Progne subis*	**Biology and Life History**	**Population**	**Distribution**
 Peter La Tourrette	Secondary cavity user	Primarily depends on artificial nest structures	Occurs in Puget Trough, Grays Harbor, Willapa Bay and lower Columbia River.

Monitoring Activities ➔	Local intensive surveys of artificial nest boxes and natural nests. Otherwise, no formal surveys conducted. Incidental observations and data from BBS routes and other neotropical migrant surveys.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Invasive animal species	Competition for nest cavities in snags and birdhouses by European Starlings and House Sparrows	Control and Monitor Invasive Species	Trap and kill European starlings and House Sparrows near remaining and former breeding areas of martins.
Limited habitat	Limited nesting habitat	Enhancement of nesting site availability.	Install single-cavity birdhouses and gourds to enhance martin populations.

Slender-billed white-breasted nuthatch *Sitta carolinensis aculeata*	**Biology and Life History**	**Population**	**Distribution**
 Peter La Tourrette	Secondary cavity user for nest sites	Very local, rare and in decline in w. Washington	Confined to Vancouver vicinity, especially Ridgefield NWR. Rare and local in Skamania Co.; may be extirpated in Steilacoom/Fort Lewis area.

Monitoring Activities ➔	No formal surveys conducted. Incidental observations and general data reported from multiple sources. Will develop protocol when and if reintroduced.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat Loss	Conversion of oak and oak-conifer woodlands	Conserve Suitable Habitat	Work with landowners to incorporate conservation of this species and oak woodlands into long-term land management
Limited distribution	small size and isolation of Washington populations	Increase distribution	conduct feasibility study for reintroductions; implement translocations
Lack of Information	Current status is unclear without systematic surveys	Research, Natural History & Conservation; Determine & Address Factors Limiting Recovery	Conduct surveys where pairs were historically found, characterize habitat, and identify additional areas to target surveys. Assess factors that may account for loss of pairs at formerly occupied sites.

Pygmy nuthatch *Sitta pygmaea*	**Biology and Life History**	**Population**	**Distribution**
 Peter La Tourrette	One of the few cooperatively breeding passerines in North America, strong preference for long-needled pine forests	Fairly common to uncommon resident in NE. counties and along e. slope of Cascades, local in some areas.	Occupies dry, open ponderosa pine forests at low elevations in eastern Washington. Local in Blue Mtns.

Monitoring Activities ➔	No formal surveys conducted. Incidental observations and data from BBS routes and other neotropical migrant surveys.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat Loss	Logging, fire suppression, grazing and commercial and residential development that degrades mature ponderosa pine habitat and reduces quality of nests sites and adequate food supply	Conserve Suitable Habitat, Restore Degraded Habitats	Maintain mature and old-growth ponderosa pine. Restore degraded pine forests by thinning dense understory fir, return natural fire regime, and maintain snags.
Lack of Information	Better define the range of the species	Determine and Map Distribution	Conduct standard surveys to better define range

Western bluebird (W WA) *Sialia mexicana*	**Biology and Life History**	**Population**	**Distribution**
 Peter La Tourrette	Inhabits open, park-like forests and edge habitats with sufficient number of larger trees and snags to provide nest and perch sites; secondary cavity user.	Locally fairly common and widely distributed summer resident in e. Washington and c. and SW. Washington except for high elevation, dense forests, and the Columbia Basin	Inhabits woodland/prairie mosaic and Puget Sound Douglas-fir in w. Washington
Monitoring Activities ➔	Intensive nest box monitoring in Pierce and Thurston Counties by George Walter. Similar efforts by NGOs at local sites throughout the state, especially Klickitat County. No formal surveys conducted. Incidental observations and data from BBS routes and other neotropical migrant surveys.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat Loss	clearcut logging, fire suppression, and snag removal, as well as commercial and residential development reduce and degrade open forest and edge habitats. Competition for cavities by starlings and house sparrows	Conserve Suitable Habitat, Restore Degraded Habitats	Conserve/restore habitat by management of snags and using prescribed fire. Conserve habitat for primary cavity excavators in order to provide nest sites. Provide nest boxes as short term solution to cavity limitation.

Invasive Animal Species	Competition for nest cavities in snags and birdhouses by European starlings and house sparrows	Control and Monitor Invasive Species	Trap and kill European starlings and House Sparrows near remaining and former breeding areas of martins. Install single-cavity birdhouses and gourds to enhance martin populations.
Lack of Information	Monitor trend in population	Research natural history and conservation; Population monitoring & research	Conduct surveys to determine trend in population and whether listing is needed

Sage thrasher *Oreoscoptes montanus*	**Biology and Life History**	**Population**	**Distribution**
 Peter La Tourrette	Sagebrush obligate	Fairly common breeder in shrub-steppe of eastern Washington.	Sagebrush and bitterbrush habitats in the Columbia Basin, north to Omak. Not present in Methow Valley and locally uncommon in Okanogan Valley.

Monitoring Activities →	Selected local populations are monitored in study areas of the WDFW research project for shrub-steppe habitat relationships and avian population dynamics.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat Loss	Habitat loss to residential development, agricultural conversion, burning, herbicide and pesticide treatments, and heavy grazing by livestock. Fragmentation of remaining habitat patches.	Conserve Suitable Habitat, Restore Degraded Habitat, Protect Significant Areas	Protect core areas of good habitat; control cheatgrass; Identify degraded habitat for restoration and establish connectivity with core areas. Work with other agencies to protect and restore habitat; evaluate CRP leases to provide functional habitat on private lands.
Lack of Information	Effects of land management activities on population persistence in landscapes	Research, Natural History & Conservation	Conduct studies on use of sagebrush patches in landscapes of differing patchiness and connectivity to design conservation strategy

Loggerhead shrike *Lanius ludovicianus*	**Biology and Life History**	**Population**	**Distribution**
 Peter La Tourrette	Small avian predator; impales prey on thorns and barbed wire, an adaptation for eating large prey without the stronger feet and talons of raptors. Shrike occupies unique position in the food chain as both passerine and a top level predator. Some have been found impaled on barbed wire themselves; horny toad revenge?	Fairly common local summer resident in e., rare in winter.	Occurs in eastern Washington where it prefers alternating patches of shrub-steppe and grassy areas
Monitoring Activities ➔	Selected local populations are monitored in study areas of the WDFW research project for shrub-steppe habitat relationships and avian population dynamics.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat Loss	Conversion of shrub-steppe to agriculture.	Conserve Suitable Habitat, Restore Degraded habitat	Conserve existing shrub-steppe habitat and restore function of degraded shrub-steppe.
Lack of Information	Lack of knowledge of source vs. sink landscapes	Research, Natural History and Conservation	Studies of populations in landscapes of varying levels of shrub-steppe amount, patchiness and connectivity with corresponding measures of demography are needed to evaluate source/sink populations and landscape characteristics.

Oregon vesper sparrow *Pooecetes gramineus affinis*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. of Fish & Wildlife	A ground-dwelling species that breeds in dry, open habitats with short, sparse and patchy herbaceous vegetation; some bare ground; and scattering of low to moderate shrubs.	In danger of extirpation	Occupies remnant prairies and grasslands in western Washington
Monitoring Activities →	No formal surveys conducted. Incidental observations, data and combined surveys from streaked horned lark research (Rogers 2000), BBS routes, and other neotropical migrant surveys.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat Loss, Invasive plant species	Conversion of prairie habitat to residential development, farmland; succession to forest due to fire suppression; Scotch broom invasion	Conserve Suitable Habitat; Restore Degraded Habitat; Research, Natural History & Conservation	use easements, acquisitions, or agreements to conserve habitat; restore prairies
Lack of Information	Potential threat from herbicide and pesticide spraying	Research, Natural History and Conservation	Conduct research to evaluate potential exposure to toxins from pesticide and herbicide applications

Sage sparrow *Amphispiza belli nevadensis*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. of Fish & Wildlife	Obligate shrub-steppe species	Uncommon migrant and summer resident in shrub-steppe of e. Washington, rare migrant w. of Cascades	Sagebrush landscapes of the Columbia Basin
Monitoring Activities ➔	Selected local populations are monitored in study areas of the WDFW research project for shrub-steppe habitat relationships and avian population dynamics.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Invasive Plant Species	Habitat degradation by cheatgrass; increased fire frequency kills native plants and depletes grass and shrub seed reservoirs while replacing native species with exotic annuals.	Conserve Suitable Habitat; Habitat Monitoring and Research	Conserve existing big sagebrush habitats from cheatgrass invasion, and develop options for management of cheatgrass to restore ecological function.
Lack of Information	Lack of knowledge about general life history and ecology of this subspecies	Population monitoring and research, Habitat Monitoring and Research	Conduct studies at landscape scales in areas of differing land management uses to determine amount, quality and connectivity of sagebrush needed to sustain populations.

Habitat Loss	Loss of big sagebrush; residential development, agricultural conversion, and road and power line rights-of-way that remove shrub-steppe habitat. Fragmentation of shrub-steppe habitat detrimental to populations.	Conserve Suitable Habitat; Restore Degraded Habitats; Research natural history and conservation	quantify effects of fragmentation of shrub-steppe habitat on sage sparrow population persistence at landscape scale. Identify areas of core habitat on public lands to function as reserves and restore function to habitat on private lands, where connectivity occurs with core habitat, through enrollment in CRP.

REPTILES

Western pond turtle *Actinemys (Clemmys) marmorata*	Biology and Life History	Population	Distribution
 Washington Dept. of Fish & Wildlife	Nests in grassland and open woodland around ponds	Natural populations occur at 2 sites; captive bred and head-started turtles used for reintroductions and augmentation at 3 sites.	Puget Tough and Columbia Gorge
Monitoring Activities ➔	Intensive annual population/nesting/productivity surveys of known and reintroduction sites.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Development	Destruction nesting habitat; isolation of breeding ponds, road mortality	Conserve suitable habitat; protect significant areas	protect or restore nesting habitat at existing and potential sites
Invasive Animal Species	bullfrog and bass predation on hatchlings, non-natives turtles: competition and introduced disease	Control and monitor introduced animals	Implement bullfrog and fish control as needed
Limited distribution	Small number and isolation of sites	Implement recovery plan	continue reintroductions

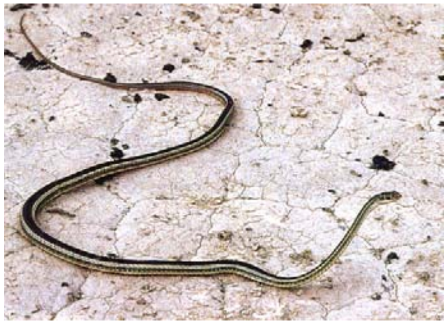
Pygmy horned lizard *Phrynosoma douglasii*	**Biology and Life History**	**Population**	**Distribution**
 William Leonard	Inhabit shrub-steppe; bear live young in summer	Uncommon; trend unknown; extinct in BC	Columbia Basin and Cascade foothills
Monitoring Activities ➔	Nature Mapping surveys conducted in eastern Washington in conjunction with Waterville Elementary School in Douglas County. Current research is being done in Kittitas County by Central WA University graduate student.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Harvest	Mortality after capture for pets	Education and outreach	discourage capture for pets
Lack of information	Trend in population and distribution largely unknown	Determine and map distribution	Record occurrence data during other activities; map locations
Habitat loss	development or conversion of habitat to agriculture	Conserve suitable habitat	Restoration, acquisition, education and citizen science.

Sagebrush lizard *Sceloporus graciosus*	**Biology and Life History**	**Population**	**Distribution**
 Adam P. Summers, Cal Photos	Restricted to sand dune and sandy habitats with shrubs and bare ground; active on sunny days from April -October; young appear in August	Declining due to habitat loss; small isolated populations	Columbia Basin and Okanogan
Monitoring Activities ➔	Ongoing surveys focusing on sand dune habitat in the Columbia Basin and Okanogan by WADNR Natural Heritage Program.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat loss	conversion to agriculture	Conserve suitable habitat	Conserve suitable habitat
Lack of information	incomplete knowledge of distribution	Determine and map distribution	Develop a formal species-specific protocol; use it to complete surveys of historic range
Limited distribution	isolated populations at risk to extinction	Protect significant sites	identify sites and protect with easements, agreements,
Invasive plants	cheatgrass degrades habitat	Restore degraded habitat	control cheatgrass at occupied sites

Racer (W WA) *Coluber constrictor*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. of Fish & Wildlife	Diurnal snake of grassland and talus; high fidelity to communal winter dens	Probably extirpated; no records since 1939	south Puget Sound prairies
Monitoring Activities →	Occasional surveys in south Puget Sound prairies by WADNR Natural Heritage and WDFW.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Lack of information and loss of habitat	Not enough known about life history and habitat; not seen in western Washington for 65 years.	Determine and map distribution	Develop a formal species-specific protocol; use it to conduct systematic surveys to determine if any extant population

Sharptail snake *Contia tenuis*	**Biology and Life History**	**Population**	**Distribution**
 William Leonard	Little known; surface active in moist conditions, otherwise retreats underground under rocks and woody debris; feeds on slugs	Small isolated populations; little known	Disjunct localities in Chelan, Kittitas, Yakima, Klickitat, Skamania and Pierce counties
Monitoring Activities ➔	Occasional surveys in Pierce County by WADNR Natural Heritage and WDFW.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Lack of information	Undocumented populations may be destroyed; conservation needs little understood	Research natural history and conservation	Limiting factors need to be identified
Limited distribution	small isolated populations vulnerable to extinction	Determine and map distribution	Develop a formal species-specific protocol; use it to survey and map
Habitat loss	disturbance to rock, woody debris, and moisture regime	Protect significant sites; conserve suitable habitat	

California mountain kingsnake *Lampropeltis zonata*	**Biology and Life History**	**Population**	**Distribution**
 Adam P. Summers, Cal Photos	Inhabits moist microhabitats in pine-oak;	Population isolated from rest of range by 200 miles; size and trend unknown	Skamania and Klickitat County
Monitoring Activities →	No formal surveys. Occurrence information primarily from incidental observation reports submitted to WDFW.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Harvest	Illegal collecting for pet trade	Education and enforcement	Education project in counties; make special effort to involve the pet trade in self-regulation and education
Lack of information	Habitat needs, limiting factors, largely unknown	Research natural history and conservation; Determine and map distribution	Identify habitat needs, mortality factors; survey potential habitat
Habitat loss	Development, destruction of overwintering sites	Protect significant sites	Seek easements, etc.
Limited distribution	restricted distribution and habitat needs suggest small vulnerable population	Conserve suitable habitat	

Striped whipsnake *Masticophis taeniatus*	**Biology and Life History**	**Population**	**Distribution**
 Jon Beck	Found in intact shrub-steppe; diurnal; overwinters communally with other snake species; reuse hibernacula	very few records	shrub-steppe in Columbia Basin
Monitoring Activities ➔	Annual surveys conducted by WADNR Natural Heritage Program with assistance from BLM, WDFW, in areas where snakes have been observed in the past. Radio-telemetry study in Grant County starting fall 2005 by WADNR Natural Heritage Program.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat loss	Loss of sagebrush habitats	Protect significant sites; Conserve suitable habitat	Restore habitat on public land; protect other sites with easements, agreements, etc.
Lack of information	Little data on habitat needs, limiting factors	Research natural history and conservation	Identify specific needs, limiting factors
Development	roadkill mortality; den site destruction	Identify and map sites of mortality	Develop mitigation strategy

Pacific gopher snake (W WA) *Pituophis catenifer catenifer*	**Biology and Life History**	**Population**	**Distribution**
 William Flaxington, Cal Photos	Inhabited prairie and dry woodland; winters in communal dens	Probably extirpated	South Puget Sound prairies
Monitoring Activities ➔	Occasional surveys in south Puget Sound prairies by WADNR Natural Heritage and WDFW.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Lack of information	No recent records.	Determine and map distribution	Develop a formal species-specific protocol; use it to conduct systematic surveys to determine if any extant population

AMPHIBIANS

Tiger salamander *Ambystoma tigrinum*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. Fish & Wildlife	eggs and larvae in ponds in steppe and ponderosa pine; some adults remain gilled and aquatic, transformed adults spend most time underground	Locally abundant	eastern Columbia Basin, northeast Washington and Okanogan Highlands
Monitoring Activities ➔	Tiger salamander surveys every 2-3 years on selected BLM allotments in Lincoln, Whitman and Douglas Counties. Other occurrence information from inventory work in the Columbia Basin (WADNR Natural Heritage Program) and incidental observation records submitted to WDFW.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Hybridization	Potential loss of genetic integrity due to out of state subspecies used for fish bait	Control and monitor genetic pollution	Conduct genetic work to determine extent of problem; control nonnative strains
Introduced animals	Introduced predatory fish	Control and monitor predatory fishes	enforce restrictions on transplantation of fishes
Harvest	use of larvae for fish bait	Deter use of larvae for fish bait	Education
Lack of information	Limiting factors and conservation needs largely unknown	Determine and map distribution, Conduct research	Protect significant areas

Dunn's salamander *Plethodon dunni*	**Biology and Life History**	**Population**	**Distribution**
 William Leonard, CalPhotos	Inhabits cool, moist habitats. Found in forested areas from sea level to 2,000 ft. in Washington. Both juveniles and adults inhabit wet, rocky substrates that are heavily shaded, including wet talus slopes, seepage and stream borders. Majority of occurrences in forests >60 years of age.	Rare, unknown, possibly declining	In Washington, found only in the Willapa Hills in extreme southwestern portion of the state.
Monitoring Activities ➔	N-type stream and down woody debris studies (LWAG).		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat loss	alteration of streams, loss of large woody debris through timber management.	Protect significant areas	survey and map locations; minimize impact by forest management.
Limited distribution	Populations may be isolated by roads, timber harvest	Conserve suitable habitat	protect streams, talus, and moist, older forest
Lack of information	Not enough known about distribution and habitat requirements	Conduct research on distribution and habitat requirements.	Research effects of forest management activities and experimental low impact techniques

Larch Mountain salamander *Plethodon larselli*	**Biology and Life History**	**Population**	**Distribution**
 William Leonard, CalPhotos	Inhabits steep talus, lava tubes, or in some areas old growth timber; surface active in wet spring and fall weather, otherwise subterranean	Population size and trends unknown	Columbia Gorge and isolated sites in the southern Washington Cascades
Monitoring Activities ➔	Chris – contact Charlie Crisafulli at USDA Forest Service (Pacific Northwest Research Station) to see if they are still surveying for PLLA.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat loss	destruction of talus for roads; microclimate disruption due to overstory removal	Protect significant areas	Conserve talus and overstory of forested talus
Lack of information	limiting factors unknown	Determine and Map distribution	Determine and Map distribution

Van Dyke's salamander *Plethodon vandykei*	**Biology and Life History**	**Population**	**Distribution**
 William Leonard, CalPhotos	Associated with streams, seeps, rocks and talus; most abundant in older forest abundant woody debris, large decaying logs near streams; females brood and guard eggs.	small isolated population complexes	3 isolated populations on the Olympic Peninsula, the Willapa Hills, and the south Cascades; only in Washington

Monitoring Activities ➔	Charlie Crisafulli at USDA Forest Service (Pacific Northwest Research Station) to see if they are still surveying for PLVA.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Lack of information	impacts of timber harvest, road building, and herbicides unknown	Population monitoring and research	research life history, movements, dispersal, impacts of forest practices
Habitat loss	alteration of streams, loss of large woody debris	Protect significant areas	survey and map locations
Limited distribution	Populations may be isolated by roads, timber harvest	Conserve suitable habitat	protect streams, talus, and moist, older forest

Cascade torrent salamander *Rhyacotriton cascadae*	**Biology and Life History**	**Population**	**Distribution**
 William Leonard, CalPhotos	Closely tied to clear cold streams, especially in splash zone; larvae in gravels in deeper water; egg to adult development may require 4.5 years	Can reach high densities in optimal habitat	west slope of southern Cascades south of Nisqually River to the Columbia
Monitoring Activities ➔	Contact Charlie Crisafulli at USDA Forest Service (Pacific Northwest Research Station) to see if they are still surveying for RHCA.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**

Habitat Loss	Degradation of habitat by sediment due to logging, road building	Habitat monitoring and research	stream buffers during timber harvest;
Lack of information	Lack of data on limiting factors, life history and potential for impacts from land uses, and forest practices.	Research life history and conservation needs	identify needed conservation measures
Limited Distribution	Populations may become isolated	Determine and map distribution, Conserve suitable habitat	survey and map sites

Columbia torrent salamander *Rhyacotriton kezeri*	**Biology and Life History**	**Population**	**Distribution**
 William Leonard, CalPhotos	Closely tied to clear cold streams, especially in splash zone; larvae in gravels in deeper water	Locally common in appropriate habitat; may be temporarily extirpated	southwest Washington
Monitoring Activities ➔			
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat loss	Degradation of habitat by sediment due to logging, road building	Habitat monitoring and research	stream buffers during timber harvest;
Lack of information	Long term effects of forest management unknown	Research life history, movements	Research life history, movements

<table>
<tr><th>Rocky Mountain tailed frog
Ascaphus montanus</th><th>Biology and Life History</th><th>Population</th><th>Distribution</th></tr>
<tr><td>
Paul Bannick, Cal Photos</td><td>Associated with cold, clear, rocky, streams in mature forest; eggs attached to underside of rocks in fast flowing streams.</td><td>Current status of populations not known</td><td>Blue Mountains</td></tr>
<tr><td>Monitoring Activities ➔</td><td colspan="3">No formal surveys at this time.</td></tr>
<tr><td>General Problems</td><td>Specific Problems</td><td>Conservation Strategies</td><td>Specific Conservation Actions</td></tr>
<tr><td>Habitat Loss</td><td>Degradation of habitat by sediment due to logging, road building</td><td>Habitat monitoring and research</td><td>stream buffers during timber harvest;</td></tr>
<tr><td>Lack of information</td><td>Potential effects of forest practices, roads, and grazing unknown; status and distribution data needed</td><td>Research natural history and conservation</td><td>Survey and map distribution; conduct research on impacts of land uses;</td></tr>
</table>

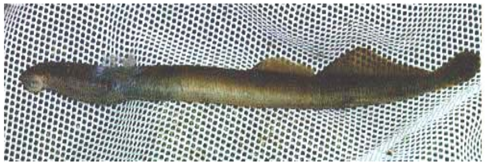
Western toad *Bufo boreas*	**Biology and Life History**	**Population**	**Distribution**
 Paul Bannick, Cal Photos	Breed in ponds, lakes, and still water off-channel river habitats; development to metamorphosis takes about 2 months, after which toadlets disperse en masse.	Locally common, but rapid unexplained declines resulted; absent from portions of historic range	In forest, prairie and canyon grasslands throughout the state; mostly absent from shrub-steppe regions
Monitoring Activities ➔	No formal statewide inventory. Annual monitoring activities at Tahuya State Forest and Ft. Lewis Military Reservation by WADNR Natural Heritage Program and WDFW. Ongoing research activities at Mt. St. Helens by USDA Forest Service. Ongoing surveys to locate breeding sites by WADNR Natural Heritage Program and WDFW. Occasional monitoring activities by some districts of the Colville National Forest.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Lack of information	Taxonomic uncertainty may mean 1 or more taxa are in greater decline; causes of declines not understood; distributional data needed	Research taxonomy, conservation	Survey and map distribution, conduct genetic studies,
Development	Roadkill mortality when moving to and from breeding sites	Conserve suitable habitat	Avoid roadbuilding near breeding sites, or provide crossings

Northern leopard frog *Rana pipiens*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. Fish & Wildlife	Breed in ponds, lakes, rivers; may stray from water in summer, but little known about habitat use.	Reduced to small areas in the Moses Lake-Potholes Reservoir and Gloyd Seeps areas	Columbia Basin, Okanogan, and northeastern Washington
Monitoring Activities ➔	Intensive surveys as part of research conducted by WDFW at Potholes Wildlife Area. Regular surveys conducted on Kalispell Indian Reservation. Occasional surveys conducted on Colville National Forest Lands near Pend Oreille River.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Lack of information	Conservation needs not understood	Research natural history and conservation	research habitat needs, impacts of exotic species, movements,
Introduced animals	Predation by bullfrogs and predatory fish; habitat degradation by carp and mosquito fish	Control and monitor introduced species	Develop methods to control or otherwise mitigate impacts of bullfrogs and fish
Environmental contamination	agricultural chemicals	Control and monitor contaminants	evaluate need for contaminant studies

Oregon spotted frog *Rana pretiosa*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. Fish & Wildlife	Highly aquatic; extant populations inhabit large shallow wetlands associated with streams; breeds in seasonally flooded margins, move underwater in winter. Require source of well-oxygenated water in winter, temperatures above freezing	Declined; only 6 populations remain	Thurston and Klickitat counties
Monitoring Activities ➔	Annual egg mass surveys conducted at 5 of 6 known populations by WDFW, WADNR Natural Heritage Program, USFWS. Decade long population study at Dempsey Creek by WDFW. Spring trapping surveys conducted in Black River Watershed to find new populations and determine dispersal patterns by WDFW.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Water development	Altered hydrology can eliminate habitat	Protect significant areas; conserve suitable habitat	protect known sites; identify and protect potential habitat
Lack of information	Potential impacts of land use, etc not understood	Research natural history and conservation	Investigate limiting factors
Introduced animals	Bullfrogs and introduced fishes	Control and monitor exotic species	Control bullfrogs and predatory fish as needed
Modification of natural processes	Loss of beaver and beaver ponds may be important	Protect natural processes	Conserve beaver populations and dynamic stream processes

Columbia spotted frog *Rana luteiventris*	**Biology and Life History**	**Population**	**Distribution**
 William Leonard, CalPhotos	relatively aquatic, rarely found far from ponds, lakes, creeks; breeds in seasonally flooded margins of wetlands	Common in Okanogan and northern Cascades; declined in other states.	Most of eastern Washington, but largely absent from Columbia Basin
Monitoring Activities →	Annual Columbia Spotted Frog egg mass surveys/census of selected BLM allotments in Lincoln and Whitman Counties. Occasional egg mass surveys in some districts of the Colville National Forest.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Water development	Altered hydrology can eliminate habitat	Protect significant areas; conserve suitable habitat	protect known sites; identify and protect potential habitat
Lack of information	Potential impacts of land use, etc not understood	Research natural history and conservation; Determine and map distribution	Investigate limiting factors; survey historic sites and potential habitat
Modification of natural processes	Loss of beaver and beaver ponds may be important	Protect natural processes	Conserve beaver populations and dynamic stream processes
Introduced animals	Bullfrogs and introduced fishes	Control and monitor exotic species	Control bullfrogs and predatory fish as needed

FISH

River lamprey *Lampetra ayresi*	**Biology and Life History**	**Population**	**Distribution**
 U.S. Fish & Wildlife Service	Juveniles spend 3-6 years as filter feeders in streams and rivers, then metamorphose into adults and migrate to ocean. Adults feed on fishes for no more than 1 year, migrate back to freshwater to spawn and die.	Population size and trend unknown.	In Washington, this fish has been documented in only 6-8 coastal rivers and lakes. May occur in other coastal rivers and possibly the Columbia River System.
Monitoring Activities ➔	No past or current monitoring activities. Accumulate incidental data.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Lack of information	Little is known about the population and trend status, but it is perceived as declining.	Determine population status and trends, and species differentiation. Of our 3 lamprey species, the least is known about river lamprey.	Survey and map distribution. Develop methods to differentiate between species of juvenile lamprey.
Hydro development	Dams and other passage barriers.	Determine what is a barrier and how to allow for fish passage.	Identify potential obstacles. Develop methods to pass barrier.
Lack of information	Although general habitat and life history requirements are known, limiting factors and critical needs are not.	Habitat monitoring and research. Determine limiting factors. Again, of the 3 lamprey species, the least is known about river lamprey.	Research habitat needs, availability and usage. Research limiting factors, such as environmental stressors, predation and trophic relationships.

Pacific lamprey *Lampetra tridentata*	**Biology and Life History**	**Population**	**Distribution**
 U.S. Fish & Wildlife Service	Juveniles spend 4-7 years as filter feeders in streams and rivers, then metamorphose and migrate to ocean. Adults parasitic on fishes for 1-2 years, migrate back to freshwater to spawn and die.	Population size and trends unknown. Columbia River lamprey appear to be on the decline according to dam counts and anecdotal information.	In Washington, distributed throughout streams and rivers of Columbia Basin up to Chief Joseph Dam, and throughout streams and rivers west of the Cascade Mountains.
Monitoring Activities ➔	Mid-Columbia Public Utility Districts are actively pursuing development of management plans. WDFW started annual redd counts in 2005. Counts of migrating adults are tallied annually by Columbia River dam operators. No other monitoring activities ongoing or planned by WDFW. Accumulate incidental data.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Lack of information	Little is known about the population and trend status, but it is perceived as declining, particularly in the Columbia River System.	Determine population status and trends, and species differentiation.	Survey and map distribution. Develop methods to differentiate between species of juvenile lamprey.
Hydro development	Dams and other passage barriers.	Determine what is a barrier and how to allow for fish passage.	Identify potential obstacles. Develop methods to pass barrier.
Lack of information	Although general habitat and life history requirements are known, limiting factors and critical needs are not.	Habitat monitoring and research. Determine limiting factors.	Research habitat needs, availability and usage. Research limiting factors, such as environmental stressors, predation and trophic relationships.

Copper rockfish *Sebastes caurinus*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. Fish & Wildlife	Copper rockfish is an important species of the nearshore, benthic rockfish assemblage in Puget Sound. Adults are relatively sedentary and have well defined home ranges. Maximum size is 26 inches. Coppers live to at least fifty years of age with reproduction starting at 4-6 years (surface ages).	Historically coppers have been the most commonly encountered rockfish species in Puget Sound. Copper rockfish populations in both North and South Sound have precipitously declined to low levels. Currently depleted in both North and South Puget Sound.	Copper rockfish live predominantly in rocky areas as adults, schooling with other rockfish species. Coppers are found throughout Puget Sound and nearshore coastal waters. This species inhabits depths of less than 200 ft and associates with high relief rocky habitats throughout the inland marine waters of Washington. Young of the year settle fairly rapidly and inhabit upper layers of kelp canopy, moving to deeper layers and cobble areas before occupying adult habitat.
Monitoring Activities →	We have limited capacity to completely assess populations of rockfish in Puget Sound. We conduct basin wide surveys using trawl to develop trend information. Nearshore survey done with quantitative video for copper and quillback including several index sites in MPAs. Lack demographic information for formal stock assessments and information about other life history stages and trophic relationships. Need a system of synoptic trawl and quantitative video surveys in deep and shallow habitats, demographic information, life history, trophic analyses and catch monitoring.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Harvest removals	Coppers are harvested recreationally and commercially and have been one of the most important rockfish species in the recreational fisheries. They are currently vulnerable as bycatch in the recreational fisheries for salmon. These fish are physoclistous (the air bladder is closed to the esophagus), and the gas bladder overextends if fish is pulled up from depth likely causing internal damage and mortality.	Reduce harvest encounters	Restrict retention. Establish Marine Protected Areas or other types of area-gear restrictions.

Predation	Increasing populations of seals, sea lions, lingcod, and other piscivorous fish.	Monitor predator populations	Monitor seal, sea lion and lingcod population trends and food habits (particularly where rockfish populations show some recovery). Conduct assessments of other fish species and evaluate trophic dynamics.
Lack of information	Insufficient information to conduct population assessments by area within Puget Sound (N and S Sound).	Assess populations using fishery independent methods	Conduct synoptic surveys to determine relative abundances periodically.
Lack of information	Areas used by all life history stages and movement of juveniles before selection of adult habitat are poorly understood and not known	Determine and map distribution, relative abundance and contributions to reproduction.	Conduct extensive distribution and relative abundance surveys. Research effective sampling techniques. Conduct focus studies on the specific habitat requirements for each life history stage. Develop methods to track and measure reproductive contribution from local populations in specific locations.
Toxic chemicals	Copper rockfish are one of the longer lived fish historically common in the urbanized basins of Puget Sound. They accumulate and concentrate persistent organic pollutants, including endocrine disrupters, and heavy metals.	Determine and map distribution and relative concentrations in fish.	Determine effects on populations and life histories, including reproduction using field studies, epidemiological information and/or laboratory studies.

Greenstriped rockfish *Sebastes elongatus*	**Biology and Life History**	**Population**	**Distribution**
 NOAA	Greenstriped rockfish reach a maximum size of 15.6 inches and live to about 54 years. Females reach a larger size than males. Fifty percent of males mature at about 10 years (10.4 inches) and 50% of the females are mature at age 7 years (8.8 inches). In British Columbia larvae are released after June.	Unknown, but this species appears to be a minor species in Puget Sound.	Puget Sound and coastal marine waters. They occur in relatively deep water.
Monitoring Activities ➔	We have limited capacity to completely assess populations of rockfish in Puget Sound. We conduct basin wide surveys using trawl to develop trend information. Lack demographic information for formal stock assessments and information about other life history stages and trophic relationships. Need a system of synoptic trawl and quantitative video surveys in deep and shallow habitats, demographic information, life history, trophic analyses and catch monitoring.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Harvest Removals	In Puget Sound, directed fisheries for rockfish are greatly reduced, but by-catch still occurs in other fisheries, predominantly the recreational salmon fishery. These fish are physoclistous (the air bladder is closed to the esophagus), and the gas bladder overextends if fish is pulled up from depth likely causing internal damage and mortality. Greenstriped rockfish is a minor species and are caught incidentally to other fisheries.	Reduce harvest encounters	Restrict retention. Establish deep-water Marine Protected Areas or other types of area-gear restrictions.
Lack of information	Insufficient information to conduct population assessments by area within Puget Sound (N and S Sound).	Assess populations using fishery independent methods	Conduct synoptic surveys to determine relative abundances periodically.

Lack of information	Areas used by all life history stages and movement of juveniles before selection of adult habitat are poorly understood and not known	Determine and map distribution, relative abundance and contributions to reproduction.	Conduct extensive distribution and relative abundance surveys. Research effective sampling techniques.
Predation	Increasing populations of seals, sea lions, lingcod, and other piscivorous fish.	Monitor predator populations	Monitor seal, sea lion and lingcod population trends and food habits (particularly where rockfish populations show some recovery). Conduct assessments of other fish species and evaluate trophic dynamics.

Quillback rockfish *Sebastes maliger*	**Biology and Life History**	**Population**	**Distribution**
 Clinton Bauder	Quillback reach a maximum size of 24 inches and live to age 95 years (73 is the oldest age from Puget Sound). Adult quillback exhibit limited movements and often have a small home range. Quillback moved from one location to another often return to their original site.	Historically, quillback rockfish is the second most common rockfish in Puget Sound. Quillback rockfish live longer and grow more slowly than copper rockfish and constitute a limiting population to the management of Puget Sound rockfish fisheries. Currently depleted in both North and South Puget Sound.	Quillback are found throughout Puget Sound and nearshore coastal marine waters. Inhabits nearshore and deep waters to 700 feet in Puget Sound and associates with high relief rocky habitats. Surveys for post-larval quillback rockfish found them in similar but fewer places as settling copper rockfish.
Monitoring Activities ➔	We have limited capacity to completely assess populations of rockfish in Puget Sound. We conduct basin wide surveys using trawl to develop trend information. Nearshore survey done with quantitative video for copper and quillback including several index sites in MPAs. Lack demographic information for formal stock assessments and information about other life history stages and trophic relationships. Need a system of synoptic trawl and quantitative video surveys in deep and shallow habitats, demographic information, life history, trophic analyses and catch monitoring.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**

Harvest pressure	Historically, one of the most important species of rockfish in Puget Sound. Currently, directed fisheries are greatly restricted but by-catch still occurs in other fisheries, predominantly the recreational salmon fishery. These fish are physoclistous (the air bladder is closed to the esophagus), the gas bladder overextends if fish is pulled up from depth likely causing internal damage and mortality.	Reduce harvest encounters	Restrict retention. Establish Marine Protected Areas or other types of area-gear restrictions.
Lack of information	Insufficient information to conduct population assessments by area within Puget Sound (N and S Sound).	Assess populations using fishery independent methods	Conduct synoptic surveys to determine relative abundances periodically.
Toxic contaminations	Because of their longevity and biology, quillback rockfish have relatively high burdens of toxic chemicals. They accumulate a variety of chemicals, particularly in the urbanized basins of Puget Sound. Potential effects on the fish include impacts on both growth and reproduction.	Assess burdens of toxic compounds throughout Puget Sound.	Determine effects on populations and life histories, including reproduction using field studies, epidemiological information and/or laboratory studies.
Predation	Increasing populations of seals, sea lions, lingcod, and other piscivorous fish.	Monitor predator populations	Monitor seal, sea lion and lingcod population trends and food habits (particularly where rockfish populations show some recovery). Conduct assessments of other fish species and evaluate trophic dynamics.

Lack of information	Areas used by all life history stages and movement of juveniles before selection of adult habitat are poorly understood and not known	Determine and map distribution, relative abundance and contributions to reproduction.	Conduct extensive distribution and relative abundance surveys. Research effective sampling techniques. Conduct focus studies on the specific habitat requirements for each life history stage. Develop methods to track and measure reproductive contribution from local populations in specific locations.

Black rockfish (Puget Sound) *Sebastes melanops*	**Biology and Life History**	**Population**	**Distribution**
 Clinton Bauder	Black rockfish is a species inhabiting the water column in proximity to nearshore rocky habitats. Blacks are a mobile, schooling species often found mid water. Black rockfish tagged in Puget Sound have moved into the coast while one fish tagged off of central Oregon was recaptured in Puget Sound. Black rockfish reach a maximum size of 27.5 inches and have been aged to 50 years (12-14, surface read, is the maximum age documented in Puget Sound).	Insufficient data exist to establish the status of black rockfish in Puget Sound. Given its continued decline in the San Juan Archipelago where this species was once abundant and its rarity in South Sound, this species should be managed in a precautionary manner in both areas. These fish comprise an important recreational catch in coastal waters and the stock is adequate to support the ocean fishery.	Coastal and Puget Sound waters in high and low relief (rocky) areas generally in waters 30-180 feet deep.
Monitoring Activities →	Stock monitoring on the coast is adequate to produce a stock assessment. We have limited capacity to completely assess populations of rockfish in Puget Sound. We conduct basin wide surveys using trawl to develop trend information. Nearshore survey done with quantitative video for copper and quillback including several index sites in MPAs. Need a system of synoptic trawl and quantitative video surveys in deep and shallow habitats, demographic information, life history, trophic analyses and catch monitoring.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**

Harvest pressure	In Puget Sound, directed fisheries are greatly restricted, but by-catch still occurs in other fisheries, predominantly the recreational salmon fishery.	Reduce harvest encounters	Restrict retention. Exception is in the western Strait of Juan de Fuca where the ocean population is harvested. Establish Marine Protected Areas or other types of area-gear restrictions.
Predation	Increasing populations of seals, sea lions, lingcod, and other piscivorous fish.	Monitor predator populations	Monitor seal, sea lion and lingcod population trends and food habits (particularly where rockfish populations show some recovery). Conduct assessments of other fish species and evaluate trophic dynamics.
Lack of information	Areas used by all life history stages are poorly understood and not known	Determine and map distribution and relative abundance.	Conduct extensive distribution and relative abundance surveys. Research effective sampling techniques. Conduct focus studies on the specific habitat requirements for each life history stage. Develop methods to track and measure reproductive contribution from local populations in specific locations.
Lack of information	Insufficient information to conduct population assessments by area within Puget Sound (N and S Sound).	Assess populations using fishery independent methods	Conduct synoptic surveys to determine relative abundances periodically.

China rockfish *Sebastes nebulosus*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. Fish & Wildlife	Chinas reach a maximum size of 18 inches and live to at least age 79 years.	The population of China rockfish is unknown. Reportedly China rockfish were an important commercial species in Puget Sound during the nineteenth century. They are uncommon throughout the Sound now.	Adults prefer high energy, high-relief rocky habitat with the numerous cavities for resting. Appear to be very territorial with small home ranges, moving less than 10 meters within their territories
Monitoring Activities ➔	We have limited capacity to completely assess populations of rockfish in Puget Sound. Nearshore survey done with quantitative video for copper and quillback including several index sites in MPAs. Need a system of synoptic trawl and quantitative video surveys in deep and shallow habitats as well as surveys that target rare or cryptic species (e.g. china, yelloweye, tiger), demographic information, life history, trophic analyses and catch monitoring.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Harvest removals	In Puget Sound, directed fisheries are greatly restricted, but by-catch still occurs in other fisheries, predominantly the recreational salmon fishery. These fish are physoclistous (the air bladder is closed to the esophagus), the gas bladder overextends if fish is pulled up from depth likely causing internal damage and mortality.	Reduce harvest encounters.	Restrict retention. Establish Marine Protected Areas or other types of area-gear restrictions.
Lack of information	Insufficient information to conduct population assessments by area within Puget Sound (N and S Sound).	Assess populations using fishery independent methods	Conduct relative abundance survey every few years.

Lack of information	Areas used by all life history stages and movement of juveniles before selection of adult habitat are poorly understood and not known	Determine and map distribution, relative abundance and contributions to reproduction.	Conduct extensive distribution and relative abundance surveys. Research effective sampling techniques. Conduct focus studies on the specific habitat requirements for each life history stage. Develop methods to track and measure reproductive contribution from local populations in specific locations.
Predation	Increasing populations of seals and sea lions; Lingcod likely eat the subadult stages.	Monitor predator populations	Monitor seal, sea lion and lingcod population trends and food habits (particularly where rockfish populations show some recovery). Conduct assessments of other fish species and evaluate trophic dynamics.

Tiger rockfish *Sebastes nigrocinctus*	**Biology and Life History**	**Population**	**Distribution**
 Andy Murch	Tiger rockfish are marked with five vertical bands of red, brown or black over a pink or white body. They can reach 24 inches in length, and live to be about 116 years of age. They are active at dawn and dusk but stay hidden most of the day.	This species has apparently always appeared in limited numbers in Puget Sound fisheries. In general, rare rockfish species have become more rare in Puget Sound in recent years.	Puget Sound and coastal waters. Tigers are sometimes seen on flat rocks with caves or cavities nearby to hide in. They live in waters between 60 and 984 feet deep as adults. Juveniles have been seen in drift vegetation.

Monitoring Activities ➔	We have limited capacity to completely assess populations of rockfish in Puget Sound. Nearshore survey done with quantitative video for copper and quillback including several index sites in MPAs. Need a system of synoptic trawl and quantitative video surveys in deep and shallow habitats as well as surveys that target rare or cryptic species (e.g. china, yelloweye, tiger), demographic information, life history, trophic analyses and catch monitoring.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Harvest removals	In Puget Sound, directed fisheries are greatly restricted, but by-catch still occurs in other fisheries. These fish are physoclistous (the air bladder is closed to the esophagus), the gas bladder overextends if fish is pulled up from depth likely causing internal damage and mortality.	Reduce harvest encounters	Restrict retention. Establish Marine Protected Areas or other types of area-gear restrictions.
Lack of information	Insufficient information to conduct population assessments by area within Puget Sound (N and S Sound).	Assess populations using fishery independent methods	Given cryptic habits of this species, targeted surveys are needed to determine relative abundances periodically.
Lack of information	Areas used by all life history stages are poorly understood and not known	Determine and map distribution and relative abundance.	Conduct extensive distribution and relative abundance surveys. Research effective sampling techniques. Conduct focus studies on the specific habitat requirements for each life history stage. Develop methods to track and measure reproductive contribution from local populations in specific locations.
Predation	Increasing populations of seals, sea lions, lingcod, and other piscivorous fish.	Monitor predator populations	Monitor seal, sea lion and lingcod population trends and food habits (particularly where rockfish populations show some recovery). Conduct assessments of other fish species and evaluate trophic dynamics.

<table>
<tr><th>Bocaccio rockfish
Sebastes paucispinis</th><th>Biology and Life History</th><th>Population</th><th>Distribution</th></tr>
<tr><td>
Clinton Bauder, Cal Photos</td><td>Bocaccio are a long-bodied rockfish with few head spines and a very large mouth. They are a large rockfish (up to 36” and 15 lbs) that range in color from pink to gray with some being dark red or golden orange. Black spots (melanistic blotches), a form of skin cancer, are common in adults. Aging for these fish has not been considered reliable, but they may live to be 50 years or more.</td><td>Once relatively common in Central Puget Sound and very common in specific habitats. Catch has declined in Puget Sound and these are now rare in the catch.</td><td>Juveniles live in nearshore habitats and move deeper with age. Surveys for young bocaccio rockfish in Puget Sound have only found them in the western Strait of Juan de Fuca near Freshwater Bay Adults are a deepwater species often associated with steep slopes consisting of sand or rocky substrate. They also inhabit high relief boulder fields and areas with drop offs.</td></tr>
<tr><td>Monitoring Activities ➔</td><td colspan="3">We have limited capacity to completely assess populations of rockfish in Puget Sound. We conduct basin wide surveys using trawl to develop trend information. Nearshore survey done with quantitative video for copper and quillback including several index sites in MPAs. Lack demographic information for formal stock assessments and information about other life history stages and trophic relationships. Need a system of synoptic trawl and quantitative video surveys in deep and shallow habitats, demographic information, life history, trophic analyses and catch monitoring.</td></tr>
<tr><th>General Problems</th><th>Specific Problems</th><th>Conservation Strategies</th><th>Specific Conservation Actions</th></tr>
<tr><td>Harvest removals</td><td>There were directed fisheries on local populations historically. Now taken as bycatch in other fisheries, especially the recreational salmon fishery. These fish are physoclistous (the air bladder is closed to the esophagus), the gas bladder overextends if fish is pulled up from depth likely causing internal damage and mortality.</td><td>Reduce harvest encounters.</td><td>Restrict retention. Establish Marine Protected Areas or other types of area-gear restrictions.</td></tr>
<tr><td>Lack of information</td><td>Insufficient information to conduct population assessments by area within Puget Sound (N and S Sound).</td><td>Assess populations using fishery independent methods</td><td>Conduct synoptic surveys to determine relative abundances every few years.</td></tr>
</table>

Predation	Increasing populations of seals, sea lions, lingcod, and other piscivorous fish.	Monitor predator populations	Monitor seal, sea lion and lingcod population trends and food habits (particularly where rockfish populations show some recovery). Conduct assessments of other fish species and evaluate trophic dynamics.
Lack of information	Areas used by all life history stages and movement of juveniles before selection of adult habitat are poorly understood and not known	Determine and map distribution, relative abundance and contributions to reproduction.	Conduct extensive distribution and relative abundance surveys. Research effective sampling techniques. Conduct focus studies on the specific habitat requirements for each life history stage. Develop methods to track and measure reproductive contribution from local populations in specific locations.

Canary rockfish *Sebastes pinniger*	**Biology and Life History**	**Population**	**Distribution**
 Kawika Chetron	Canaries can grow to 29 inches long and at least 84 years old.	Because of their increased rarity, their overfished condition in coastal waters, and a lack of assessment information in Puget Sound, canary rockfish is at a precautionary status in both North and South Sound.	Larvae and juveniles spend several months up in the water column before moving to kelp beds and very shallow water. They move deeper as they grow. A deeper living rockfish associated with a variety of rocky and coarse habitats, adults collect in large numbers around pinnacles and high relief rock, often in high current areas and deeper water (264-660 feet). Some adults tagged in the ocean have moved long distances.

Monitoring Activities ➔	Coastal stock assessments occur. We have limited capacity to completely assess populations of rockfish in Puget Sound. We conduct basin wide surveys using trawl to develop trend information. Nearshore survey done with quantitative video for copper and quillback including several index sites in MPAs. Lack demographic information for formal stock assessments and information about other life history stages and trophic relationships. Need a system of synoptic trawl and quantitative video surveys in deep and shallow habitats, demographic information, life history, trophic analyses and catch monitoring.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Harvest removals	This species is not observed with regularity in commercial trawl fisheries but can make up to 5% of the rockfish catch by other commercial gears in North Sound. It has constituted less than 2% of recreational catch historically but has decreased in the catch. In Puget Sound, directed fisheries for this species are closed, but by-catch still occurs in other fisheries, predominantly the recreational salmon fishery. These fish are physoclistous (the air bladder is closed to the esophagus), the gas bladder overextends if fish is pulled up from depth likely causing internal damage and mortality.	Reduce harvest encounters	Keep bag limits at zero. Establish Marine Protected Areas or other types of area-gear restrictions.
Lack of information	Insufficient information to conduct population assessments by area within Puget Sound (N and S Sound).	Assess populations using fishery independent methods	Conduct synoptic surveys to determine relative abundances every few years.
Predation	Increasing populations of seals and sea lions	Monitor predator populations	Monitor seal, sea lion and lingcod population trends and food habits (particularly where rockfish populations show some recovery). Conduct assessments of other fish species and evaluate trophic dynamics.

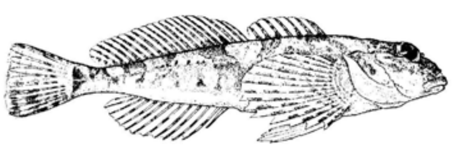
Lack of information	Areas used by all life history stages and movement of juveniles before selection of adult habitat are poorly understood and not known	Determine and map distribution, relative abundance and contributions to reproduction.	Conduct extensive distribution and relative abundance surveys. Research effective sampling techniques. Conduct focus studies on the specific habitat requirements for each life history stage. Develop methods to track and measure reproductive contribution from local populations in specific locations.

Redstripe rockfish *Sebastes proriger*	**Biology and Life History**	**Population**	**Distribution**
 Richard Jack	Redstripe are a smaller schooling rockfish. Maximum size is about 20 inches and maximum age 55 years. About one half of the fish are sexually mature at age 7 years. Larvae are released April to July.	Found uncommonly throughout most basins in Puget Sound.	Redstripe associates with rocky and coarse habitats in broad range of depths from 60 feet to almost 700 feet that uncommonly occur throughout most basins in Puget Sound.
Monitoring Activities ➔	We have limited capacity to completely assess populations of rockfish in Puget Sound. We conduct basin wide surveys using trawl to develop trend information. Nearshore survey done with quantitative video for copper and quillback including several index sites in MPAs. Lack demographic information for formal stock assessments and information about other life history stages and trophic relationships. Need a system of synoptic trawl and quantitative video surveys in deep and shallow habitats, demographic information, life history, trophic analyses and catch monitoring.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**

Harvest removals	In Puget Sound, directed fisheries are greatly restricted, but by-catch still occurs in other fisheries, predominantly the recreational salmon fishery. During daylight hours, these fish school up off the bottom in their preferred habitats and can be caught by hook and line readily. These fish are physoclistous (the air bladder is closed to the esophagus), the gas bladder overextends if fish is pulled up from depth likely causing internal damage and mortality.	Reduce harvest encounters.	Restrict retention. Establish Marine Protected Areas or other types of area-gear restrictions.
Predation	Increasing populations of seals and sea lions; Lingcod likely eat the subadult stages.	Monitor predator populations	Monitor seal, sea lion and lingcod population trends and food habits (particularly where rockfish populations show some recovery). Conduct assessments of other fish species and evaluate trophic dynamics.
Lack of information	Insufficient information to conduct population assessments by area within Puget Sound (N and S Sound).	Assess populations using fishery independent methods	Conduct synoptic surveys to determine relative abundances every few years.
Lack of information	Areas used by all life history stages and movement of juveniles before selection of adult habitat are poorly understood and not known	Determine and map distribution, relative abundance and contributions to reproduction.	Conduct extensive distribution and relative abundance surveys. Research effective sampling techniques. Conduct focus studies on the specific habitat requirements for each life history stage. Develop methods to track and measure reproductive contribution from local populations in specific locations.

Yelloweye rockfish *Sebastes ruberrimus*	**Biology and Life History**	**Population**	**Distribution**
 Clinton Bauder	Yelloweye are largest of the local species of rockfish and can reach 36 inches in length and a weight of 25 pounds. Yelloweye can live to an age of 118 years (the oldest aged in Puget Sound to date was 73). About one half of the fish are sexually mature at age 17 for males and 19 for females.	Population is listed as precautionary for management. Yelloweye were never common in Puget Sound but historically available to fishers who targeted very specific locations.	Juveniles occupy shallow water with the common rockfish species (coppers, quillback, etc.) and move into deeper water as they age. Adults are relatively sedentary living in association with high-relief rocky habitats and often near steep slopes. Adults are most common at depths from 300 to 600 feet.
Monitoring Activities ➔	A coastal stock assessment for this species is now done, but it needs additional information about non-trawlable habitat. We have limited capacity to completely assess populations of rockfish in Puget Sound. We conduct basin wide surveys using trawl to develop trend information. Nearshore survey done with quantitative video for copper and quillback including several index sites in MPAs. Lack demographic information for formal stock assessments and information about other life history stages and trophic relationships. Need a system of synoptic trawl and quantitative video surveys in deep and shallow habitats, demographic information, life history, trophic analyses and catch monitoring.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Harvest Removals	In Puget Sound, directed fisheries for this species are closed, but by-catch still occurs in other fisheries, predominantly the recreational salmon fishery. These fish can be caught readily by hook and line in their preferred habitats with specific fishing methods. These fish are physoclistous (the air bladder is closed to the esophagus), the gas bladder overextends if fish is pulled up from depth likely causing internal damage and mortality.	Reduce harvest encounters.	Keep bag limits at zero. Establish deep-water Marine Protected Areas or other types of area-gear restrictions.

Lack of information	Insufficient information to conduct population assessments by area within Puget Sound (N and S Sound).	Assess populations using fishery independent methods	Conduct synoptic surveys to determine relative abundances every few years.
Predation	Increasing populations of seals, sea lions, lingcod, and other piscivorous fish.	Monitor predator populations	Monitor seal, sea lion and lingcod population trends and food habits (particularly where rockfish populations show some recovery). Conduct assessments of other fish species and evaluate trophic dynamics.
Lack of information	Areas used by all life history stages and movement of juveniles before selection of adult habitat are poorly understood and not known	Determine and map distribution, relative abundance and contributions to reproduction.	Conduct extensive distribution and relative abundance surveys. Research effective sampling techniques. Conduct focus studies on the specific habitat requirements for each life history stage. Develop methods to track and measure reproductive contribution from local populations in specific locations.

Margined sculpin *Cottus marginatus*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. Fish & Wildlife	Margined sculpin are a benthic fish inhabiting pools and glides in streams, usually over small gravel and silt. Spawning takes place in May-June. Most likely they feed on benthic invertebrates, fish eggs and young fish.	Locally common, but very restricted range.	Limited to the Walla Walla and Tucannon River drainages of SE Washington.
Monitoring Activities ➔	Habitat usage study conducted in 1990s by UW graduate student. No monitoring activities at this time.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**

Limited distribution	A restricted distribution puts it at risk to habitat disturbances or alterations.	Monitor relative abundance	Conduct relative abundance survey every few years.
Habitat loss	Logging, agriculture or other activities that elevate temperature, alter hydrology, increase sedimentation, etc.	Conserve suitable habitat.	Identify and protect all known and potential habitat within its range.

Green sturgeon *Acipenser medirostris*	**Biology and Life History**	**Population**	**Distribution**
 Pat Higgins	Most often in marine waters; estuaries, lower reaches of large rivers, salt or brackish water off river mouths. Has been reported 140 miles inland in the Columbia River. No confirmed spawning in Washington.	Low and declining	There are two distinct population segments: the Oregon and Washington segment, which includes south coastal Washington (Grays Harbor and Willapa Bay) and the Columbia River estuary, and the California segment. The Oregon/Washington segment is not listed, however the California segment is listed, and the individuals mix between the two segments.
Monitoring Activities ➔	Standard harvest monitoring of white and green sturgeon is carried out cooperatively by WDFW and ODFW. The emphasis of Bonneville Power Administration and USFWS funded monitoring programs is to track general population status.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Harvest	Overfishing and bycatch in white sturgeon fishery	Sustainable harvest levels cannot be determined until the stock structure of green sturgeon is understood.	Conduct population abundance and distribution surveys. Implement and enforce restricted harvest regulations.
Hydropower	Dams and hydropower development	Determine what is a barrier and how to allow for fish passage.	Identify potential obstacles. Develop methods to pass barrier.

Habitat degradation	Logging, road construction, overgrazing, pollution runoff	Develop and implement environmentally sound land use policies and regulations	Work with public and private landowners through education, planning and regulatory pathways.
Lack of information	Information is needed on abundance and distribution.	Range-wide inventories needed to determine distribution and abundance.	Research and monitor population distribution and abundance, limiting factors, habitat requirements.

Pacific herring (Cherry Point and Discovery Bay stocks) *Clupea pallasi*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. Fish & Wildlife	Herring spawn by depositing eggs on vegetation or other shallow water substrate in the shallow sub-tidal zone. Following hatching, larvae drift in the ocean currents. After metamorphosis, Puget Sound stocks of young herring spend their first year in Puget Sound. Following the attainment of sexual maturity at age two to four, the herring migrate back to their spawning grounds. Herring formerly lived to ages in excess of 10 years in Puget Sound. However, the mortality rate of adult fish has been increasing in recent years. Fish older than age 6 are now rare.	The population of two of the herring stocks in Puget Sound, Cherry Point and Discovery Bay, is depressed and critical. These declines are in sharp contrast to other stocks in Puget Sound which have been stable.	Herring currently spawn annually at approximately 20 well defined locations in Washington: 2 coastal locations and 18 locations east of Cape Flattery. The spawning period for the Cherry Point stock is different from the other Puget Sound stocks.
Monitoring Activities ➔	Population biomass estimates are conducted annually and have documented precipitous declines. Trophic analyses, disease monitoring, contaminant studies and ecological studies needed to determine cause of declines and develop recovery strategies. Need information on movement of adults when away from spawning areas and distribution of juveniles.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**

Habitat loss and degradation	Maintaining viable spawning grounds is the largest challenge to herring management in Washington. Spawning grounds can be lost or damaged through construction activities, loss of vegetation or oiling. While this is a general threat for all herring populations, it is particularly critical for those stocks in such sharp decline.	Maintenance of herring spawning habitat is of prime importance to the preservation of herring resource. These areas are under pressure as the demand for residential and industrial use of shoreline increases. Spawning grounds are quite specific and there is no known method to successfully replace or mitigate for lost spawning grounds.	Enforcement of shoreline management regulations. Control and monitor pollution in aquatic habitat; minimize risk of oil spills. Minimize or eliminate shading over vegetation in documented herring spawning areas to prevent loss of spawning substrate.
Lack of knowledge	The increase in non-fishing mortality rate is alarming and needs further investigations. Fishing for these stocks on the spawning areas has been closed by all fishers. Sources of continued mortality absent fishing must be determined.	Investigate and partition potentially important sources of mortality: Changes in disease patterns, changes in prey abundances due to oceanographic or environmental changes, changes in predator populations, concentrations of persistent organic pollutants (esp PCBs) in herring, other environmental factors	Research on stock-specific life history attributes, habitat conditions, disease and pollution, predation and other factors contributing to mortality rates.

Westslope cutthroat *Oncorhynchus clarki lewisi*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. Fish & Wildlife	Adfluvial, fluvial and resident forms, utilizing headwater streams, rivers and lakes. Spring spawners and opportunistic feeders.	Stable	Ubiquitous. Found throughout the mid-and upper Columbia River and tributaries, as well as lakes. Also found in the Pend Oreille River system and tributaries.
Monitoring Activities ➔	WDFW has no formal statewide monitoring program at this time. Current information is an assemblage of field notes taken during field reconnaissance by WDFW staff and other agencies.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Hybridization	Hybridize readily with rainbow	Reduce or eliminate hybridization.	Avoid introduction of rainbows or only introduce sterile fish.
Habitat loss	Degradation and loss due to inappropriate forest management practices, inappropriate agriculture practices, road construction and maintenance, and residential development and urbanization.	Restore and maintain suitable habitat conditions for all life stages.	Protect riparian areas, restore suitable habitat, enforce and encourage proper land-use management practices.

Inland redband trout *Oncorhynchus mykiss gairdneri*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. Fish & Wildlife	Native to streams east of the Cascade Crest. Anadromous, adfluvial, fluvial and resident forms. Cool waters of lakes, rivers and streams. Spring spawners and opportunistic feeders.	Unknown for most of their distribution around the state. Several populations have been identified in NE Washington but a complete inventory has not been completed. Populations are presumed stable.	Known populations are found in the mid and upper Columbia River System including Spokane, and Snake river systems. Presumed in other parts of the upper Columbia System.
Monitoring Activities ➔	WDFW has no formal statewide monitoring program at this time. Current information is an assemblage of field notes taken during field reconnaissance by WDFW staff and other agencies.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat loss	Logging, agriculture or other activities that elevate temperature, alter hydrology, increase sedimentation, etc.	Conserve suitable habitat	Protect riparian areas and conduct proper land-use management
Hybridization	May hybridize with planted hatchery rainbow trout.	Avoid hybridization.	Use local populations of red-ban rainbow trout in connecting waters or stock sterile fish.

Bull trout Salvelinus confluentus	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. Fish & Wildlife	Bull trout are Washington's only native char species. They require colder waters that other trout species. Bull trout exhibit anadromous, amphidromous, adfluvial, fluvial and resident live history forms, spawning in headwater streams and rivers from late summer – late fall spawners.	29 western WA stocks, 17% healthy, 83% unknown status. 51 eastern WA stocks, 17% healthy, 16% critical or depressed, and 67% unknown status.	Occurs throughout Washington but reduced from historical levels particularly in eastern Washington. Apparently extirpated from Lake Chelan.
Monitoring Activities ➔	Fisheries monitored to ensure that direct and incidental harvest do not adversely impact long-term productivity. Structured stock assessment surveys in the form of spawner surveys, redd counts, and juvenile surveys are conducted in various river systems around the state.		
General Problems	**Specific Problems**	**General Problems**	**Specific Problems**
Harvest	Overfishing was once identified as a cause for decline in bull trout but current fishing regulations adequately protect bull trout populations. Harvest is now limited only to healthy populations.	Impacts from incidental take in other fisheries are not well known.	Creel surveys to determine incidental take in various fisheries.
Habitat loss	Degradation and loss due to inappropriate forest management practices, inappropriate agriculture practices, road construction and maintenance, and residential development and urbanization. Hydropower installations that do not allow for two-way fish passage.	Restore and maintain suitable habitat conditions for all bull trout life stages.	Protect riparian areas, migration corridors, and upper watershed habitat, restore suitable habitat, and encourage proper land-use management practices.

Lack of information	More information is needed on distribution, abundance, and gene flow among populations.	Acquire more complete information on the current distribution and abundance of stocks.	Characterize, conserve, and monitor genetic diversity and gene flow among local populations of bull trout.
Non-native species	Nonnative species such as brook trout continue to pose a threat through introgression in some core areas.	In areas were naturally spawning brook trout are present, spawning between brook trout and bull trout may occur.	Prevent the interaction of spawning between bull trout and brook trout by removing brook trout populations.

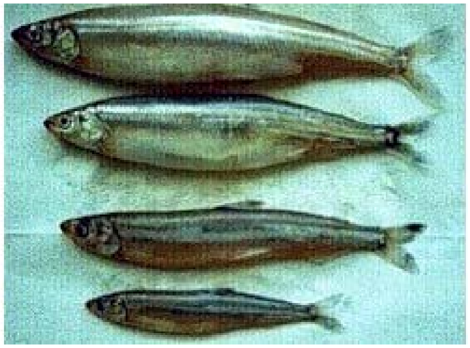
Pygmy whitefish *Prosopium coulteri*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. Fish & Wildlife	Reside primarily in the deeper sections of lakes, but can be found in streams. Usually found in water with temperature less than 11 degrees C. Late summer-late fall spawners in streams and lake shallows. Live for average of 4-7 years. Diet of macroinvertebrates, crustaceans and fish eggs.	Population size and trends unknown.	In Washington, currently found in 9 lakes. Historically they were known to occur in 15 lakes. Washington is at the southern end of its range.
Monitoring Activities ➔	Baseline distribution survey first conducted by WDFW in the 1990s. No further monitoring activities at this time. University of British Columbia is conducting genetic analyses on some Washington populations.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat loss	Water temperature increases	Conserve suitable habitat.	Monitor land use practices or other developments that would increase water temperature.
Environmental contamination	Fish Pesticides	Do not use in lakes with pygmy whitefish.	Do not use piscicides in lakes with pygmy whitefish.

Limited distribution	A small, patchy distribution puts it at risk to habitat disturbances or alterations.	Monitor relative abundance.	Conduct relative abundance survey every few years.
Introduced piscivorous fish	Bass and other piscivorous fish prey on pygmy whitefish	Control fish species introductions.	Monitor lakes for illegal introductions. Do not permit legal introductions.

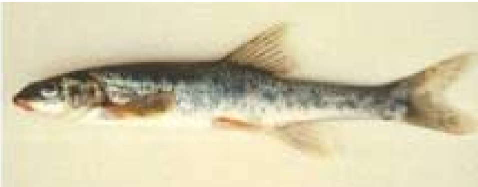
Eulachon *Thaleichthys pacificus*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. Fish & Wildlife	Adults returns to the Columbia River to spawn in the winter usually starting in December and continuing until spring. Eggs are deposited and adhere to the bottom substrate in the mainstem and tributaries. Certain sites are utilized for spawning each year. Other sites are used sporadically, occasionally being heavily utilized then not utilized for several years. The timing and locations of spawning appears to be highly influenced by river conditions such as water temperature, current and turbidity. There is a high level of mortality of adult eulachon following spawning. Larvae incubate in the gravel until hatching, then rapidly drift downstream and enter the ocean where little is known of their life history. Eulachon larvae have been detected in the lower river as late as June.	Declining. This species has always shown some fluctuations in abundance and frequently selected mainly one of several tributaries in which to spawn. However, this species has had several years of extremely poor runs which can not be explained by changes in spawning locations, etc.	Found in the Columbia River and some of its tributaries. Adult fish spend most of their lives in the Pacific Ocean and may range from Oregon to Vancouver Island.

Monitoring Activities ➔	Some monitoring of fisheries on spawning runs. No other regular monitoring is conducted for this species for any life history stage. Limited information has been gained from research projects, scientific collection permits, and museum specimen collections. Need estimation of run size, description of spawning grounds and estimation of sport catch.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Lack of information	The portion of the mainstem river utilized for spawning is subject to frequent dredging to maintain shipping lanes. The impact of this dredging on the spawning grounds, on the incubating eggs or on the larvae is unknown. The spawning habitat is poorly known. Despite frequent changes in spawning location, certain characteristics of sediment, stream depth and current may be necessary for successful spawning. Survival may be heavily influenced by oceanic events including oceanographic changes.	Gather information on life histories outside the spawning areas as well as spawning habitat conditions, locations and requirements.	Conduct studies on life history, suitable habitat, population monitoring. Survey river stretches where dredging takes place. Collect information on predation and other environmental factors that may be contributing to the precipitous recent declines. Investigate the relationship between oceanic regimes and other ocean occurrences and smelt run strength.
Harvest	No quantitative stock assessment is conducted. Commercial landings are monitored by tallying the annual catch. There is no annual estimate of the total stock size. Therefore no estimate of the harvest rate is made.	Urgent need of a management plan to control harvest and to ascertain stock size.	Implement management plan to control harvest. Develop a method to determine the abundance of each year's run size so that harvest may be appropriately scaled to the anticipated run size.

Olympic mudminnow *Novumbra hubbsi*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. Fish & Wildlife	Three habitat requirements: little to no flow, several cm of mud substrate, and abundant aquatic vegetation. Spring spawners that build nests, but offer no parental care. Diet typical of a small, carnivorous fish consisting of crustaceans (zooplankton), mollusks and macroinvertebrates.	Locally common, but limited distribution.	Occurs only in Washington. Occurs in the southern and western lowlands of the Olympic Peninsula, the Chehalis and lower Deschutes River drainages, and South Puget Sound lowlands west of the Nisqually River. Populations also in the Cherry Creek and Issaquah Creek drainages of Snohomish and King Counties.
Monitoring Activities ➔	Monitoring of specific sites conducted in the 1990s. No further monitoring at this time. Accumulate incidental data.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat loss	Wetland conversion or drainage.	Conserve suitable habitat.	Survey for mudminnows in potential sites before issuing permits.
Introduced piscivorous fish.	Bass and other piscivorous fish probably prey on Olympic mudminnows.	Control fish species introductions.	Monitor lakes and streams for illegal introductions. Do not permit legal introductions.
Limited distribution	A restricted distribution puts it at risk to habitat disturbances or alterations.	Monitor relative abundance	Conduct relative abundance survey every few years.

Surfsmelt *Hypomesus pretiosus*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. Fish & Wildlife	The life history other than spawning of the surfsmelt is not known. Surfsmelt are very poorly represented in mid-water research catches, suggesting a tendency to inhabit shallower nearshore zones and/or to remain close to the bottom at all times. Surfsmelt appear to be relatively short-lived fish, with most spawning populations comprised of 1-2 year old fish. Spawning occurs at high tides on mixed sand-gravel substrates in the upper intertidal zone. Surfsmelt eggs adhere tightly to the beach surface substrate. Subsequent wave action disperses the eggs into the top several inches of beach material. Depending on location, surfsmelt spawning activity occurs year-round in Washington State. Although the occurrence of surfsmelt spawning activity on a spawning beach is highly predictable each year, the degree to which spawning surfsmelt may "home" back to their hatching beaches is unknown.	Stable	Surfsmelt are widespread in Washington, occurring in the outer coastal estuaries, the shores of the Olympic peninsula, and the greater Puget Sound basin from Olympia to the US-Canada border.

Monitoring Activities ➔	Spawning beaches are documented. No other regular monitoring is conducted for this species for any life history stage. Limited information has been gained from research projects, scientific collection permits, and museum specimen collections. Need information on the movement of fish when away from the spawning areas.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat loss and degradation	Prior to 1972, there was no regulation of surfsmelt spawning beaches in the face of widespread shoreline armoring practices, and many miles of such habitat were damaged or destroyed in the Puget Sound basin. Surfsmelt spawning habitats can be damaged or destroyed by physical burial by armoring bulkhead/fill structures intruding into the intertidal zone from adjacent uplands, alteration or disruption of the natural erosion and longshore transport of beach substrate (the "longshore drift"), or by oiling. The habitat quality of surfsmelt spawning beaches used during the hot summer months may be degraded by the routine deforestation of the marine-riparian zone during the course of shoreline development.	Current habitat protection efforts focus on the preservation of all naturally-occurring surfsmelt spawning sites. There is no mitigation methodology known to suitably replace surfsmelt spawning habitat. Surfsmelt spawn survival on those beaches used in the summer months is significantly increased by the occurrence of overhanging, shading canopies from marine-riparian-zone forests bordering the beaches.	The systematic inventory of all shoreline areas to document existing surfsmelt spawning areas needs to be completed, so that all such areas have regulatory habitat protection. Enforcement of zoning and shoreline management regulations. Establishment and enforcement of adequate marine riparian zone buffers for the conservation of shoreline-bordering forests. Consideration of policies to encourage the pro-active re-forestation of degraded marine riparian zones where possible.
Harvest	Recreational fisheries for surfsmelt occur at many traditional sites throughout the marine areas of Washington. Adequate fishery statistics are generally lacking for these fisheries, in spite of their local importance. The sport catch tonnage may exceed that of the commercial catch for this species.	Basic biological information needs to be gathered from a variety of surfsmelt spawning stocks.	Conduct recreational fishery monitoring and fishery-independent net sampling.

Leopard dace *Rhinichthys falcatus*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. Fish & Wildlife	Can occur in lakes and streams, preferring slow to moderate current. Associated with stone substrate covered by fine sediments. Spring spawners.	Population size and status unknown.	In Washington, a Columbia River Drainage fish. Has not been documented east of the Okanogan River. Most often in larger rivers, very few documented records for this fish.
Monitoring Activities ➔	Some WDFW distribution surveys conducted in 1990s. No further monitoring at this time.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Lack of information	Population status unknown.	Determine and map distribution and relative abundance.	Conduct extensive distribution and relative abundance surveys. Research effective sampling techniques.

Mountain sucker *Catostomus platyrhynchus*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. Fish & Wildlife	Most often found in clear, cold mountain streams, but can occur in lakes and larger rivers over sand, gravel or boulders. Utilizes areas of slow to moderate current and pools. Spawn in riffles in early summer. Diet consists almost entirely of algae and diatoms.	Population size and status unknown.	In Washington, mid and lower Columbia River drainages.
Monitoring Activities ➔	No monitoring activities have been conducted. Incidental data collected from smolt traps.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**

Lack of information	Population status unknown.	Determine and map distribution and relative abundance.	Conduct extensive distribution and relative abundance surveys. Research effective sampling techniques.

Salish sucker *Catostomus sp.*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. Fish & Wildlife	Mainly found in low velocity areas of streams and rivers, but also in lakes and ponds. Usually associated with sand-silt substrate and aquatic or overhanging vegetation. Spring spawners in riffles.	Population size and status unknown.	In Washington, in the Puget Trough from the Canadian border to Lake Cushman.
Monitoring Activities ➔	Distribution surveys by WDFW in the 1990s. No further monitoring at this time.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Lack of information	Population status unknown.	Determine and map distribution and relative abundance.	Conduct extensive distribution and relative abundance surveys. Research effective sampling techniques.
Loss of habitat	This fish only occurs in an area of rapid urban development. Impacts are unknown.	Conserve suitable habitat.	Determine suitable habitat.
Limited distribution	A restricted distribution puts it at risk to habitat disturbances or alterations.	Monitor relative abundance.	Conduct relative abundance survey every few years.

Pacific sand lance *Ammodytes hexapterus*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. Fish & Wildlife	Very little is known about the life history or biology of sand lance populations in Washington. Typically, sand lances are poorly represented in the catches most standard types of net-fishing gear, due to their body shape and behavior. Upper intertidal sand and sand/gravel spawning sites appear to be used year-after-year, during the November-February sand lance spawning season. Incubating sand lance eggs may occur in the same substrate as the eggs of surfsmelt spawning populations, as both species may use the same stretches of beach for spawning at the same times of year. The overlap in use of areas is roughly 10%.	Unknown	A common fish of nearshore marine waters throughout Washington. It is generally acknowledged to be of great ecological importance in local marine food webs.
Monitoring Activities →	Spawning beaches are documented. No other regular monitoring is conducted for this species for any life history stage. Limited information has been gained from research projects, scientific collection permits, and museum specimen collections. Need estimation of population size.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Lack of information	No known sampling program by any local resource agency or research institution has yielded a comprehensive data set for an adult sand lance population in throughout the Puget Sound basin.	Basic biological information needs to be collected for spawning populations. The inventory of sand lance spawning habitats in Washington needs to be completed, so that all sites can be afforded regulatory habitat protection, and none inadvertently destroyed for lack of knowledge of the presence of the resource.	Design and conduct extensive distribution and relative abundance surveys. Research effective sampling techniques.

Habitat loss and degradation	The Pacific sand lance's habit of depositing and incubating its eggs in the upper intertidal zone makes it vulnerable to nearshore habitat alterations of the type commonly being undertaken along the local shorelines. Sand lance spawning habitats can be damaged or destroyed by physical burial under bulkhead-fill structures intruding into the intertidal zone from adjacent uplands, by alteration of the normal supply and movement of beach sediments, and by oiling.	Healthy sand lance spawning habitats can only be maintained by the preservation of erosional sediment inputs, commonly in direct opposition to local trends in increased shoreline armoring to prevent erosion on developing shorelines.	The systematic inventory of all beaches to document existing sand lance spawning areas needs to be completed. The surveys to identify spawning areas need to be conducted so that all such areas have regulatory habitat protection. Enforcement of zoning and shoreline management regulations.

INVERTEBRATES

BEETLES

Columbia River tiger beetle *Cicindela columbica*	**Biology and Life History**	**Population**	**Distribution**
 Pacific Northwest National Laboratory	Predatory beetle	May be extirpated	sandy bars along the eastern Columbia Gorge and Snake River
Monitoring Activities ➔	Coleopterists surveyed in the 1970's and WDFW conducted limited searches in 1995 (Grant, Adams and Franklin Co): no *C. columbica* located. Amateur Coleopterists conduct searches opportunistically; efforts and findings often not reported.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat loss	Habitat inundation from Columbia and Snake River dams	Conserve suitable habitat	Identify extant suitable habitat for protection and possible reintroduction
Lack of information	Distribution, habitat needs poorly known, Survey and identification expertise not widely held	Develop survey and identification expertise, Determine and map distribution, Research natural history and conservation	Survey historic sites and potential habitat

Siuslaw sand tiger beetle *Cicindela hirticollis siuslawensis*	**Biology and Life History**	**Population**	**Distribution**
NO PHOTO AVAILABLE	Restricted to moist sand above normal high tide on coastal beaches	unknown	Grays Harbor County
Monitoring Activities ➔	None at this time		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Lack of information	Distribution, biology, needs poorly known, Survey and identification expertise not widely held	Develop survey and identification expertise, Determine and map distribution, Research natural history and conservation	Survey historic sites and potential habitat, research limiting factors, describe habitat
Invasive plants	European beachgrass	Control and monitor invasive species	Continue beachgrass control (note: does anyone do this?)
Limited distribution	Restricted to parts of Oregon and Washington;	Population monitoring and research	Survey historic sites and potential habitat
Human disturbance	human and vehicle traffic	Protect significant sites	determine if protection of snowy plover and streaked horned lark nesting adequately addresses this species

Beller's ground beetle *Agonum belleri*	**Biology and Life History**	**Population**	**Distribution**
NO PHOTO AVAILABLE	Bog inhabitant; flightless	about 30 known sites	Bogs in western Washington
Monitoring Activities ➔	None at this time.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**

Lack of information	Survey and identification expertise not widely held, Distribution, biology, need poorly known	Develop survey and identification expertise, Determine and map distribution, Research natural history and conservation	Survey historic sites and potential habitat
Limited habitat	Isolated sites at risk of local extinction	Population monitoring and research	Population monitoring and research
Development	Destruction/degradation of bogs; disruption of hydrology	Protect significant sites	protect with easements, agreements, acquisition; fence sites where necessary to protect fragile vegetation

Long-horned leaf beetle *Donacia idola*	**Biology and Life History**	**Population**	**Distribution**
NO PHOTO AVAILABLE	Bright metallic copper leaf beetle reported only from bogs; plant eating	Few known isolated populations	Sphagnum bogs of Puget Sound lowlands; Snohomish, Kitsap counties
Monitoring Activities ➔	None at this time.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Lack of information	Survey and identification expertise not widely held, taxonomic uncertainty, possible synonymous with *Plateumaris dubia*?	Develop survey and identification expertise, Research natural history, conservation, taxonomy; Determine and map distribution	Determine if *Donacia idola* is distinct taxon; survey additional potential sites
Limited habitat	Isolated sites at risk of local extinction	Population monitoring and research	Population monitoring and research
Development	Destruction/degradation of bogs; disruption of hydrology	Protect significant sites	protect with easements, agreements, acquisition; fence sites when necessary to protect fragile vegetation

Hatch's click beetle *Eanus hatchii*	**Biology and Life History**	**Population**	**Distribution**
NO PHOTO AVAILABLE	Restricted to floating Sphagnum mats;	Only 4 or 5 sites	Sphagnum bogs of Puget Sound lowlands
Monitoring Activities ➔	None at this time.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Lack of information	Survey and identification expertise not widely held, Distribution, biology, need poorly known	Develop survey and identification expertise, Determine and map distribution, Research natural history and conservation	Survey historic sites and potential habitat
Limited habitat	Isolated sites at risk of local extinction	Population monitoring and research	Population monitoring and research
Development	Destruction/degradation of bogs; disruption of hydrology	Protect significant sites	protect with easements, agreements, acquisition; fence sites when necessary to protect fragile vegetation

Mann's mollusk-eating ground beetle *Scaphinotus mannii*	**Biology and Life History**	**Population**	**Distribution**
NO PHOTO AVAILABLE	Restricted to moist woodland in canyons; feeds on mollusks	Few isolated populations	Riparian woodland in tributary canyons of Snake and Grand Ronde Rivers
Monitoring Activities ➔	Coleopterists have recently searched most potential habitat.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**

Lack of information	Survey and identification expertise not widely held, Distribution, biology, needs poorly known	Develop survey and identification expertise, Determine and map distribution, Research natural history and conservation	Survey historic sites and potential habitat
Habitat loss, Limited habitat	Habitat inundation from Snake River dams, Rural development, grazing, isolated populations at risk of extinction	Protect extant sites, restore degraded habitat, conserve suitable habitat	seek easements, management agreements, erect livestock fencing

BUTTERFLIES

Propertius' duskywing *Erynnis propertius*	**Biology and Life History**	**Population**	**Distribution**
 Paul Opler, USGS	Associated with Garry oak *(Quercus garryana)*	Eastern WA: Not uncommon where oaks remain intact Western WA: Declining, few isolated populations	Garry oak stands: low-elevation Eastern Cascades, primarily south of I-90; and patchily distributed sites in Puget Sound
Monitoring Activities ➔	Incidental surveys in recent years while conducting searches for other rare butterflies using similar habitat that have overlapping flight times. Focal searches have occurred in SW WA small oak patches. Target species of a recent academic study researching gene flow, abundance, and range impacts from global climate change.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Limited Habitat	Oak groves	Conserve suitable habitat	seek easements, management agreements , Restore edge and understory habitat

Lack of information	Survey and identification expertise not widely held, Current distribution not known	Develop survey and identification expertise, Determine and map distribution	Survey historic sites and potential habitat
Habitat destruction/degradation, loss	Stands being logged or cleared for development, Encroachment/overtopping by Douglas-fir	Conserve suitable habitat	Seek easements, management agreements, Restore edge and understory habitat, Remove firs, Education, volunteer programs,

Oregon branded skipper *Hesperia Colorado oregonia*	**Biology and Life History**	**Population**	**Distribution**
 Paul Opler, USGS	Grasslands, glacial outwash prairies, grasses are larval food plant	Very irregular and rare	Southwestern Washington Lowlands, San Juan Islands
Monitoring Activities ➔	Incidental surveys for a few sites in recent years while conducting searches for other rare butterflies using similar habitat that have overlapping flight times.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Development, invasive plant species	Invasion of exotics in grasslands, development	Conserve suitable habitat; determine status	Identify sites for protection, develop management recommendations; control invasives and exotics
Lack of information	Survey and identification expertise not widely held, Distribution, biology, needs poorly known	Develop survey and identification expertise, Determine and map distribution, Research natural history and conservation	Survey historic sites and potential habitat

Mardon skipper *Polites mardon*	**Biology and Life History**	**Population**	**Distribution**
 WDFW	Associated with grassland/ grasses are larval food plant	Endangered	Two disjunct areas in Washington, South Puget Sound and vicinity of Mt. Adams
Monitoring Activities ➔	Ongoing surveys to determine distribution and range in southern Puget Sound and in the southern Cascades. Limited monitoring of population on WDFW-managed site. Developed survey protocol.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat Loss	grassland conversion, recreational use, inappropriate grazing, fire	Conserve suitable habitat; increase distribution	determine appropriate levels of grazing, benefits of military training to maintain and enhance populations (Fort Lewis)
Limited distribution	Less than 10 locations known in Washington; grassland habitat disappearing.	Conserve suitable habitat; increase distribution	Conduct full surveys of western Washington grasslands and heath/shrublands with respect to the distribution, habitat, and management requirements
Invasive Plant species	Exotic grasses and weeds,	Control and monitor invasive species	Control exotic species,

Dog star skipper *Polites sonora siris*	**Biology and Life History**	**Population**	**Distribution**
 Paul Opler, USGS	grasslands, forest glades/ grasses are larval food plant	Reduced populations in other states, status in WA unknown	Western Washington Lowlands
Monitoring Activities →	Incidental surveys for a few sites in recent years while conducting searches for other rare butterflies using similar habitat that have overlapping flight times.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat Loss	herbicides along roadsides, exotic species	Conserve suitable habitat; determine status	Identify limiting factors, sites for protection, and develop management recommendations
Lack of information	Survey and identification expertise not widely held, Current distribution not known	Develop survey and identification expertise, Determine and map distribution	Survey historic sites and potential habitat

Yuma skipper *Ochlodes yuma*	**Biology and Life History**	**Population**	**Distribution**
 Paul Opler, USGS	Found at the edges of marshes.	Extremely rare endemic	Approximately 1 population in Grant County.
Monitoring Activities ➔	Little monitoring since discovery of site.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Limited Distribution	Recreation management, park development	Protect Significant Areas	Develop management recommendations and meet with land managers
Lack of information	Habitat not well understood.	Gather information on suitable habitat.	Conduct surveys for suitable habitat and new sites.

Shepard's parnassian *Parnassius clodius shepardi*	**Biology and Life History**	**Population**	**Distribution**
 Corel, USGS	Found in moist areas of canyons	Local, very rare	Snake River drainages, Southeast Washington
Monitoring Activities ➔	Little monitoring since discovery of taxon and sites.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Invasive plant species	exotic plants, weeds,	Monitor and control invasive species	Conserve and restore suitable habitat, control invasive weeds
Development	Impoundments – Snake and Columbia Rivers	Conserve preferred habitat in moist canyons	Existing sites should be defined, registered, protected, and monitored.
Lack of information	Distribution not well known; known colonies very rare.	Determine and map distribution; research is needed to determine what plants host these butterflies.	Determine distribution, develop and implement management recommendations

Island marble *Euchloe ausonides insulanus*	**Biology and Life History**	**Population**	**Distribution**
 Paul Opler, USGS	Grassland associate	Extremely rare: 2 or 3 known populations	North Puget Sound
Monitoring Activities ➔	Systematic searches of potential habitat were conducted in 2005; a few sites have been searched in multiple years. All known sites were monitored in 2005.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Limited Distribution, Limited Habitat	Not well known	Determine and map distribution, conserve suitable habitat	Continue searching for new populations and monitoring extant , Determine threats to larval food plants, occupied sites, and nectar species, Seek easements, management agreements, Education, volunteer programs

Makah (Queen Charlotte) copper *Lycaena mariposa charlottensis*	**Biology and Life History**	**Population**	**Distribution**
 Corel, USGS	Found in coastal bogs	restricted distribution	Currently known from Olympic Peninsula
Monitoring Activities ➔	Opportunistic searches during the last few years have been conducted at several coastal bogs. No populations are regularly monitored.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat Loss	Conversion and destruction of bogs, Road building	Conserve suitable habitat, determine and map distribution	Determine appropriate strategies (shrub and tree removal, hydrology, etc.) to maintain habitat over time
Lack of information	Taxonomic uncertainty, coastal WA taxon possibly a distinct ssp.	Research taxonomy, Determine and map distribution	Determine if coastal WA *mariposa* are distinct taxon; survey additional potential sites

Chinquapin hairstreak *Habrodais grunus herri*	**Biology and Life History**	**Population**	**Distribution**
 Paul Opler, USGS	Associated with stands of golden chinquapin	Rare: one known in WA	Skamania County
Monitoring Activities ➔	Little monitoring since discovery of site.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Limited habitat, Habitat loss	Herbicides, disease, logging, Current distribution not known	Conserve suitable habitat; Determine and map distribution of habitat and butterfly	Survey historic site and potential SW WA habitat

Johnson's hairstreak *Mitoura johnsoni*	**Biology and Life History**	**Population**	**Distribution**
 Paul Opler, USGS	Associated with Old Growth forests, larvae feed on mistletoe of western hemlock and Douglas-fir trees	Status Unknown; few known locations	Low-elevation Western Washington
Monitoring Activities ➔	None at this time.		

General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat Loss	Forest management	Determine and map distribution; habitat monitoring and research	Survey likely stands to determine distribution
Environmental contamination	Forestry practices of spraying BTK (*Bacillus thuringiensis k.*) to control tussock moth and spruce budworms.	Alert forestry industry to detrimental effects of spraying.	Avoid spraying in areas where known populations occur.

Juniper hairstreak *Mitoura grynea barryi*	**Biology and Life History**	**Population**	**Distribution**
 Corel, USGS	Associated with juniper	Few populations known	Columbia Basin
Monitoring Activities ➔	None at this time.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Human disturbance	Loss of Juniper from development and nectar plant destruction from land management practices	conserve and protect suitable habitat.	Juniper woodlands should be kept intact and not converted to rangelands or used for off-road recreational vehicles. Grazing should be limited, minimized, or halted to the degree necessary in order to retain nectar plants and to allow them to flower. Existing sites should be defined, registered, and protected.
Lack of information	Fewer than 6 sites known in western U.S.; 3 occur in SE Washington	Research and survey population status and trends.	survey for new populations and monitor existing populations.

Hoary elfin (W WA) *Incisalia polia obscura*	**Biology and Life History**	**Population**	**Distribution**
 Paul Opler, USGS	Prairies, heaths; larval host is kinnikinnick; flight period April-May	Few populations known	South Puget Sound and Kitsap Peninsula
Monitoring Activities ➔	Incidental surveys for a few sites in recent years while conducting searches for other rare butterflies using similar habitat that have overlapping flight times. No populations are regularly monitored.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Limited distribution	fragmentation of habitat, isolation of populations	Determine and map current distribution	Survey historic sites and potential habitat
Habitat loss, Development	loss of prairie and open woodland, degradation	Conserve suitable habitat; restore degraded habitat	Conserve suitable habitat; restore degraded habitat

Puget (Blackmore's) blue *Icaricia icarioides blackmorei*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. Fish & Wildlife	Grassland associate with Lupines	populations isolated, uncommon, declining	Southern Puget Sound lowlands and Olympic Mountains
Monitoring Activities →	Coordinated searches have occurred on south Puget Sound grasslands over the last few years. Research being conducted on life history, captive rearing and behavior. No monitoring of Olympic Mtn populations.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat Loss	Invasive exotic plant species, habitat degradation	Conserve suitable habitat; restore degraded habitat	Manage grassland habitats to maintain *Lupinus albicaulis* in southern Puget Sound

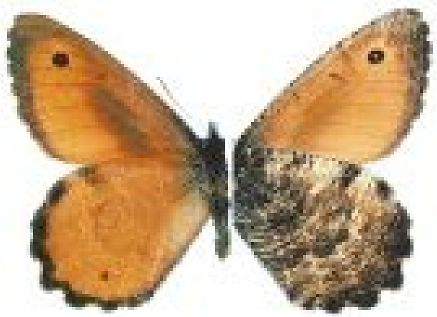
Puget Sound fritillary *Speyeria cybele pugetensis*	**Biology and Life History**	**Population**	**Distribution**
 Paul Opler, USGS	Inhabits grasslands and edges of oak woodlands and forest openings	Status unknown	southern Puget Sound lowlands
Monitoring Activities ➔	Incidental surveys for a few sites in recent years while conducting searches for other rare butterflies using similar habitat that have overlapping flight times. No populations are regularly monitored.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat Loss	Development, habitat degradation, invasive species	Conserve suitable habitat; determine and map distribution, restore degraded habitat, control and monitor invasive species	Survey, identify, and protect additional sites, develop management recommendations

Oregon silverspot *Speyeria zerene hippolyta*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. Fish & Wildlife	Associated with coastal grasslands	Endangered Extirpated from Washington	coastal dunes and grasslands south of Westport
Monitoring Activities ➔	Searches were conducted irregularly during the 1980's; regular searches were conducted during the 1990's.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat Loss	Accelerated succession due to dune stabilization, exotic species	Restore degraded habitats; increase distribution; reintroduction	Work to restore habitat at sites on the Long Beach Peninsula; coordinate with USFWS to facilitate reintroduction from Oregon

<table>
<tr><th>Valley silverspot
Speyeria zerene bremnerii</th><th>Biology and Life History</th><th>Population</th><th>Distribution</th></tr>
<tr><td>
Washington Dept. Fish & Wildlife</td><td>Grasslands and forest bald associate</td><td>Highly localized</td><td>Willapa Hills, Puget Trough lowlands, and Olympic Mountains</td></tr>
<tr><td>Monitoring Activities ➔</td><td colspan="3">Incidental surveys for a few sites in recent years while conducting searches for other rare butterflies using similar habitat that have overlapping flight times. No populations are regularly monitored.</td></tr>
<tr><th>General Problems</th><th>Specific Problems</th><th>Conservation Strategies</th><th>Specific Conservation Actions</th></tr>
<tr><td>Habitat Loss</td><td>Degradation of grassland habitat</td><td>Conserve suitable habitat; restore degraded habitat; increase distribution</td><td>Identify and protect additional sites; control exotics and invasives at protected sites.</td></tr>
</table>

Silver-bordered fritillary *Boloria selene atrocostalis*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. Fish & Wildlife	True bogs and wet meadows	Status unknown	Eastern Washington
Monitoring Activities ➔	None at this time.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat Loss, Development	Wetland drainage, water table alteration; succession of wetlands	Determine and map distribution; conserve suitable habitat	Survey and monitoring; habitat management at Moxee Bog; development of statewide habitat management recommendations

Taylor's checkerspot *Euphydryas editha taylori*	**Biology and Life History**	**Population**	**Distribution**
 Washington Dept. Fish & Wildlife	Grassland associate in the Puget Lowlands, north Olympic Peninsula coast and San Juan Islands	Recent declines, few populations remaining	Puget Trough, including San Juan Islands and north coast of the Olympic Peninsula
Monitoring Activities ➔	Considerable searching for new sites has occurred during last few years, this includes incidental surveys at many sites conducted while searching for other rare butterflies using similar habitat that have overlapping flight times. Most South Puget Sound sites have been monitored for 2 years. Little monitoring of Olympic Peninsula populations has occurred.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Habitat Loss, development, invasive plant species	Invasive species like scotch broom, exotic grasses, recreation, lack of fire	Conserve suitable habitat, restore degraded habitat,	Improve habitat quality;
Lack of information	Reintroductions/translocation likely necessary: methods have not been developed; Population fluctuations annually and over time unknown	Develop methods for successful reintroduction/translocation; regular monitoring	Test captive rearing, reintroduction and translocation methods, Determine female food plant preference, Standardized annual monitoring

Great arctic *Oeneis nevadensis gigas*	**Biology and Life History**	**Population**	**Distribution**
 Canadian Biodiversity Information Facility	Uncertain; probably forest openings, balds	One known site: No records since 1950	San Juan Islands
Monitoring Activities ➔	None at this time.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Lack of Information	Not known	Determine and map distribution	Surveys are needed

Sand-verbena moth *Copablepharon fuscum*	**Biology and Life History**	**Population**	**Distribution**
 Dr. Jeremy Tatum, Environment Canada	Restricted only to sites with obligate host yellow sand-verbena	5 known sites	sandy coastal sites of northern Puget Sound

Monitoring Activities ➔	Fairly extensive searches have been done. No populations are regularly monitored.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Limited habitat	small isolated sites vulnerable to extinction	Protect significant sites, Conserve suitable habitat	easements, agreements, acquisitions, habitat restoration
Lack of information	Need information to enable protecting sites	Determine and map distribution	survey remaining potential sites
Invasive plant species	Scotch broom, European beachgrass	Control and monitor invasives	assess needs and implement veg control as needed
Human disturbance	Trampling of host plants	Protect habitat	Education and enforcement; restricted public access

White-belted ringtail *Erpetogomphus compositus*	**Biology and Life History**	**Population**	**Distribution**
 William Leonard, CalPhotos	streams and rivers	May be extirpated	Crab Creek, Grant County, and Yakima River, Benton County; northernmost extent of range
Monitoring Activities →	Unknown. Occasional opportunistic searches by local entomologists.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Lack of information	Limiting factors unknown	Determine and map distribution; Population monitoring	Conduct surveys, survey potential sites, determine if extant
Limited distribution	isolated populations at risk of extinction	Conserve suitable habitat	Protect and restore current habitat, survey for suitable habitat sites

Columbia (Lynn's) clubtail *Gomphus lynnae*	**Biology and Life History**	**Population**	**Distribution**
 Slater Museum, U of Puget Sound	PNW endemic associated with shallow muddy or gravelly rapids	May only be 1 population in Washington	One site in Benton County, Washington and 4 sites in Oregon.
Monitoring Activities ➔	Unknown. Occasional opportunistic searches by local entomologists.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Lack of information	Limiting factors unknown	Determine and map distribution; Research natural history and conservation	Conduct surveys annually, survey potential sites, identify factors affecting population
Invasive animals	Carp, mosquito fish	Limit introduction of invasive species	Enforcement, education.
Environmental contaminants	Agricultural chemicals may be a problem	Determine and address factors limiting recovery	Investigate chemicals present and potential problems
Limited distribution	single population vulnerable	Population monitoring, habitat inventory	Conduct surveys, survey potential sites, determine if extant

Pacific clubtail *Gomphus kurilis*	**Biology and Life History**	**Population**	**Distribution**
 Slater Museum, U of Puget Sound	Lakes, possibly streams	2 known sites	Thurston and Skamania Counties; also Oregon and California
Monitoring Activities ➔	Unknown. Occasional opportunistic searches by local entomologists.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Lack of information	Limiting factors unknown	Determine and map distribution; Population monitoring	Conduct surveys annually, survey potential sites, identify factors affecting population
Limited distribution	isolated populations at risk of extinction	Conserve suitable habitat	Restore and maintain habitat.

Subarctic darner *Aeshna subarctica*	**Biology and Life History**	**Population**	**Distribution**
 Slater Museum, U of Puget Sound	Found in bogs and marshes; lays eggs in floating moss; flight period late July-Sept	1 known site in Washington; boreal species	Ferry County
Monitoring Activities ➔	Unknown. Occasional opportunistic searches by local entomologists.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Lack of information	Limiting factors unknown	Determine and map distribution; Population monitoring	Survey potential sites, identify factors affecting population
Limited distribution	isolated populations at risk of extinction	Conserve suitable habitat	Restrict public access, restore and maintain habitat.

Boreal whiteface *Leucorrhinia borealis*	**Biology and Life History**	**Population**	**Distribution**
 U.S. Geological Survey	marshy ponds; flight period June-July	1 site in Washington	Okanogan County
Monitoring Activities ➔	Unknown. Occasional opportunistic searches by local entomologists.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Lack of information	Limiting factors unknown	Determine and map distribution; Population monitoring	Survey potential sites, identify factors affecting population
Limited distribution	isolated populations at risk of extinction	Conserve suitable habitat	Restrict public access, restore and maintain habitat.

Subarctic bluet *Coenagrion interrogatum*	**Biology and Life History**	**Population**	**Distribution**
 Slater Museum, U of Puget Sound	prefers open fens, bogs, and marshes especially those with sphagnum moss.	1 known site	Ferry County
Monitoring Activities ➔	Unknown. Occasional opportunistic searches by local entomologists.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Lack of information	Limiting factors unknown; life history, habitat needs, etc. poorly understood	Determine and map distribution; Population monitoring and research	Survey potential sites, identify factors affecting population; monitor known sites; research life history, habitat needs
Limited distribution	isolated populations at risk of extinction	Conserve suitable habitat	Restrict public access, restore and maintain habitat.

California floater *Anodonta californiensis*	**Biology and Life History**	**Population**	**Distribution**
 from Nedeau, et al. 2005	A freshwater bivalve; larval stage is parasitic on fish. Reaches maturity at 4-5 years, life span to 15 years.	Past declines; current status poorly known	Columbia and Okanogan rivers; Curlew Lake, Ferry County; extirpated from much of historic range
Monitoring Activities →	No monitoring activities at this time.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Hydro development	dams, fluctuating water levels, decline of native host fish	Population monitoring and research	Population monitoring and research
Environmental contamination	pollution, sedimentation	Control and monitor contaminants	reduce sedimentation and pollution
Limited distribution	may be reduced to isolated populations; status unknown	Determine and map current distribution; restore habitat.	survey historic and potential sites.
Lack of information	current distribution poorly known; taxonomic uncertainty; limited data on demographics and biology	Research life history, conservation, taxonomy	Support surveys, taxonomic and life history studies
Invasive animals	competition from *Corbicula*, an Asian clam, and other invaders	Control and monitor invasives	Enforcement and education

Western floater *Anodonta kennerlyi*	**Biology and Life History**	**Population**	**Distribution**
 from Nedeau, et al. 2005	Freshwater bivalve; larval stage is parasitic on fish. Muddy or sandy habitats in rivers and lakes, particularly mid- to high elevations.	unknown	Large rivers and lakes; known from Puget Trough, Yakima and Grays Harbor counties
Monitoring Activities ➔	No monitoring activities at this time.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Hydro development	dams, fluctuating water levels, decline of native host fish	Population monitoring and research	Conduct surveys on population and research life history attributes, habitat elements
Environmental contamination	pollution, sedimentation	Control and monitor contaminants	reduce sedimentation and pollution
Limited distribution	may be reduced to isolated populations	Determine and map current distribution; restore habitat;	survey historic and potential sites.
Lack of information	current distribution poorly known; taxonomic uncertainty; limited data on demographics and biology	Research life history, conservation, taxonomy	Support surveys, taxonomic and life history studies,
Invasive animals	competition from *Corbicula*, an Asian clam, and other invaders	Control and monitor invasives	Enforcement and education

Winged floater Anodonta nuttalliana	**Biology and Life History**	**Population**	**Distribution**
 from Nedeau, et al. 2005	Freshwater bivalve; larval stage is parasitic on fish. Muddy or sandy rivers and lakes, especially in low gradient, low elevation areas of coastal watersheds. Long-term brooders.	unknown	Large rivers and reservoirs. Lower Columbia River.
Monitoring Activities ➔	No monitoring activities at this time.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Hydro development	dams, fluctuating water levels, decline of native host fish	Population monitoring and research	Research mitigation alternatives
Environmental contamination	pollution, sedimentation	Control and monitor contaminants	reduce sedimentation and pollution
Lack of information	current distribution poorly known; taxonomic uncertainty; limited data on demographics and biology	Research life history, conservation, taxonomy	Support surveys, taxonomic and life history studies,
Limited distribution	may be reduced to isolated populations	Determine and map current distribution; Restore habitat;	survey historic and potential sites.

Invasive animals	competition from *Corbicula*, an Asian clam, and other invaders	Control and monitor invasives	Enforcement, education

Oregon floater *Anodonta oregonensis*	**Biology and Life History**	**Population**	**Distribution**
 from Nedeau, et al. 2005	Freshwater bivalve; larval stage is parasitic on fish. Shallow water, low gradient, low elevation lakes, rivers and reservoirs.	unknown	Columbia River and tributaries.
Monitoring Activities →	No monitoring activities at this time.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Hydro development	dams, fluctuating water levels, decline of native host fish	Population monitoring and research	Research mitigation alternatives
Environmental contamination	pollution, sedimentation	Control and monitor contaminants	reduce sedimentation and pollution
Lack of information	current distribution poorly known; taxonomic uncertainty; limited data on demographics and biology	Research life history, conservation, taxonomy	Support surveys, taxonomic and life history studies.

Limited distribution	may be reduced to isolated populations	Determine and map current distribution; Restore habitat;	survey historic and potential sites.
Invasive animals	competition from *Corbicula*, an Asian clam, and other invaders	Control and monitor invasives	Enforcement, education

Western ridged mussel *Gonidea angulata*	**Biology and Life History**	**Population**	**Distribution**
 from Nedeau, et al. 2005	Freshwater bivalve; larval stage is parasitic on fish. Found in all size streams; rarely found in lakes and reservoirs. Found mainly low to mid-elevation watersheds.	unknown	Found throughout the state; limited distribution west of the Cascades.
Monitoring Activities ➔	No monitoring activities at this time. Distribution survey conducted on the Similkameen in 2005.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Environmental contamination	pollution, sedimentation	Control and monitor contaminants	reduce sedimentation and pollution
Limited distribution	may be reduced to isolated populations	Determine and map current distribution; Restore habitat;	survey historic and potential sites.

Lack of information	current distribution poorly known; taxonomic uncertainty; limited data on demographics and biology	Research life history, conservation, taxonomy	Support surveys, taxonomic and life history studies,

Western pearlshell *Margaritifera falcata*	**Biology and Life History**	**Population**	**Distribution**
 from Nedeau, et al. 2005	Freshwater bivalve; requires cold, well oxygenated, low gradient streams with gravel/sand bottom; larva are largely parasitic on salmonids. Sexually mature at 9-12 years, capable of living over 100 years.	Widespread declines; formerly very abundant.	Streams in western Washington, and scattered localities in eastern Washington.
Monitoring Activities →	No monitoring activities at this time. Distribution survey conducted on the Similkameen in 2005.		
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Environmental contamination	pollution, sedimentation	Control and monitor contaminants	reduce sedimentation and pollution
Limited distribution	may be reduced to isolated populations	Determine and map current distribution; Restore habitat;	survey historic and potential sites.
Lack of information	current distribution poorly known; taxonomic uncertainty; limited data on demographics and biology	Research life history, conservation, taxonomy	Support surveys, taxonomic and life history studies

Blue-gray taildropper *Prophysaon coeruleum*	**Biology and Life History**	**Population**	**Distribution**
 Kriistina Ovaska, CalPhotos	Associated with moist forest floor conditions; abundant coarse woody debris; bigleaf maple	A few isolated populations; a rare regional endemic	scattered sites in Puget Trough; extant populations in Lewis and Cowlitz counties
Monitoring Activities ➔			
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Limited distribution	isolated populations vulnerable	Increase distribution	Attempt experimental reintroduction?
Habitat loss	logging, development	Protect significant sites; Conserve suitable habitat	easements, agreements
Lack of information	life history, habitat needs, etc. poorly understood	Determine and map distribution; Population monitoring and research	survey potential sites; monitor known sites research life history, habitat needs

Crowned tightcoil *Pristiloma pilsbryi*	**Biology and Life History**	**Population**	**Distribution**
 William Leonard, CalPhotos	Terrestrial snail found in decaying leaf litter in salal	May be extinct	3 occurrences, 1 locality, Pacific County
Monitoring Activities ➔			
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Limited distribution	isolated populations vulnerable	Increase distribution; Protect significant sites; Conserve suitable habitat	Attempt experimental reintroduction?; easements, agreements
Lack of information	Taxonomic uncertainty, may be synonymous with more widespread species; life history, habitat needs, etc. unknown	Determine and map distribution; Population monitoring and research; research taxonomy	survey potential sites; research life history, habitat needs

Columbia oregonian *Cryptomastix hendersoni*	**Biology and Life History**	**Population**	**Distribution**
 Kriistina Ovaska, CalPhotos	An endemic land snail that inhabits margins of spring-fed streams and associated talus in otherwise arid landscape; likely eats algae and vegetation	Declining; currently known from only 4 isolated sites in Washington and several sites in Oregon	found at only 4 locations in Columbia River gorge in Klickitat County; Columbia Plateau ecoregion.
Monitoring Activities ➔			
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Lack of information	Almost nothing known about species ecology, life history, reproduction	Determine status and trend of population, limiting factors	Determine full extent of distribution; monitor populations; support studies of ecology, life history.
Habitat degradation	Blackberries degrading habitat; livestock pose trampling hazard and grazing has degraded vegetation; alteration of hydrology by diversions could eliminate population; pollution from roads and railroad deg	Monitor habitat status; permanent habitat protection; restore/enhance habitat; control invasive species	Monitor habitat condition; control blackberries.
Limited distribution	Only 4 isolated sites in an otherwise hostile environment	Protect known populations	Pursue possibility of permanent protection through easement, agreements, etc. Investigate the potential for reintroductions at other suitable sites.

Oregon megomphix *Megomphix hemphilli*	**Biology and Life History**	**Population**	**Distribution**
 William Leonard, CalPhotos	Terrestrial snail of moist hardwood/conifer forest; often associated with bigleaf maple and large woody debris	Few isolated populations; extinct at some historic sites	Regional endemic; Scattered localities from Olympia to Columbia River; Thurston, Lewis, Grays Harbor and Cowlitz counties
Monitoring Activities ➔			
General Problems	**Specific Problems**	**Conservation Strategies**	**Specific Conservation Actions**
Limited distribution	isolated populations vulnerable to logging, flooding, fires	Increase distribution	Attempt experimental reintroduction?
Habitat loss	logging, development	Protect significant sites; Conserve suitable habitat	easements, agreements
Lack of information	life history, habitat needs, etc. poorly understood	Determine and map distribution; Population monitoring and research	survey potential sites; monitor known sites; research life history, habitat needs

V. IMPLEMENTATION

A. A First Step in Wildlife Conservation Planning

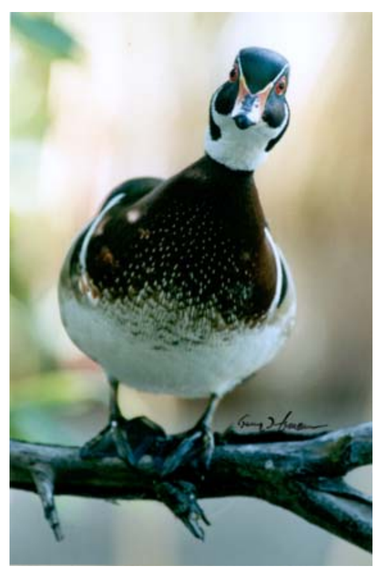
Development of the CWCS is an important step in setting the future direction for fish and wildlife conservation in Washington. This strategic document establishes a good biological foundation and planning framework. Further operational planning and program prioritization, at both the statewide and ecoregional scales, will need to be done to address the species and habitat priorities in the CWCS and to fully implement the strategy over time.

Although WDFW is driven by planning at many different levels, from multi-agency salmon recovery plans to individual Wildlife Area plans, creation of the State Wildlife Grants program and the CWCS requirement provided an opportunity for WDFW to undertake an agency-wide effort to reassess wildlife conservation priorities and set a new direction for the future. Specifically, the CWCS process provided the impetus for:

- a thorough reevaluation of priorities for species and habitat conservation
- a transition from statewide to ecoregional conservation
- acceleration of the evolution from species management (fine filter) to a more ecosystems-based management approach (coarse filter)
- expanding the emphasis on biodiversity conservation, at the statewide and ecoregional scales

In times of diminishing habitat resources and declining revenues for conservation it has been important for WDFW to initiate a new round of strategic planning and begin to establish new ground rules for how we prioritize species, habitats and conservation actions—and where we direct future funding and human resources to address these priorities.

B. Narrowing the Scope of Implementation



Development of the Washington CWCS has proceeded on a parallel track with completion of ecoregional assessments (EA) for nine ecoregions within Washington (see Chapter VI, Washington's Ecoregional Conservation Strategy) during 2003, through 2005. This was a huge undertaking for WDFW. Whereas this EA process has been completed in many areas of the country, we worked as partners with The Nature Conservancy to create the EAs in tandem with the CWCS process. The CWCS was completed in the fall of 2005; the EAs are expected to be finished in 2006.

By reviewing and synthesizing hundreds of conservation planning efforts, defining and listing priority wildlife species and associated habitats, and by articulating alternative, ecoregional conservation actions, the CWCS has greatly refined the scope of Washington's implementation strategy. An initial list of thousands of species classified as wildlife in Washington was systematically narrowed to about 700, then to about 200 Species of Greatest Conservation Need and their associated habitats.

The EAs, when completed, will establish conservation targets and map biodiversity at the ecoregional level. This effort will build on the CWCS by further targeting the range of funded actions to those areas on the landscape that show the most promise for long-range, cost-effective conservation.

When taken together, these two major statewide efforts, the CWCS and the EAs, will considerably refine the scope and breadth of Washington's current statewide wildlife conservation strategy. They provide a good starting point for setting long-term and shorter-range conservation goals and objectives; identifying conservation opportunities at the statewide, regional, and local levels; and designing or redefining projects to achieve these goals and objectives. The nearly concurrent completion of the CWCS and the ecoregional assessments will position WDFW and its conservation partners to embark on a well planned and more directed approach to future wildlife conservation.

C. Beginning the Implementation Process

While many actions have already have been taken, using previous State Wildlife Grants (SWG) and other funding sources, further implementation of the Washington CWCS will begin in 2006, after it has been approved by the US Fish and Wildlife Service, and after WDFW knows how much funding is available from State Wildlife Grants (SWG), as well as other sources, to begin or resume addressing the identified conservation needs of wildlife Species of Greatest Conservation Need and associated habitats that are outlined in the CWCS.

A number of important factors will influence the initial implementation of the Washington CWCS in 2006. The first is development of the state budget. Unlike the federal government, Washington state agencies develop and implement their budgets on a biennial rather than annual basis. Washington state agencies are expected to prioritize program activities and establish performance measures each biennium, and the first review and possible revision of the CWCS will be timed to coincide with the development of the 2007-09 biennial budget.

Another important factor, discussed above, is completion of the ecoregional assessments (EA) in 2006; these are described in Chapter VI, Washington's Ecoregional Conservation Strategy. State Wildlife Grant (SWG) funds are being used in the development of these assessments, and the results of the assessments will influence how and where WDFW and its conservation partners direct their future CWCS implementation efforts and implementation funds within each ecoregion. New projects may be identified and funded to implement the CWCS, and existing SWG-funded projects may also be extended or expanded.

The initial CWCS program review and detailed implementation planning for State Wildlife Grants funding will be led by the Wildlife Diversity Division within WDFW, but will also involve other programs with WDFW. WDFW intends to reconvene and ask the CWCS Advisory Committee (See Appendix 11) to assist in shaping this process. Some of the factors to be considered include:

- The relative priority of habitat types beyond the current stratification of these areas.
- Integration of the CWCS into the 30-year Biodiversity Conservation Strategy currently being crafted by the new Washington Biodiversity Council.

- Coordination of multi-agency land acquisition through the Interagency Committee for Outdoor Recreation (IAC)
- Acceleration of coordinated conservation planning among federal and state land management agencies
- Better integration of management of marine and aquatic systems with terrestrial ecosystems, both within WDFW and among state and federal agencies.
- Incorporation of identified species and habitat conservation priorities into operational work plans within WDFW and other conservation partners. (e.g. WDFW Wildlife Program activities matrix.)
- Correlation of identified conservation actions into WDFW's cost accounting systems to assist in the development and monitoring of project budgets and relative priorities with other mandated activities.

As specific CWCS implementation needs are reviewed, projects will be designed, redefined or extended into the future to meet these needs.

D. Implementation Partners

Although the Washington Department of Fish and Wildlife (WDFW) has lead responsibility for administering Washington's allocation of federally-appropriated State Wildlife Grants (SWG), as well as developing, implementing and updating the Washington Comprehensive Wildlife Conservation Strategy (CWCS), the implementation of this CWCS cannot be fully accomplished by WDFW alone.

WDFW will never be adequately funded or staffed to address all the conservation problems and issues addressed in the CWCS. Even with additional funding, wildlife conservation is almost always more effective when accomplished through working partnerships with other public land management agencies, Indian tribes, conservation groups, local governments and the private sector, especially agriculture and forest landowners.

By developing a new list of Species of Greatest Conservation Need, identifying associated priority habitats, and identifying specific conservation actions, the CWCS sets up a framework for WDFW to implement comprehensive wildlife conservation in partnership with other agencies and conservation organizations.

As other public and private partners are asked to help with CWCS implementation, WDFW will consider grants to these partners to help fund these projects. How and when these grants would be made available to other partners will be determined by WDFW as part of the initial review, possible revision and implementation of the CWCS in 2006.

The following discussion identifies some of the potential roles and responsibilities of WDFW and its major potential public and private conservation partners in implementing the Washington CWCS.

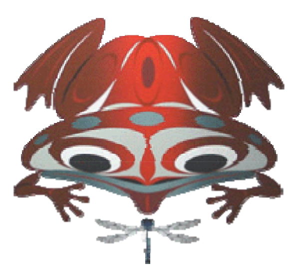
Washington Department of Fish and Wildlife

Many of the statewide conservation strategies described in Chapter III, State Overview, and the conservation actions discussed in Chapter VI, Ecoregional Conservation Strategy, are primary responsibilities of WDFW. WDFW owns or manages about 840,000 acres of wildlife habitat and, within the agency's funding and staffing capabilities, these public lands are managed to provide optimal benefit to Species of Greatest Conservation Need and associated habitats. As well as managing its own lands for fish and wildlife habitat and wildlife-related recreation, WDFW works to influence the management of other lands and waterways for maximum benefits to fish and wildlife, conducts research and surveys on priority species and habitats, enforces rules and regulations affecting wildlife and habitat, and assists local governments and landowners to identify and help protect important fish and wildlife habitat on private land. WDFW takes a lead role in many programs and activities related to fish and wildlife conservation, some of which are discussed in Chapter I, Introduction and Background; Chapter III, State Overview; and elsewhere in the Washington CWCS.

Other Public Land Management Agencies

Approximately 40% of the land area of Washington state is in public ownership, and a high level of management cooperation and coordination takes place between WDFW and other federal and state land management agencies, including the Washington Department of Natural Resources, U.S. Fish and Wildlife Service, Bureau of Land Management, Bureau of Reclamation, USDA Forest Service, and the Washington State Parks and Recreation Commission. These public agencies have their own legislative mandates to conserve or at least consider fish and wildlife resources on the public lands and trust lands they manage. The Department of Defense and Department of Energy also own and manage thousands of acres of important wildlife habitat in Washington, and they conduct or participate in cooperative habitat and species conservation efforts with WDFW on Army, Navy and Air Force installations, as well as the Hanford Nuclear Reservation. WDFW works closely with these state and federal land managers on various fish and wildlife conservation issues, ranging from on-site habitat protection to invasive species control and grazing practices, and also cooperates with them on developing and conducting wildlife and habitat research and surveys.

Tribal Land Management Agencies



Washington's Treaty Indian tribes are important conservation partners, and they have a potentially key role in implementing the various conservation strategies outlined in the CWCS. All Treaty tribes have some responsibility for fish and wildlife conservation on their tribal lands. Under various treaties, many also have fishing and hunting rights on public land and "co-management" responsibility for harvested fish, on and off their reservations. Some tribes such as the Yakama Nation, Colville Confederated Tribes, and Quinault Indian Nation, control and manage vast areas of wildlife habitat on their reservations. As with federal and state agencies, as well as private landowners, WDFW may need to expand its existing coordination efforts with the tribes to ensure that CWCS species and habitat priorities are recognized and addressed on tribal lands and co-management areas on public land.

Private Forest Landowners

Approximately 36 percent of Washington's forested land area is owned and managed by private forest landowners. WDFW works closely with these companies to try to ensure that forest practices are compatible with sound management of wildlife species and habitats, and to promote responsible public recreational access to these private lands. Coordination with large private landowners often takes place within the regulatory context of the federal Endangered Species Act (ESA) or the Washington Forest Practices Act, although much cooperative wildlife research and management also occurs on private lands without any regulatory requirement. WDFW works cooperatively with private forest landowners through the Washington Forest Practices Board and the Forest and Fish Agreement on policies and measures to conserve fish, wildlife and habitat on private forestlands. Many forest landowners have also adopted Habitat Conservation Plans (HCP) with federal fish and wildlife agencies to protect ESA-listed fish, wildlife and associated habitats.

Local Governments

Washington's cities and counties have a key role in identifying and protecting critical fish and wildlife habitat on private lands. Cities and counties have always done comprehensive land use planning, but their conservation responsibilities were greatly expanded with passage of Washington's Growth Management Act (GMA) by the State Legislature in 1990. Under the Act, amended in 1995, cities and counties must use "best available science" to identify and protect the values and functions of "critical areas", which are defined in the GMA to include wetlands and "fish and wildlife habitat conservation areas".

Upon completion of the CWCS and the ecoregional assessments described in Chapter VI, Washington's Ecoregional Conservation Strategy, WDFW will expand its efforts to help local governments use "best available science" in protecting important habitat. This will be done by providing good habitat mapping products to local planners and by working with them to ensure that their local GMA plans, as well as other local conservation programs such as "conservation futures" and open space property tax incentives, address the Species of Greatest Conservation Need, associated habitats, and conservation actions identified in the CWCS.

This effort to provide local habitat assessments to local governments is discussed again, to include links to county pilot projects, in Chapter III, State Overview.

Other Public and Private Conservation Partners

WDFW works with many other public agencies, private conservation groups and private individuals on wildlife conservation and recreation issues, and many of these agencies and organizations will be asked to partner with WDFW in implementing the Washington CWCS. WDFW is also actively involved in a number of public-private conservation partnerships such as the Salmon Recovery Funding Board and the Pacific and Intermountain West Joint Ventures (for migratory birds).

Although they do not manage large areas of habitat, federal agencies such as the National Marine Fisheries Service and Environmental Protection Agency do have regulatory responsibility for anadromous fish, marine mammals and wetlands. Washington state agencies such as the Department of Ecology, Department of Transportation, Puget Sound Action Team, and the Office of the Superintendent of Public Instruction also have conservation and education responsibilities that may be effectively applied to the implementation of the CWCS. Local conservation districts, irrigation districts, land trusts and weed boards are important potential partners in addressing problems such as habitat fragmentation and invasive species, which are discussed at both the ecoregional and local levels in the CWCS.

Some of WDFW's most important conservation partners are various nonprofit conservation and wildlife recreation groups and coalitions such as The Nature Conservancy, Audubon Washington, Trust for Public Land, Washington Wildlife Federation, Trout Unlimited, Rocky Mountain Elk Foundation, Ducks Unlimited, Partners In Flight, Defenders of Wildlife and various local and regional land trusts. All of these groups, and many others, are potential partners in implementing the CWCS, through projects as varied as creating the new Pacific Education Institute, to surveying neotropical migratory birds, to restoring and enhancing habitat on public lands.

Some of WDFW's conservation partners, including many state and federal agencies, have broad conservation mandates. The role of other agencies and conservation organizations is more narrowly defined. The following matrix, while not intended to be complete or inclusive, tries to associate major responsibilities of some of these public and private partners with the statewide fish and wildlife conservation strategies discussed in Chapter III, State Overview. This loose association hopefully gives some indication of which conservation partners, other than WDFW, might be asked to help implement certain elements or recommendations in the CWCS.

		OTHER PUBLIC LAND MANAGEMENT AGENCIES									
CONSERVATION ACTIONS*	**WDFW**	DNR	USFWS	BLM	BUREAU OF RECLAM.	USDA FS	WA PARKS & RECREATION	**WASHINGTON INDIAN TRIBES**	**PRIVATE LANDOWNERS**	**LOCAL GOVERNMENTS**	**OTHER CONSERVATION PARTNERS**
Species conservation strategies	X		X					X			X
Coordinated salmon recovery	X	X				X	X	X	X	X	X
Habitat conservation on public lands and waterways	X	X	X	X	X	X	X			X	X
Habitat conservation on private lands	X								X	X	X
Habitat acquisition	X	X	X	X						X	X
Research, monitoring and surveys of fish, wildlife and habitat	X	X	X	X		X		X			X
Direct enforcement of state laws to protect fish, wildlife and habitat	X	X									

		OTHER PUBLIC LAND MANAGEMENT AGENCIES									
CONSERVATION ACTIONS*	**WDFW**	DNR	USFWS	BLM	BUREAU OF RECLAM.	USDA FS	WA PARKS & RECREATION	**WASHINGTON INDIAN TRIBES**	**PRIVATE LANDOWNERS**	**LOCAL GOVERNMENTS**	**OTHER CONSERVATION PARTNERS**
Indirect enforcement of local, state and federal laws to protect fish, wildlife and habitat	X	X	X			X	X	X			
Wildlife information and conservation education	X	X	X	X	X	X	X				X
Wildlife recreation programs	X		X					X			
Harvest management	X		X					X			
Forest practices management	X	X	X	X	X	X			X	X	X
Biological assessment, local planning and information services	X	X	X					X		X	X

* Primary or key conservation actions.

VI. ECOREGIONS: WASHINGTON'S ECOREGIONAL CONSERVATION STRATEGY

A. Why Ecoregions?

Even the untrained eye will notice that Washington's natural vegetation exhibits regional differences. Lands west of the Cascade Crest are dominated by forest, but lands in the center of Washington have no forest at all; they are covered with sage shrubs and grasses. Forests on the western slopes of the Cascades are dominated by western hemlock and Douglas-fir. Forests on the eastern slopes are dominated by a very different tree species—ponderosa pine. The regional differences in vegetation cause regional variation in wildlife species, and collectively, these regional differences in both vegetation and wildlife manifest regional variation in biodiversity.

These obvious differences in regional vegetation and biodiversity led to the concept of ecoregions, which are defined as relatively large areas of land and water that contain geographically distinct assemblages of natural communities. These communities 1) share a large majority of their species, dynamics, and environmental conditions, and 2) function together effectively as a conservation unit at global and continental scales. Most ecoregions in North American span millions of acres across multiple states or provinces. They provide a useful framework for cooperating with federal agencies, neighboring states and Canadian provinces on conservation planning.

For purposes of conservation assessment and planning, The Nature Conservancy, the Washington Natural Heritage Program and WDFW have adopted ecoregions for landscape-level planning because they provide an ecological basis for partitioning the state into coherent units that circumscribe common habitat types, wildlife species, stakeholders, land uses, and various conservation issues across geopolitical boundaries. Local decisions with regard to preserving biodiversity will be most effective when made within the context of a broader, ecoregional-scale conservation strategy.

The Nature Conservancy adapted the USDA Forest Service ECOMAP framework as the base map for all ecoregional assessment work in the United States. For the Washington ecoregional assessments, slight modifications to the boundaries were made by the Washington Natural Heritage Program using local data and boundaries developed by the U.S. Environmental Protection Agency in 2000. As shown in Figure 11 below, portions of nine ecoregions occur within Washington.

Figure 11. Washington's ecoregions.

B. <u>Ecoregional Assessments</u>

Limited resources, as well as social and economic considerations, make protection of all wildlife habitats impractical. To be effective, conservation must efficiently use limited resources. Addressing this predicament requires a reliable method for prioritizing potential conservation areas. To guide biodiversity conservation and inform land use planning across the state, WDFW and the Washington Department of Natural Resources joined The Nature Conservancy to complete ecoregional assessments (EA) for each of Washington's nine ecoregions. The East Cascades and West Cascades ecoregions were combined into one assessment. These eight EAs attempt to identify and prioritize places for the conservation of all biodiversity in an ecoregion. The relative priority of places is based on such factors as species rarity, species richness, species representation, site suitability and overall efficiency. They do not replace individual species recovery or management plans, or any other species-based or habitat-based planning, but are designed to ensure that the highest priority biodiversity sites are identified and protected.

Ecoregional assessments are one decision support tool that can be used to help implement the CWCS. The main products of these assessments are a comprehensive compilation of conservation data for the ecoregion, a conservation utility map, and a conservation portfolio map. These maps and the data used to recreate them can guide cost efficient conservation efforts at various scales on both public and private land. The primary uses of these maps are 1) prioritizing potential land acquisitions and conservation easements, 2) rating grant proposals for habitat protection or restoration, and 3) informing local planners for the purposes of county comprehensive plans and other local planning projects.

WDFW will use the ecoregional assessments to help guide statewide conservation strategies as well as the conservation actions listed in the ecoregional chapters of the CWCS. Focusing conservation effort in the higher priority conservation areas within each ecoregion will do the most good for the greatest number of wildlife species and habitats of concern.

Toward this end, Conservation Utility Maps, which display relative conservation value across a whole ecoregion, are included in the CWCS for three representative ecoregions, the Okanogan, Northwest Coast, and Puget Trough. WDFW recognizes that the landscapes or watersheds with the highest value on these conservation utility maps are the logical starting places for implementing biodiversity conservation, while acknowledging that conservation efforts for individual Species of Greatest Conservation Need (SGCN) should be first be conducted in the areas identified in various species recovery and management plans.

All of the ecoregional assessments will be completed by year-end 2006, and will be posted on the WDFW website as they become available. For a more detailed description of the ecoregional assessment process and products, see Appendix 12.

C. Local Conservation Planning

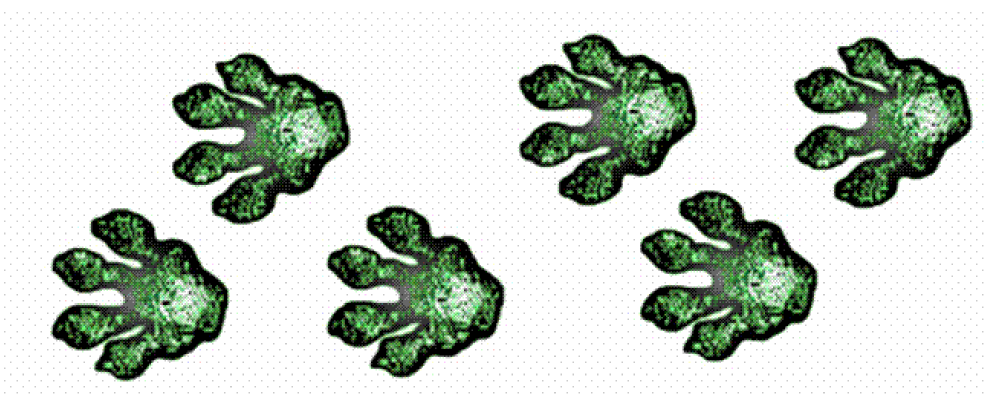
Efficient conservation strategies should begin at a regional level, but conservation decisions and actions are increasingly occurring at the local level, and local conservation efforts can be more effective when made within the context of a broader, regional-scale strategy. However, since ecoregional assessments cover huge areas, they cannot adequately address all fish and wildlife resources important to local governments and citizens. Consequently, WDFW is also using the products from ecoregional assessments to develop local habitat assessments, which will identify the relative value of wildlife habitats across an entire county.

This process combines local information with ecoregional priorities to assist in county land use planning. Local habitat assessments will provide citizens and officials with a better understanding of the relative value of wildlife resources across their county, as well as the potential contribution of an area to regional biodiversity. WDFW field biologists can use the local assessments, as well as the information provided in the following ecoregional chapters of the CWCS, to help prioritize their work and provide technical assistance to local and regional conservation projects.

D. Ecoregional Conservation Strategies

Washington's CWCS is organized at both statewide and ecoregional scales in order to help WDFW and its conservation partners be as strategic as possible in confronting the challenges of conserving Washington's wildlife diversity. While some information is repeated in several of the ecoregional chapters included below, this is intentional so that each ecoregional chapter can stand alone. Most of the information included in the following ecoregional chapters is drawn from completed ecoregional assessments as well as other plans and assessments listed for each ecoregion. All ecoregional chapters contain the following elements:

- Map showing the ecoregion's location in Washington
- Discussion of physiography and land ownership
- Conservation Utility Map for the ecoregion (where they are completed)
- Map of land ownership
- Major conservation partners, plans and assessments
- List of Species of Greatest Conservation Need
- Description of habitats in greatest need of conservation
- Map of habitat types
- Major problems and management issues
- Recommended conservation actions



NORTHWEST COAST ECOREGION

PHYSIOGRAPHY AND FISH AND WILDLIFE DIVERSITY

Geography

The Northwest Coast ecoregion includes most of the Olympic Peninsula of Washington, the coast mountain ranges (including the Willapa Hills) extending down to central Oregon, and most of Vancouver Island in British Columbia. Approximately 11 percent of Washington is within this ecoregion. A majority of the Washington portion has been converted to timber management, agricultural or urban uses.

The Olympic Mountains, the ocean coast and coastal plain, and the Willapa Hills are the ecoregion's dominant landforms. Glaciated peaks in the Olympic Mountains rise to an elevation of nearly 8,000 feet above sea level. Streams and rivers typically begin as deeply incised, steep gradient drainages that eventually feed large, low-gradient river systems on the coastal plain. The coastal plain is up to 20 miles wide on the west side of the Olympic Peninsula and mostly underlain by glacial till and outwash. Major estuaries and associated dunes are found on the southern coast. The Willapa Hills mountain range consists of worn highlands with old, well-weathered soils.

Geology

Viewed from above, the mountains of the Olympic Peninsula seem to present a disorganized, circular array of jagged peaks above a deep, forested labyrinth of canyons, but the dominant design is controlled by 11 major rivers radiating from the mountains like the spokes of a wheel. This topography shows that the Olympics developed as a separate uplift, not as part of a long, coastal mountain chain. They comprise a massif in themselves. Between the major rivers in the core of the range are extensive tracts of alpine and subalpine terrain: flowered meadows, barren rocky expanses, and glacial ice.

In the southern half of the ecoregion, the Willapa Hills have rounded topography and deep weathering profiles. Erosion carved these hills into a deep slab of oceanic crust that still lies almost as flat as it formed. During the Pleistocene, a major river existed in the present-day valley of the Chehalis River. This glacial-age river channeled melt waters from the western foothills of the Cascades and the southernmost extent of the Puget lobe towards the Pacific Ocean.

Climate

High precipitation typifies the ecoregion, averaging 60 to 240 inches annually (some of the highest levels on earth). Most precipitation falls as rain from November through April. Snow pack and rain-on-snow zones cover a considerable area in the Olympic Mountains. Due to the rain shadow effect, the northeastern Olympic Mountains receive the lowest precipitation of equivalent elevations anywhere in western Washington. Along the outer coast and adjacent valleys, fog and cool temperatures in the summer are important climatic factors.

Habitat and Plant Associations

The forests in this ecoregion are among the most productive in the world, characterized by large trees, substantial woody debris, luxuriant growth of mosses and lichens on trees, and abundant ferns and herbs on the forest floor. Coniferous forests dominate the vegetation. The most widespread forest type is dominated by Douglas-fir, western hemlock and western redcedar. Douglas-fir is the most common tree at lower elevations, but is an early seral species; western hemlock is the climax species in many of the same lowland areas. These forests occur from sea level up to elevations of 2200-3200 feet in the Coast Range and Olympic Mountains. This forest type occupies a wide range of environments with variable composition and structure and includes such other species as grand fir, Sitka spruce and western white pine.

While hemlock and fir dominate much of the ecoregion, cool and wet conditions along the coast create a narrow band of forests distinguished by Sitka spruce. With its high tolerance of salt spray, Sitka spruce may form nearly pure forests or co-dominate with lodgepole pine in areas near the ocean. Forests in the mountains are mostly dominated by Pacific silver fir and mountain or western hemlock. High elevations in the Olympic Mountains have subalpine parkland and alpine habitats.

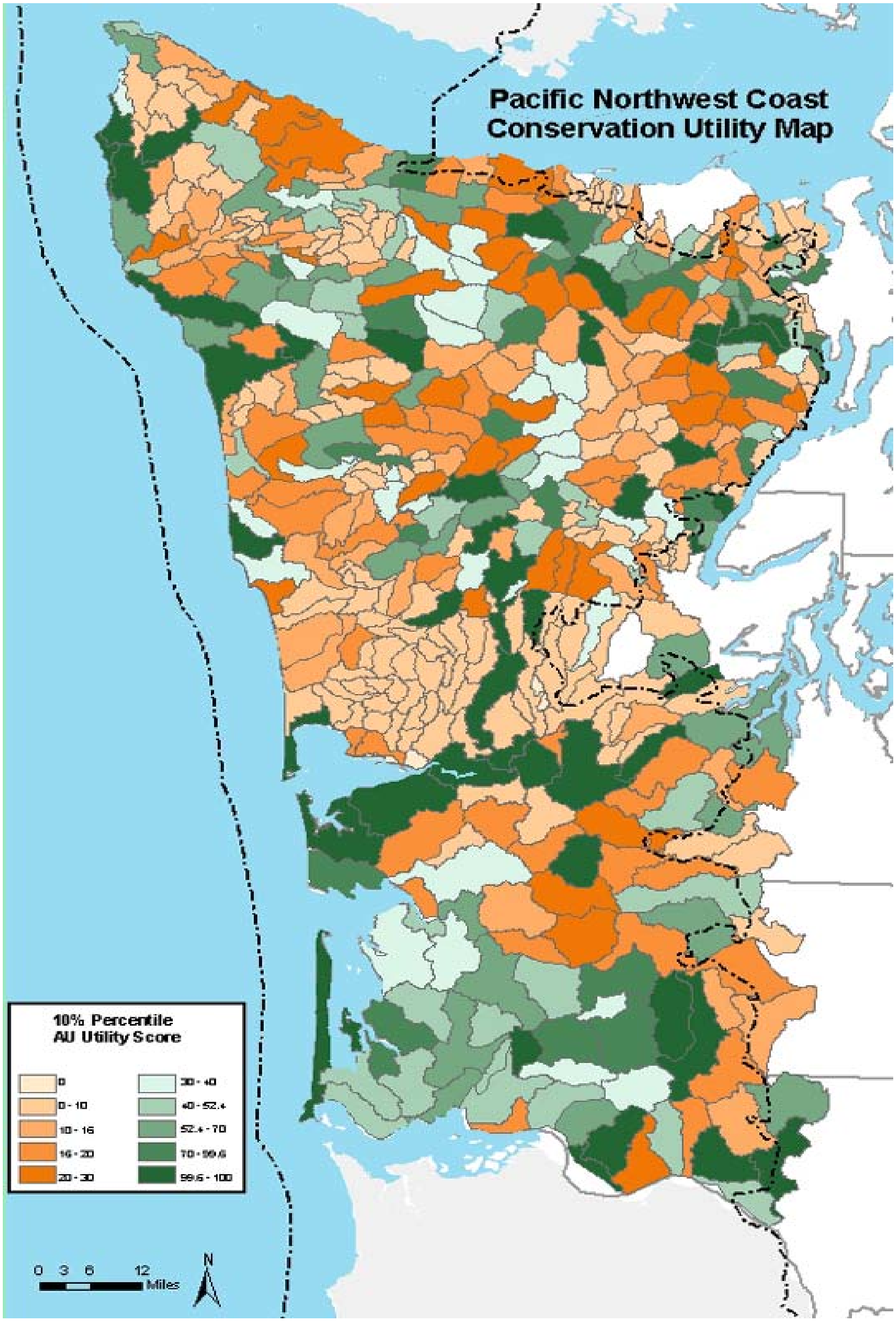
Riparian forests of this ecoregion are quite distinct from the Douglas-fir/hemlock forests. Broadleaf species such as black cottonwood and red alder replace the otherwise ubiquitous conifers along the many rivers and streams. Occasional native grasslands, sand dune and strand communities, rush meadows and marshes, and western redcedar and alder swamps, often formed by beaver activity, break up the conifer forests.

Fish and Wildlife Diversity

The Northwest Coast ecoregion has not experienced the rapid population growth of the Puget Trough ecoregion and still retains a high level of biodiversity. The region's temperate coniferous forests rank among the richest in the world in terms of forest and wildlife diversity. The Olympic Mountains are rich in rare plant species due to their isolation, the number of unusual habitats, and the presence of steep environmental gradients. Among the rare and endangered species in this ecoregion are the Oregon silverspot butterfly, sea otter, Pacific fisher (extirpated), snowy plover, marbled murrelet and northern spotted owl. The Olympic Coast National Marine Sanctuary, consisting of 3310 square miles of marine waters off the coast of Washington's Olympic Peninsula, contains rocky and sandy shores, kelp forests, sea stacks, islands and open ocean. The Sanctuary harbors more kinds of kelp than anywhere else in the world and a large variety of migratory fish, seabirds and marine mammals. Willapa Bay and Grays Harbor, the second and third largest estuaries on North America's west coast, also contribute to the biodiversity of the Northwest Coast ecoregion. Both of these estuaries are critical migratory stopover sites for shorebirds, Pacific brant, and other migratory birds. Other habitats that contribute to biodiversity include coastal dunes, mud flats, wetlands and sphagnum bogs. Roosevelt elk, blacktail deer, black bear and cougar were not abundant in coastal Douglas-fir forest until settlement by European Americans and forest harvest resulted in fewer old-growth forests and an increase in earlier forest successional stages. Large marine mammals, including the California gray whale, Steller sea lion, sea otter and harbor seal are found in adjacent waters of the Pacific Ocean.

While the CWCS focuses on wildlife diversity, the ecoregional assessments address the full range of Washington's biological diversity. One product of the ecoregional assessment, the conservation utility map, depicts the relative biodiversity value of landscapes or watersheds within the ecoregion. A sample map, titled Conservation Utility Scores, is shown below for the Northwest Coast ecoregion (Figure 12). The utility scores indicate both the biodiversity value of an assessment unit (AU) and its suitability for conservation. The AU varies by ecoregion and is either a hexagon or a watershed. The scores are generated with a computer algorithm under the assumption that all AUs are not equally suitable for conservation (a suitability index was used). For instance, lands adjacent to intensive agriculture or residential development are considered less suitable for conservation than lands adjacent to undisturbed forest. The algorithm assigns a high utility score to AUs that contain rare targets (species or communities), contain a large amount of a target (i.e., has high representation of a target), or has a high number of targets (i.e., has high richness). When a set of AUs have similar biological contents, the algorithm uses the suitability index to choose the best AU from the set. AUs with a score of 100 are either irreplaceable or are the most suitable place to conserve particular targets. Refer to Appendix 12 for a description of how these maps were developed.

Figure 12.



Pacific Northwest Coast
Conservation Utility Map
10% Percentile
AU Utility Score
0
0 - 10
10 - 16
16 - 20
20 - 30
30 - 40
40 - 52.4
52.4 - 70
70 - 99.6
99.6 - 100
0 3 6 12
Miles
N

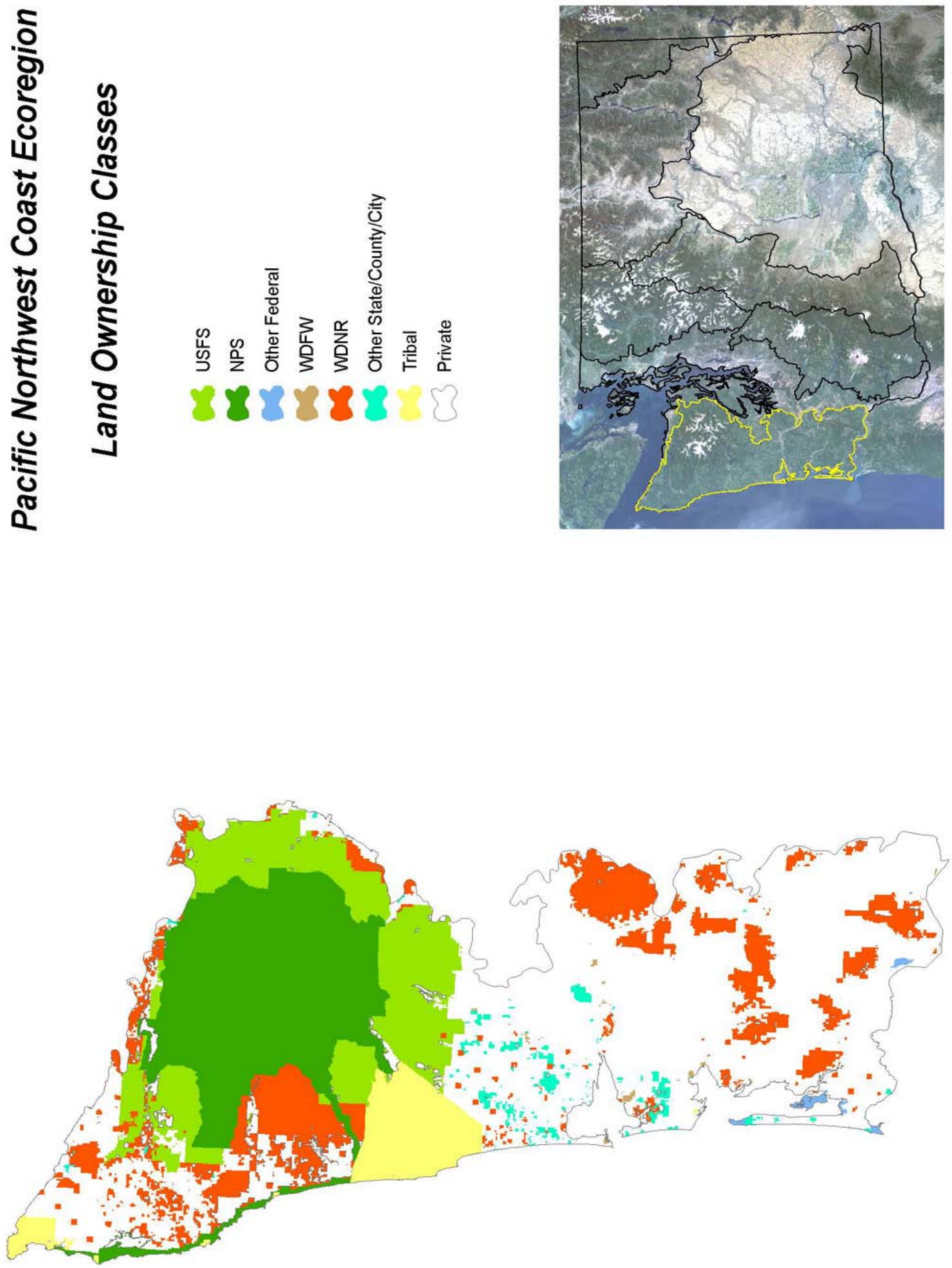
LAND OWNERSHIP

Over half of the Northwest Coast ecoregion is privately owned, with commercial timber companies making up a large portion of this private land. Approximately 31 percent is managed by six federal agencies (USDA Forest Service, National Park Service, U.S. Fish and Wildlife Service, Department of Defense, and U.S. Army Corps of Engineers), with the Forest Service (Olympic National Forest) making up nearly half. Around 12 percent of the region is public trust land managed by the Washington Department of Natural Resources or county governments, with the remaining two percent under tribal ownership and management, primarily the Quinault and Makah Indian tribes.

Dominant land use is commercial forestry. Sport fishing, hunting and hiking are common recreational pursuits. Harvest of specialty forest products, such as mushrooms, ferns, salal, mosses and lichens is increasing. Small communities and tourism dominate coastal areas. The only metropolitan area in the ecoregion is Aberdeen-Hoquiam in Grays Harbor County. Other coastal communities include Long Beach and the Raymond-South Bend area in Pacific County. Population numbers in Westport and Ocean Shores in Grays Harbor County appear to be on the verge of a major increase.

The largest protected area in the ecoregion is Olympic National Park and the surrounding wilderness areas in the Olympic National Forest. The majority of the protected area lies at higher elevations. Logging and other human activities have significantly altered nearly all habitats outside the national park. Figure 13 maps land ownership classes for the Northwest Coast ecoregion.

Figure 13.


Pacific Northwest Coast Ecoregion
Land Ownership Classes
USFS
NPS
Other Federal
WDFW
WDNR
Other State/County/City
Tribal
Private

ECOREGIONAL CONSERVATION PARTNERSHIPS

Effective conservation of fish, wildlife and biodiversity in Washington requires close coordination and cooperation with many public and private conservation partners. Major partners in the Northwest Coast ecoregion include:

- Makah Indian Tribe
- National Park Service (Olympic National Park)
- Quinault Indian Nation
- U.S. Fish and Wildlife Service
- USDA Forest Service (Olympic National Forest)
- Washington Department of Agriculture
- Washington Department of Natural Resources (WDNR)
- Washington Parks and Recreation Commission

The Washington Department of Fish and Wildlife also works closely on conservation projects with private conservation partners such as The Nature Conservancy, Trust for Public Land, Trout Unlimited, Audubon Washington, Ducks Unlimited, Pacific Coast Joint Venture and a growing number of fisheries enhancement groups and local land trusts.

Major Plans and Assessments

A number of ongoing or completed planning efforts involving WDFW and its public and private partners guide the conservation and management of fish and wildlife resources statewide and in the Northwest Coast ecoregion. Important planning efforts affecting conservation in the Northwest Coast ecoregion include:

- Forest Practices Habitat Conservation Plan (WDNR)
- Grays Harbor Estuary Management Plan
- Lower Columbia River Estuary Program
- National Estuary Program (NEP) Comprehensive Conservation Management Plan
- NOAA Fisheries Draft Killer Whale Conservation Plan (2005)
- Northwest Coast Ecoregional Assessment
- Northwest Forest Plan (1994)
- Pacific County Dune Management Plan
- USFWS Columbian White-tailed Deer Recovery Plan (1983)
- USFWS Draft Bull Trout Coastal/Puget Sound DPS Recovery Plan (2004)
- USFWS Draft Northern Spotted Owl Recovery Plan (1992)
- USFWS Marbled Murrelet Recovery Plan (1997)
- USFWS Oregon Silverspot Butterfly Recovery Plan (2001)
- Washington Forest and Fish Agreement (1999)
- Washington Forest Practices Board Wildlife Strategy (in progress)
- Washington State Coastal Zone Management Plan
- WDFW Aquatic Nuisance Species Management Plan
- WDFW Bald Eagle Status Report (2001)
- WDFW Bull Trout and Dolly Varden Management Plan (2000)
- WDFW Common Loon Status Report (2000)
- WDFW Fisher Recovery Plan (2004)
- WDFW Fisher Status Report (1998)
- WDFW Forage Fish Management Plan (1998)
- WDFW Killer Whale Status Report (2004)
- WDFW Marbled Murrelet Status Report (1993)

- WDFW Draft Mazama Pocket Gopher, Streaked Horned Lark and Taylor's Checkerspot Status Report (2005)
- WDFW Draft Northwest Coast Regional Wildlife Area Management Plan
- WDFW Olympic Mudminnow Status Report (1999)
- WDFW Outline for Salmon Recovery Plans (2003)
- WDFW Peregrine Falcon Status Report (2002)
- WDFW Sea Otter Recovery Plan (2004)
- WDFW Snowy Plover Recovery Plan (1995)
- WDFW Steller (Northern) Sea Lion Status Report (1993)
- WFW Pygmy Whitefish Status Report (1998)

Supporting references to these and other important statewide planning documents are included at the end of this chapter and/or in Appendices 6 and 7.

SPECIES AND HABITATS OF GREATEST CONSERVATION NEED

This section provides a short summary of priority species and associated habitats for the Washington portion of the Northwest Coast ecoregion.

Species of Greatest Conservation Need

The following species list for the Northwest Coast ecoregion is a regional subset of the statewide Species of Greatest Conservation Need (SGCN) list shown in Appendices 1 and 2. The process and criteria used to develop the statewide SGCN list are provided in Volume Two, Approach and Methods, as well as in Appendix 3. Species listed below are found in the Northwest Coast ecoregion for all or part of their lifecycle. Supporting tables and information for these species and habitats can be found in Chapter IV and Appendices 1, 2, 8, 9, 10 and 14.

	Population Size/Status						Population Trend					
COMMON NAME	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown	State Status*	WNHP
Mammals												
Keen's myotis						x				x	C	S1
Townsend's big-eared bat			x							x	C	S3
Olympic marmot			x							x	N	S3
Mazama (western) pocket gopher			x				x				C	S2
Killer whale			x				x				E	S1
Pacific harbor porpoise			x							x	C	G4
Gray wolf (historic)	?									x	E	S1
Steller sea lion			x				x				T	S2
Marten			x				x				G	S4
Fisher	x							x			E	SH
Sea otter			x						x		E	S2
Columbian white-tailed deer			x						x		E	S1
Birds												
Common loon			x					x			S	S2
Western grebe			x				x				C	S3
Great blue heron			x							x	M	S4
Trumpeter swan			x						x		G	S3
Tule greater white-fronted goose			x							x	G	S3
Brant			x				x				G	S3
Northern pintail					x		x				G	S3
Greater scaup				x							G	S5
Lesser scaup				x			x				G	S4

	Population Size/Status						Population Trend					
COMMON NAME	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown	State Status*	WNHP
Long-tailed duck			x				x				N	S3
Black scoter			x				x				G	S4
Surf scoter				x			x				G	S3
Bald eagle				x					x		T	S4
Northern goshawk			x							x	C	S3
Golden eagle			x							x	C	S3
Peregrine falcon			x						x		S	S2
Snowy plover			x						x		T	S1
Black oystercatcher			x					x			M	S4
Willet			x							x	N	S3
Marbled godwit			x							x	N	S3
Red knot			x				x				N	S3
Rock sandpiper			x				x				N	S3
Arctic tern						x				x	M	S2
Common murre				x			x				C	S4
Marbled murrelet			x				x				T	S3
Ancient murrelet			x							x	N	S3
Cassin's auklet				x			x				C	S3
Tufted puffin			x				x				C	S3
Northern spotted owl			x				x				E	S1
Vaux's swift			x				x				C	S3
Pileated woodpecker				x						x	C	S4
Streaked horned lark		x								x	N	S1
Purple martin			x					x			C	S3
Western bluebird			x				x				M	S3
Amphibians												
Dunn's salamander			x							x	C	S2
Van Dyke's salamander			x							x	C	S3
Columbia torrent salamander				x						x	C	S3
Western toad				x			x				C	S3
Fish												
River lamprey						x				x	C	S2
Pacific lamprey						x				x	N	S3
Copper rockfish		x						x			C	

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
Greenstriped rockfish						x				x	C	
Quillback rockfish		x						x			C	
China rockfish						x				x	C	
Tiger rockfish						x				x	C	
Bocaccio rockfish		x								x	C	
Canary rockfish			x							x	C	
Redstripe rockfish						x				x	C	
Yelloweye rockfish		x								x	C	
Green sturgeon				x			x				G	S2
Bull trout						x				x	C	G3
Pygmy whitefish						x				x	S	S1
Eulachon		?								x	C	S4
Ozette sockeye											C	G5
Lake Pleasant sockeye											G	G5
Lower Columbia steelhead											C	G5
Lower Columbia coho											G	G4
Olympic mudminnow						x				x	S	S2
Surfsmelt				x						x	G	G5
Pacific sand lance					x					x	N	
Invertebrates												
Siuslaw sand tiger beetle			x							x	N	S3
Dog star skipper (butterfly)						x				x	N	S2
Makah (Queen Charlotte) copper (butterfly)			x							x	C	S2
Johnson's hairstreak (butterfly)						x				x	C	S2
Puget (Blackmore's) blue (butterfly)			x				x				N	S2
Puget Sound fritillary (butterfly)						x	x				N	S3
Oregon silverspot (butterfly)	x									x	E	SX
Valley silverspot (butterfly)			x				x				C	S2
Western floater (bivalve)			x				x				N	S4
Winged floater (bivalve)			x				x				N	G3
Oregon floater (bivalve)			x				x				N	S3
Western ridged mussel			x				x				N	S2
Western pearlshell				x			x				N	S4
Crowned tightcoil (snail)	?									x	N	S1

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
Oregon megomphix (snail)			x				x				N	G2

* Status Codes	** WNHP Codes (S = state, G = global)
E = endangered	1 = critically imperiled
T = threatened	2 = imperiled
S = sensitive	3 = vulnerable to extirpation or extinction
C = candidate	4 = apparently secure
M = monitor	5 = demonstrably widespread, abundant and secure

Species Conservation in the Northwest Coast Ecoregion

Species of Greatest Conservation Need (SGCN) found in the Northwest Coast ecoregion (see table above) include those classified by WDFW as Endangered, Threatened, Candidate or Monitor species, as well as species identified by WDFW as needing additional research or funding attention. Conservation actions are recommended for these SGCN species at both the statewide and ecoregional levels. These recommended conservation actions are summarized in a series of matrices included in Chapter IV and as Appendices 9 and 10. These matrices also display the life history, population status and distribution of these species.

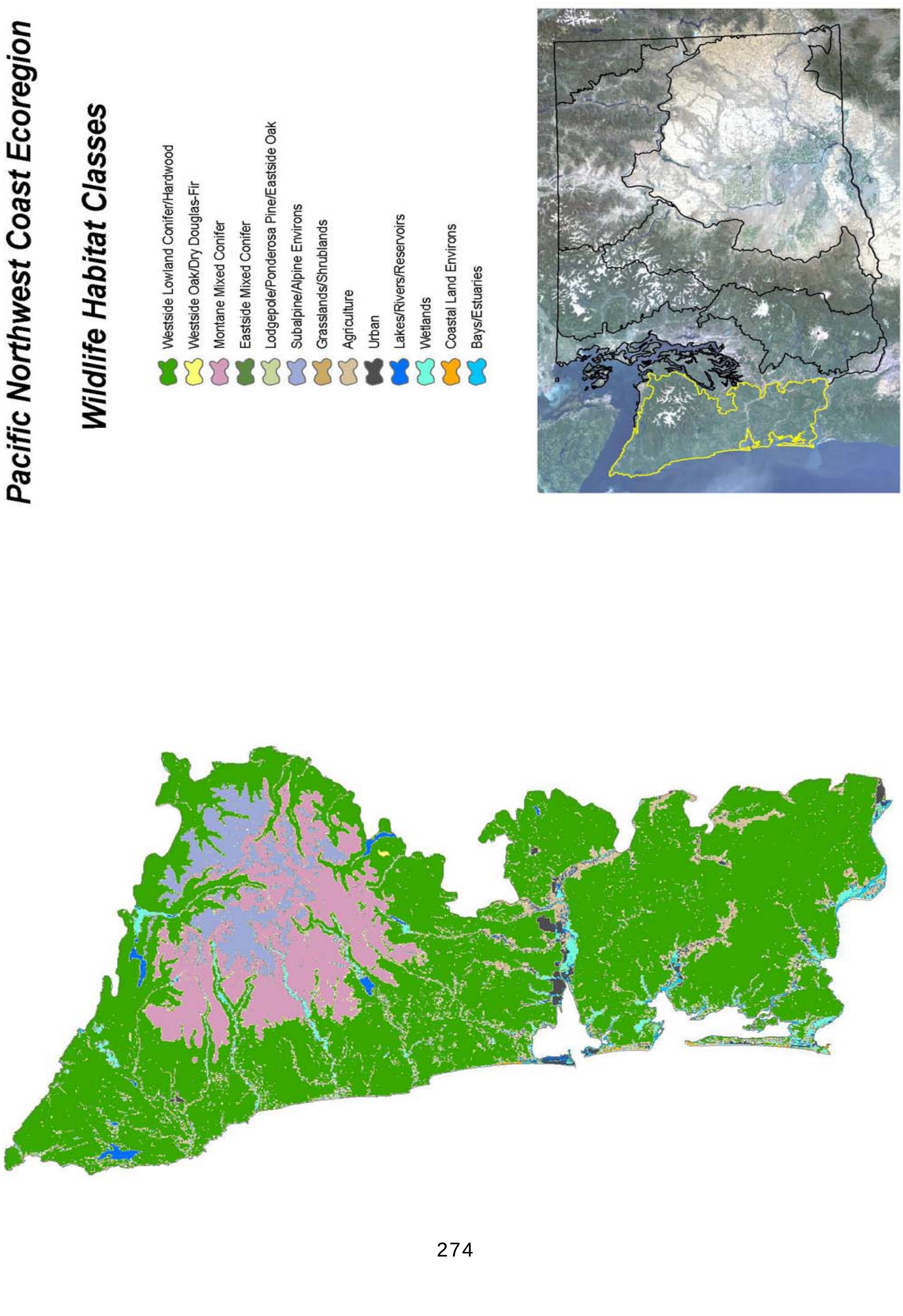
Ecoregional Habitat Overview

Although preservation of old growth forest has been a dominant issue in terrestrial wildlife conservation in the Northwest Coast ecoregion during the last 20 years, many other non-forested habitats and associated species are also in peril and are often overlooked. Special habitats such as dunes, estuaries, headlands, native grasslands and wetlands are threatened by timber harvest and land development in the region. The Oregon silverspot butterfly is an example of non-forest species that are extremely rare and vulnerable wherever they occur. Figure 14 maps wildlife habitat classes for the Northwest Coast ecoregion.

The following habitat types classified, coded and described in Wildlife and Habitat Relationships in Oregon and Washington (WHROW), are present in the Northwest Coast ecoregion. In the next section, descriptions are provided for priority habitats associated with Species of Greatest Conservation Need found in this ecoregion.

- Westside Lowlands Conifer-Hardwood Forest
- Westside Oak and Dry Douglas-fir Forest and Woodlands
- Montane Mixed Conifer Forest
- Subalpine Parkland
- Alpine Grasslands and Shrublands
- Agriculture, Pasture and Mixed Environs
- Urban and Mixed Environs
- Open Water: Lakes, Rivers and Streams
- Herbaceous Wetlands
- Westside Riparian-Wetlands
- Montane Coniferous Wetlands
- Coastal Dunes and Beaches
- Coastal Headlands and Islets
- Bays and Estuaries
- Inland Marine Deeper Waters
- Marine Nearshore
- Marine Shelf
- Oceanic

Figure 14.



Pacific Northwest Coast Ecoregion
Wildlife Habitat Classes
Westside Lowland Conifer/Hardwood
Westside Oak/Dry Douglas-Fir
Montane Mixed Conifer
Eastside Mixed Conifer
Lodgepole/Ponderosa Pine/Eastside Oak
Subalpine/Alpine Environs
Grasslands/Shrublands
Agriculture
Urban
Lakes/Rivers/Reservoirs
Wetlands
Coastal Land Environs
Bays/Estuaries

Priority Habitats in the Northwest Coast Ecoregion

The following six habitat types have been identified as the highest priority for current conservation action in the Northwest Coast ecoregion. Selection of these habitats as a priority was determined by their importance to regional Species of Greatest Conservation Need, as well as priorities outlined in the Northwest Coast Ecoregional Assessment and the subbasin plans listed in the "Major Plans" section above. More discussion on the selection of priority habitats is included in Chapter III: Statewide Overview and in Volume Two: Approach and Methods.

- Westside Lowlands Conifer-Hardwood Forest
- Westside Riparian-Wetlands
- Herbaceous Wetlands
- Coastal Dunes and Beaches
- Bays and Estuaries
- Marine Nearshore and Shelf

Westside Lowlands Conifer-Hardwood Forest

The particularly cool and wet conditions along the Pacific coast form a naturally-occurring narrow band of forest dominated by Sitka spruce and lodgepole pine, which are tolerant of persistent salt spray. The most widespread forest type in the Northwest Coast ecoregion is Douglas-fir/hemlock. Other widespread tree species include western redcedar, grand fir and western white pine. Riparian forests along rivers and streams are often dominated by broadleaf hardwood species such as bigleaf maple, black cottonwood and red alder.

Selected Species Closely Associated with Westside Lowlands Conifer-Hardwood Forest in the Northwest Coast Ecoregion

Fisher	Keen's myotis
Marbled murrelet	Northern spotted owl
Western bluebird	Marten
Puget (Blackmore's) blue butterfly	
Crowned tightcoil (snail)	

Westside Riparian-Wetlands

Westside riparian-wetlands habitat typically occupies patches or strips within a matrix of mature or young forests. It is most frequently associated with Westside lowlands conifer and hardwood forests, but is also found within agriculture, urban and coastal dunes and beaches habitats. In riparian areas associated with lowland forests, characteristic vegetation includes willows, alder, Oregon ash, black cottonwood, Pacific ninebark, Indian plum, vine maple, hazelnut, sedges and stinging nettle. Westside riparian-wetlands habitat also forms mosaics with or includes small patches of herbaceous wetlands, sphagnum bogs, forested woodlands and scrub-shrub wetlands. This habitat occurs not just along rivers, but at isolated sites as well.

Herbaceous Wetlands

Herbaceous wetlands exist as integral components of larger landscape ecosystems and are found in association with most other habitats occurring in the Northwest Coast ecoregion. They commonly form a pattern with Westside riparian-wetlands habitats along stream corridors. Herbaceous wetlands include ponds, marshes and seasonally flooded meadows. Although many freshwater wetlands are associated with lakes, rivers and other shorelines, many more are isolated from surface water bodies and owe their existence to groundwater discharge through springs, seeps and precipitation. Fens are of particular concern; these systems are especially susceptible to disturbance, including blocked drainage and the resultant change in water level. Along the ecoregion's extensive coastal deflation plain (areas where the ground has subsided), wetlands have developed between coastal dunes and beaches habitat and the Pacific Ocean.

Selected Species Closely Associated with Westside Riparian-Wetlands and/or Herbaceous Wetlands in the Northwest Coast Ecoregion

Great blue heron	Van Dyke's salamander
Trumpeter swan	Western grebe
Western toad	Columbia torrent salamander
Fisher	Olympic mudminnow
Makah (Queen Charlotte) copper butterfly	
Dunn's salamander	

Coastal Beaches and Dunes

Dunes: Much of the south Pacific coast is backed by dry, shifting sand dunes and ephemeral pools, subject to salty winds. Dune segments form spits or peninsulas at the mouth of Grays Harbor, Willapa Bay and the Columbia River. The dunes' shapes are controlled by sand supply, wind, water and stabilization by plants. Wind plays an important role in shifting the dunes. Foredunes, closest to the ocean, form an important defense against ocean storm damage and very high tides, and the troughs between the foredunes and the inner dunes hold groundwater reserves.

Beaches: Much of the western coast of the ecoregion in Washington, from Point Grenville to the mouth of the Columbia River, is composed of beaches that were historically nourished primarily by sediment from the Columbia River. The sand is constantly stirred by strong wave action, which results in a moveable substrate unsuitable for attachment by large plant species shoreward of the dunes. Beds of surf grass, a seed plant that flowers and pollinates itself underwater, grow in gravelly areas that are partially covered with sand. Where gravel dominates the substrate, rockweed is not uncommon. Eelgrass and surf grass beds thrive in pocket beaches. Further shoreward near the base of the dunes where wave action is minimal, beach silvertop and beach primrose can be found.

Selected Species Closely Associated with Coastal Beaches and Dunes in the Northwest Coast Ecoregion

Snowy plover	Streaked horned lark
Siuslaw sand tiger beetle	Oregon silverspot butterfly

Bays and Estuaries

The three major estuaries of the Northwest Coast ecoregion are the shallow coastal embayments of Grays Harbor and Willapa Bay, and the Columbia River estuary. Their shorelines are characterized by small cities and towns, extensive farms and dairy lands, and shellfish aquaculture. Most shorelines are in private ownership with the exception of Willapa Bay and Grays Harbor, where portions lie within the Willapa and Grays Harbor National Wildlife Refuges.

Grays Harbor: the Wishkah, Chehalis, Elk, Humptulips and other rivers feed Grays Harbor, a shallow estuary encompassing 58,000 acres. It is an important nursery ground for juvenile salmon and passageway for returning adults. One of the most important staging areas for shorebirds along the west coast of North America, this estuary provides a critical refueling point for western sandpipers and other shorebirds migrating between their northern breeding grounds and winter grounds to the south. In 1988, approximately 1500 acres was designated as the Grays Harbor National Wildlife Refuge, which is managed by the U.S. Fish and Wildlife Service. In 1996, the Grays Harbor estuary was recognized as a Western Hemisphere Shorebird Reserve Network site of hemispheric importance.

Willapa Bay: Willapa Bay is the largest of Washington's estuaries and covers roughly 129 miles of shoreline. Rivers such as the North and the Willapa drain over 680,000 acres of Willapa Bay watershed. Approximately half of Willapa Bay as measured at high tide becomes exposed at low tide, thus creating around 47,000 acres of intertidal area. The twice-daily tidal change exposes large sand or mudflats adjacent to emergent salt marshes. These mudflats are typically empty of emergent vegetation, but support eelgrass and benthic invertebrates, which are essential food for higher-order organisms.

> *November 18, 1805.* Clark: I set out with 10 men and my man York to the Ocian by land...the waves appear to brake with tremendious force in every direction quite across...a large Sand bar lies within the mouth nearest to point Adams which is nearly covered at high tide. men appear much Satisfied with their trip beholding with astonishment the high waves dashing against the rocks & this emence Ocian.

Columbia River Estuary: The Columbia River estuary is the largest in the Pacific Northwest at 147 square miles. Unlike other large estuaries in the ecoregion, the open ocean influence is considerable. Large vessels involved in world trade navigate through the estuary enroute to several ports upstream, the largest of which is Portland, Oregon. Only a moderate proportion of the total estuary is intertidal. The estuary is of key significance to waterfowl, anadromous fish and Columbia white-tailed deer, a federally-listed endangered species. Marsh habitats were once more extensive, but large areas have been diked and are now used for agricultural purposes.

Selected Species Closely Associated with Bays and Estuaries in the Northwest Coast Ecoregion	
Brant	Common loon
Greater scaup	Great blue heron
Northern pintail	Marbled godwit
Surf scoter	Purple martin
Western grebe	Surfsmelt
Pacific sand lance	Lower Columbia steelhead
Red knot	Columbia white-tailed deer

Marine Nearshore and Shelf

The outer coast of Washington is oriented in a roughly north-south direction for about 150 miles from Cape Flattery at the mouth of the Strait of Juan de Fuca to Cape Disappointment at the mouth of the Columbia River. The coast is flanked by a relatively shallow, flat submerged area of land under the Pacific Ocean called the continental shelf. This shelf extends offshore to a depth of approximately 600 feet (100 fathoms). Although the earth's coastal shelf waters comprise only about seven percent of the total ocean area, they support more than 90 percent of the fisheries because of the high concentration of plankton that feed fish larvae and their prey. The sea floor, which in large part determines the plant and animal life common to the area, can be soft-bottomed or rocky.

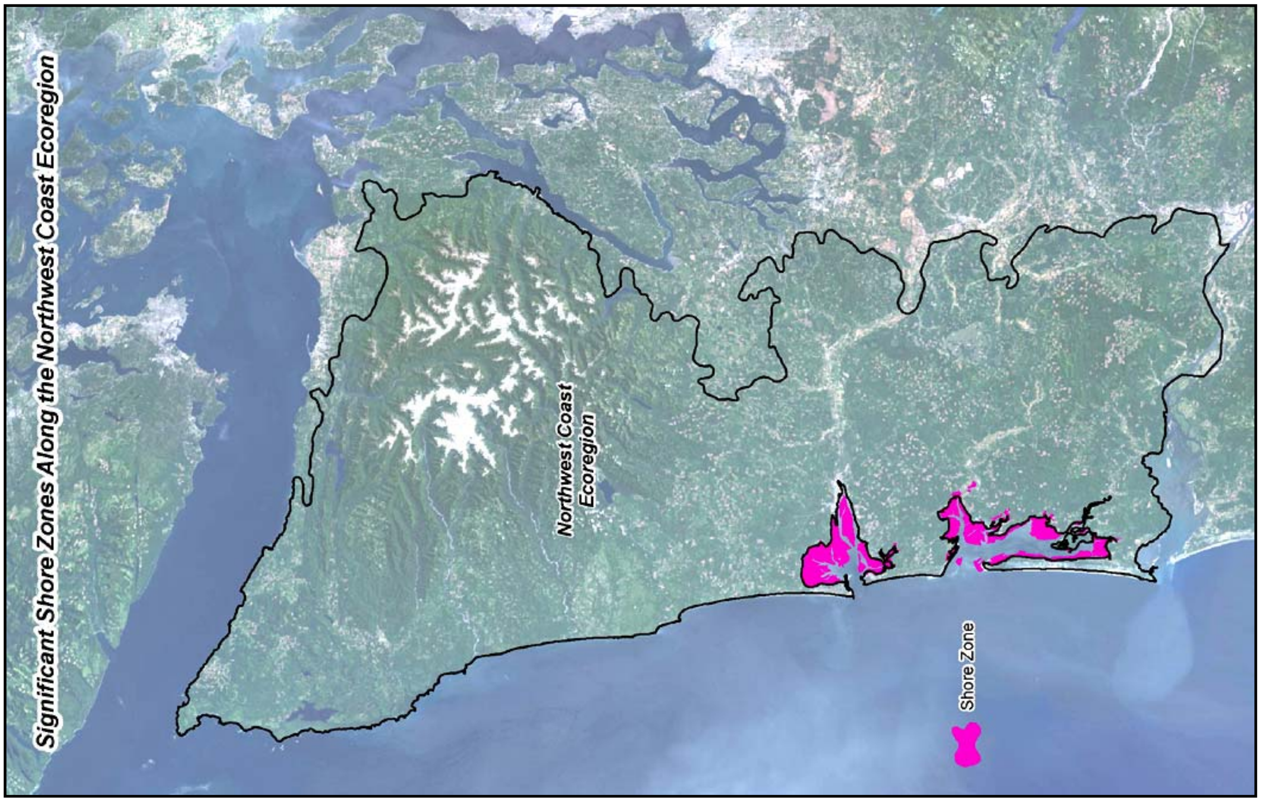
Coastal waters: Giant kelp beds float along open coasts in waters about 15 to 90 feet deep. These large brown seaweeds are so thick and well anchored to the sandy bottom that they significantly moderate wave action, helping to protect beaches from erosion. Bull kelp has long hollow stems ending in inflated gas bladders that keep it floating at the water's surface. Dense canopies of kelp provide habitat to coastal animals including the giant kelpfish, striped sea perch, and a small but expanding population of sea otters. Northern sea otters were native to the outer coast of Washington but were eliminated by hunting for the fur trade before 1910. Reintroduced from Alaska, the recovering population is listed as endangered in Washington State.

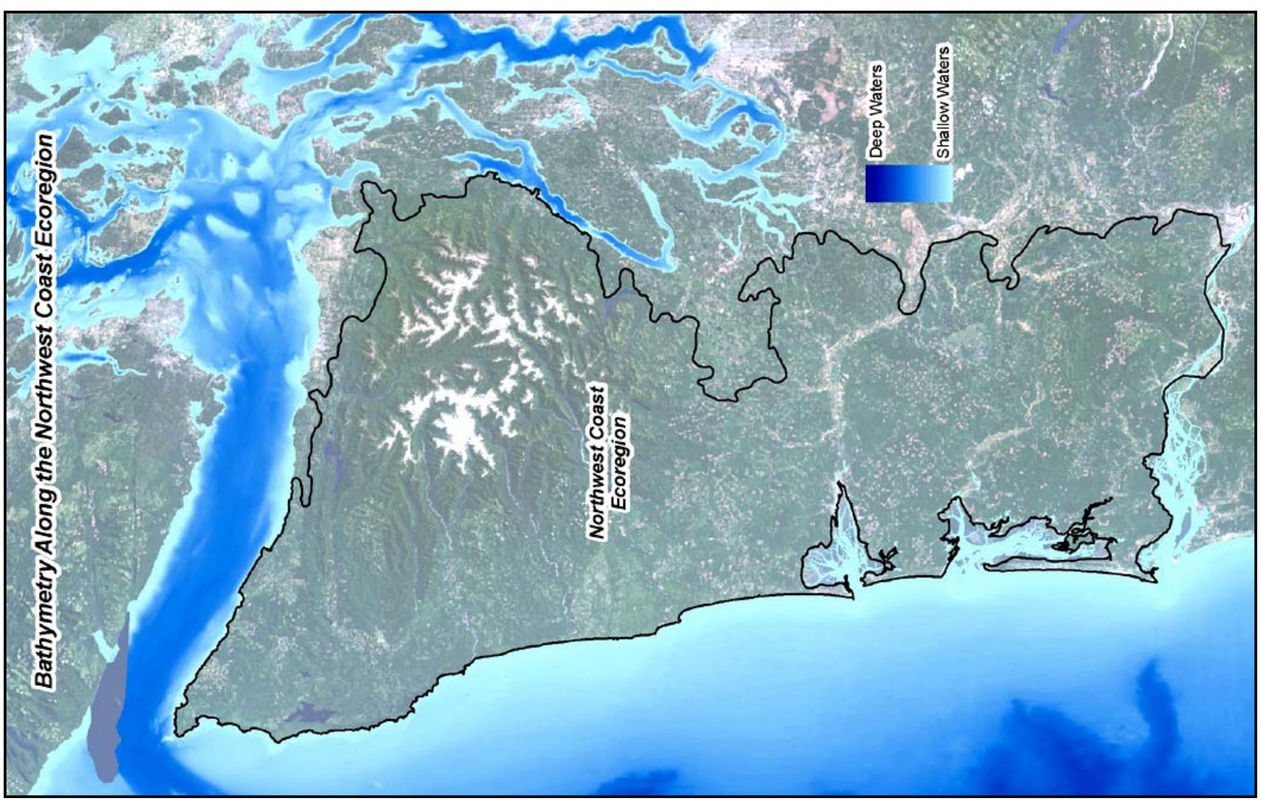
Rocky intertidal: Rocky substrate, moderate to strong wave and surf exposure, and a visible, vertical zonation pattern characterize rocky intertidal habitat. Diverse communities of invertebrates and algae grow in distinct horizontal bands dominated by rockweed, mussels or barnacles. Other common species include chitons, sea urchins, grazing snails, sea stars, hermit crabs and sea anemones, as well as worms and sea cucumbers that hide in crevices and under rocks. There are sheltered rocky shores that consist of vertical rock walls, bedrock outcrops, wide rock platforms and boulder-strewn ledges. These are usually found along sheltered bays or along the inside of bays and coves. Gravel, cobble and boulder beaches are usually narrow and steep. Kelps grow in abundance during the spring and summer; their biomass supports not only the rocky intertidal habitat, but soft-bottom habitats as well. See Figure 15 for a map depicting marine features of the Northwest Coast ecoregion.

Selected Species Closely Associated with Marine Nearshore and Shelf Habitats in the Northwest Coast Ecoregion

Common loon	Common murre
Rock sandpiper	Marbled murrelet
Steller sea lion	Sea otter
Surf scoter	Western grebe
Cassin's auklet	Killer whale
Pacific harbor porpoise	Tufted puffin
Copper rockfish	Black oystercatcher

Figure 15. Marine features of the Northwest Coast ecoregion.





CONSERVATION PROBLEMS

Clearcut logging, road building and the fragmentation and conversion of natural habitats by commercial plantation forests, agriculture and expanding urban and residential development have seriously impacted this ecoregion, especially over the last 50 years.

Logging and Associated Road Building

Logging and associated road building on both private and public forest lands was intensive for many years, until the federal ESA listing of the northern spotted owl in 1990 and subsequent adoption of the Northwest Forest Plan. Even though logging on the Olympic Peninsula and Willapa Hills has slowed in recent years, especially on public land, it remains the most significant potential long-term impact on wildlife and habitat in the Northwest Coast ecoregion.

Timber harvest changes upland and riparian vegetative cover and influences snow accumulation and melt rates. It may also contribute to fragmentation of habitat, soil erosion, sediment delivery to creeks and streams, and channel simplification from loss of large woody debris recruitment within the riparian zone. Native plant communities may be replaced by alien species following timber harvest. Road building associated with timber harvest may further exacerbate erosion and sedimentation, habitat fragmentation, and creates barriers to fish passage if culverts are impassable.

The future condition and value of the ecoregion's terrestrial and aquatic habitats will depend to a large degree on how intensively they are managed for timber and other uses in the future. The Northwest Forest Plan brought major improvements in streamside protections on federal lands. The recent State Forest and Fish Agreement has improved the outlook for this habitat type on private lands. However, riparian habitats that were altered and degraded in the past due to logging and road building need restoration.

Invasive Alien Plants and Animals

Invasive alien plants and animals are a significant threat to biodiversity, second only to habitat loss. They are introduced in a number of ways, including hitchhiking on horses, boats, cars, trucks and ships, travel on ocean currents, being imported in aquaculture and horticultural products and the pet/aquarium trade, through ballast water from large ships, and accidental releases from research institutions and laboratories. Invasive plants displace native vegetation, resulting in the loss of habitat diversity and function. They can severely impact native plant and animal communities and alien grasses and shrubs can add significantly to the fire fuel load, resulting in hotter wildfires that increase damage to native vegetation. The number and abundance of introduced species in an ecoregion is an indicator of declining ecosystem health. A number of nuisance species are especially problematic in the Northwest Coast ecoregion.

Habitat Loss and Modification

Marine, estuarine and tidally influenced freshwater rivers and streams are associated with the Pacific Ocean, Grays Harbor and Willapa Bay. These highly productive ecosystems have been most impacted by human activity: over 80 percent of the state's estuaries have been lost. Of those remaining, all have been degraded to some degree. Although population growth in the Northwest Coast ecoregion is much less than in the Puget Trough ecoregion, human activity over the last 100 years has significantly altered coastal estuaries and has resulted in significant habitat loss or modification. An estimated 40 percent of the original

Columbia River estuary has also been converted to dry land by diking and filling. Overall, development since the mid-19th century has resulted in a loss of 77 percent of the tidal swamps, 62 percent of the tidal marshes and 7 percent of the tidal flats in the Columbia River estuary. Dams, dikes, dredging, and agricultural and forest practices have also contributed to this loss and alteration of habitat.
Beaches, and especially dunes, are fragile, unstable and dynamic environments. Bulkheads, roads and other types of construction, if not properly designed and constructed, reduce the supply of sediments as well as the wind and wave action that form and help maintain beach and dune structure.

Habitat Fragmentation

Wildlife species depend on corridors within and between wetlands, riparian areas and uplands for critical habitat. If the habitat becomes fragmented due to logging or development, the survival of certain species may be jeopardized. High-quality regionally rare wetlands such as peatlands and forested wetlands are especially sensitive to disturbance and take a very long time to regenerate.

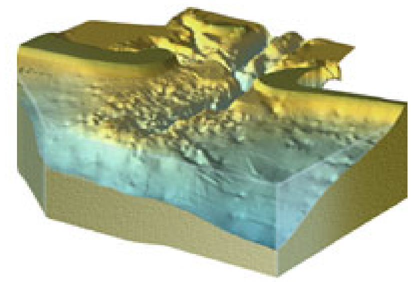
Urban Development

Urban areas in this ecoregion are largely concentrated near estuaries and bays. Although the Northwest Coast is not growing as fast as some other regions of the state, urbanization has significantly impacted the natural system in some areas, especially Grays Harbor, and residential and commercial development is expanding in all coastal areas. Population growth and residential development is anticipated to continue at significant rates and the impacts of development practices and growth will result in irreversible loss of fish and wildlife habitat, especially estuarine and freshwater ecological processes._ Low to medium density development along the ocean front is expanding, especially in coastal communities such as Westport, Ocean shores and Long Beach. This development is altering natural beach and dune-building processes.

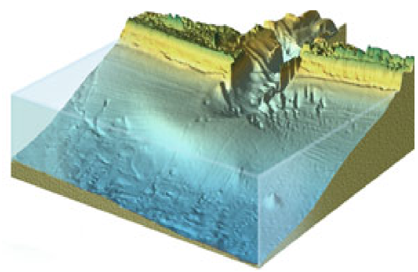
Shoreline Armoring

Shoreline armoring is increasing with residential and commercial development and can increase erosion by interfering with natural wave action. Bulkheads and other structures force waves to wash away the sand and small pebbles in front of them and the result is often a rocky beach lacking the fine sediment required for survival by many beach-dwelling plants and animals. See Figure 16 for an example of shoreline armoring effects.

Figure 16.



Grays Harbor:
before jetty construction, 1900
Ebb-tidal currents moved sand out of the estuary. Longshore currents carried this sand north and south along the coast and deposited it on beaches.



Grays Harbor:
after jetty construction, 1999
Sand from the ebb-tidal delta piled onshore, creating new land, a deeper nearshore zone, and a steeper shoreface.

Environmental Contaminants

Estuaries are especially vulnerable to nonpoint source pollution from water-based or land use activities, surface water runoff from agricultural lands, urban areas and forest lands; subsurface or underground sources; and discharges from boats or other marine vessels. Although degradation from any single activity or site usually will not violate water quality standards, the cumulative effects of all the activities in a watershed can result in significant water quality problems. The sources of pollution include untreated stormwater (particularly with heavy metals), septic leachate, sediment, nutrient and pesticide (weed and feed) fluxes, toxins, garbage, off-road vehicles and groundwater pumping. Impairment of water quality or quantity will particularly affect plant species diversity and amphibian and bird populations. Offshore oil spills have occurred in recent years, and as petroleum shipping activity increases, it poses an increasing threat to marine and shore-dwelling wildlife species.

Increasing Recreational Demand

As the Northwest Coast ecoregion's population increases, so does the demand for water-related opportunities, especially on public land and beaches. Increasing public demand results in shoreline development of buildings, jetties and moorage facilities, all of which may destroy habitat and cause both point and nonpoint pollution.

The following additional habitat and species conservation problems have been identified in the Northwest Coast Ecoregion:

Wildlife species and population problems: includes disease, pathogens, competition, food scarcity, predation, overharvest, and limited population size and distribution.

- Populations of killer whale, Steller sea lion, sea otter, Columbian white-tailed deer, common loon, bald eagle, peregrine falcon, snowy plover, marbled murrelet, northern spotted owl, pygmy whitefish, Olympic mudminnow and Oregon silverspot have declined to the point that they are listed as endangered, threatened or state sensitive. Populations of gray wolf and fisher have become extirpated.
- Small population sizes and loss of genetic diversity are problems in Olympic marmot, southern resident killer whale, sea otter, marten, Columbian white-tailed deer, Van Dyke's salamander and Columbia torrent salamander, and are a concern in other species reduced to isolated populations, including Keen's myotis, pygmy whitefish, Olympic mudminnow, western floater, winged floater, Oregon floater, western ridged mussel, western pearlshell and Oregon megomphix.
- Competition for food exists between Columbian white-tailed deer and elk.
- Visitor feeding of coyotes may increase predation on Olympic marmot.
- Predation by gulls, eagles, and other avian and mammalian predators at breeding colonies can negatively impact common murre and Cassin's auklet.
- Predation by sea lions, seals, lingcod, and other piscivorous fish contribute significant amounts of mortality to copper rockfish, greenstriped rockfish, quillback rockfish, China rockfish, tiger rockfish, bocaccio rockfish, canary rockfish, redstriped rockfish and yelloweye rockfish.
- Historic declines in salmon and possibly other fish likely reduce prey availability for southern resident killer whale.
- Commercial fisheries harvest may reduce important prey for Steller sea lion and common murre.
- Incidental mortality from gill nets, salmon trolls and other fishery gear affects Pacific harbor porpoise, Steller sea lion, sea otter, western grebe, common murre, marbled murrelet, ancient murrelet and Cassin's auklet.
- Illegal take occurs for bald eagle and migrating and spawning fish species of concern.
- Northern pintail, greater scaup, lesser scaup, long-tailed duck, scoters (black, surf, white-winged) and bull trout are susceptible to overharvest.
- Overharvest, as bycatch by both commercial and recreational fishermen, is an important source of mortality in copper rockfish, greenstriped rockfish, quillback rockfish, China rockfish, tiger rockfish, bocaccio rockfish, canary rockfish, redstriped rockfish, yelloweye rockfish, green sturgeon and bull trout.
- Historic declines of native fish populations limit the availability of hosts for parasitic larval stages of western floater, winged floater and Oregon floater.

Lack of biological information on species and habitats:

- Adequate information is lacking on the population status of state candidate species, including Keen's myotis, Townsend's big-eared bat, Mazama pocket gopher, Pacific harbor porpoise, western grebe, tule greater white-fronted goose, northern goshawk, golden eagle, common murre, Cassin's auklet, tufted puffin, Vaux's swift, pileated woodpecker, purple martin, Dunn's salamander, Van Dyke's salamander, Columbia torrent salamander, western toad, river lamprey, copper rockfish, greenstriped rockfish, quillback rockfish, China rockfish, tiger rockfish, bocaccio rockfish, canary rockfish, redstriped rockfish, yelloweye rockfish, eulachon, Makah (Queen Charlotte) copper, Johnson's hairstreak, and valley silverspot.

- Additional distributional data are needed for Dunn's salamander, Van Dyke's salamander, western toad, green sturgeon, bull trout, Siuslaw sand tiger beetle, Makah (Queen Charlotte) copper, Johnson's hairstreak, Puget Sound fritillary, valley silverspot, western floater, winged floater, Oregon floater, western ridged mussel, western pearlshell, and Oregon megomphix.
- There is a lack of information on whether marten and crowned tightcoil continue to exist in the ecoregion.
- Data are needed on limiting factors, habitat associations, demography, or food habits for many species, including Keen's myotis, Mazama pocket gopher, southern resident killer whale, fisher, marbled murrelet, pileated woodpecker, Dunn's salamander, Van Dyke's salamander, Columbia torrent salamander, river lamprey, Pacific lamprey, copper rockfish, greenstriped rockfish, quillback rockfish, China rockfish, tiger rockfish, bocaccio rockfish, canary rockfish, redstriped rockfish, yelloweye rockfish, eulachon, Siuslaw sand tiger beetle, Puget Sound fritillary, western floater, winged floater, Oregon floater, western ridged mussel, western pearlshell, crowned tightcoil, and Oregon megomphix.
- Information is needed on the causes of decline for western toad, river lamprey, and Pacific lamprey.
- Standard survey protocols are needed to determine the abundance and trends of great blue heron and marbled murrelet.
- The effects of plastic pollution and ingestion at sea need investigation in tufted puffins.
- Information on the impacts of land use practices and forest practices is lacking for Columbia torrent salamander.
- Better data are needed on the amount of gene flow among bull trout populations.
- The impacts of river dredging on spawning habitat and the survival of incubating eggs and larvae needs study in eulachon.
- Annual quantitative stock assessments of eulachon are needed to estimate desirable harvest rates.
- Adequate harvest statistics are generally lacking for sport and commercial surfsmelt fisheries.
- Taxonomic relationships need investigation in western toad, western floater, winged floater, Oregon floater, western ridged mussel, western pearlshell, and crowned tightcoil.
- There is a shortage of adequate spatial inventory and assessment data on most habitat types.
- There is an absence of baseline data on the habitat values and functions of natural wetlands and a poor understanding of the status of resident macroinvertebrates in aquatic systems.

<u>Habitat loss, conversion, fragmentation and degradation:</u>

- Only 3% of western Washington forest is currently in the old growth age class and nearly all of it is in high elevation national forests or national parks. Maintenance of old growth forest across the landscape is important for at least 1,000 species. Loss and fragmentation of late-successional coniferous forests negatively impacts fisher, northern goshawk, marbled murrelet, northern spotted owl, pileated woodpecker, and Johnson's hairstreak butterfly.
- Grassy and herbaceous balds are rare patch habitats distributed in low and high elevation forests. They often have associated rare species that are vulnerable to certain forest practices and recreation.
- Suburban sprawl is a concern for resource managers as indicated by the growing number of ranchettes and residential subdivisions in previous managed forest and

cropland. Development often occurs near lakes or streams and poses an increased threat of fire and impacts to water quality.

- Shoreline timber harvest and development may destroy nesting, foraging, or roosting sites for common loon, great blue heron, and bald eagle.
- Human development and logging negatively impacts forest habitat for northern goshawk and Oregon megomphix.
- Forest clearing may destroy habitat for Van Dyke's salamander and may degrade habitat for Townsend's big-eared bat.
- Reclamation of abandoned mines may destroy critical maternity roosts and hibernacula for Townsend's big-eared bat.
- Flooding of riverine areas temporarily damages the habitat of Columbian white-tailed deer.
- Drainage and degradation of wetlands and development of agricultural lands have reduced winter habitat and food abundance for trumpeter swan, tule greater white-fronted goose, northern pintail, and lesser scaup.
- Wetland conversion and drainage may destroy habitat for Olympic mudminnow.
- Conversion of coastal bogs negatively impacts Makah (Queen Charlotte) copper.
- Urbanization and industrialization of coastal shorelines, bays and estuaries have degraded some winter habitat and reduced food abundance for long-tailed duck and scoters.
- Declines of eelgrass reduce foraging habitat for brant.
- Loss of or damage to spawning beaches caused by armoring, deforestation, erosion, or oiling of shorelines affects populations of surfsmelt and Pacific sand lance.
- Degradation of streams and rivers due to inappropriate forest management and agricultural practices and human development is harmful to bull trout.
- Future modifications to the Tokeland marina could eliminate the only important roost site for willet and marbled godwit in the ecoregion.
- Insufficient nesting sites limit population growth of purple martin and western bluebird.
- Commercial and residential development reduces and degrades open forest and edge habitats used by western bluebirds.
- Degradation of open areas with lupine negatively impacts Puget (Blackmore's) blue butterfly.
- Coastal dune stabilization has altered the plant communities used by Oregon silverspot.
- Degradation of native grasslands and forest balds damages the habitat of valley silverspot.
- The small number of haul-out sites forces Steller sea lion to concentrate at a few important locations.

<u>Incompatible land management practices</u>:

- Various timber cutting, snag removal, and replanting practices have degraded or eliminated habitat for a variety of species, including Keen's myotis, bald eagle, marbled murrelet, northern spotted owl, Vaux's swift, pileated woodpecker, and western bluebird.
- Forestry practices that result in the removal of forest overstory above talus, loss of large woody debris, and alteration of streams destroy habitat for Dunn's salamander and Van Dyke's salamander.
- Forestry practices that reduce the occurrence of mistletoe likely affect Johnson's hairstreak.
- Logging activities that elevate stream temperature, alter hydrology, and increase stream sedimentation eliminate aquatic habitat for Columbia torrent salamander.

- The spraying of forests with BTk to kill tussock moths and budworms has caused population losses in Johnson's hairstreak butterfly.
- Forestry practices that cause declining moisture conditions on forest floors and a loss of coarse woody debris in stands of bigleaf maple and mixed hardwood-conifer stands reduce habitat for Oregon megomphix and other invertebrates.
- Modern agricultural practices often reduce the quality, patch size and connectivity of wildlife habitat in farmlands.

<u>Alien and invasive plant and animal species</u>:

- Encroachment of non-native species such as reed canary grass, purple loosestrife, domestic pets, bullfrogs and rats is a threat to the ecology of native wetland and riparian ecosystems.
- Saltmeadow cordgrass (*Spartina patens*) generally occupies the upper salt marsh zone, but also colonizes sand dunes. It is an aggressive noxious weed that severely disrupts the ecosystems of native shoreline habitats. European beachgrass (*Ammophila arenaria*) is an invasive, introduced grass brought in for dune stabilization. It poses the biggest threat for dune habitat, impacting western snowy plover and streaked horned lark nesting areas.
- A large portion of Willapa Bay's mudflats have been invaded and drastically altered by the introduced cordgrass *Spartina alterniflora*, which aggressively colonizes mudflats and salt marshes, displacing native plant and animal species and altering the ecological landscape by transforming mudflats into salt marshes. As of 2003, 32% (15,040) acres of the intertidal area of Willapa Bay was infested with *Spartina*.
- Reed canary grass thrives in reservoirs and wetland stream outlets where water levels fluctuate and directly affects habitats that support 27 Washington state-listed plant species. A number of native fish, amphibians and other animals are not well adapted to spawn or reproduce in reed canary grass thickets.
- Species such as the European green crab, the Asiatic clam and the Japanese oyster drill pose threats to both native wildlife species and the shellfish industry.
- There is considerable evidence of competition for nesting territories between northern spotted owl and expanding populations of barred owl.
- Non-native European starlings and house sparrows compete extensively for nest cavities in snags and birdhouses with purple martins and western bluebirds.
- Dense growth of European beachgrass reduces habitat for snowy plover, streaked horned lark, and Siuslaw sand tiger beetle.
- Habitat changes caused by the invasion of non-native plants have negatively affected dog star skipper, Puget (Blackmore's) blue butterfly, Puget Sound fritillary, Oregon silverspot, and valley silverspot.
- The spread of *Spartina* spp. threatens the quality of foraging habitat for red knots visiting Willapa Bay.
- Predation by introduced fish negatively impacts pygmy whitefish and Olympic mudminnow.
- Non-native fish such as brook trout pose a threat to bull trout through competition, hybridization and predation.
- Competition from introduced clams such as the Asian clam and other aquatic invaders affects western floater, winged floater, and Oregon floater.

Human disturbance and recreational impacts:

- Human disturbance can disrupt the maternity roosts and hibernacula of Pacific Townsend's big-eared bat, breeding colonies of great blue heron, common murre, Cassin's auklet, and colonies of Olympic marmot.
- Shoreline development, recreational boating and fishing and other forms of human presence may disturb or displace nesting or foraging birds, including common loon, great blue heron, brant, greater scaup, bald eagle, black oystercatcher.
- Vessel disturbance and noise disturbs killer whales and Pacific harbor porpoise
- Nesting peregrine falcons are vulnerable to disturbance from human activities, such as blasting and timber cutting.
- Backcountry recreation such as motorized vehicles and hiking may disturb or displace golden eagle and peregrine falcon.
- Mortality of lesser scaup from fishing nets and lines may be substantial.
- Beach walkers, pets, and cars may disturb snowy plover and streaked horned lark and destroy their nests.
- Cars compact beach soils, thereby reducing prey availability for snowy plover.
- Trampling and crushing by people and vehicles may cause mortality in Siuslaw sand tiger beetle along coastal beaches.
- Recreational activities such as offroad recreational vehicles, horses, mountain bikes, and even hikers can create unauthorized trails that disturb soil and allow invasive plants to establish.

Environmental contaminants:

- Ingestion of lead fishing sinkers by common loon and lead shot by trumpeter swan, bald eagle, and golden eagle results in lead poisoning.
- High concentrations of environmental contaminants such as PCBs, PBDEs, dioxins, furans, and heavy metals) have been found in killer whale and Pacific harbor porpoise.
- Ship-related oil spills pose a significant risk to killer whale, Pacific harbor porpoise, Steller sea lion, sea otter, commons loon, western grebe, brant, long-tailed duck, snowy plover, black oystercatcher, willet, marbled godwit, red knot, rock sandpiper, arctic tern, common murre, marbled murrelet, ancient murrelet, Cassin's auklet, tufted puffin, and streaked horned lark.
- Chemical and heavy metal contamination of winter food supplies may affect the reproductive success or survival of tule greater white-fronted goose, brant, greater scaup, long-tailed duck, and scoters (black, surf, white-winged).
- Accumulation of persistent organic pollutants, endocrine disrupting chemicals, and heavy metals may disrupt the growth and reproduction of copper rockfish and quillback rockfish.
- Aquatic pollution is harmful to green sturgeon, western floater, winged floater, Oregon floater, western ridged mussel, and western pearlshell.
- Piscicides such as rotenone that are used for eliminating undesirable fish species from lakes and streams also kill pygmy whitefish.
- Roadside herbicide spraying can damage the habitat of dog star skipper.
- Toxic contaminants have been found in sediment and fish tissue. Levels of PCBs, DDE and dioxin are high enough in the ecoregion that they may be linked to reproductive failure in bald eagle, mink and river otters.

Incompatible transportation and energy development:

- Roads placed near great blue heron rookeries may result in site abandonment.
- Roads located near breeding sites may cause highway mortality in western toad.
- Highway mortality affects Columbian white-tailed deer.
- Road building may isolate populations of Dunn's salamander and Van Dyke's salamander.
- Golden eagle and other raptors can be electrocuted on power lines.

Inadequate water quantity and quality:

- Increased sedimentation, increased water temperature, and reduced water quality caused by logging, road construction, improperly managed grazing, and overdevelopment negatively impacts Columbia torrent salamander, green sturgeon, pygmy whitefish, western floater, winged floater, Oregon floater, western ridged mussel, and western pearlshell.
- Dams and other passage barriers limit the movement of river lamprey, Pacific lamprey, green sturgeon, and bull trout.
- Fluctuating water levels and dam presence can degrade or eliminate habitat for western floater, winged floater, and Oregon floater.

CONSERVATION ACTIONS

Conserve and recover wildlife species and populations: includes population management, protect known populations, augment and reintroduce populations, control and monitor mortality and enhance food/prey.

- Implement recovery actions for the Steller sea lion, fisher, sea otter, Columbian white-tailed deer, northern spotted owl, snowy plover, marbled murrelet, bull trout, and Oregon silverspot butterfly.
- Survey potential nesting habitat prior to timber harvest and follow existing federal and state statutes regarding occupancy to protect the marbled murrelet and spotted owl.
- Implement the Northwest Forest Plan for managing northern spotted owl habitat.
- Prepare or complete recovery plan for the southern resident killer whale, northern spotted owl, and bull trout.
- Complete the Washington Bat Conservation Plan.
- Develop management plans for state sensitive species, including common loon, peregrine falcon, pygmy whitefish, and Olympic mudminnow.
- Develop management recommendations for dog star skipper.
- Continue transplanting Columbian white-tailed deer to appropriate sites along the Columbia River to increase numbers and distribution.
- Reintroduce fisher into areas of suitable habitat on the Olympic peninsula and Oregon silverspot butterflies to coastal sites on the Long Beach Peninsula, as called for in recovery plans and feasibility studies.
- Investigate opportunities for translocating or reintroducing Mazama pocket gopher, marten, winged floater, Oregon floater, western ridged mussel, western pearlshell, crowned tightcoil, and Oregon megomphix.
- Implement salmon recovery strategies to enhance the prey base for southern resident killer whale and bald eagle.
- Establish and implement fisheries management objectives that are compatible with bull trout recovery.
- Use special hunts and fencing to minimize competition between Columbian white-tailed deer and elk at Julia Butler Hansen National Wildlife Refuge and other sites along the Columbia River.
- Continue limited coyote control to reduce predation on Columbian white-tailed deer fawns.
- Conduct predator control programs at nesting colonies of common murre and Cassin's auklet, as necessary.
- Maintain conservative hunting regulations for northern pintail, greater scaup, lesser scaup, long-tailed duck, and scoters (black, surf, white-winged).
- Implement and enforce restricted harvest regulations for green sturgeon.
- Develop and implement a management plan to control the harvest of eulachon.
- Reduce opportunities for harvest and restrict retention by fishermen to protect copper rockfish, greenstriped rockfish, quillback rockfish, China rockfish, tiger rockfish, bocaccio rockfish, canary rockfish, redstriped rockfish, and yelloweye rockfish.
- Monitor harvest levels of surfsmelt.
- Manage fisheries harvests to reduce competitive impacts on southern resident killer whale, Steller sea lion, common murre, marbled murrelet, ancient murrelet, Cassin's auklet, and tufted puffin.
- Install single-cavity birdhouses and gourds to enhance populations of purple martin.
- Provide nest boxes to western bluebirds as a short-term solution to limited cavity availability.

- Establish marine protected areas or other types of area-gear restrictions to restore populations of copper rockfish, greenstriped rockfish, quillback rockfish, China rockfish, tiger rockfish, bocaccio rockfish, canary rockfish, redstriped rockfish, and yelloweye rockfish.
- Identify and protect sites for Olympic mudminnow, dog star skipper, ***valley silverspot***, crowned tightcoil, and Oregon megomphix.

Conduct research, assessment and monitoring: includes species and habitat distribution, abundance, limiting factors, suitable habitat and population trends.

- Determine the status of candidate species, including Townsend’s big-eared bat, Keen’s myotis, Mazama pocket gopher, Pacific harbor porpoise, western grebe, northern goshawk, golden eagle, common murre, Cassin’s auklet, tufted puffin, Vaux’s swift, pileated woodpecker, purple martin, Dunn’s salamander, Van Dyke’s salamander, Columbia torrent salamander, western toad, river lamprey, copper rockfish, greenstriped rockfish, quillback rockfish, China rockfish, tiger rockfish, bocaccio rockfish, canary rockfish, redstriped rockfish, yelloweye rockfish, eulachon, Makah (Queen Charlotte) copper, Johnson’s hairstreak, and valley silverspot.
- Monitor population trends of Steller sea lion, fisher, sea otter, Columbian white-tailed deer, northern spotted owl, snowy plover, marbled murrelet, bull trout and Oregon silverspot butterfly to determine whether recovery objectives are being met.
- Monitor post-downlisted populations of peregrine and bald eagle for signs of decline that could result from bio-accumulation of contaminants or other factors.
- Monitor populations of rockfish (copper, quillback, China, tiger, bocaccio, canary, redstriped, yelloweye) using multiple methods, including ones not dependent on harvest.
- Seek reports of sightings of southern resident killer whales along the outer coast and of martens on the Olympic Peninsula.
- Gather further distribution data on Keen’s myotis, Townsend’s big-eared bat, Mazama pocket gopher, southern resident killer whale, Dunn’s salamander, Van Dyke’s salamander, western toad, river lamprey, Pacific lamprey, copper rockfish, greenstriped rockfish, quillback rockfish, China rockfish, tiger rockfish, bocaccio rockfish, canary rockfish, redstriped rockfish, yelloweye rockfish, bull trout, green sturgeon, Olympic mudminnow, surfsmelt, Pacific sand lance, Siuslaw sand tiger beetle, Makah (Queen Charlotte) copper, Johnson’s hairstreak, Puget Sound fritillary, western floater, winged floater, Oregon floater, western ridged mussel, western pearlshell, crowned tightcoil and Oregon megomphix.
- Identify important nearshore foraging areas along the coast for marbled murrelet.
- Identify roost sites and hibernacula of Townsend’s big-eared bat.
- Conduct habitat selection studies at multiple spatial scales for Keen’s myotis, marbled murrelet, Vaux’s swift, river lamprey, Pacific lamprey, green sturgeon, eulachon, western floater, crowned tightcoil, and Oregon megomphix.
- Continue to investigate the levels and effects of contaminants on killer whales and Pacific harbor porpoise.
- Investigate the foraging ecology of Steller sea lion and the available prey base.
- Monitor predator (e.g. seals, sea lions and piscivorous fish) population trends and food habits, especially in areas of rockfish recovery, copper rockfish, greenstriped rockfish, quillback rockfish, China rockfish, tiger rockfish, bocaccio rockfish, canary rockfish, redstriped rockfish, and yelloweye rockfish.

- Monitor populations of prey eaten by long-tailed ducks and scoters (black, surf, white-winged).
- Determine the causes of wintering population declines in western grebes and scoters (black, surf, white-winged).
- Investigate the conservation needs of Columbia torrent salamander.
- Identify the limiting factors in populations of river lamprey and Pacific lamprey.
- Determine the extent of mortality from gillnet fisheries in Pacific harbor porpoise, Steller sea lion, sea otter, western grebe, common murre, marbled murrelet, ancient murrelet, and Cassin's auklet.
- Improve identification methods to distinguish between river lamprey and Pacific lamprey.
- Identify all spawning beaches for surfsmelt and Pacific sand lance so they receive regulatory protection.
- Develop survey protocols to monitor the abundance of great blue heron, copper rockfish, greenstriped rockfish, quillback rockfish, China rockfish, tiger rockfish, bocaccio rockfish, canary rockfish, eulachon, and Pacific sand lance.
- Develop methods to track and measure reproductive contribution of localized populations of copper rockfish, greenstriped rockfish, quillback rockfish, China rockfish, tiger rockfish, bocaccio rockfish, canary rockfish, redstriped rockfish, and yelloweye rockfish.
- Evaluate whether existing forest management prescriptions are adequate to maintain populations of pileated woodpeckers.
- Develop habitat management recommendations for Oregon megomphix.
- Determine the amount of genetic diversity and gene flow among bull trout populations.
- Investigate the taxonomy of western toad, western floater, winged floater, Oregon floater, western ridged mussel, western pearlshell, and crowned tightcoil using genetic techniques and other analyses.
- Determine abundance, status, trend, distribution, and limiting factors of candidate species, including, Pacific Townsend's big-eared bat, Keen's myotis, Mazama pocket gopher, killer whale, Pacific harbor porpoise, sea otter, Steller sea lion, marten, Columbian white-tailed deer, great blue heron, tule greater white-fronted goose, northern goshawk, marbled murrelet, Vaux's swift, western bluebird, western toad, Dunn's salamander, Van Dyke's salamander, Columbia torrent salamander, river lamprey, Pacific lamprey, copper rockfish, greenstriped rockfish, quillback rockfish, China rockfish, tiger rockfish, bocaccio rockfish, canary rockfish, redstriped rockfish, yelloweye rockfish, green sturgeon, pygmy whitefish, eulachon, Olympic mudminnow, surfsmelt, Pacific sand lance, Siuslaw sand tiger beetle, dog star skipper, Makah (Queen Charlotte) copper, Johnson's hairstreak, Puget Sound fritillary, valley silverspot, western floater, winged floater, Oregon floater, western ridged mussel, western pearlshell, crowned tightcoil, Oregon megomphix.
- Research life history, population dynamics, limiting factors, dispersal, and impacts of forest practices and development and habitat needs at various scales as needed for Keen's myotis, tufted puffin, Vaux's swift, pileated woodpecker, Dunn's salamander, Van Dyke's salamander, Columbia torrent salamander, western toad, river lamprey, Pacific lamprey, copper rockfish, greenstriped rockfish, quillback rockfish, China rockfish, tiger rockfish, ***bocaccio rockfish***, canary rockfish, redstriped rockfish, yelloweye rockfish, green sturgeon, eulachon, Siuslaw sand tiger beetle, western floater, winged floater, Oregon floater, western ridged mussel,

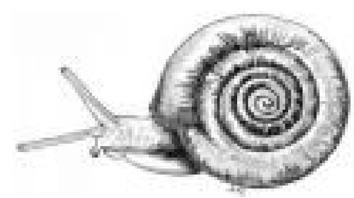
western pearlshell, crowned tightcoil, Oregon megomphix.

- Assess and map important habitats and areas of high biodiversity in the ecoregion using ecoregional assessments, local habitat assessments, Interagency Vegetation Mapping Project, and other habitat inventories and plans. Update ecoregional assessments every five years.
- Develop statewide land cover and threats data layers to improve connectivity between priority conservation areas.
- Identify and assess key connectivity areas and wildlife corridors between fragmented habitats and between protected areas. Restore habitat connectivity and wildlife corridors where appropriate on both public and private lands.
- Improve understanding of the ecological processes of seeps, bogs, wet meadows, forested wetlands, marshes, springs and other wetlands, and how they are impacted by human development.
- Conduct hydrologic studies that include water quantity and chemical budgets at wetlands known to be supporting rare and endangered species. Use this information to inform wetland management.
- Inventory and prioritize riparian habitat types and attributes needing protection and conservation.
- Identify important habitats for restoration and assess the feasibility of successfully restoring these sites. Include an evaluation of current and projected land use in and adjacent to potential restoration sites.
- Coordinate the collection and analysis of data on alien species, shoreline modifications, trends in kelp beds and other indicators of ecosystem health in Puget Sound.
- Develop a cohesive, priority-driven research program for westside grassland habitats that integrates university, agency and private researchers. Inventory important grassy and herbaceous balds. Work with land management agencies and private land owners to protect these habitats from disturbance and development.

Protect, restore and connect habitats:

- Maintain mature and late-successional coniferous forests from harvest to protect fisher, northern goshawk, marbled murrelet, northern spotted owl, Vaux's swift, and Johnson's hairstreak butterfly.
- Establish new protected areas where ecological gaps remain in the existing protected areas system on public land, especially in natural-origin forests in the Willapa Hills and on the Olympic Peninsula coastal plain.
- Manage timber harvest and fire management activities on state, private, and federal lands to perpetuate adequate amounts of habitat for the marbled murrelet and northern spotted owl.
- Protect rare habitat types such as grassy and herbaceous balds, snag patches, caves, cliffs, rocky outcrops, and talus.
- Continue to restore woodland, grassland, and wetland habitats along the Columbia River for Columbian white-tailed deer.
- Manage marine bays and estuaries to the reduce impacts of urbanization and industrialization, thereby protecting habitats used by brant, greater scaup, lesser scaup, long-tailed duck, scoters (black, surf, white-winged), and marbled murrelet.
- Protect eelgrass beds for brant by managing shoreline development and other human activities.
- Protect land near large great blue heron colonies and known marbled murrelet nesting areas through acquisitions, conservation easements and agreements, and management plans.

- Protect wetlands and agricultural lands from development through acquisitions, easements, conservation agreements, and management plans, thereby benefiting trumpeter swan, tule white-fronted goose, northern pintail, and lesser scaup.
- Protect and restore riparian areas for bull trout.
- Limit vehicle traffic along beaches used by snowy plover and streaked horned lark.
- Determine if protection of other beach species such as snowy plover and streaked horned lark adequately addresses the needs of Siuslaw sand tiger beetle.
- Protect nesting areas for streaked horned lark on dredge spoil islands in the lower Columbia River and manage spoil deposition to maintain and increase open habitat.
- Restore coastal grasslands on the Long Beach Peninsula for Oregon silverspot.
- Determine appropriate strategies such as prescribed fire or tree removal to maintain the natural vegetation of coastal bogs used by Makah (Queen Charlotte) copper.
- Enforce zoning and shoreline management regulations to protect spawning beaches and other nearshore habitat for surfsmelt and Pacific sand lance.
- Establish buffers to conserve forests bordering shorelines and consider policies to encourage reforestation of degraded shoreline areas for surfsmelt.
- Work with local authorities at Tokeland on northern Willapa Bay to maintain roosting sites for marbled godwit and willet.
- Maintain and enforce Forest Practice rules protecting bald eagle roost sites and nests.
- Continue to require bald eagle habitat plans that require retention of trees.
- Protect important roost sites and hibernacula for Townsend's big-eared bat.
- Maintain alpine areas and suitable nesting and foraging habitats for golden eagle.
- Maintain and restore lupine in open areas used by Puget (Blackmore's) blue butterfly.
- Protect sites with known populations of ***Oregon megomphix*****.**
- Protect suitable breeding lakes for common loons from development and recreational pressure.
- Manage small fish populations in lakes with nesting common loon.



- Conserve prey populations of golden eagles by reducing deliberate control programs.
- Prioritize conservation areas using ecoregional assessments and other biological assessments. Protect important habitat types, biodiversity areas, and environmentally sensitive lands that should not be altered through a variety of techniques including acquisitions, conservation easements, life estates and cooperative agreements with willing landowners.
- Coordinate with local land trusts, conservation districts and other conservation organizations and agencies to conserve important habitat on both public and private land. Focus limited resources in regionally significant areas. Identify all possible acquisition and restoration grants and coordinate applications.
- Work with the USDA Forest Service and other public landowners to protect existing roadless areas and expand the roadless area network where justified for habitat protection and connectivity.
- Protect key connectivity areas and wildlife corridors between fragmented habitats and between protected areas through a variety of techniques including acquisitions, conservation easements, life estates and cooperative agreements with willing landowners. Use statewide land cover and threats data layers to improve connectivity between priority conservation areas.
- Restore native habitats, habitat connectivity and wildlife corridors where appropriate on both public and private lands. Consider restoring lands adjacent to existing protected areas to increase their effective size and function as wildlife habitat.

- Purchase water rights from willing sellers in unregulated tributaries; use these water rights to restore and maintain adequate year-round flows for both instream and out-of-stream riparian fish and wildlife habitat.
- Rehabilitate and restore stream channels, floodplain functions, riparian habitat and connectivity where streams have been diverted, fragmented, or degraded. Use livestock exclusions, instream structures, bank modifications and other methods.
- Preserve and/or restore buffer areas in appropriate locations along tributaries and mainstem waterways to a condition that is adequate to maintain healthy, functioning riparian zones for the ecoregion's rivers and estuaries.

Improve land management practices:

General

- Restore mature and late-successional coniferous forests by encouraging longer harvest rotations and maintaining snags, large trees with cavities, and coarse woody debris to enhance populations of northern goshawk, marbled murrelet, northern spotted owl, Vaux's swift, pileated woodpecker, Keen's myotis, Dunn's salamander, Van Dyke's salamander, and Johnson's hairstreak.
- Evaluate effectiveness of current management practices for maintaining forest birds, including northern goshawk, marbled murrelet, northern spotted owl, Vaux's swift, and pileated woodpecker.
- Retain snags in forest harvest units and during salvage logging of burns for western bluebirds and other cavity nesters.
- Maintain stream buffers during timber harvest and conduct proper land-use management to protect habitat for Dunn's salamander, Van Dyke's salamander, Columbia torrent salamander, and bivalves.
- Maintain forest buffers around talus during timber harvest to protect habitat for Dunn's salamander and ***Van Dyke's salamander*.**

- Conduct prescribed burns on grassland sites where and when needed and feasible for rare butterflies and other grassland species.
- Retain moist understory conditions during timber harvest to protect Oregon megomphix.
- Allow natural disturbances and successional functions and processes to occur on conserved wetlands.
- Manage undeveloped publicly-owned land for conservation of priority habitats and species.

Forest management

- Protect remaining old growth hardwood and conifer stands to benefit late successional species, and manage some stands on long rotation (>200 years).
- Work with the Washington Department of Natural Resources and the Washington Forest Practices Board to develop, implement and enforce forest practices regulations to enhance biological diversity on existing state and private managed and protected areas.
- Work through the Washington Forest Practices Board and directly with forest landowners to implement forest management prescriptions, including prescribed burns, which will maintain and enhance biodiversity and natural ecosystem function. Encourage modified silvicultural prescriptions that promote local topographic, soil

and vegetative conditions. Retain snags, downed woody debris and a complement of live trees in harvested areas. Sensitive areas such as wetlands, remnant old growth and wildlife breeding sites should not be disturbed.

- Encourage the development of selective harvest policies and guidelines on both public and private forestland that will leave adequate components of old growth habitat such as large tree, snags and downed wood as habitat for associated wildlife such as fisher, northern goshawk, marbled murrelet, northern spotted owl, Vaux's swift, pileated woodpecker, Van Dyke's salamander, Dunn's salamander, and Johnson's hairstreak butterfly. Minimize logging roads and decommission them after the period of entry. Ensure that all logging and forest access roads are located in stable, non-erodible areas and outside riparian management zones.
- Ensure the integrity of riparian habitat by maintaining adequate riparian management zones along streams in all logging sites, on both public and private land.
- Support implementation and enforcement of the Washington Forest Practices Act to accomplish habitat conservation and regeneration on both state and private forestlands.
- Encourage public and private forest landowners to manage forested watersheds that maintain an appropriate mix of successional stages and provide connectivity of riparian and upland vegetation as protected travel corridors for wildlife.

Grazing and agricultural practices

- Work with public and tribal and management agencies to fence or otherwise protect riparian zones from livestock grazing and unauthorized offroad vehicle use. Consider retirement rather than renewal of grazing leases on sensitive lands.
- Work with conservation districts, Natural Resource Conservation Service, USDA Forest Service and private landowners to implement best management practices in riparian areas and associated upland habitat in conjunction with the Conservation Reserve Program, Wetland Reserve Program and other Farm Bill programs.
- Use the Comprehensive Resource Management Plan process for large landscapes with a mix of public and private landowners to modify grazing regimes and improve grassland and understory conditions and enhance biodiversity.
- Assist private landowners in securing funding to fence riparian zones on private land. In areas where it is impractical to exclude livestock, protect habitat quality by controlling the timing and intensity of livestock grazing through regulation and landowner agreements.
- Work with private and public landowners to minimize the impacts on habitat and wildlife from modern agriculture, including agrochemical use, water use, grazing and soil erosion.

<u>Control and prevent introduction of alien and invasive species</u>:

- Evaluate the role of timber harvest in promoting the range expansion of barred owl, which interact negatively with northern spotted owl.
- Reduce the occurrence of European beachgrass at coastal site used by snowy plover, streaked horned lark, and Siuslaw sand tiger beetle.
- Control weeds and alien grasses on native grasslands and forest balds occupied by dog star skipper, Puget Sound fritillary, and valley silverspot.
- Monitor lakes, streams and wetlands for illegal fish introductions and prohibit legal introductions to protect pygmy whitefish and Olympic mudminnow.

- Control and monitor introduced bivalves and other aquatic invasives through enforcement and education to protect western floater, winged floater, and Oregon floater.
- Continue programs to control and eradicate *Spartina* spp., especially in Willapa Bay, to protect foraging habitat for red knot.
- Avoid introduction of non-native fish in fishless lakes and where species of conservation concern occur such as bull trout, native amphibians and reptiles.
- Trap and kill European starlings and house sparrows near current and past nesting areas of purple martin.
- Develop a regional plan for the detection, rapid response and eradication of invasive species.
- Work with other public agencies and private agricultural organizations such as the Farm Bureau and Washington Grange to develop basic techniques for mapping and monitoring the spread of invasive plant species over time.
- Participate in federal and state agency partnerships to develop and implement weed control strategies for impacted sites and ecosystems. Promote adequate funding and coordination of weed control efforts on both public and private lands using environmentally sound methods.
- Develop educational and public information materials to increase public awareness of the ways that invasive alien species are introduced to sensitive ecosystems.
- Provide funding, incentives and technical assistance to private landowners to eliminate undesirable invasive plant species in riparian zones and to restore native plants that provide important habitat for native fish and wildlife. Use integrated pest management practices to control currently established invasive species with help from volunteers.
- Participate in federal and state agency partnerships to develop and implement weed control strategies for impacted sites and ecosystems.
- Continue to focus state, federal and private efforts on eradicating *Spartina* in Puget Sound and bays on the outer coast.
- Coordinate ballast water management and treatment standards development with the U.S. Coast Guard and the International Maritime Organization to prevent or control pollution and the spread of aquatic nuisance species into Washington.

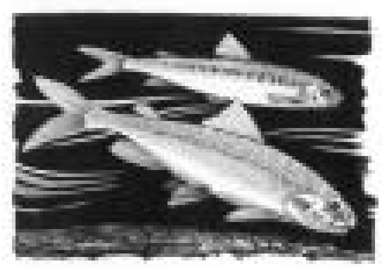
<u>Control and monitor disturbance</u>:

- Limit disruptive types of recreational activity in beach areas to prevent disturbance of nesting snowy plover and streaked horned lark.
- Restrict human activity in and around breeding colonies of common murre and Cassin's auklet.
- Limit access to roost sites and hibernacula used by Townsend's big-eared bat.
- Minimize disturbance of great blue heron, bald eagle, golden eagle, and peregrine falcon nests from human activities such as development, logging, boating, and other recreational activity by restricting access to public lands as needed, working with permitting agencies to reduce levels of disturbance, and informing the public of sensitive areas and periods.
- Reduce human disturbance and coyote feeding through education to protect Olympic marmot.
- Eliminate vehicular access and campsites in conservation areas identified as sensitive habitats such as montane wetlands, bogs, prairies, and dunes.
- In sensitive habitats, manage both land and water access by using fencing, trails, elevated boardwalks, railings, seasonal restrictions, signage and livestock restrictions.

- Reduce the amount and impact of unauthorized recreational access and use on important wildlife habitat through better enforcement of existing laws, more fencing and posting of critical habitat areas, selective road closures and increased public education and information for recreational users and user groups.
- Protect nesting golden eagle, bald eagle and peregrine falcon through use and access restrictions on public lands as needed, and work with private landowners and permitting agencies to prevent blasting or construction disturbance during nesting. Inform rock climbers of sensitive periods and locations to reduce disturbance of nesting peregrine and golden eagle.

Control and prevent environmental contamination:

- Prevent oil spills or rapidly clean up any that occur to safeguard all marine and coastal species, including marine mammals, common loon, western grebe, waterfowl, shorebirds, alcids, streaked horned lark, and fish.
- Identify winter concentration areas of marine and coastal mammals and birds and incorporate into oil spill plans.
- Minimize contaminants entering marine waters, estuaries, and eelgrass beds, and remediate sites of known contamination to protect killer whale, Pacific harbor porpoise, tule greater white-fronted goose, brant, greater scaup, long-tailed duck, scoters (black, surf, white-winged), bald eagle, and peregrine falcon.
- Protect common loon, trumpeter swan, bald eagle, and golden eagle from lead poisoning by advocating the use of non-toxic fishing sinkers and steel shot.
- Minimize sources of freshwater pollution that harm western floater, winged floater, Oregon floater, western ridged mussel, and western pearlshell.
- Restrict the use of piscicides such as rotenone in waters with common loons and ***pygmy whitefish***.



- Work with governmental and nonprofit agencies to develop an ecoregion-wide strategy for identified toxins and other pollutants: their sources, destinations and effects, and ways to reduce their discharge.
- Work with other agencies, industry and private landowners to encourage use of integrated pest management techniques and phase out the use of pesticides and herbicides.
- Clean up contaminated sites and sediments whenever possible, and prevent further toxic contamination of areas, including unconfined spoil disposal sites.
- Reduce the use of hazardous chemicals by continuing to implement the persistent bioaccumulative toxins strategy and by using a variety of best management practices and improved treatment methods.
- Continue to place a priority on actions to prevent and respond to oil and hazardous material spills.

Improve transportation and energy development:

- Power lines near breeding and foraging areas should be built or modified to reduce the occurrence of golden eagle and other raptor electrocutions.
- Reduce road mortality in western toads by providing road crossings near breeding sites.
- Avoid road building near breeding sites for western toad.
- Work with the Washington Department of Transportation to locate highways away from important wildlife habitats and biodiversity areas. If impacts are unavoidable,

design adequate mitigation such as underpasses, overpasses and fencing to accommodate wildlife that need passage, such as western toad.

Improve water quantity and quality:

- Provide floating nest platforms for common loon at lakes with fluctuating water levels.
- Reduce the impacts of land use practices that increase water temperature and sedimentation, thereby harming pygmy whitefish, western floater, winged floater, Oregon floater, western ridged mussel, and western pearlshell.
- Identify dams and other passage barriers that limit the movement of river lamprey, Pacific lamprey, and ***green sturgeon***, and develop methods of passage past such barriers.

- Use water control structures to manage water levels in sloughs and marshes to reduce the impacts of flooding on Columbian white-tailed deer habitat.
- Manage fluctuating water levels to reduce effects on populations of western floater, winged floater, and Oregon floater.
- Manage wetland areas on public land for both high water quality and habitat value. Ensure that the water quality of inflow does not lead to deterioration of the wetland habitat.
- Where possible restore or rehabilitate the hydrology, water quality and native plant communities in degraded and disturbed wetlands. Methods should emphasize creating or restoring natural wetland functions such as conserving beaver populations and dynamic stream processes, to benefit species such as Dunn's salamander, Van Dyke's salamander, Columbia torrent salamander, western toads, and Makah (Queen Charlotte) copper. Manage runoff from highways according to the updated highway runoff manual. Improve the road drainage network in riparian zones by removing unnecessary culverts, increasing the size of inadequate culverts, or replacing culverts with bridges.
- Reduce the harm from stormwater runoff by working to improve the effectiveness of the National Pollutant Discharge Elimination System stormwater permit programs.
- Assist local jurisdictions in finding solutions to increase landowner compliance with onsite sewage system maintenance and animal waste management practices through education and regulated inspection. Work to reduce the number and volume of combined sewer overflow events.

Improve coordination, planning, permitting and mitigation:

- Strengthen the Shoreline Management Act to protect bald eagle nesting and roosting sites.
- Provide credible scientific information on priority habitats and species and biodiversity areas, their significance, management needs and compatible land uses to decision-makers at site, local and regional scales.
- Provide technical assistance to counties in using fish and wildlife and biodiversity information to update comprehensive land use plans, community or watershed plans, Shoreline Master Plan, etc.

- Assist counties in developing and updating county ordinances and incentives that help to mitigate or control development in areas with resource and conservation values and that encourage environmentally sensitive development in growth areas.
- Work with local governments and conservation organizations to identify and protect areas of important habitat and biodiversity through existing environmental laws and other local programs.
- Encourage floodplain management and shoreline zoning protection programs.
- Develop a coordinated conservation vision and strategy for conservation of large landscapes using a structured process like The Nature Conservancy's 5-S Project Management System or the Cascade Dialogs.
- Review state and federal land management plans to ensure adequate protection for priority habitats and species, biological diversity and ecosystem health.
- Develop site management plans for protected areas.
- Work with public and tribal land management agencies to protect important habitat and areas of high biodiversity from loss and fragmentation, as well as degradation.
- Coordinate and integrate species recovery and management plans with land management and watershed plans using regulatory and voluntary approaches.
- Participate in Growth Management Act, Shoreline Management Act, Forest Protection Act and Federal Energy Regulatory Commission permitting processes for new or expanded residential, recreational or hydropower development on private land.
- Use information from ecoregional assessments to illustrate important habitats and areas of high biodiversity. Encourage permitting agencies to designate and protect these areas from residential and recreational development, and to require mitigation for habitat conversion and fragmentation where it occurs.
- Work closely with the USDA Forest Service and other land management agencies to prevent or mitigate potential adverse impacts to fish and wildlife habitat from proposed recreational or hydropower development on public lands.
- Work with regulatory agencies to design effective mitigation strategies for projects that result in wildlife impacts or direct conversion or fragmentation of habitat.
- Encourage the permitting of land uses practices that protect the integrity of beach, dune, shoreline and nearshore ecosystems. Regulate and control the construction of jetties and other structures that may obstruct the natural dynamics of dune and beach habitats.
- Represent WDFW's conservation interests on interagency recovery teams and working groups.

<u>Improve enforcement of laws and regulations</u>:

- Enforce existing protections for bald eagle through vigorous investigation and prosecution.
- Enforce fishing regulations, seasons, and stream closures to protect bull trout from fishing pressure.
- Enforce recreational access restrictions on public lands and aquatic areas.

<u>Improve landowner assistance</u>:

- Develop, periodically update, and provide WDFW Priority Habitats and Species management recommendations to assist landowners in conserving priority habitats and species.
- Work with large and small timber companies and landowners to accomplish habitat conservation through nonregulatory approaches such as landowner incentives, conservation easements, habitat conservation plans and acquisition of critical habitat from willing landowners.

- Secure state and federal tax incentives that discourage habitat fragmentation and destruction and that encourage landowners to protect and manage their land to benefit wildlife habitat.
- Work with local government to implement the Public Benefit Rating System and encourage effective use of open space tax incentives for landowners.
- Work with private landowners to identify and protect areas with important habitats and biodiversity and protect these areas through landowner incentives and other nonregulatory programs. This would assist species such as great blue heron, trumpeter swan, tule white-fronted goose, northern pintail, bald eagle, snowy plover, willet, marbled godwit, Vaux's swift, pileated woodpecker, streaked horned lark, purple martin, and Siuslaw sand tiger beetle. Provide educational materials to private landowners that describe management techniques for maintaining and restoring various wildlife habitats.
- Work with private landowners to identify and protect important wetland habitats and buffers by providing adequate water, controlling invasive plants, reducing disturbance to nesting wildlife, and fencing or otherwise keeping livestock out of wetlands and associated upland habitat.
- Influence the application of federal Farm Bill funds, including the Conservation Reserve Program and the WDFW Landowner Incentive Program, on private agricultural lands most critical for wildlife movement and most suitable for restoration of native wetlands and grassland habitat.
- Promote grant programs to assist landowners with implementation of management plans.

<u>Improve wildlife conservation education</u>: includes outreach, volunteer and watchable wildlife programs.

- Conduct outreach and education programs to engage the public in conservation programs for many species.
- Educate the public on minimizing disturbance to great blue heron and common murre colonies during the nesting period.
- Develop education programs targeted to reduce disturbance of common loon, western grebe, greater scaup, and black oystercatcher by boaters and other human activities.
- Educate boaters to avoid disturbing killer whale and other marine mammals.
- Continue to work with tribal and non-tribal fishermen to reduce gill net entanglement of marine mammals and birds.
- Educate fishermen to reduce lesser scaup mortality from entanglement with discarded lines and nets.
- Education programs are needed to curtail recreational pressure on common loon at suitable breeding lakes.
- Establish volunteer programs for monitoring common loon activity at lakes.
- Engage and involve local and tribal governments, state and federal agencies, organizations and citizens in efforts to protect and restore priority habitats and species through a variety of outreach projects, programs and education efforts.
- Increase the use of citizen science for the collection of data, monitoring, restoration and conservation of important habitats and associated wildlife species. Coordinate volunteer monitoring and involvement.
- Promote and maintain public information and education efforts that focus on endangered species, habitat loss, ecological function, biological diversity and environmentally aware lifestyle practices. Emphasize the connection between habitat and environmental quality and human health and welfare.

- Expand conservation education programs for both adults and children to emphasize the critical nature and vulnerability of sensitive habitats such as wetlands, oak and grassland habitats and associated wildlife.
- Connect with user groups through education to make them part of the conservation solution in areas that have high recreation values.
- Work with large corporations to increase awareness and develop financial support for conservation of biodiversity.

Black oystercatchers.

PUGET TROUGH ECOREGION

(Washington's portion of the
Willamette Valley-Puget Trough-Georgia Basin Ecoregion)

PHYSIOGRAPHY AND FISH AND WILDLIFE DIVERSITY

Geography

The Washington portion of the Willamette Valley-Puget Trough-Georgia Basin ecoregion unfurls in a long ribbon of broad lowland valleys and the inland sea of Puget Sound. It is flanked by the rugged Cascade Range to the east and Olympic Mountains to the west and includes the foothills of these ranges. Although the ecoregion's terrestrial elevation averages 445 feet, the effect of the adjacent mountains, ocean intrusions and glaciation during prior ice ages have caused dramatic localized differences in climate, soils and geology. The result is a diverse array of ecological communities ranging from coniferous forests to open prairies and oak savannas to various marine and estuarine environments.

Geology

The marine waters of the Puget Trough ecoregion consist of three natural basins that formed nearly 150 million years ago as colliding continental plates formed the deep Georgia Depression, or Georgia Basin. The Puget Lobe of the Cordilleran Ice sheet entered the Puget Sound in the late Pleistocene (about 15,000 years ago). At its maximum extent, the glacier extended south of Olympia and may have been more than 3,000 feet thick in some areas. Before the last advance of ice, known as the Vashon glaciation, Puget Sound almost certainly did not have the same shape as now. Some north-south troughs may not have existed and there may have been troughs where uplands now occur. Advance outwash deposits filled in the sounds, lakes, and valleys of the pre-glacial lowlands. The topography of these lowlands was almost entirely eroded by Vashon-age subglacial meltwater.

Climate

The Puget Trough ecoregion is characterized by a maritime climate with warm, relatively dry summers and mild, wet winters. Annual precipitation ranges from 25 to over 60 inches. The drier areas are caused by rain shadows from the Olympic Mountains, resulting in the development of natural grassland and savanna communities. There are 386 mountain glaciers in the Cascades Mountains to the east, covering 116 square miles and containing 13 million acre-feet or 3.85 cubic miles of ice. To the west, there are about 266 glaciers crowning the peaks of the Olympic peninsula. The prominent glaciers are those on Mount Olympus, covering approximately ten square miles. In the summer, meltwater from these glaciers provides a steady and constant release of fresh, cold water to streams and rivers in the Puget Trough ecoregion, which is extremely important to juvenile salmon for growth and development.

Habitat and Plant Associations

Douglas-fir forests with western hemlock and redcedar are the primary late-successional species and currently dominate the vegetation of the Puget Trough. Oregon white oak, Pacific madrone, bigleaf maple, and red alder forests are frequent components of the landscape. Grassland habitats are often associated with oak and support a number of rare species, including the federally threatened golden paintbrush and a number of butterfly species. Historically, fires set by Native Americans over the last 5,000 years maintained these native grasslands and the adjacent open oak woodlands. Many rare grassland species are declining as this landscape becomes more urbanized and fire suppression leads to more densely forested areas.

The biological diversity of the Puget Trough ecoregion is very high, ranging from the foothills of the Cascade and Olympic mountain ranges to the nearshore and deepwater environments of Puget Sound. Puget Sound is an estuary of global significance. Here the marine waters from the Pacific are diluted by thousands of rivers and streams, large and small. Each hour, aquifers, rivers and streams in the Puget Sound ecoregion release about 27 million gallons of freshwater into the marine environment. The largest river entering Puget Sound is the Skagit River.

Marine Environment

Puget Sound’s marine nearshore environment is a rich, complex, and important part of the ecoregion. The sound features a wide variety of deepwater and nearshore habitats including coastal lagoons, kelp and seagrass beds, rocky shores, sandy beaches and spits, and salt marsh wetlands. These and surrounding forests support a complex web of plants, fish and other organisms. This web of life evolved through millennia of interactions with the freshwater and saltwater environments in and around Puget Sound.

Marine Species

More than 220 species of fish, 26 different kinds of marine mammals, 100 species of seabirds and thousands of marine invertebrate species are found in Puget Sound. Marine mammals include harbor seals, killer whales, porpoises, and California sea lions. Some of these species are migratory, while others reside year-round. Other local marine animals include many native and introduced species of shellfish, sea urchins, a number of rockfish species, and some of the largest octopus and barnacle species in the world. The nearshore and deepwater habitats of all these animals are largely hidden from view, as are impacts on them. Wild Pacific salmon, Pacific herring, scoters and harbor seals are good indicators of the health of Puget Sound’s fish and wildlife populations, primarily because each occupies a very different place in the Sound’s ecology.

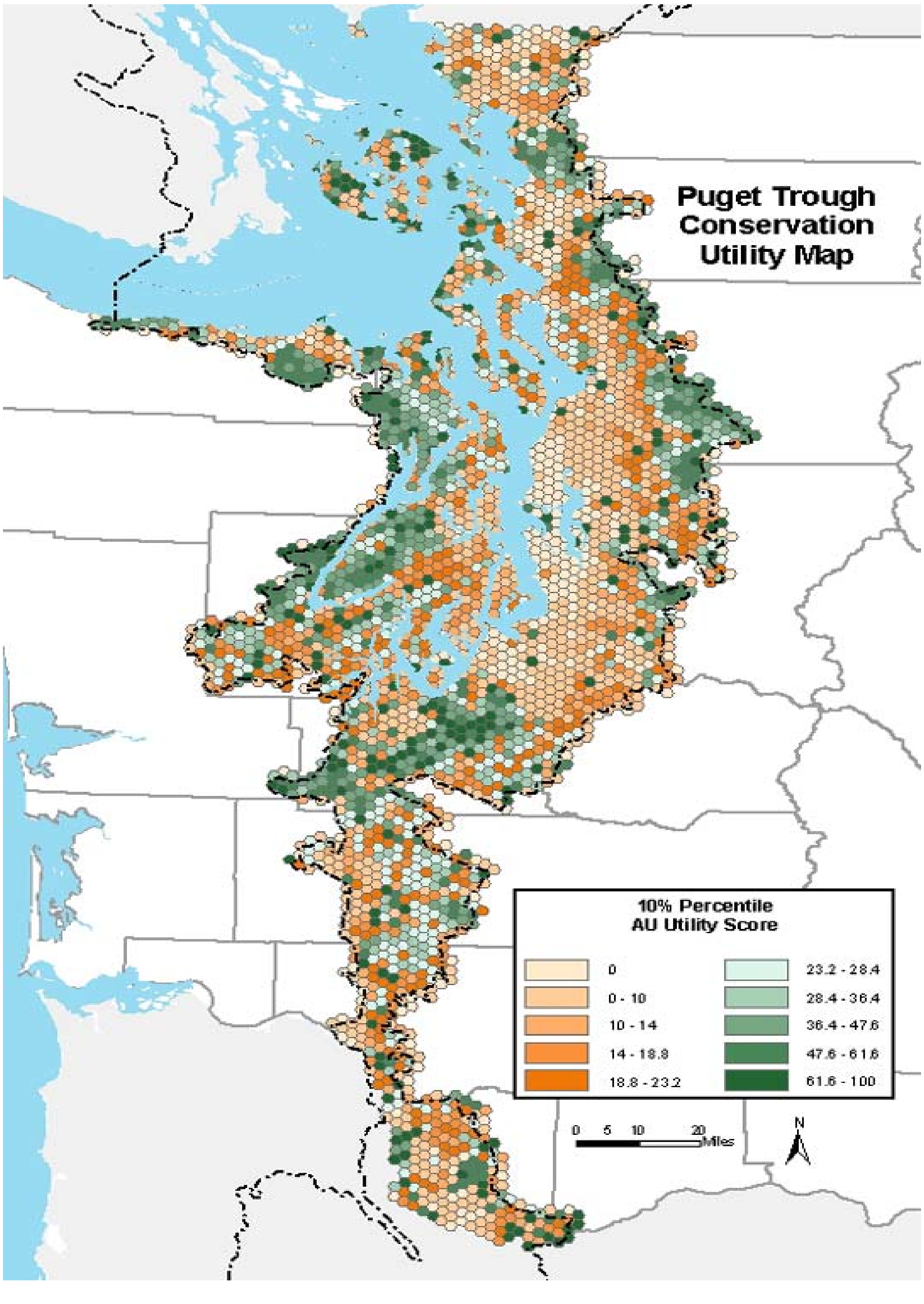
Terrestrial Species

Terrestrial species are also diverse. However, a number of terrestrial plant and animal species have shown significant declines in the ecoregion over the past 100 years, primarily related to increased human development and resulting habitat loss. Population declines include amphibians endemic to the Northwest such as the Oregon spotted frog; birds such as the northern spotted owl and marbled murrelet; invertebrates including Taylor's checkerspot butterfly; mammals like the western gray squirrel; and reptiles such as the western pond turtle. Although populations of declining animals still persist in many areas, their long-term viability may be called into question as these populations become more isolated from each other by continued development and fragmentation of their habitat.

While the CWCS focuses on wildlife diversity, the ecoregional assessments address the full range of Washington's biological diversity. One product of the ecoregional assessment, the conservation utility map, depicts the relative biodiversity value of landscapes or watersheds within the ecoregion. A sample map, titled Conservation Utility Scores, is shown below for the Northwest Coast ecoregion (Figure 12). The utility scores indicate both the biodiversity value of an assessment unit (AU) and its suitability for conservation. The AU varies by ecoregion and is either a hexagon or a watershed. The scores are generated with a computer algorithm under the assumption that all AUs are not equally suitable for conservation (a suitability index was used). For instance, lands adjacent to intensive agriculture or residential development are considered less suitable for conservation than lands adjacent to undisturbed forest. The algorithm assigns a high utility score to AUs that contain rare targets (species or communities), contain a large amount of a target (i.e., has high representation of a target), or has a high number of targets (i.e., has high richness).

When a set of AUs have similar biological contents, the algorithm uses the suitability index to choose the best AU from the set. AUs with a score of 100 are either irreplaceable or are the most suitable place to conserve particular targets. Refer to Appendix 12 for a description of how these maps were developed.

Figure 17.



LAND OWNERSHIP AND POPULATION

The intimate relationship between the forest and the sea is perhaps demonstrated better in the Puget Trough than in any other region of United States. Although altered and under stress, both the terrestrial and marine environments are still extremely productive. In many places, modern land use conversion has had a major impact on native biodiversity.

Land Use

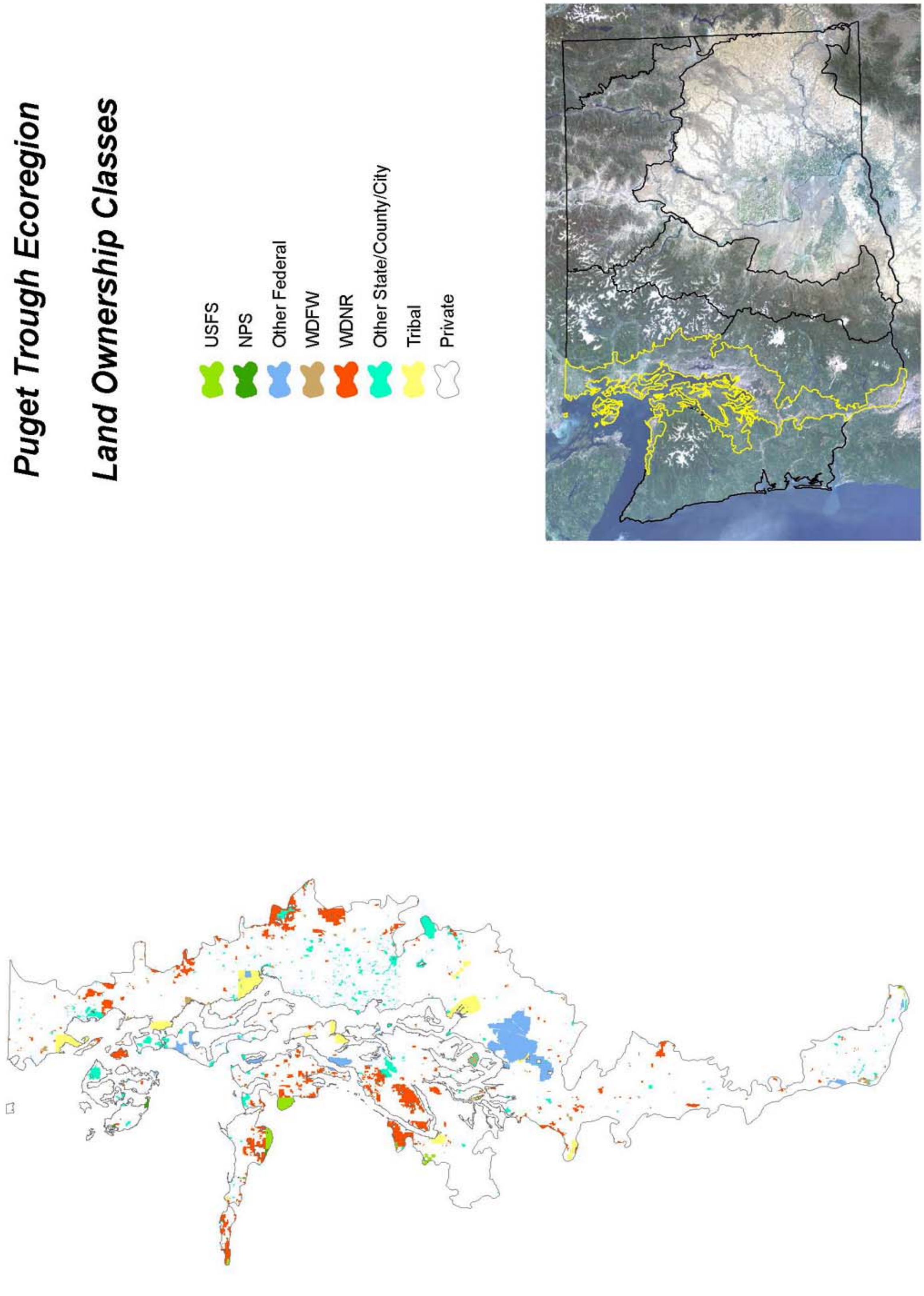
Rural areas in the Puget Trough are managed largely for intensive industrial and private forestry, and pasture and cropland are still dispersed throughout the ecoregion. Much of the ecoregion has grown into one long metropolitan area from Everett to Olympia, including the major Pacific Rim ports of Seattle and Tacoma, as well as industrial complexes and smaller communities such as Bellingham and Mt. Vernon. Most of the dense lowland coniferous forest was cut and converted long ago, and few sizeable mature forest areas remain.

Population

Consistent and continued rapid growth of the human population is a central issue for the Puget Trough ecoregion. Washington's population was approximately 520,000 in the year 1900. In 2000, the population had grown to 5.9 million, an increase of more than 1100%. About 75% of Washington's population lives in the Puget Trough ecoregion, from Bellingham to Olympia. In the southern part of the ecoregion, Clark County's population increased by 33% between 1990 and 1997, the highest in the state for that period. The ecoregion's population is expected to reach 5 million by 2020. In 1999, nearly 3.9 million people lived in the Puget Sound ecoregion – double the population of the mid-1960s. This region has been experiencing incredible urban expansion over the last decade, and projections indicate much of the same into the foreseeable future.

Population growth in the Puget Trough ecoregion will result in more cars that will further degrade water and air quality; more energy generated and consumed; greater demand for land for houses, business and transportation corridors, leading to development of previously rural or resource production land; increased demand for forest products, minerals, and gravel and rock pits; increased need for treatment and disposal of solid waste, sewage and storm water; a greater challenge to provide a clean and adequate supply of drinking water; more crowded recreation areas such as parks, beaches and wilderness areas; and more stress on native wildlife and habitats. Figure 18 below maps land ownership classes for the Puget Trough ecoregion.

Figure 18.


Puget Trough Ecoregion
Land Ownership Classes
USFS
NPS
Other Federal
WDFW
WDNR
Other State/County/City
Tribal
Private

ECOREGIONAL CONSERVATION PARTNERSHIPS

Effective conservation of fish, wildlife and biodiversity in Washington requires close coordination and cooperation with many public and private conservation partners. Major partners in the Puget Trough ecoregion include:

- U.S. Fish and Wildlife Service (Nisqually National Wildlife Refuge, San Juan Islands National Wildlife Refuge, Ridgefield National Wildlife Refuge)
- U.S. Forest Service (Mt. Baker-Snoqualmie National Forest)
- U.S. Department of Defense (Fort Lewis, McChord Air Force Base, Naval Station Everett, Whidbey Island Naval Air Station, Bangor Naval Submarine Base)
- Washington Department of Natural Resources (WDNR)
- Washington Department of Ecology
- Washington State Parks and Recreation Commission
- Puget Sound Action Team
- Northwest Indian Fisheries Commission
- Interagency Committee/Salmon Recovery Funding Board
- Pacific Coast Joint Venture
- San Juan, Whatcom, Skagit, Snohomish, King, Pierce, Thurston, Lewis, Cowlitz, and Clark counties

The Washington Department of Fish and Wildlife also works closely on conservation projects with private conservation partners such as The Nature Conservancy, Trust for Public Land, Cascade Land Conservancy, Audubon Washington, People for Puget Sound, Ducks Unlimited and a growing number of fisheries enhancement groups and local land trusts.

Major Plans and Assessments

A number of ongoing or completed planning efforts involving WDFW and its public and private partners guide the conservation and management of fish and wildlife resources statewide and in the Puget Trough ecoregion. Important planning efforts affecting conservation in the Puget Trough ecoregion include:

- Elochoman and Cowlitz Subbasin Plans (2004)
- Forest Practices Habitat Conservation Plan (WDNR)
- National Estuary Program (NEP) Comprehensive Conservation and Management Plan
- Nearshore Fishery Management Plan
- Northwest Forest Plan (1994)
- Partners in Flight Conservation Plans
- Puget Sound and Adjacent Waters Program
- Puget Sound Restoration Program
- Puget Sound Water Quality Work Plan
- Shared (Salmon) Strategy for Puget Sound
- USFWS Columbian White-tailed Deer Recovery Plan (1983)
- USFWS Draft Bull Trout Coastal/Puget Sound DPS Recovery Plan (2004)
- USFWS Draft Northern Spotted Owl Recovery Plan (1992)
- USFWS Marbled Murrelet Recovery Plan (1997)
- Washington Forest Practices Board Wildlife Strategy (in progress)
- Washington Forests and Fish Agreement (1999)
- WDFW Aquatic Nuisance Species Management Plan
- WDFW Bald Eagle Status Report (2001)
- WDFW Bull Trout and Dolly Varden Management Plan (2000)

- WDFW Draft Mazama Pocket Gopher, Streaked Horned Lark and Taylor's Checkerspot Status Report (2005)
- WDFW Draft Puget Trough Regional Wildlife Area Management Plan
- WDFW Fisher Recovery Plan (2005)
- WDFW Forage Fish Management Plan (1998)
- WDFW Larch Mountain Salamander Status Report (1993)
- WDFW Marbled Murrelet Status Report (1993)
- WDFW Mardon Skipper Status Report (1999)
- WDFW Oregon Spotted Frog Status Report (1997)
- WDFW Outline for Salmon Recovery Plans (2003)
- WDFW Peregrine Falcon Status Report (2002)
- WDFW Puget Sound Groundfish Management Plan (1998)
- WDFW Sea Otter Recovery Plan (2004)
- WDFW Steller (Northern) Sea Lion Status Report (1993)
- WDFW Western Gray Squirrel Recovery Plan (2005)
- WDFW Western Pond Turtle Recovery Plan (1999)
- Willamette Valley-Puget Trough-Georgia Basin Ecoregional Assessment

Supporting references to these and other important statewide planning documents are included in Appendices 6 and 7.

SPECIES AND HABITATS OF GREATEST CONSERVATION NEED

This section provides a short summary of priority species and associated habitats for the Washington portion of the Puget Trough ecoregion.

Species of Greatest Conservation Need

The following species list for the Puget Trough ecoregion is a regional subset of the statewide Species of Greatest Conservation Need (SGCN) list shown in Appendices 1 and 2. The process and criteria used to develop the statewide SGCN list are provided in Volume Two: Approach and Methods, as well as in Appendix 3. Species listed below are found in the Puget Trough ecoregion for all or part of their lifecycle. Supporting tables and information for these species and habitats can be found in Chapter IV and in Appendices 1, 2, 8, 9, 10 and 14.

	Population Size/Status						Population Trend					
COMMON NAME	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown	State Status*	WNHP
Mammals												
Keen's myotis						x				x	C	
Townsend's big-eared bat			x							x	C	
Western gray squirrel			x				x				T	
Brush Prairie pocket gopher			x							x	C	
Mazama (western) pocket gopher			x				x				C	
Shaw Island Townsend's vole			x							x	N	S1
Gray-tailed vole			x							x	C	
Killer whale			x				x				E	
Pacific harbor porpoise			x							x	C	
Steller sea lion			x				x				T	
Fisher	x							x			E	
Sea otter			x						x		E	
Columbian white-tailed deer			x						x		E	
Birds												
Common loon			x					x			S	
Western grebe			x				x				C	
Great blue heron			x							x	M	
Trumpeter swan			x						x		G	S3
Tule greater white-fronted goose			x							x	G	S3
Brant			x				x				G	S3
Northern pintail					x		x				G	S3
Greater scaup				x							G	S5

	Population Size/Status						Population Trend					
COMMON NAME	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown	State Status*	WNHP
Lesser scaup				x			x				G	S4
Long-tailed duck			x				x				N	S3
Black scoter			x				x				G	S4
Surf scoter				x			x				G	S3
White-winged scoter			x				x				G	S5
Bald eagle				x					x		T	S4
Northern goshawk			x							x	C	S3
Golden eagle			x							x	C	S3
Peregrine falcon			x						x		S	S2
Black oystercatcher			x					x			M	S2
Marbled godwit			x							x	N	S3
Red knot			x				x				N	S3
Rock sandpiper			x				x				N	S3
Arctic tern						x				x	M	S2
Common murre				x			x				C	S4
Marbled murrelet			x				x				T	S3
Ancient murrelet			x							x	N	S3
Cassin's auklet				x			x				C	S3
Tufted puffin			x				x				C	S3
Yellow-billed cuckoo	?									x	C	SH
Northern spotted owl			x				x				E	S1
Vaux's swift			x				x				C	S3
Pileated woodpecker				x						x	C	S4
Streaked horned lark		x								x	N	S1
Purple martin			x					x			C	S3
Slender-billed white-breasted nuthatch		x					x				N	S1
Western bluebird			x				x				M	S3
Oregon vesper sparrow			x				x				N	S1
Reptiles												
Western pond turtle			x						x		E	S1
Racer	?									x	N	S5
Sharptail snake			x							x	C	S2
Pacific gopher snake	?	x								x	M	S5

	Population Size/Status						Population Trend					
COMMON NAME	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown	State Status*	WNHP
Amphibians												
Larch Mountain salamander			x							x	S	S3
Van Dyke's salamander			x							x	C	S3
Cascade torrent salamander				x						x	C	S3
Columbia torrent salamander				x						x	C	S3
Western toad				x			x				C	S3
Oregon spotted frog			x				x				E	S1
Fish												
River lamprey						x				x	C	S2
Pacific lamprey						x				x	N	S3
Copper rockfish		x						x			C	
Greenstriped rockfish						x				x	C	
Quillback rockfish		x						x			C	
Black rockfish			x							x	C	
China rockfish						x				x	C	
Tiger rockfish						x				x	C	
Bocaccio rockfish		x								x	C	
Canary rockfish			x							x	C	
Redstripe rockfish						x				x	C	
Yelloweye rockfish		x								x	C	
Green sturgeon				x			x				G	S2
Bull trout						x				x	C	G3
Lower Dungeness pink salmon											G	S2
Upper Dungeness pink salmon											G	S2
South Puget Sound steelhead											G	S5
North Puget Sound steelhead											G	S5
Pacific herring (Cherry Pt, Discovery Bay)		x						x			C	
Eulachon		?								x	C	S4
Olympic mudminnow						x				x	S	S2
Surfsmelt				x						x	G	G5
Salish sucker						x				x	M	S1
Pacific sand lance					x					x	N	
Invertebrates												
Beller's ground beetle			x							x	C	S3

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
Long-horned leaf beetle			x							x	C	
Hatch's click beetle			x							x	N	S1
Propertius' duskywing (butterfly)			x				x				M	S3
Oregon branded skipper (butterfly)						x				x	M	S2
Mardon skipper (butterfly)		x								x	E	S1
Dog star skipper (butterfly)						x				x	N	S2
Island marble (butterfly)		x								x	N	S1
Johnson's hairstreak (butterfly)						x				x	C	S2
Hoary elfin (butterfly)						x				x	N	S3
Puget (Blackmore's) blue (butterfly)			x				x				N	S2
Puget Sound fritillary (butterfly)						x	x				N	S3
Valley silverspot (butterfly)			x				x				C	S2
Taylor's checkerspot (butterfly)		x					x				C	S1
Great arctic (butterfly)	?					x				x	C	SH
Sand-verbena moth			x				x				N	S1
Pacific clubtail (dragonfly)			x							x	N	S1
Western floater (bivalve)			x				x				N	S1
Western ridged mussel			x				x				N	S2
Western pearlshell				x			x				N	S4
Bluegray taildropper (slug)		x					x				N	S4
Oregon megomphix (snail)			x				x				N	G2

* Status Codes	** WNHP Codes (S = state, G = global)
E = endangered	1 = critically imperiled
T = threatened	2 = imperiled
S = sensitive	3 = vulnerable to extirpation or extinction
C = candidate	4 = apparently secure
M = monitor	5 = demonstrably widespread, abundant and secure

Species Conservation in the Puget Trough Ecoregion

Species of Greatest Conservation Need (SGCN) found in the Puget Trough ecoregion (see table above) include those classified by WDFW as Endangered, Threatened, Candidate or Monitor species, as well as species identified by WDFW as needing additional research or funding attention. Conservation actions are recommended for these species at both the statewide and ecoregional levels. These recommended conservation actions are summarized in a series of matrices included in Chapter IV and as Appendices 9 and 10. These matrices also display the life history, population status and distribution of these species.

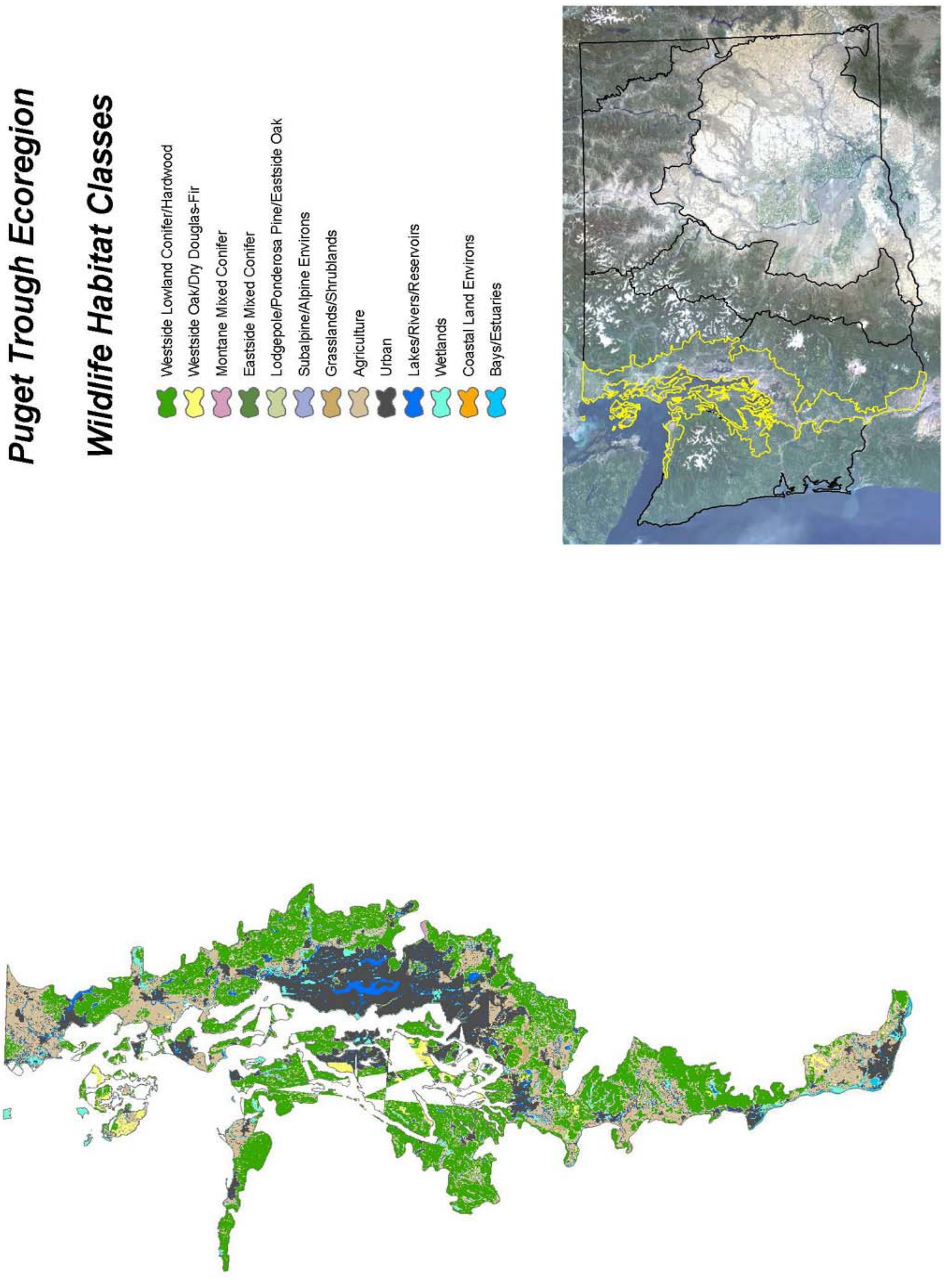
Ecoregional Habitat Overview

The Puget Trough ecoregion was historically dominated by dense coniferous forests of western red cedar, western hemlock, and Douglas-fir. Tree species on drier sites included Douglas-fir, Oregon white oak, Pacific dogwood, and Pacific madrone. Some prairie and bog communities were scattered throughout the ecoregion and the numerous islands and inlets were surrounded by a variety of nearshore habitats. Although altered and under stress, both the terrestrial and marine environments are still extremely productive. Most of the dense lowland coniferous forest was cut and converted long ago, and few sizeable unlogged forest areas remain. The larger prairie areas in the southern portion of the ecoregion near Tacoma and Olympia have been largely converted by urbanization and agriculture. The U.S. Army base at Fort Lewis contains some of the largest and highest quality prairie communities left in the ecoregion. Many of the interior wetlands have been developed, but some still remain intact. Figure 19 below maps wildlife habitat classes for the Puget Trough ecoregion.

The following major habitat types classified, coded and described in Wildlife and Habitat Relationships in Oregon and Washington (WHROW) are present in the Puget Trough ecoregion. In the next section, descriptions are provided for priority habitats associated with Species of Greatest Conservation Need found in this ecoregion.

- Westside Lowlands Conifer-Hardwood Forest
- Westside Oak and Dry Douglas-fir Forest and Woodlands
- Montane Mixed Conifer Forest
- Westside Grasslands (Prairie)
- Agriculture, Pasture and Mixed Environs
- Urban and Mixed Environs
- Open Water: Lakes, Rivers, Ponds and Reservoirs
- Herbaceous Wetlands
- Westside Riparian-Wetlands
- Montane Coniferous Wetlands
- Coastal Dunes and Beaches
- Coastal Headlands and Islets
- Bays and Estuaries
- Inland Marine Deeper Waters
- Marine Nearshore

Figure 19.


Puget Trough Ecoregion
Wildlife Habitat Classes
Westside Lowland Conifer/Hardwood
Westside Oak/Dry Douglas-Fir
Montane Mixed Conifer
Eastside Mixed Conifer
Lodgepole/Ponderosa Pine/Eastside Oak
Subalpine/Alpine Environs
Grasslands/Shrublands
Agriculture
Urban
Lakes/Rivers/Reservoirs
Wetlands
Coastal Land Environs
Bays/Estuaries

Priority Habitats in the Puget Trough Ecoregion

The following six habitat types have been identified as the highest priority for current conservation action in the Puget Trough ecoregion. Selection of these habitats as a priority was determined by their importance to regional Species of Greatest Conservation Need, as well as priorities outlined in the Puget Trough Ecoregional Assessment and the subbasin plans listed in the "Major Plans" section above. More discussion on the selection of priority habitats is included in Chapter III: Statewide Overview and in Volume Two, Approach and Methods.

- Inland Marine Deeper Waters, Bays and Estuaries, Marine Nearshore
- Westside Grasslands
- Westside Oak and Dry Douglas-fir Forest and Woodlands
- Westside Riparian-Wetlands
- Herbaceous Wetlands
- Westside Lowlands Conifer-Hardwood Forest

Bays and Estuaries, Inland Marine Deeper Waters, and Marine Nearshore

The marine systems of Puget Sound, Strait of Georgia, Hood Canal and the Strait of Juan de Fuca significantly define the climate, habitats and animals found in the greater Puget Trough ecoregion. The abundance of tidal salt water creates a home for a wide variety of resident and migratory marine fish and mammals.

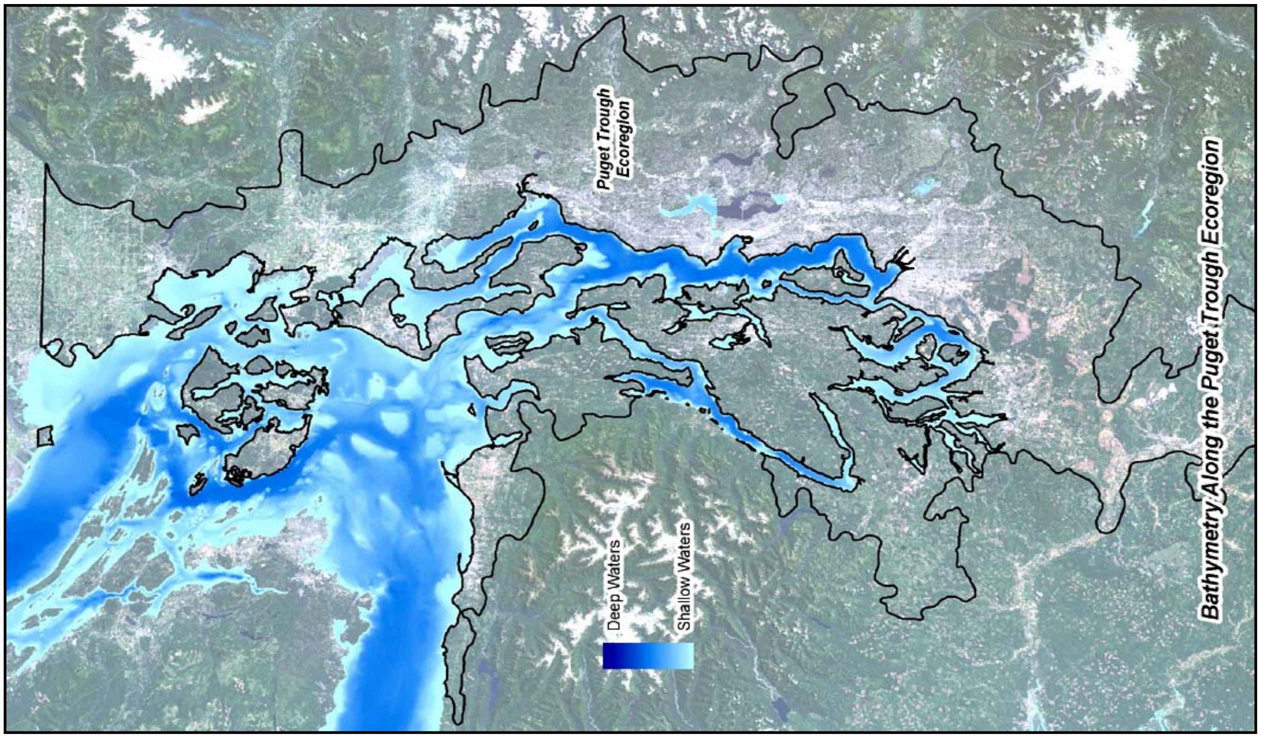
Kelp beds, eelgrass meadows, salt marshes, rocky shores, beaches and tidal flats are vital to the biodiversity and health of Puget Sound. They provide critical habitat for wildlife populations of great biological and economic value, including shellfish, salmon, marine ground fish, seabirds and marine mammals.

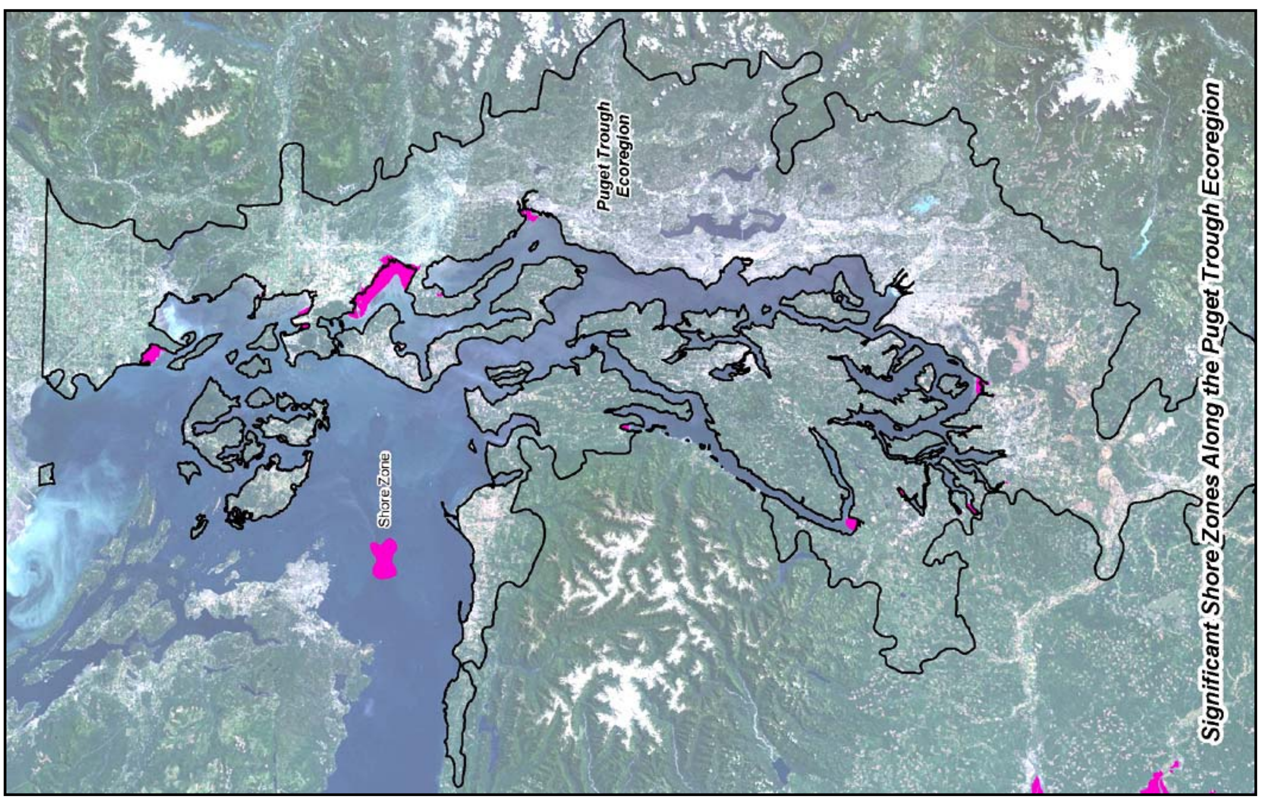
Freshwater rivers and streams drain from lands surrounding these inland marine waters to create nearshore estuarine environments. Estuarine habitat reflects the interface between land and sea, and is also the site of intense commercial and navigational activities such as seaports, marinas, ferry docks, and log booms. Estuaries are considered by many to be the most productive ecosystems in the world, supporting diverse populations of plants and animals. Because many marine and terrestrial species depend on these ecosystems during all or a portion of their life cycles, estuaries are often referred to as "nurseries of the sea". Juvenile and adult fish species, including salmon, require estuaries as transition areas on their journey to the ocean. Degree of wave and current action, substrate, availability of sunlight, and presence of vegetation diversify nearshore subtidal habitats. Figure 20 below maps marine features of the Puget Trough ecoregion.

Selected Species Closely Associated with Marine Habitats in the Puget Trough Ecoregion

Killer whale	Common loon
Pacific harbor porpoise	Western grebe
Brant	Yelloweye rockfish
Marbled murrelet	Pacific herring
Pacific sand lance	Surfsmelt

Figure 20. Marine features of the Puget Trough ecoregion.





Westside Grasslands

This is one of the rarest ecosystems in the United States. Open prairies were created by retreating glaciers 15,000 years ago, which scoured some areas and in others left behind gravelly soils that dried out quickly during summer droughts. These prairies are areas of locally low annual precipitation, excessively drained soils, and exposure to dry southwest winds. The defining features of the woodland/prairie mosaic are native grasslands interspersed with groves of trees that include species characteristic of dry conditions such as Oregon white oak. This habitat type is found in the dry southern parts of some of the San Juan Islands, the Sequim-Dungeness area, and part of Whidbey Island as well as the prairies in the southern Puget Trough near Olympia and Tacoma. Native prairies in the south Puget Sound area occur on gravelly soils derived from glacial outwash. Woodlands and native grasslands on the San Juan Islands are often on shallow, rocky ground scoured by glaciers.

About fifty species of butterflies can be found on prairies in the Puget Trough ecoregion, including seven that depend on prairies for food and habitat. Populations of the Mazama pocket gopher, which may require specific types of prairie soils, are also disappearing in the Puget Trough ecoregion. The intertwining of oak woodland, coniferous and wetland habitats also provides an ideal landscape for a variety of reptile and amphibian species.

Selected Species Closely Associated with Westside Grasslands in the Puget Trough Ecoregion

Gray-tailed vole	Mazama (western) pocket gopher
Taylor's checkerspot	Oregon branded skipper butterfly
Streaked horned lark	Mardon skipper butterfly
Oregon vesper sparrow	Puget (Blackmore's) blue butterfly
Western pond turtle	Island marble butterfly

Westside Oak and Dry Douglas-fir Forest and Woodlands

Oregon white oak is Washington's only native oak. Although limited and declining, oaks and their associated flora comprise distinct woodland ecosystems. The various plant communities and stand age mixtures within oak forests provide valuable habitat that contributes to wildlife diversity in the Puget Trough ecoregion. In conjunction with other forest types, oak woodlands provide a mix of feeding, resting, and breeding habitat for many wildlife species. More than 200 vertebrate species and a profusion of invertebrate species use Washington's oak woodlands. Some species occur in especially high densities, whereas others are not typically found in Washington. Several rare and declining animal species are found exclusively in association with Oregon white oak. The elusive western gray squirrel, listed as threatened in Washington, dwells among the oaks, using them for food and relying on their extensive canopies as aerial pathways. Recent surveys have shown this species to be declining precipitously in the ecoregion. Oaks woodlands provide essential habitat for other oak-dependent species that are state listed as Sensitive, Threatened, Endangered, candidates for these listings, or that are locally extirpated. This habitat also includes dry Douglas-fir forests, as well as Pacific madrone/Douglas-fir forests and local areas of lodgepole pine.

Selected Species Closely Associated with
Westside Oak and Dry Douglas-fir Forest and Woodlands
in the Puget Trough Ecoregion

Western gray squirrel	Western bluebird
Propertius' duskywing butterfly	Puget Sound fritillary butterfly
Slender-billed white-breasted nuthatch	

Westside Riparian-Wetlands

Freshwater systems in the Puget Trough ecoregion include a variety of still water (lakes, ponds) and riparian habitat types influenced by highly variable geology and dramatic moisture and elevation gradients. Most of the streams entering Puget Sound originate in glacier fields high in the Cascade and Olympic mountain ranges.

Forested riparian habitat usually has an abundance of snags critical to cavity-nesting birds and mammals and to many insect-eating birds. Downed logs provide cover and nesting habitat for amphibians, reptiles and small mammals. Intact riparian habitat has well-developed vegetation, usually with multiple canopy layers. Each layer consists of unique habitat niches that together support a diversity of birds and mammals. The relatively mild microclimate of riparian areas offers relief from hot, dry summers and cold winters, a factor which is especially important to black-tailed deer and elk. Riparian habitat forms natural corridors, providing important travel routes between foraging areas, breeding areas and seasonal ranges.

Herbaceous Wetlands

Herbaceous wetlands are generally a mix of emergent herbaceous plants and grasses. They include ponds, marshes, and seasonally flooded meadows. These meadows often occur with deep or shallow water habitats with floating or rooting aquatic forbs. Herbaceous wetlands are generally flat, usually with stream or river channels or open water nearby. They are often associated with Westside riparian-wetlands, and along stream corridors. They also occur in closed basins in a mosaic with open water by lakeshores or ponds. Wetlands are among the most biologically productive ecosystems in the world; they host unique and diverse species populations, many of which are endangered or threatened. They are associated with every terrestrial habitat in the ecoregion and contribute essential wildlife resources to each of those habitats. Herbaceous wetlands serve as natural water filters, allowing silt to settle out and trapping other pollutants. Consequently, they protect offshore water resources from siltation and pollution. They also serve as natural flood control zones, able to accommodate large amounts of water without suffering damage. Freshwater marshes are among the most susceptible of all herbaceous wetlands to human-induced impacts. They are easily drained or filled because they are often small and have low water levels.

Selected Species Closely Associated with
Westside Riparian-Wetlands and Herbaceous Wetlands
in the Puget Trough Ecoregion

- Western pond turtle
- Trumpeter swan
- Yellow-billed cuckoo
- Hatch's click beetle
- Beller's ground beetle
- Oregon spotted frog
- Western toad
- Pacific lamprey
- North Puget Sound steelhead
- South Puget Sound steelhead
- Salish sucker
- Pacific clubtail dragonfly
- Long-horned leaf beetle

Westside Lowlands Conifer-Hardwood Forest

The Westside lowlands conifer-hardwood forest zone occupies the lowlands around Puget Sound. It is the most extensive habitat in the lowlands on the west side of the Cascades, and forms the matrix within which other habitats occur as patches, especially riparian-wetlands. This forested habitat is dominated by Douglas-fir, western hemlock, western redcedar, red alder and bigleaf maple. All of these species except the short-lived red alder are capable of exhibiting dominance and persisting for at least a few hundred years. Eventually a multi-layered canopy will develop and be well expressed by stand age 200-400 years. Throughout this habitat, western hemlock tends to increase in importance as stands mature.

This forested habitat is the wintering area for numerous birds that breed in more northerly climates, at higher elevations in the surrounding mountains, or on the east side of the state. The most important areas of this forested habitat for wildlife and biodiversity are the remaining stands of mature timber (80-≥200 years old), of which only five percent (5%) remain in the Puget Trough ecoregion. Most of this remaining mature timber is in federal or state ownership.

The central and southern Kitsap Peninsula, eastern Jefferson County, northwestern Snohomish County, and northern Clallam County probably have the greatest potential for improving biodiversity protection within this mature forest habitat while maintaining connectivity with surrounding zones. The Nisqually River corridor currently serves as a relatively unbroken wildlife link between the Nisqually Glacier on Mount Rainier and the Nisqually Delta. The Tiger Mountain-Squak Mountain-Rattlesnake Mountain "lobe" of the West Cascades ecoregion extends further into the greater Seattle area than any other expanse of largely forested land and major public-private efforts are underway to permanently protect this "Mountains to the Sound" corridor from development and fragmentation. The mostly agricultural corridor along and between the White and Green Rivers is also being engulfed by housing and industrial development, and is unlikely to contribute to recovery of the Westside lowlands-conifer hardwood forest habitat type.

Selected Species Closely Associated with
Westside Lowlands Conifer-Hardwood Forest
in the Puget Trough Ecoregion

Keen's myotis	Northern spotted owl
Purple martin	Oregon megomphix (snail)
Marbled murrelet	Blue-gray taildropper
Northern goshawk	Johnson's hairstreak

CONSERVATION PROBLEMS

Since most of Washington's human population is concentrated in the Puget Trough ecoregion, there are a variety of human activities and land uses that have contributed to habitat loss and degradation, including incompatible forest and grazing practices, conversion of habitat to agriculture, urbanization, dispersed residential development, pollution, overfishing and overhunting, water extraction, incompatible mining, hydropower and energy developments and transportation systems. These developments disturb and displace wildlife, disrupt migration corridors, and encourage the establishment of invasive plant and animal species.

Marine and Nearshore Habitats

The three most significant problems for the marine and nearshore environments are loss of natural shoreline and estuary habitat and habitat degradation, pollution and invasive species. Approximately 47% of Puget Sound estuarine wetlands have been lost from diking and draining for agriculture, industrial and urban development. Some evidence of ecosystem harm is shown in the high incidence of closed shellfish harvest areas, the list of polluted water bodies, the salmon populations listed under the Endangered Species Act, and the disappearance of forage fish and eelgrass in areas of shoreline modification.

Shoreline Modification

The most serious long-term problem for the Puget Sound environment is shoreline modification. Population growth and resulting development have modified natural shorelines and other critical areas, compromising and eliminating the ecological functions they provide.

Shoreline modification such as bulkheading, filling, and dredging can lead to direct habitat loss and changes in the sediment and wave energy on beaches and in adjacent subtidal areas. Alterations in the physical characteristics of the beach will eventually affect species dependent on the shoreline for survival. One third of Puget Sound's shorelines, approximately 800 miles, have been modified. The central Puget Sound region, with high human population levels, shows the highest level of modification overall at 52%. In the last 100 years, over 73% of tidal wetlands and perhaps as much as 33% of eelgrass beds have been lost to dredging, filling and diking.

Environmental Contamination

Large portions of Puget Sound's 1.8 million acres of submerged sediments show some form of chemical or biological degradation. More than 5,700 acres have been classed as contaminated because they exceed the Washington state sediment management standards. Some of this contaminated acreage may naturally recover without remediation if the sources of contamination are controlled. Contaminated underwater sediment sites are concentrated in the major urban bays, including Commencement Bay (Tacoma), Elliott Bay (Seattle), Bellingham Bay, Bremerton, and other bays with extensive histories of industrial activities. The contaminated sites on land are widely scattered, as were the oil storage facilities, dry cleaners, creosote plants and other activities that caused the contamination.

Toxic substances threaten the Sound's rich marine diversity. Seals and other marine mammals in Puget Sound have high levels of polychlorinated biphenyls (PCBs), fire retardants (PBDEs), and other toxins. Juvenile salmon from rivers with contaminated bays show higher levels of toxins than fish from clean estuaries. A high percentage of adult salmon returning to certain urban streams are dying before they spawn. Although some toxic compounds have been banned, continuing sources of toxins include industrial and municipal discharges, oil spills, hazardous material spills, seepage from hazardous sites on land, illegal discharges and dumping activities. Stormwater runoff from roads, parking lots and other impervious surfaces further degrades the shoreline environment.

Alien and Invasive Species

Once established, aquatic nuisance species are expensive to control and almost impossible to eradicate. Non-native species can enter inland waters in many ways, including accidental releases from research institutions and laboratories, aquaculture operations, the aquarium trade, discharge of ballast water from vessels, and the distribution of seafood commodities.

Forest Habitats

Habitat Loss and Degradation

Historically, most of the Puget Trough ecoregion was covered in conifer forest. Over 50% of these conniver forests have been converted to urban and agricultural use. Many of the remaining forests are now hardwood and mixed conifer. Approximately 30,000 acres of forest a year is converted from forest management to developed uses in the Puget Trough ecoregion. This is a more profound and final disturbance than the logging of the original old-growth forest. It is also more detrimental to water, wildlife and fisheries resources. Accelerated erosion, more severe and frequent landslides, and other types of environmental degradation are occurring as a result of urbanization. Urban development increases runoff and adds pollutants to affected watersheds, particularly septic field drainage, herbicides, and pesticides. Over the last 30 years, more than 2.3 million acres of forest land have been converted to urban, residential, commercial and transportation uses in the Puget Trough ecoregion. Remaining stands of native conifer forest are usually small and widely fragmented, further compromising their value as wildlife habitat.

Management Practices

Forest management practices including clearcutting, slash burning, herbicide applications, disease control, salvage logging, plantation forestry, road building, and short harvest rotations have resulted in a loss of forest diversity in both individual stands and at the landscape scale throughout the Puget Trough ecoregion. Most of the remaining habitat is now in private Douglas-fir plantations, and intensive logging of both mature and young stands continues on both private and public land.

Westside Grasslands and Oak Woodlands

Habitat Loss and Fragmentation

More than 90% of historic prairie habitat has been converted to other uses, and this destruction continues today as prime prairie is replaced by housing developments or agriculture. Only seven prairie areas, a total of less than 6,000 acres, have been set aside for conservation. Activities such as improperly managed grazing, soil compaction, trampling, etc. may also degrade prairie and oak woodlands.

The remaining native prairies/oak woodland mosaics are small and isolated from each other. This makes it difficult for wildlife to travel between prairie/oak woodland environments to access food resources and to breed and disperse. Plant populations may also have difficulty dispersing. Fragmentation greatly increases the difficulty of restoring natural ecological processes in the prairie landscape.

Decades of human settlement and intensive land use in the Puget Trough ecoregion have altered substantial amounts of lowland forest and prairie/oak woodlands habitat. Most of the original South Sound oak woodlands are gone. Only scattered fragments of oak woodlands survive, some just a few acres or a few trees in size. Management practices: Encroachment by native Douglas-fir is a significant threat to remaining oaks and is aggravated by urban development, fire suppression, timber conversion and improperly managed cattle grazing.

Grazing is a primary use of oak woodlands in Western Washington. Grazing reduces species richness of ground cover, increases soil moisture, compacts soils, and disturbs sod, all of which may promote conifer growth and encroachment.

Fire suppression has contributed to the decline of Oregon white oak woodlands and prairies. Fires set by Native Americans historically played an important role in prairie and oak forest ecology, especially natural oak regeneration, by curbing conifer encroachment, controlling stand density, and initiating oak sprouting.

Alien and Invasive Species

All remaining prairie/oak habitats, both privately and publicly owned, are under stress from encroachment by both native and alien plants. Invasive plants such as Scot's broom, Himalayan blackberry, mouse-ear hawkweed, and pasture grasses are of particular concern because they can change the composition, structure and ecological processes of native plant communities. In the absence of fire, even native woody and herbaceous species such as Douglas-fir, wild rose, snowberry and bracken fern invade. Fire is a part of the native prairie ecology, and the suppression of fires can lead to conditions where Douglas-fir trees form dense stands that are rarely used by wildlife species that inhabit the open structure of prairies or savannas.

Riparian and Wetland Habitats

Freshwater riparian and wetland habitat has been, and continues to be, altered in the Puget Trough ecoregion. Whether they are cleared, inundated, built upon, or overtaken by non-native species, these disturbed areas no longer provide habitat for dependent plants and animal species. When they no longer function as habitat, they also may no longer help hold soil in place, soak up water or filter pollutants.

Habitat Loss and Fragmentation

Habitat loss and fragmentation of essential riparian habitat from urban and rural development are occurring throughout the Puget Trough ecoregion, with a cumulative negative impact on unique and valuable fish and wildlife resources. Other human activities and land uses that have contributed to degradation and fragmentation of riparian habitat include agriculture, chemical treatments, improperly managed grazing, dikes and culverts, roads, stream crossings and ever-increasing recreational demands.

Grazing Practices

Improperly managed grazing and livestock trampling decrease native aquatic plants and facilitate the introduction of invasive species, both native and non-native, eventually converting wetlands into low-productivity pasture.

Invasive Alien Plants and Animals

Invasive plants and animals continue to threaten the diversity and/or abundance of native species, the ecological stability of infested waters, and the commercial, agricultural or recreational activities that depend on such waters. Aquatic nuisance species have little or no habitat value for native wildlife, and once established they are very expensive to control and almost impossible to eradicate.

Water Quality

Water quality is significantly impacted by urbanization that generates problems such as untreated and excessive stormwater runoff, septic leachate, sediment, nutrients and pesticides (weed and feed), heavy metals, garbage, and groundwater pumping. Modern agricultural practices include heavy use of pesticides, fertilizers and concentrated livestock waste that reduce water quality. Impairment of water quality or quantity will particularly affect plant species diversity and amphibian, salmonid and bird populations, as well as carry secondary impacts to other wildlife species.

Disease and Pathogens

Disease can decimate vulnerable wildlife populations. With the reduction and fragmentation of habitat concentrating some wildlife populations and reducing other populations to low levels, disease can become a limiting factor. This increases the opportunity for diseases like plague, avian cholera or botulism to extract a heavy toll. Widespread environmental treatment of organisms that carry disease, such as spraying for mosquito-borne West Nile virus, must be carefully planned and executed to avoid massive mortality of non-target species.

The following additional habitat and species conservation problems have been identified in the Puget Trough ecoregion:

Wildlife species and population problems: includes disease, pathogens, competition, food scarcity, predation, overharvest, and limited population size and distribution.

- Populations of sea otter, southern resident killer whale, Steller sea lion, fisher, western gray squirrel, Columbian white-tailed deer, western pond turtle, Oregon spotted frog, marbled murrelet, northern spotted owl, and mardon skipper have declined to the point where they are listed as threatened or endangered. Fisher are extinct in the Puget Trough.
- Recovery plans are needed to guide conservation actions for threatened or endangered species including southern resident killer whale, northern spotted owl, Oregon spotted frog, and mardon skipper.
- Management plans are needed for the sensitive species including common loon, peregrine falcon, and Olympic mudminnow. State sensitive species need to be managed to avoid becoming threatened or endangered.

- Small population size and loss of genetic diversity is a problem in Western gray squirrels, and mange can cause high mortality in populations.
- In addition to species listed as threatened or endangered, many other species are found at a small number of isolated sites and may be affected by inbreeding or otherwise at risk of local extinction, including streaked horned lark, Oregon vesper sparrow, slender-billed white-breasted nuthatch, Mazama pocket gopher, Brush Prairie pocket gopher, gray-tailed vole, Shaw Island Townsend's vole, Keen's myotis, island marble, Taylor's checkerspot, hoary elfin, Pacific clubtail, blue-gray taildropper, Beller's ground beetle, Hatch's click beetle, long-horned leaf beetle, sand-verbena moth, Salish sucker and Olympic mudminnow.
- The great arctic (butterfly) was historically known from the San Juan Islands, but there have been no records since 1950.
- Steller sea lion are vulnerable because of the small number of haul outs that are used.
- Elk compete with Columbian white-tailed deer for food.
- Predation from gulls and introduced mammals at breeding colonies may impact populations of common murre and Cassin's auklet.
- Predation of nests by crows may be an important mortality factor for streaked horned lark.
- Illegal persecution and harvest occurs for bald eagle and migrating and spawning fish species of concern.
- Rockfish (copper, greenstriped, quillback, black, China, tiger, bocaccio, canary, redstriped, yelloweye) are caught as bycatch in the recreational salmon fisheries and are vulnerable to overharvest; when rockfish are pulled up from depth, their gas bladders extend, likely causing internal damage and mortality.
- Overharvest is a problem for Pacific herring (Cherry Point and Discovery Bay stocks), green sturgeon and bull trout. Quantitative stock assessment and annual estimate of the total stock size of eulachon is needed in order to estimate the harvest rate.
- Populations of rockfish predators including seals, sea lions, lingcod, and other piscivorous fish are increasing.
- The decline in some salmon stocks likely affects southern resident killer whale.
- Pacific harbor porpoise are affected by incidental mortality in gill nets, salmon trolls, or hake trawls.
- Steller sea lion, sea otter and western grebe are negatively impacted by entanglement in gill nets and other fishery gear.
- Commercial fisheries and shellfish harvest may reduce important prey species for Steller sea lion, sea otter and common murre. The timing of kelp harvest may affect some organisms.
- There is potential for overharvest of northern pintail, greater scaup, lesser scaup, long-tailed duck, and scoter (black, surf, white-winged).

<u>Lack of biological information on species and habitats</u>:

- Data are needed on population trends in state threatened and endangered species including sea otter, southern resident killer whale, Steller sea lion, fisher, western gray squirrel, Columbian white-tailed deer, western pond turtle, Oregon spotted frog, marbled murrelet, northern spotted owl, and mardon skipper.
- Populations of the peregrine falcon, which has been downlisted to sensitive, and bald eagle, which may soon be downlisted to sensitive, need to be monitored to confirm their continued recovery.
- Additional sensitive species need to be surveyed periodically to ensure they do not become threatened, including common loon and Olympic mudminnow.

- Information is needed about the status of populations of state candidate species including Townsend's big-eared bat, Keen's myotis, Mazama pocket gopher, Brush Prairie pocket gopher, gray-tailed vole, Pacific harbor porpoise, western grebe, common murre, Cassin's auklet, tufted puffin, Vaux's swift, northern goshawk, pileated woodpecker, purple martin, slender-billed white-breasted nuthatch, Oregon vesper sparrow, yellow-billed cuckoo, sharp-tail snake, western toad, Van Dyke's salamander, rockfish (copper, greenstriped, quillback, black, China, tiger, bocaccio, canary, redstriped, yelloweye), bull trout, eulachon, river lamprey, Beller's ground beetle, Hatch's click beetle, long-horned leaf beetle, Taylor's checkerspot, Johnson's hairstreak, valley silverspot, island marble, Puget (Blackmore's) blue, and great arctic.
- Research is needed on habitat needs, limiting factors, demographics and dispersal in western gray squirrel, Mazama pocket gopher, streaked horned lark, Oregon spotted frog, Taylor's checkerspot and mardon skipper to facilitate recovery planning or reintroductions.
- Information is needed on the current distribution and abundance of many other species, including Shaw Island Townsend's vole, great blue heron, mountain quail, black oystercatcher, tule greater white-fronted goose, scoters, western bluebird, Salish sucker, green sturgeon, Pacific lamprey, Oregon branded skipper, dog star skipper, propertius duskywing, hoary elfin, Puget Sound fritillary, sand-verbena moth, Pacific clubtail, western floater, western ridged mussel, western pearlshell, blue-gray taildropper, and Oregon megomphix.
- Data are needed on effects of contaminants and limiting factors for southern resident killer whale and other marine mammals.
- Areas used by all rockfish life history stages and movements of juveniles before selection of adult habitat are largely unknown.
- There is insufficient information to conduct rockfish population assessments within Puget Sound; harvest needs to be appropriately scaled to the anticipated run size.
- There is a pressing need to conduct research on deep-water zones in Puget Sound. Information on substrates and bathymetry, salinity, currents, sea surface temperature and productivity might be combined to create a model for offshore ecosystems. Survey efforts are also needed to verify the condition and biodiversity value of nearshore marine zones.
- Thorough mapping of kelp and eelgrass beds is needed.
- Taxonomic and/or genetic work needs include: formally describe Salish sucker; western toad taxonomy is uncertain, so one or more taxa may be in greater decline; the long-horned leaf beetle may be synonymous with *Plateumaris dubia*; data is needed on genetic diversity and gene flow in bull trout.
- Information is needed on the population dynamics and the impact of dredging on the spawning grounds, incubating eggs, and larvae of eulachon.
- The causes of decline of tufted puffin, western toad and eulachon are unknown.
- Information is needed on the impacts of development on the Salish sucker.
- Life history other than spawning of the surf smelt is not known.
- Adequate fishery statistics are generally lacking for recreational surfsmelt fisheries, in spite of their local importance.
- There is no comprehensive data set for an adult sand lance population in the Puget Sound basin.
- There is a shortage of adequate spatial inventory and assessment data on most habitat types.
- There is an absence of baseline data on the habitat values and functions of natural wetlands and a poor understanding of the status of resident macroinvertebrates in aquatic systems.

Habitat loss, conversion, fragmentation and degradation:

- Only 3% of western Washington forest is currently in the old growth age class, and nearly all of it is in high elevation national forests or national parks. Maintenance of old growth forest across the landscape is important for at least 1,000 species.
- Suburban sprawl is a concern for resource managers, as indicated by the growing number of ranchettes and residential subdivisions in previous managed forest and cropland. Development often occurs near lakes or streams and poses an increased threat of fire and impacts to water quality.
- Grassland conversion, recreational use, and rural development has resulted in loss or degradation of habitat of the Mazama pocket gopher, Brush Prairie pocket gopher, Shaw Island Townsend's vole, streaked horned lark, mardon skipper, Taylor's checkerspot, Puget Sound fritillary, valley silverspot, Oregon branded skipper, dog star skipper, hoary elfin, and Puget (Blackmore's) blue.
- Loss, fragmentation and degradation of oak and mixed oak/conifer habitats by encroachment of conifers and development affect western gray squirrel, Propertius' duskywing, slender-billed white-breasted nuthatch, hoary elfin and other oak-dependent wildlife.
- Development or other land uses that degrade or alter hydrology can eliminate bog habitat of Beller's ground beetle and long-horned leaf beetle.
- Degradation of shorelines by residential development can eliminate nesting habitat for common loon and bald eagle. Urbanization and industrialization of coastal shorelines, bays and estuaries have degraded some winter habitat and reduced food abundance for long-tailed duck and scoter.
- Continued clearing of woodlands adjacent to high value foraging areas reduces great blue heron populations.
- Loss of suitable riparian habitat may be responsible for decline of yellow-billed cuckoo.
- Development or other land uses alters hydrology and can eliminate bog or wetland habitat of Oregon spotted frog, Beller's ground beetle, Hatch's click beetle and long-horned leaf beetle.
- The loss of forest habitat to development has affected populations of fisher, northern spotted owl, marbled murrelet, northern goshawk, Vaux's swift, pileated woodpecker, Keen's myotis, Johnson's hairstreak, blue-gray taildropper, and Oregon megomphix.
- Flooding of habitat can be a problem for Columbian white-tailed deer.
- Loss of trumpeter swan, northern pintail and tule greater white-fronted goose foraging habitat due to development of agricultural lands.
- Drainage of wetlands and conversion to agriculture and degradation of marshes impact northern pintail, tule greater white-fronted goose, lesser scaup, Oregon spotted frog, and Olympic mudminnow.
- The decline of eelgrass beds has negatively impacted brant.
- Any changes in management of Jetty Island, Everett, may affect nesting arctic terns; human activity on the island and at waterfront nest locations may impact nest success.
- Surfsmelt and Pacific sand lance spawning habitats can be damaged or destroyed by physical burial due to armoring bulkhead/fill structures intruding into the intertidal zone from adjacent uplands, alteration or disruption of the natural erosion, and longshore transport of beach substrate (the "longshore drift").
- The habitat quality of surfsmelt spawning beaches used during the hot summer months may be degraded by the routine deforestation of the marine-riparian zone during the course of shoreline development.

- Sandy habitat of sand-verbena moth is being degraded by stabilization by vegetation, and lost to recreational development.

Incompatible land management practices:

- Logging of mature/old timber and reduction in abundance of snags may negatively impacts populations of northern spotted owl, marbled murrelet, northern goshawk, Vaux's swift and pileated woodpecker and Keen's myotis. Reduction in occurrence of mistletoe likely affects Johnson's hairstreak.
- Improperly managed grazing may impact habitat of mardon skipper, valley silverspot, Taylor's checkerspot, Puget Sound fritillary, Mazama pocket gopher and Brush Prairie pocket gopher.
- Lack of fire on grassland and in prairie/oak woodland edges allows invasion by Douglas-fir, shrubs, and non-native vegetation, degrading habitat of mardon skipper, Oregon branded skipper, dog star skipper, Taylor's checkerspot, Puget Sound fritillary, valley silverspot, Puget (Blackmore's) blue, streaked horned lark, Oregon vesper sparrow, and western bluebird.
- Logging, conversion to conifers and firewood cutting in oak habitats may have negatively impacted western gray squirrel, Propertius' duskywing, slender-billed white-breasted nuthatch and other oak dependent species.
- Reduction of snags in clearcuts, ecotones, oak savannah, affects western bluebird and slender-billed white-breasted nuthatch.
- Decline in moist forest floor conditions and coarse woody debris in stands of bigleaf maple or mixed hardwood-conifer stands apparently has eliminated populations of blue-gray taildropper and Oregon megomphix.
- Spraying of BTk can impact butterflies including Taylor's checkerspot, Johnson's hairstreak, mardon skipper, Oregon branded skipper, dog star skipper, Puget Sound fritillary, valley silverspot and Puget (Blackmore's) blue.
- Logging, agriculture, road building or other activities that elevate temperature, alter hydrology and increase sedimentation degrade habitat of Olympic mudminnow, Salish sucker, and bull trout.
- Modern agricultural practices have reduced the quality, patch size and connectivity of wildlife habitat in farmlands.

Alien and invasive plant and animal species:

- *Spartina* cordgrass, European green crabs and the Asiatic clam are some of the alien plant and animal species that pose a threat to the marine environments of Puget Sound.
- Purple loosestrife, knotweeds and reed canary grass can take over a wetland and grow so densely that no other plants can survive, which in turn affects the fish and wildlife that depend on the native plants for food and cover.
- Alien grasses and weeds affect habitat of mardon skipper, Taylor's checkerspot, Puget Sound fritillary, Puget (Blackmore's) blue, valley silverspot, and other grassland butterflies.
- Western gray squirrel are negatively affected by competition from non-native eastern gray and fox squirrels.
- *Spartina* spp., a non-native cordgrass, is spreading and degrading intertidal shorebird and waterfowl habitat.
- Scot's broom, alien grasses and weed invasion affect habitat of mardon skipper, Taylor's checkerspot, Puget Sound fritillary, valley silverspot, Oregon branded skipper, Dog star skipper, hoary elfin, Puget (Blackmore's) blue, streaked horned lark, and Oregon vesper sparrow.

- Scot's broom and European beachgrass are degrading sandy coastal habitat of the sand-verbena moth by increasing vegetation stabilization of sandy areas.
- Bullfrogs and introduced predator fish such as bass prey on young western pond turtle and Oregon spotted frog. Non-native predator fish also negatively affect Olympic mudminnows.
- Non-native turtles threaten western pond turtle through competition and the potential for introduced disease.
- Non-native trout such as brook trout compete with, and may hybridize with, bull trout.
- House cats kill Mazama pocket gopher, and probably Brush Prairie pocket gopher and Shaw Island Townsend's vole as well.
- Competition for nest cavities in snags and birdhouses by European starling and house sparrow impact purple martin and western bluebird.
- Filbert worms and other alien pests affect acorns needed by western gray squirrel and other wildlife species.
- Barred owl have expanded their range and are replacing northern spotted owl in many locations.
- Nutria have expanded their range into the Puget Trough ecoregion, and they compete with and displace native muskrats. Nutria feeding habits can also be quite destructive to wetland vegetation; by selectively foraging on vegetative root mats, they uproot entire plants, loosen soil and contribute to erosion.

Human disturbance and recreational impacts:

- Human disturbance can be a significant problem for breeding sites of great blue heron, peregrine falcon and bald eagle, and at breeding or maternity roosts and hibernacula of Townsend's big-eared bat.
- Recreational boating can create disturbance problems for loons, brant, greater scaup and foraging bald eagle; eagles often avoid foraging in water around stationary boats.
- Disturbance of black oystercatcher, common murre and Cassin's auklet nesting sites by kayakers, boaters, fisherman, and low flying aircraft may reduce fledging rate.
- Military training and activities sometimes disturb nesting streaked horned lark, and can impact Taylor's checkerspot and other butterflies, and result in soil compaction that likely negatively affects Mazama pocket gopher.
- Bog habitats of Beller's ground beetle, Hatch's click beetle and long-horned leaf beetle are sensitive to human trampling.
- Recreational disturbance of grassland sites likely negatively impacts mardon skipper, Taylor's checkerspot, Puget Sound fritillary, valley silverspot, and Puget (Blackmore's) blue by crushing eggs, larvae, pupae, and host plants.
- Mazama pocket gopher and Brush Prairie pocket gopher are poisoned and trapped by landowners and killed by cats and dogs.
- Vessel disturbance and noise can disturb southern resident killer whale and Pacific harbor porpoise.
- Mortality of lesser scaup from fishing nets and lines may be substantial.
- Gill net fisheries result in the accidental bycatch of sizable numbers of common murres, ancient murrelet, Cassin's auklet, and tufted puffin.
- Trampling damage to host plants of sand-verbena moth may occur on public beaches.
- Recreational activities such as offroad recreational vehicles, horses, mountain bikes, and even hikers can create unauthorized trails that disturb soil and allow invasive plants to establish.
- The nature and timing of farm disturbances are increasingly hazardous to wildlife. Tilling, planting and harvesting are more synchronous, widespread and intense, thus stressing wildlife during critical periods of nesting, rearing and dispersal

Environmental contaminants

- Lead fishing sinkers poison common loon, and trumpeter swan are poisoned by lead shot ingested on wintering grounds.
- Pacific harbor porpoise, rockfish (coppers, quillback), southern resident killer whale, bald eagle and peregrine falcon accumulate persistent toxins such as DDE, PCBs, PBDEs, dioxins, furans, organochlorines and heavy metals; contamination from prey causes reduced reproduction of bald eagles on the Columbia River. Eagles and falcons concentrate persistent chemicals that can cause eggshell thinning.
- Chemical contamination such as oil spills, DDE and PCBs and heavy metal accumulation in winter food supplies may affect reproductive success of brant, greater scaup, long-tailed duck, scoters and common murre.
- Steady shipping traffic and associated oil spills pose a risk to birds (loons, grebes, brant, long-tailed duck, scoters, black oystercatcher, willet, red knot, rock sandpiper, arctic terns, common murre, ancient murrelet, Cassin's auklet, tufted puffin), mammals (southern resident killer whale, Pacific harbor porpoise, Steller sea lion, sea otter), and fish (surfsmelt, Pacific sand lance).
- Plastic pollution and ingestion at sea is widespread in tufted puffins, but detrimental effects have not been documented.

- The spraying of BTk to eradicate gypsy moth infestations could eliminate populations of rare butterflies, such as mardon skipper, Taylor's checkerspot, Puget Sound fritillary, valley silverspot, Oregon branded skipper, dog star skipper, and Puget (Blackmore's) blue.

Incompatible transportation and energy development:

- Dams and other passage barriers negatively affect bull trout, green sturgeon, river lamprey and Pacific lamprey, and water level manipulations from hydroelectric dams can affect nesting loons.
- Roadkill mortality is a problem for western toad, western pond turtle, salamanders, and Columbian white-tailed deer.
- Bald eagle and other raptors are susceptible to electrocution on powerlines.

Inadequate water quantity and quality:

- Development, logging, road construction, and improperly managed grazing that contribute to sedimentation, increases in water temperature and pollution runoff affect bull trout, Olympic mudminnow, green sturgeon, Salish sucker, Pacific clubtail, western floater, western ridged mussel, and western pearlshell.

CONSERVATION ACTIONS

Conserve and recover wildlife species and populations: includes population management, protect known populations, augmentation and reintroduction of populations, control and monitor mortality and enhance food/prey.

- Implement recovery actions for the western gray squirrel, fisher, sea otter, Steller sea lion, Columbian white-tailed deer, marbled murrelet, western pond turtle, and bull trout.
- Develop or complete recovery plans for southern resident killer whale, northern spotted owl, Oregon spotted frog, bull trout and mardon skipper.
- Develop management plans for the state sensitive species including common loon, peregrine falcon, and Olympic mudminnow.
- Evaluate other species for possible addition to the state candidate list.
- Continue head starting, captive breeding, and reintroductions of western pond turtle.
- Assess feasibility of augmenting populations of western gray squirrel, Taylor's checkerspot and mardon skipper and conduct translocations as needed.
- Complete the Washington Bat Conservation Plan.
- Implement and enforce restricted fishing regulations to protect green sturgeon and bull trout.
- Maintain conservative hunting regulations for northern pintail, greater scaup, lesser scaup, long-tailed duck, and scoters.
- Rebuild salmon stocks to restore many ecosystem parts and processes, including southern resident killer whale.
- Minimize competition between elk and Columbian white-tailed deer with fencing and transplants.
- Conduct limited predator control to reduce coyote predation of Columbian white-tailed deer fawns.
- For rockfish (copper, greenstriped, quillback, black, China, tiger, bocaccio, canary, redstriped, yelloweye), reduce harvest encounters, restrict retention, and establish Marine Protected Areas or other types of area-gear restrictions.
- Pacific herring (Cherry Point and Discovery Bay stocks): develop and implement management plan to control harvest. Develop a method to determine the abundance of each year's run size so that harvest may be appropriately scaled to the anticipated run size.
- Manage fisheries harvests to reduce competitive impacts on seabirds
- Conduct crow, gull and mammal control programs, if needed and feasible, to protect common murre and Cassin's auklet colonies, and streaked horned lark.
- Implement eulachon management plan to control harvest. Develop a method to determine the abundance of each year's run size so that harvest may be appropriately scaled to the anticipated run size.
- Conserve beaver populations and dynamic stream processes to benefit Oregon spotted frog, birds and fishes.
- Assess and map important habitats and areas of high biodiversity in the ecoregion using ecoregional assessments, Interagency Vegetation Mapping Project, and other habitat inventories and plans. Update Ecoregional Assessments every five years.
- Develop statewide land cover and threats data layers to improve connectivity between priority conservation areas.
- Identify and assess key connectivity areas and wildlife corridors between fragmented habitats and between protected areas. Restore habitat connectivity and wildlife corridors where appropriate on both public and private lands.

- Improve understanding of the ecological processes of seeps, bogs, wet meadows, forested wetlands, marshes, springs and other wetlands, and how they are impacted by human development.
- Conduct hydrologic studies that include water quantity and chemical budgets at wetlands known to be supporting rare and endangered species. Use this information to inform wetland management.
- Inventory and prioritize riparian habitat types and attributes needing protection and conservation.
- Identify important habitats for restoration and assess the feasibility of successfully restoring these sites. Include an evaluation of current and projected land use in and adjacent to potential restoration sites.
- Coordinate the collection and analysis of data on alien species, shoreline modifications, trends in kelp beds and other indicators of ecosystem health in Puget Sound.
- Develop a cohesive, priority-driven research program for westside grassland habitats that integrates university, agency and private researchers. Inventory of important grassy and herbaceous balds. Work with land management agencies and private landowners to protect these habitats from disturbance and development.

<u>Conduct research, assessment and monitoring</u>: includes species and habitat distribution, abundance, limiting factors, suitable habitat and population trends.

- Monitor the population trends of the sea otter, southern resident killer whale, Steller sea lion, fisher, western gray squirrel, Columbian white-tailed deer, western pond turtles, Oregon spotted frog, marbled murrelet, northern spotted owl, bull trout and mardon skipper to determine if recovery objectives are being met.
- Determine the status of candidate species including Townsend's big-eared bat, Keen's myotis, Mazama pocket gopher, Brush Prairie pocket gopher, gray-tailed vole, Pacific harbor porpoise, western grebe, common murre, Cassin's auklet, tufted puffin, Vaux's swift, northern goshawk, pileated woodpecker, purple martin, slender-billed white-breasted nuthatch, Oregon vesper sparrow, yellow-billed cuckoo, sharp-tail snake, western toad, Van Dyke's salamander, rockfish (copper, greenstriped, quillback, black, China, tiger, bocaccio, canary, redstriped, yelloweye), eulachon, river lamprey, Beller's ground beetle, Hatch's click beetle, long-horned leaf beetle, Taylor's checkerspot, Johnson's hairstreak, valley silverspot, island marble, Puget (Blackmore's) blue, and great arctic.
- Conduct periodic surveys of sensitive species including common loon and Olympic mudminnow.
- Monitor post-downlisted populations of peregrine and bald eagle for signs of decline that could result from bioaccumulation of contaminants or other factors.
- Investigate limiting factors, the impacts of land management, demographics, and dispersal of western gray squirrel, Mazama pocket gopher, western pond turtle, streaked horned lark, Oregon spotted frog, Taylor's checkerspot and mardon skipper to facilitate recovery planning or reintroductions.
- Determine the current distribution and abundance of Shaw Island Townsend's vole, great blue heron, mountain quail, black oystercatcher, tule greater white-fronted goose, scoters, western bluebird, Salish sucker, green sturgeon, Pacific lamprey, Oregon branded skipper, dog star skipper, Propertius' duskywing, hoary elfin, Puget Sound fritillary, sand-verbena moth, Pacific clubtail, western floater, western ridged mussel, western pearlshell, blue-gray taildropper, and Oregon megomphix. Research effective sampling techniques.
- Identify potential reintroduction sites for western pond turtle and continue reintroductions.

- Investigate foraging ecology of Steller sea lion and available prey base. Assess impact of incidental mortality from fishing gear on Steller sea lion.
- Assess burdens of toxic compounds and effects on populations and reproduction in southern resident killer whale, copper and quillback rockfish throughout Puget Sound.
- Investigate limiting factors for southern resident killer whale.
- Conduct studies to identify factors that are responsible for the recent declines in eulachon and western toads.
- Research habitat needs and limiting factors, predation and trophic relationships of river lamprey and Pacific lamprey.
- Identify potential obstacles to lamprey, green sturgeon, and bull trout and develop methods to pass barrier.
- Evaluate the effects of timber harvest at landscape scale on occupancy of habitat by northern spotted owl and barred owls.
- Investigate the systematics of western toad, Salish sucker, long-horned leaf beetle, western floater, western ridged mussel, and western pearlshell using DNA or other techniques.
- Develop standard survey protocol to monitor populations of great blue heron.
- Design and conduct extensive distribution and relative abundance surveys for Pacific sand lance. Research effective sampling techniques
- Develop methods of restoring native prairie habitats of Mazama pocket gopher, Taylor's checkerspot, mardon skipper, Puget (Blackmore's) blue, Puget Sound fritillary, valley silverspot, and island marble.
- Determine appropriate levels of grazing for mardon skipper and pocket gopher sites.
- Determine extent of mortality of ***western grebe***, tufted puffin, and other species from gillnet fishery.
- Investigate the relationship between oceanic regimes and other ocean occurrences and smelt run strength in Pacific herring (Cherry Point and Discovery Bay), and eulachon.
- Monitor population trends of rockfish predators including seals, sea lions and lingcod (particularly where rockfish populations show some recovery). Investigate food habits and trophic dynamics.

- Conduct focus studies on the specific habitat requirements for each rockfish life history stage. Develop methods to track and measure reproductive contribution from local populations in specific locations.
- Basic biological information needs to be gathered from a variety of surfsmelt and Pacific sandlance spawning stocks
- Conduct recreational surfsmelt fishery monitoring and fishery-independent net sampling.
- Complete a systematic inventory of all shoreline areas to document existing surfsmelt and Pacific sand lance spawning areas to facilitate regulatory habitat protection.
- Complete mapping of all kelp and eelgrass beds.

Protect, restore and connect habitats:

- Identify roosting sites for Pacific Townsend's big-eared bat and limit access to these areas. Protect and conserve preferred roost and hibernacula sites.
- Protect land around large great blue heron colonies through management agreements, conservation easement or fee title.
- Protect hydrology of known western pond turtle, Oregon spotted frog, Olympic mudminnow, and Van Dyke's salamander sites.
- Protect, remove invading trees and shrubs, and restore function to prairies, balds, and heaths and other habitats of Mazama pocket gopher, Brush Prairie pocket gopher, gray-tailed vole, Shaw Island Townsend's vole, streaked horned lark, Puget Sound fritillary, mardon skipper, Oregon branded skipper, island marble, Taylor's checkerspot, hoary elfin, Puget (Blackmore's) blue, Oregon vesper sparrow, valley silverspot from residential and recreational development through management plans, conservation agreements, easements, or acquisition and restore native vegetation.
- Preserve Beller's ground beetle, Hatch's click beetle and long-horned leaf beetle sites through management programs; protect fragile vegetation with fencing if necessary.
- Protect habitat of western gray squirrel from residential and recreational development through management plans, conservation agreements, easements, and acquisitions.
- Protect small prey fish populations and shoreline habitat at lakes where common loon nests.
- Survey for Olympic mudminnow in potential sites before issuing hydraulic permits.
- Provide floating platform nest structures for common loon where water levels fluctuate dramatically.
- Protect oak habitats for western gray squirrel, western bluebird, slender-billed white-breasted nuthatch, Propertius' duskywing, hoary elfin, etc.
- Manage grassland habitats to maintain *Lupinus albicaulis* in southern Puget Sound for Puget (Blackmore's) blue.
- Protect sites where blue-gray taildropper or Oregon megomphix occur.
- Use water control structures on refuge to manage water levels in sloughs and marshes to reduce flooding of Columbian white-tailed deer habitat.
- Acquire conservation easements on agricultural lands and wetlands to maintain waterfowl habitat.
- Protect eelgrass beds and intertidal areas from destruction and human activity to conserve brant.
- Manage marine areas, bays, estuaries to reduce impacts of urbanization and industrialization, monitor prey populations for long-tailed duck and scoters.
- Work with community officials and private businesses to reduce disturbance during the nesting season and to manage Jetty Island compatible with arctic tern nesting.
- Develop conservation strategies with Fort Lewis, McChord Air Force Base, and area airports for streaked horned lark.
- Protect streaked horned lark nests on dredge spoil islands in lower Columbia, and manage spoil deposition to maintain and increase open nesting habitat.
- Install single-cavity birdhouses and gourds to enhance purple martin and western bluebird populations.
- Preserve all naturally occurring surfsmelt spawning sites by protecting overhanging, shading canopies from marine-riparian zone forests bordering the beaches.
- Maintain healthy Pacific sand lance spawning habitat by preserving erosional sediment inputs and preventing shoreline armoring.
- Encourage reforestation of degraded marine shorelines where possible to restore surfsmelt spawning habitat.

- Protect and restore unstable sandy habitat where sand-verbena moths are found; restrict access to protect host plant yellow sand-verbena as necessary.
- Prioritize conservation areas using ecoregional assessments and other biological assessments. Protect important habitat types, biodiversity areas, and environmentally sensitive lands that should not be altered through a variety of techniques including acquisitions, conservation easements, life estates and cooperative agreements with willing landowners.
- Coordinate with local land trusts, conservation districts and other conservation organizations and agencies to conserve important habitat on both public and private land. Focus limited resources in regionally significant areas. Identify all possible acquisition and restoration grants and coordinate applications.
- Work with the USDA Forest Service and other public landowners to protect existing roadless areas and expand the roadless area network where justified for habitat protection and connectivity.
- Protect key connectivity areas and wildlife corridors between fragmented habitats and between protected areas through a variety of techniques including acquisitions, conservation easements, life estates and cooperative agreements with willing landowners. Use statewide land cover and threats data layers to improve connectivity between priority conservation areas.
- Restore native habitats, habitat connectivity and wildlife corridors where appropriate on both public and private lands. Consider restoring lands adjacent to existing protected areas to increase their effective size and function as wildlife habitat.
- Purchase water rights from willing sellers in unregulated tributaries; use these water rights to restore and maintain adequate year-round flows for both instream and out-of-stream riparian fish and wildlife habitat.
- Rehabilitate and restore stream channels, floodplain functions, riparian habitat and connectivity where streams have been diverted, fragmented, or degraded. Use livestock exclusions, instream structures, bank modifications and other methods.
- Preserve and/or restore buffer areas in appropriate locations along tributaries and mainstem waterways to a condition that is adequate to maintain healthy, functioning riparian zones for the ecoregion's rivers and estuaries.
- Identify and protect all remaining high quality prairie/woodland mosaic and low-elevation mature conifer-hardwood forest.
- Implement the Puget Sound Nearshore Ecosystem Restoration Project (PSNERP) to plan and undertake large-scale restoration initiatives. Coordinate PSNERP with other restoration efforts, including the Puget Sound and Adjacent Waters Program, the Northwest Straits Commission, salmon habitat restoration through the Salmon Recovery Funding Board, and other efforts.

<u>Improve land management practices</u>:

General

- Identify and protect essential habitat through management agreements, easements, or acquisitions as needed to recover listed species including western pond turtle, Oregon spotted frog, western gray squirrel, northern spotted owl, marbled murrelet, and mardon skipper.
- Protect and restore oak and oak/conifer woodlands, oak savannah and oak/grassland ecotones for western gray squirrel, slender-billed white-breasted nuthatch, Propertius' duskywing, western bluebird, and Taylor's checkerspot.
- Protect grassland habitats of Taylor's checkerspot, Puget Sound fritillary, mardon skipper, and valley silverspot from residential and recreational development through management plans, conservation agreements, easements, or acquisition.

- Discourage intensive grazing of native grasslands that degrades habitat for Mazama and Brush Prairie pocket gopher, mardon skipper and mountain quail.
- Conduct prescribed burns on grassland sites where and when needed and feasible for Taylor's checkerspot, mardon skipper, Puget Sound fritillary, valley silverspot, and other rare butterflies.
- Buffer prairies, meadows and heaths from BTk spraying to protect mardon skipper, Taylor's checkerspot, Puget Sound fritillary, valley silverspot, and hoary elfin.
- Survey mature bigleaf maple stands and protect sites for blue-gray taildropper and Oregon megomphix, and protect moist conditions at all occurrences.
- Preserve Beller's ground beetle and long-horned leaf beetle sites through land purchase or management programs and protect fragile vegetation with fencing if necessary.
- Reduce mortalities of eagles and other raptors through modification of electric transmission and distribution lines where needed.
- Continue to require bald eagle habitat plans that include retention of trees. Enforce/strengthen Shoreline Management Act
- Identify and protect preferred roost and hibernacula sites for Townsend's big-eared bat and limit access to these areas.
- Allow natural disturbances and successional functions and processes to occur on conserved wetlands.
- Manage undeveloped publicly owned land for conservation of priority habitats and species.

Forest management

- Protect remaining old growth conifer and hard stands to benefit late successional species, and manage some stands on long rotations (>200 years) as needed for northern spotted owl, marbled murrelet, Vaux's swift, pileated woodpecker, northern goshawk, Keen's myotis, western gray squirrel and Johnson's hairstreak.
- Maintain stream buffers and during timber harvest and protect hydrology of seeps, streams, wet meadows and wetlands for western pond turtle, Van Dyke's salamander, Oregon spotted frog, Olympic mudminnow, bull trout, Salish sucker, western ridged mussel, and western pearlshell. Conserve beaver populations and dynamic stream processes.
- Evaluate effectiveness of current management practices for maintaining forest species including fisher, northern spotted owl, marbled murrelet, pileated woodpecker, and Vaux's swift.

- Maintain and enforce Forest Practice rules protecting northern spotted owl nests, ***marbled murrelet*** and bald eagle roosts and nests.
- Protect chinquapin stands along Hood Canal and survey for chinquapin hairstreak.
- Work with the Washington Department of Natural Resources and the Washington Forest Practices Board to develop, implement and enforce forest practices regulations to enhance biological diversity on existing state and private managed and protected areas.
- Work through the Washington Forest Practices Board and directly with forest landowners to implement forest management prescriptions, including prescribed burns, which will maintain and enhance biodiversity and natural ecosystem function. Encourage modified silvicultural prescriptions that promote local topographic, soil and vegetative conditions. Retain snags, downed woody debris and a complement of

live trees in harvested areas. Sensitive areas such as wetlands, remnant old growth and wildlife breeding sites should not be disturbed.

- Encourage the development of selective harvest policies and guidelines on both public and private forestland that will leave adequate components of old growth habitat such as snags and downed wood as habitat for associated wildlife such as western bluebird, purple martin, and other cavity nesters.
- Minimize logging roads and decommission them after the period of entry. Ensure that all logging and forest access roads are located in stable, non-erodible areas and outside riparian management zones.
- Ensure the integrity of riparian habitat by maintaining adequate riparian management zones along streams in all logging sites, on both public and private land.
- Support implementation and enforcement of the Washington Forest Practices Act to accomplish habitat conservation and regeneration on both state and private forestlands.
- Encourage public and private forest landowners to manage forested watersheds that maintain an appropriate mix of successional stages and provide connectivity of riparian and upland vegetation as protected travel corridors for wildlife.

Grazing and agricultural practices

- Work with public and tribal and management agencies to fence or otherwise protect riparian zones from livestock grazing and unauthorized offroad vehicle use. Consider retirement rather than renewal of grazing leases on sensitive lands.
- Work with conservation districts, Natural Resource Conservation Service, USDA Forest Service and private landowners to implement best management practices in riparian areas and associated upland habitat in conjunction with the Conservation Reserve Program, Wetland Reserve Program and other Farm Bill programs.
- Use the Comprehensive Resource Management Plan process for large landscapes with a mix of public and private landowners to modify grazing regimes and improve grassland understory conditions and enhance biodiversity.
- Assist private landowners in securing funding to fence riparian zones on private land. In areas where it is impractical to exclude livestock, protect habitat quality by controlling the timing and intensity of livestock grazing through regulation and landowner agreements.
- Work with private and public landowners to minimize the impacts on habitat and wildlife from modern agriculture, including agrochemical use, water use, grazing and soil erosion.
- Eliminate grazing in oak woodlands on public lands in the Puget Trough.

<u>Control and prevent introduction of alien and invasive species</u>:

- Develop a regional plan for the detection, rapid response and eradication of invasive species.
- Continue programs to control and eradicate *Spartina* spp. to protect habitat value of shorebird and waterfowl habitat. Remove nutria from wetlands.
- Conduct limited control of eastern gray and fox squirrels that are competing with western gray squirrel.
- Control bullfrogs and predatory fish as needed for western pond turtle, Oregon spotted frog Olympic mudminnow, and Pacific clubtail.
- Control Scot's broom, weeds and alien grasses on native grasslands and in oak savannah for mardon skipper, dog star skipper, Oregon branded skipper, Taylor's

checkerspot, hoary elfin, Puget Sound fritillary, valley silverspot, Puget (Blackmore's) blue, slender-billed white-breasted nuthatch and western bluebird.

- Control Scot's broom, weeds, European beachgrass and other alien grasses that are degrading sandy habitat of sand-verbena moth.
- Avoid introduction of non-native fish in fishless lakes and where species of conservation concern occur such as bull trout, native amphibians and reptiles. Avoid introduction of non-native trout to protect bull trout from hybridization, competition, and predation.
- Remove European starlings and house sparrows near remaining and former purple martin and western bluebird breeding areas, or provide starling-proof boxes.
- Work with other public agencies and private agricultural organizations such as the Farm Bureau and Washington Grange to develop basic techniques for mapping and monitoring the spread of invasive plant species over time.
- Participate in federal and state agency partnerships to develop and implement weed control strategies for impacted sites and ecosystems. Promote adequate funding and coordination of weed control efforts on both public and private lands using environmentally sound methods.
- Develop educational and public information materials to increase public awareness of the ways that invasive alien species are introduced to sensitive ecosystems.
- Provide funding, incentives and technical assistance to private landowners to eliminate undesirable invasive plant species in riparian zones and to restore native plants that provide important habitat for native fish and wildlife. Use integrated pest management practices to control currently established invasive species with help from volunteers.
- Participate in federal and state agency partnerships to develop and implement weed control strategies for impacted sites and ecosystems.
- In semi-native grasslands, control habitat-modifying invasive species such as Scot's broom, pasture grasses and blackberries. On wetland edges, plant native trees and shrubs to shade out invasive plants such as reed canary grass.

- Continue to focus state, federal and private efforts on eradicating ***Spartina*** spp. in Puget Sound and bays on the outer coast.
- Coordinate ballast water management and treatment standards development with the U.S. Coast Guard and the International Maritime Organization to prevent or control pollution and the spread of aquatic nuisance species into Washington.

<u>Control and monitor disturbance</u>:

- Protect Townsend's big-eared bats and nesting areas of peregrine falcon, northern spotted owl, marbled murrelet, great blue heron and bald eagle through use and access restrictions on public lands as needed, and work with private landowners and permitting agencies to prevent blasting or construction disturbance during nesting. Inform rock climbers of sensitive periods and locations to reduce disturbance of nesting peregrines.
- Work with the U.S. Army, Air Force, and Navy to reduce mortality or disturbance of mardon skipper, Taylor's checkerspot, and other grassland butterflies, streaked

horned lark, Mazama pocket gopher, southern resident killer whale and other marine mammals.

- Eliminate vehicular access and campsites in conservation areas identified as sensitive habitats such as montane wetlands, bogs, prairies, and dunes.
- In sensitive habitats, manage both land and water access by using fencing, trails, elevated boardwalks, railings, seasonal restrictions, signage and livestock restrictions.
- Reduce the amount and impact of unauthorized recreational access and use on important wildlife habitat through better enforcement of existing laws, more fencing and posting of critical habitat areas, selective road closures and increased public education and information for recreational users and user groups.

Control and prevent environmental contamination:

- Facilitate use of nontoxic alternatives to lead shot and lead fishing sinkers.
- Identify and remediate sources of lead shot poisoning for trumpeter swan.
- Work with other agencies to reduce and remediate sources of contaminants entering Puget Sound to protect southern resident killer whale, Pacific harbor porpoise, greater scaup, brant, long-tailed duck, scoters, bald eagle, peregrine falcon, copper rockfish and quillback rockfish.
- Minimize risk of, and damage from, oil spills to protect marine mammals, birds, fish, and invertebrates through regulations and maintaining rapid response and clean-up capabilities.
- Identify winter concentration areas of common loon, western grebe, tufted puffin and other birds and incorporate into oil spill plans.
- Do not use piscicides to eradicate unwanted fishes in lakes or ponds with Olympic mudminnow, and where common loon nest or where good potential for colonization exists.
- Work with governmental and nonprofit agencies to develop an ecoregion-wide strategy for identified toxins and other pollutants: their sources, destinations and effects, and ways to reduce their discharge.
- Work with other agencies, industry and private landowners to encourage use of integrated pest management techniques and phase out the use of pesticides and herbicides.
- Clean up contaminated sites and sediments whenever possible, and prevent further toxic contamination of areas, including unconfined spoil disposal sites.
- Reduce the use of hazardous chemicals by continuing to implement the persistent bioaccumulative toxins strategy and by using a variety of best management practices and improved treatment methods.
- Continue to place a priority on actions to prevent and respond to oil and hazardous material spills.

Improve transportation and energy development:

- Where feasible remove barriers to passage for bull trout, green sturgeon, river lamprey and Pacific lamprey.
- Reduce mortalities of eagles and other raptors through modification of electric transmission and distribution lines where needed.
- Work with the Washington Department of Transportation to locate highways away from important wildlife habitats and biodiversity areas. If impacts are unavoidable, design adequate mitigation such as underpasses, overpasses and fencing to accommodate wildlife that need passage, for western gray squirrel, western pond turtle, western toad, and Van Dyke's salamander.

Improve water quantity and quality:

- Work with public and private landowners through education, planning and regulatory pathways to reduce sedimentation and pollution for bull trout, green sturgeon, Salish sucker, river lamprey, Pacific lamprey, western floater, western ridged mussel, and western pearlshell.
- Manage wetland areas on public land for both high water quality and habitat value. Ensure that the water quality of inflow does not lead to deterioration of the wetland habitat.
- Where possible restore or rehabilitate the hydrology, water quality and native plant communities in degraded and disturbed wetlands. Methods should emphasize creating or restoring natural wetland functions such as conserving beaver populations and dynamic stream processes to benefit species like Oregon spotted frog, Salish sucker, ***western pond turtle*** and Olympic mudminnow.

- Manage runoff from highways according to the updated highway runoff manual. Improve the road drainage network in riparian zones by removing unnecessary culverts, increasing the size of inadequate culverts, or replacing culverts with bridges.
- Reduce the harm from stormwater runoff by working to improve the effectiveness of the National Pollutant Discharge Elimination System stormwater permit programs.
- Assist local jurisdictions in finding solutions to increase landowner compliance with onsite sewage system maintenance and animal waste management practices through education and regulated inspection. Work to reduce the number and volume of combined sewer overflow events.
- Prevent nutrient and pathogen pollution caused by human and animal wastes by focusing efforts and resources geographically, in high-risk locations such as Hood Canal, in threatened or contaminated shellfish harvest areas, and in streams where state and local partners can carry out water cleanup plans and shellfish restoration strategies to reduce loading.

Improve coordination, planning, permitting and mitigation:

- Consider seasonal limitations on human activity near black oystercatcher nesting sites.
- Continue to require bald eagle habitat plans that include retention of trees. Enforce/strengthen Shoreline Management Act.
- Protect nesting bald eagle, northern spotted owl, marbled murrelet and peregrine falcon by maintaining buffer zones during nesting.
- Provide scientific information on priority habitats and species and biodiversity areas, their significance, management needs and compatible land uses to decision-makers at site, local and regional scales.
- Provide technical assistance to counties in using fish and wildlife and biodiversity information to update comprehensive land use plans, community or watershed plans, Shoreline Master Plan, etc.
- Assist counties in developing and updating county ordinances and incentives that help to mitigate or control development in areas with resource and conservation values and that encourage environmentally sensitive development in growth areas.

- Work with local governments and conservation organizations to identify and protect areas of important habitat and biodiversity through existing environmental laws and other local programs.
- Encourage floodplain management and shoreline zoning protection programs.
- Develop a coordinated conservation vision and strategy for conservation of large landscapes using a structured process like The Nature Conservancy's 5-S Project Management System or the Cascade Dialogs.
- Review state and federal land management plans to ensure adequate protection for priority habitats and species, biological diversity and ecosystem health.
- Develop site management plans for protected areas.
- Work with public and tribal land management agencies to protect important habitat and areas of high biodiversity from loss and fragmentation, as well as degradation.
- Coordinate and integrate species recovery and management plans with land management and watershed plans using regulatory and voluntary approaches.
- Participate in Growth Management Act, Shoreline Management Act, Forest Protection Act and Federal Energy Regulatory Commission permitting processes for new or expanded residential, recreational or hydropower development on private land.
- Use information from ecoregional assessments to illustrate important habitats and areas of high biodiversity. Encourage permitting agencies to designate and protect these areas from residential and recreational development, and to require mitigation for habitat conversion and fragmentation where it occurs.
- Work closely with the USDA Forest Service and other land management agencies to prevent or mitigate potential adverse impacts to fish and wildlife habitat from proposed recreational or hydropower development on public lands.
- Work with regulatory agencies to design effective mitigation strategies for projects that result in wildlife impacts or direct conversion or fragmentation of habitat.
- Encourage the permitting of land uses practices that protect the integrity of beach, dune, shoreline and nearshore ecosystems. Regulate and control the construction of jetties and other structures that may obstruct the natural dynamics of dune and beach habitats.
- Represent WDFW's conservation interest on interagency recovery teams and working groups.

Improve enforcement of laws and regulations:

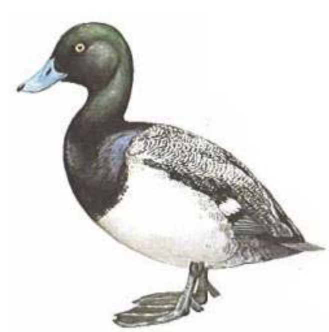
- Protect listed wildlife through enforcement, education and outreach.
- Enforce prohibition of killing bald eagle and non-permitted possession of parts through investigation and vigorous prosecution.
- Enforce restriction on transplantation of fishes to protect western pond turtle, Oregon spotted frog, bull trout, Olympic mudminnow, Salish sucker, and Pacific clubtail.
- Continue requirements on net design and daily and seasonal fishing activity of gillnetting to protect common murre, ancient murrelet, and Cassin's auklet.
- Restrict human activity in and around common murre and Cassin's auklet breeding colonies.
- Enforce zoning and shoreline management regulations and establish and enforce adequate marine riparian zone buffers for the conservation of shoreline-bordering forests to protect surfsmelt spawning areas.
- Enforce recreational access restrictions on public lands and aquatic areas.

Improve landowner assistance:

- Develop, periodically update, and provide WDFW Priority Habitats and Species management recommendations to assist landowners in conserving priority habitats and species.
- Work with large and small timber companies and landowners to accomplish habitat conservation through non-regulatory approaches such as landowner incentives, conservation easements, habitat conservation plans and acquisition of critical habitat from willing landowners.
- Secure state and federal tax incentives that discourage habitat fragmentation and destruction and that encourage landowners to protect and manage their land to benefit wildlife habitat.
- Work with local government to implement the Public Benefit Rating System and encourage effective use of open space tax incentives for landowners.
- Work with private landowners to identify and protect areas with important habitats and biodiversity and protect these areas through landowner incentives and other nonregulatory programs. Important areas include prairies, oak woodlands, balds, bogs, old growth forest, marshes and undeveloped shoreline.
- Provide educational materials to private landowners that describe management techniques for maintaining and restoring various wildlife habitats.
- Work with private landowners to identify and protect important wetland habitats and buffers by providing adequate water, controlling invasive plants, reducing disturbance to nesting wildlife, and fencing or otherwise keeping livestock out of wetlands and associated upland habitat.
- Influence the application of federal Farm Bill funds, including the Conservation Reserve Program and the WDFW Landowner Incentive Program, on private agricultural lands most critical for wildlife movement and most suitable for restoration of native wetlands, shrub-steppe and grassland habitat.
- Promote grant programs to assist landowners with implementation of management plans.

Improve wildlife conservation education: includes outreach, volunteer and watchable wildlife programs.

- Develop education program targeted to minimizing disturbance of great blue heron colonies during breeding period.
- Develop and/or disseminate education materials to prevent introductions of alien shellfish competitors of western ridged mussel and western pearlshell.
- Develop education program targeted to reduce disturbance of southern resident killer whale, common loon, bald eagle, black oystercatcher, common murre, Cassin's auklet, brant, scaup, and western grebe by boaters, kayakers, fishermen, and low flying aircraft.
- Encourage homeowners to keep cats indoors to protect Mazama pocket gopher, Brush Prairie pocket gopher, gray-tailed vole and Shaw Island Townsend's vole. Distribute literature and web site link to American Bird Conservancy campaign.
- Inform local residents of legal status of Mazama pocket gopher. Promote non-lethal methods of damage control.
- Continue efforts with tribal fisheries to reduce gill entanglement of Pacific harbor porpoise, common murre, ancient murrelet, Cassin's auklet, and tufted puffin.
- Education programs targeting ***greater scaup*** sensitivity at



important wintering areas in bays and estuaries.

- Develop educational materials and programs targeted to fishermen to reduce lesser scaup mortality from entanglement with discarded line and nets
- Facilitate use of nontoxic alternatives to fishing sinkers to protect loons.
- Use signage or fences to prevent trampling of host plants of sand-verbena moth on public beaches and bog habitats of Beller's ground beetle, Hatch's click beetle and long-horned leaf beetle.
- Engage and involve local and tribal governments, state and federal agencies, organizations and citizens in efforts to protect and restore priority habitats and species through a variety of outreach projects, programs and education efforts.
- Increase the use of citizen science for the collection of data, monitoring, restoration and conservation of important habitats and associated wildlife species. Coordinate volunteer monitoring and involvement.
- Promote and maintain public information and education efforts that focus on endangered species, habitat loss, ecological function, biological diversity and environmentally aware lifestyle practices. Emphasize the connection between habitat and environmental quality and human health and welfare.
- Expand conservation education programs for both adults and children to emphasize the critical nature and vulnerability of sensitive habitats such as wetlands, oak and grassland habitats and associated wildlife.
- Connect with user groups through education to make them part of the conservation solution in areas that have high recreation values.
- Work with large corporations to increase awareness and develop financial support for conservation of biodiversity.

Male Puget blue butterfly.

NORTH CASCADES ECOREGION

PHYSIOGRAPHY AND FISH AND WILDLIFE DIVERSITY

Geography

The North Cascades ecoregion includes the Cascade Mountains north of Snoqualmie Pass and west of the crest and extends northward into British Columbia. Approximately 10 percent of Washington occurs within this ecoregion. As of 2003, less than two percent of the Washington portion of the ecoregion had been converted to urban and agricultural development. Major rivers in the ecoregion include the Skagit, Stillaguamish, Snohomish and Nooksack. The Skagit is the largest river flowing into Puget Sound. Approximately 240 natural mountain lakes are contained within the rugged landscape of the North Cascades ecoregion.

Geology

The North Cascades is composed of highly dissected, glaciated mountain terrain, mostly between 1000 and 7000 feet above sea level. The highest peaks are volcanoes that rise to more than 10,000 feet. Valley bottoms extend down to as low as 500 feet. Glacially carved U-shaped valleys and cirques are prominent features. Watersheds typically begin as steep-gradient small stream drainages that feed major rivers flowing into the adjacent Puget Trough ecoregion. Natural lakes, most of which were created by glacial processes, are plentiful.

Climate

High precipitation typifies the ecoregion varying from approximately 60 to 160 inches per year. Most precipitation accumulates from October through April as snow and rain. High elevations in the mountains are covered with snow for many months. Middle elevations have significant snowpacks that fluctuate over the course of the winter with rain-on-snow events. Lower elevations within the ecoregion accumulate little snow or have transient snowpacks.

Habitat and Plant Associations

The vegetation of the North Cascades ecoregion in Washington consists mostly of western hemlock/Douglas-fir/western redcedar forests at low elevations, Pacific silver fir/western hemlock forests at middle elevations, and a mosaic of mountain hemlock/silver fir forests and subalpine parkland at high elevations. Natural stand replacement fires occur at irregular intervals of 90 to 250 years. Above timberline, alpine heaths, meadows and fellfields (stony habitats with low mat and cushion plants) are interspersed with barren rock, ice and snow. Special habitats include riparian areas dominated by broadleaf trees, avalanche chutes dominated by Sitka alder or vine maple and wetlands. Rare plant species in this ecoregion are often circumboreal species (species occurring in high northern latitudes around the world) on the southern edge of their range, with populations scattered in the high Cascades.

Fish and Wildlife Diversity

The North Cascades ecoregion has experienced less logging disturbance and development than other regions of the Cascade Mountains and retains high biodiversity, especially in the North Cascades National Park and designated wilderness areas. The region is home to approximately 75 mammal species, 21 species of reptiles and amphibians, roughly 200 species of birds, and at least 28 species of fish. Recent surveys have documented over 500 types of land insects and approximately 250 aquatic invertebrate species. This ecoregion is one of several in Washington that provides important habitat for wide-ranging carnivores including lynx, gray wolves, grizzly bears and wolverines. Salmon inhabit most of the large rivers. The ecoregion hosts a wide variety of breeding birds, including bald eagles, osprey, harlequin ducks and many species of Neotropical migrants.

LAND OWNERSHIP

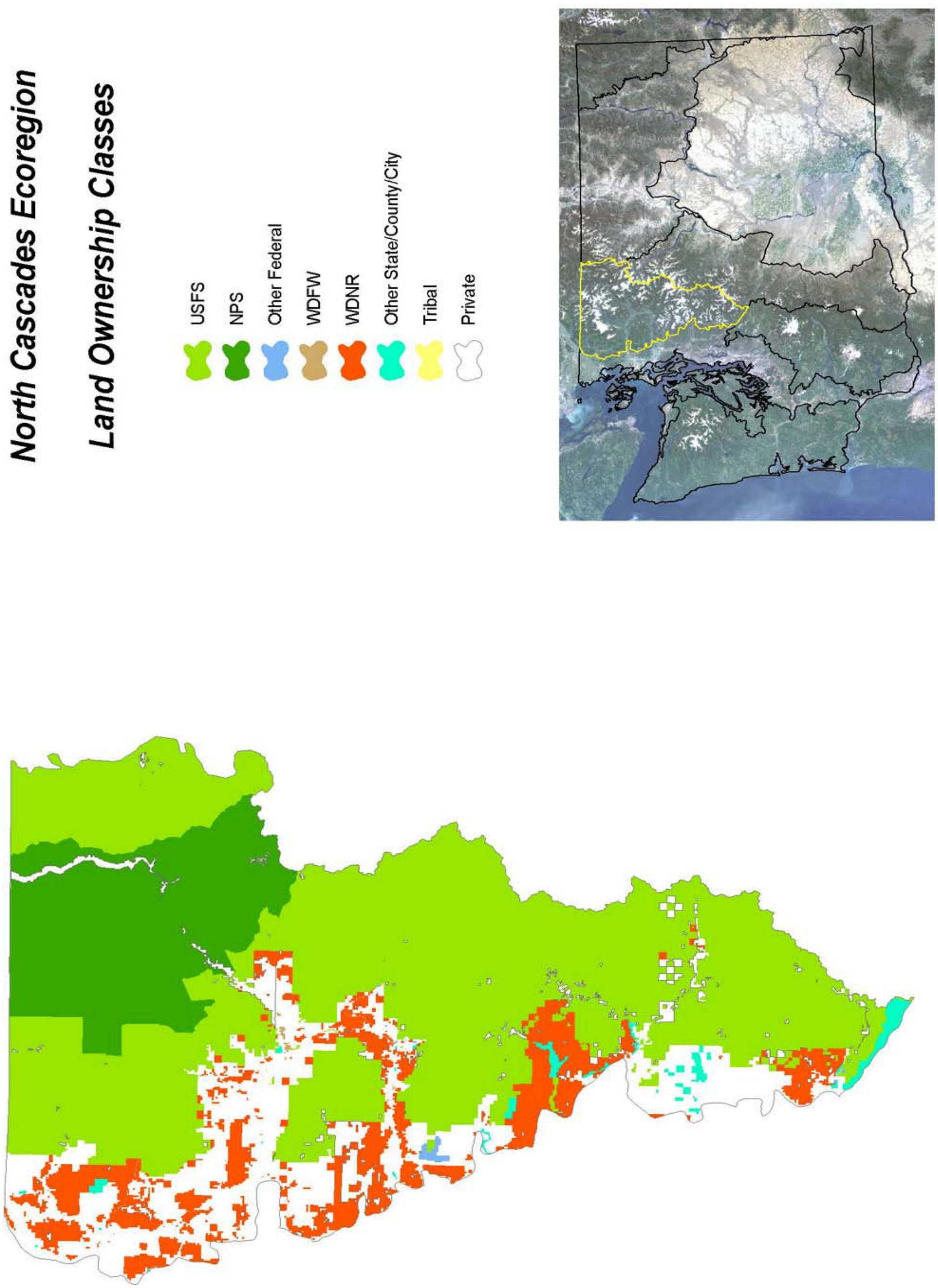
Major landowners in the North Cascades ecoregion are the National Park Service, the USDA Forest Service (Mt. Baker-Snoqualmie National Forest), Washington Department of Natural Resources, and private timber companies. The private land in the Cascades is a legacy of the 1864 Northern Pacific Land Grant, which bestowed vast amounts of land on the railroad that built a trans-continental link to the Pacific Northwest. The Weyerhaeuser Co. moved into the region, just over a century ago, through a 900,000-acre land sale by railroad baron James J. Hill to his Minnesota neighbor, timber magnate Frederick Weyerhaeuser. The Plum Creek Timber Co. is an independent company, but has its origins as the Burlington Northern subsidiary that managed the company's timber holdings from western Montana to the Washington Cascades.

The North Cascades National Park Service Complex is made up of three park units managed as one: North Cascades National Park and Ross Lake and Lake Chelan National Recreational Areas. Each area contains different ecosystems and wilderness attributes. Most of the park complex, over 93 percent, is managed as the Stephen T. Mather Wilderness, established by Congress in 1988. North Cascades National Park is notable for its large size and strict protection status.

Mt. Baker-Snoqualmie National Forest encompasses a large portion of the remaining westside slopes of the North Cascades ecoregion (1,724,229 acres), about 41% of which is designated wilderness.

Settlement within the remote and rugged North Cascades occurred slowly over many years. Although some towns developed along the North Cascades Highway, a combination of natural and cultural factors prevented the growth of communities of any size in the ecoregion. The difficulties of physical access and the relatively small amount of workable agricultural land were primary deterrents to settlement. In addition, the lack of surveyed lands and the creation of the Washington Forest Reserve in 1887 may also have discouraged individuals from seeking homesteads in the area that is today mostly a national park. Dominant land uses in the North Cascades ecoregion include recreation, forestry and conservation. Figure 21 below maps land ownership classes for the North Cascades ecoregion.

Figure 21.



North Cascades Ecoregion
Land Ownership Classes
USFS
NPS
Other Federal
WDFW
WDNR
Other State/County/City
Tribal
Private

ECOREGIONAL CONSERVATION PARTNERSHIPS

Effective conservation of fish, wildlife and biodiversity in Washington requires close coordination and cooperation with many public and private conservation partners. Major partners in the North Cascades ecoregion include:

- National Park Service
- Seattle City Light
- U.S. Fish & Wildlife Service
- USDA Forest Service (Mt. Baker-Snoqualmie National Forest)
- Washington Department of Natural Resources (WDNR)
- Washington State Parks and Recreation Commission
- Whatcom, Skagit, Snohomish, King and Kittitas Counties

The Washington Department of Fish and Wildlife also works closely on conservation projects with private conservation partners such as The Nature Conservancy, Trust for Public Land, Rocky Mountain Elk Foundation, Audubon Washington, the Grizzly Bear Outreach Project, Northwest Ecosystem Alliance and a growing number of fisheries enhancement groups and local land trusts.

Major Plans and Assessments

A number of ongoing or completed planning efforts involving WDFW and its public and private partners guide the conservation and management of fish and wildlife resources statewide and in the North Cascades ecoregion. Important planning efforts affecting conservation in the North Cascades ecoregion include:

- Mt. Baker-Snoqualmie General Management Plan
- North Cascades Ecoregional Assessment
- North Cascades National Park General Management Plan
- Northwest Forest Plan (1994)
- USFWS Draft Bull Trout Coastal/Puget Sound DPS Recovery Plan (2004)
- USFWS Draft Northern Spotted Owl Recovery Plan (1992)
- USFWS Grizzly Bear Recovery Plan (1993)
- USFWS Marbled Murrelet Recovery Plan (1997)
- Washington Forest Practices Board Wildlife Strategy (in progress)
- Washington Forests and Fish Agreement (1999)
- WDFW Bald Eagle Status Report (2001)
- WDFW Bull Trout and Dolly Varden Management Plan (2000)
- WDFW Common Loon Status Report (2000)
- WDFW Draft North Cascades Regional Wildlife Area Management Plan
- WDFW Fisher Recovery Plan (2005)
- WDFW Fisher Status Report (1998)
- WDFW Game Management Plan (2003)
- WDFW Lynx Recovery Plan (2001)
- WDFW Marbled Murrelet Status Report (1993)
- WDFW North Cascade (Nooksack) Elk Herd Management Plan (2002)
- WDFW Oregon Spotted Frog Recovery Plan (1998)
- WDFW Outline for Salmon Recovery Plans (2003)
- WDFW Peregrine Falcon Status Report (2002)
- WDFW Pygmy Whitefish Status Report (1998)

Supporting references to these and other important statewide planning documents are included at the end of this chapter and/or in Appendices 6 and 7.

SPECIES AND HABITATS OF GREATEST CONSERVATION NEED

This section provides a short summary of priority species and associated habitats for the Washington portion of the North Cascades ecoregion.

Species of Greatest Conservation Need

The following species list for the North Cascades ecoregion is a regional subset of the statewide Species of Greatest Conservation Need (SGCN) list shown in Appendices 1 and 2. The process and criteria used to develop the statewide SGCN list are provided in Volume Two, Approach and Methods, as well as in Appendix 3. Species listed below are found in the North Cascades ecoregion for all or part of their lifecycle. Supporting tables and information for these species and habitats can be found in Chapter IV and in Appendices 1, 2, 8, 9, 10 and 14.

	Population Size/Status						Population Trend					
COMMON NAME	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown	State Status*	WNHP
Mammals												
Townsend's big-eared bat			x							x	C	S3
Gray wolf	?									x	E	S1
Grizzly bear		x							x		E	S1
Fisher	x							x			E	SH
Wolverine		x						x			C	S1
Lynx			x							x	T	S1
Elk (Nooksack herd, mixed)			x				x				G	S5
Birds												
Common loon			x					x			S	S2
Great blue heron			x							x	M	S4
Bald eagle				x					x		T	S4
Northern goshawk			x							x	C	S3
Golden eagle			x							x	C	S3
Peregrine falcon			x						x		S	S2
Marbled murrelet			x				x				T	S3
Northern spotted owl			x				x				E	S1
Vaux's swift			x				x				C	S3
Pileated woodpecker				x						x	C	S4
Amphibians												
Western toad				x			x				C	S3
Oregon spotted frog			x				x				E	S1

	Population Size/Status						Population Trend					
COMMON NAME	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown	State Status*	WNHP
Columbia spotted frog			x							x	C	S4
Fish												
River lamprey						x				x	C	S2
Pacific lamprey						x				x	N	S3
Bull trout						x				x	C	G3
Salish sucker						x				x	M	S1
Invertebrates												
Beller's ground beetle			x							x	C	S3
Long-horned leaf beetle			x							x	C	
Propertius' duskywing (butterfly)			x				x				M	S3
Johnson's hairstreak (butterfly)						x				x	C	S2

* Status Codes	** WNHP Codes (S = state, G = global)
E = endangered	1 = critically imperiled
T = threatened	2 = imperiled
S = sensitive	3 = vulnerable to extirpation or extinction
C = candidate	4 = apparently secure
M = monitor	5 = demonstrably widespread, abundant and secure

Species Conservation in the North Cascades Ecoregion

Species of Greatest Conservation Need (SGCN) found in the North Cascades ecoregion (see table above) include those classified by WDFW as Endangered, Threatened, Candidate or Monitor species, as well as species identified by WDFW as needing additional research or funding attention. Conservation actions are recommended for these SGCN species at both the statewide and ecoregional levels. These recommended conservation actions are summarized in a series of matrices included in Chapter IV and as Appendices 9 and 10. These matrices also display the life history, population status and distribution of these species.

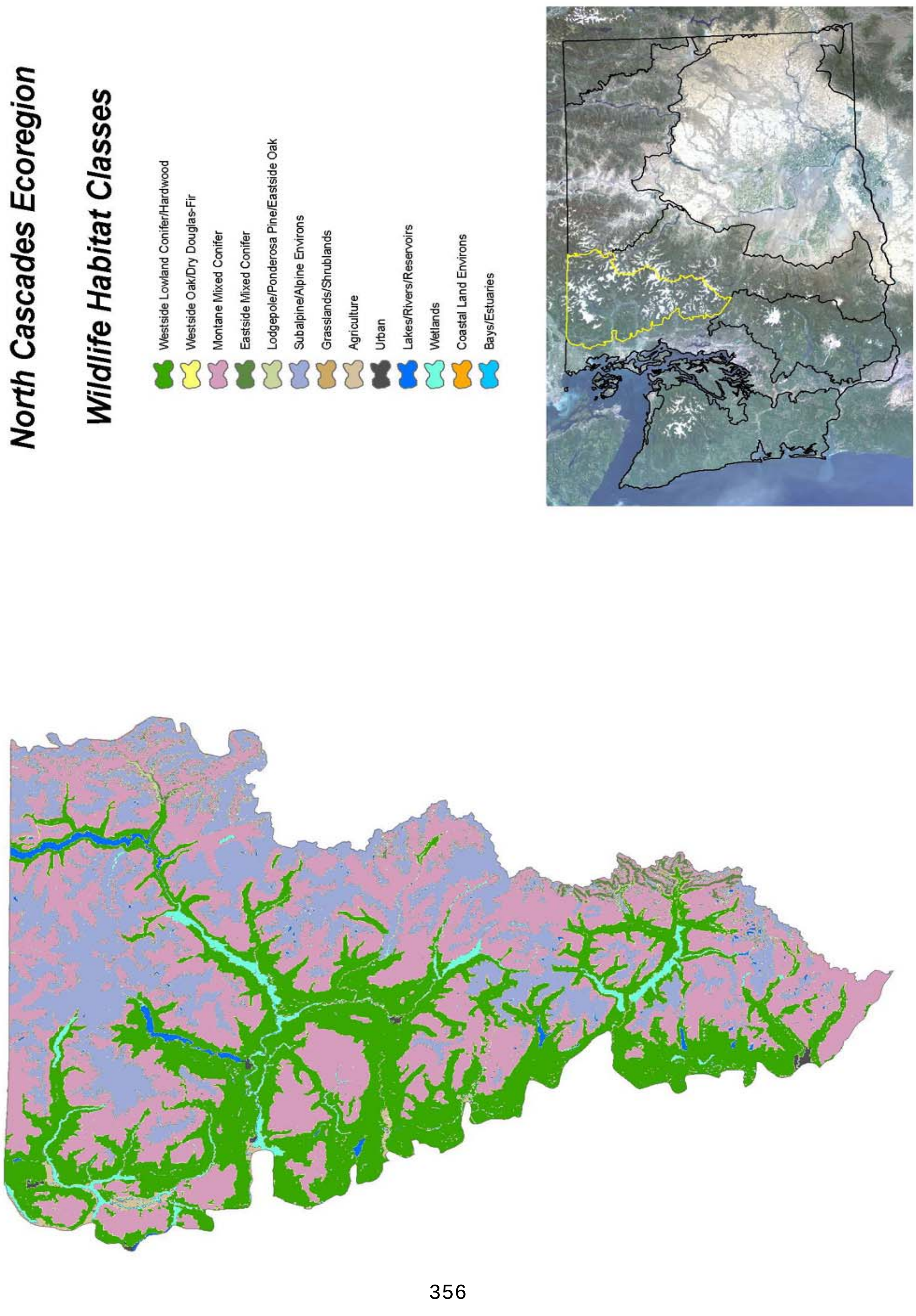
Ecoregional Habitat Overview

Vegetation in the North Cascades ecoregion exhibits relatively high diversity in response to variations in elevation and other conditions. Lower elevation areas tend to be dominated by mature stands of Douglas-fir, western redcedar and western hemlock. Higher elevation species typically comprise mountain hemlock, Pacific silver fir and yellow cedar. Douglas-fir can be found in drier sites, while red alder favors disturbed alluvial sites. About 75 percent of the ecoregion is covered by western lowland and montane coniferous forest habitat. Most of the higher elevation conifer forest is protected in wilderness areas, the North Cascades National Park and the Ross Lake National Recreation Area. Figure 22 below maps wildlife habitat classes in the North Cascades ecoregion.

The following major habitat types classified, coded and described in Wildlife and Habitat Relationships in Oregon and Washington (WHROW), are present in the North Cascades ecoregion. In the next section, descriptions are provided for priority habitats associated with Species of Greatest Conservation Need found in this ecoregion.

- Westside Lowlands Conifer-Hardwood Forest
- Montane Mixed Conifer Forest
- Eastside (Interior) Mixed Conifer Forest
- Subalpine Parkland
- Alpine Grasslands and Shrublands
- Agriculture, Pasture and Mixed Environs
- Urban and Mixed Environs
- Open Water: Lakes, Rivers and Streams
- Herbaceous Wetlands
- Westside Riparian-Wetlands
- Montane Coniferous Wetlands

Figure 22.



North Cascades Ecoregion
Wildlife Habitat Classes
Westside Lowland Conifer/Hardwood
Westside Oak/Dry Douglas-Fir
Montane Mixed Conifer
Eastside Mixed Conifer
Lodgepole/Ponderosa Pine/Eastside Oak
Subalpine/Alpine Environs
Grasslands/Shrublands
Agriculture
Urban
Lakes/Rivers/Reservoirs
Wetlands
Coastal Land Environs
Bays/Estuaries

Priority Habitats in the North Cascades Ecoregion

The following three habitat types have been identified as the highest priority for current conservation action in the North Cascades ecoregion. Selection of these habitats as a priority was determined by their importance to regional Species of Greatest Conservation Need, as well as priorities outlined in the North Cascades Ecoregional Assessment and the subbasin plans listed in the “Major Plans” section above. More discussion on the selection of priority habitats is included in Chapter III: Statewide Overview and in Volume Two: Approach and Methods.

- Westside Lowlands Conifer-Hardwood Forest
- Subalpine Parkland
- Westside Riparian-Wetlands

Westside Lowlands Conifer-Hardwood Forest

This habitat occurs as lowland to low montane forests on the western slopes of the North Cascades. Western hemlock is the most characteristic species; vegetation is also dominated by western redcedar, Douglas-fir, Sitka spruce and red alder. Understory shrub species include salal, dwarf Oregon grape, vine maple, Pacific rhododendron, salmonberry, trailing blackberry, red elderberry, fools huckleberry, oval-leaf huckleberry, evergreen huckleberry and red huckleberry. Sword fern is the most common herbaceous species and is often dominant on nitrogen-rich or moist sites.

Large areas of this forested habitat remain on the west slopes of the North Cascades ecoregion, although only a fraction of the original old growth remains, mostly in the North Cascades National Park. This habitat forms the matrix within which other habitats occur as patches, especially westside riparian-wetlands and, less commonly, herbaceous wetlands and open water. Bordering this habitat at upper elevations is montane mixed conifer forest.

Selected Species Closely Associated with Westside Lowlands Conifer-Hardwood Forest in the North Cascades Ecoregion

Fisher	Marbled murrelet
Northern spotted owl	Nooksack elk herd
Johnson’s hairstreak butterfly	

Subalpine Parkland

Subalpine parkland in the North Cascades occurs at 5000 to 7000 feet in elevation above montane conifer forest or lodgepole pine forest habitat. Associated wetlands in subalpine parklands extend a short distance into the alpine zone. Subalpine habitat generally appears as a mosaic of treeless openings and small patches of trees or as woodlands or savanna-like stands of scattered trees. Herb or shrub-dominated wetlands appear within the parkland areas and are considered as part of this habitat. Fragile plants such as heather, partridge foot and Sitka valerian flourish in high elevation meadows. The parklands include slide alder and false azalea. Numerous alpine and subalpine flowers like phlox, Indian paintbrush, elephant head, columbine, Davidson's penstemon and mountain lupine cover the slopes. Parkland trees are mostly subalpine fir, mountain hemlock, Alaska yellow cedar, and near the eastern edge of the Washington part of the ecoregion, whitebark pine.

Selected Species Closely Associated with Subalpine Parkland in the North Cascades Ecoregion

Grizzly bear	Wolverine
Nooksack elk herd	

Westside Riparian-Wetlands

Riparian habitat covers a relatively small area in the North Cascades ecoregion, yet it supports a higher diversity and abundance of fish and wildlife than any other habitat in the ecoregion; provides important fish and wildlife breeding habitat, seasonal ranges, and movement corridors; is highly vulnerable to alteration; and has important social values, including water purification, flood control, recreation and aesthetics.

Historically, riparian habitat was limited in the North Cascades, except near the mouths of the river tributaries. Riparian-wetland habitat is characterized by a mosaic of plant communities occurring at irregular intervals along streams and dominated by grass-forbs, shrub thickets and mature forests with tall deciduous trees. Beaver activity and natural flooding are two ecological processes that have affected the quality and distribution of riparian-wetlands in the North Cascades.

Selected Species Closely Associated with Westside Riparian-Wetlands and Herbaceous Wetlands in the North Cascades Ecoregion

Fisher	Great blue heron
Western toad	Long-horned leaf beetle
Columbia spotted frog	Beller’s ground beetle

CONSERVATION PROBLEMS

A number of human activities pose significant potential threats to the integrity of this forest habitat, particularly in valley bottoms. These activities include timber harvest, transportation systems, urbanization, dispersed residential development, mining and hydropower production.

Forest Management Practices

Past forest management practices and related land uses have disrupted or distorted many natural ecosystem functions, which in turn have affected the value and functions of these forests as wildlife habitat. The future condition and value of the ecoregion's terrestrial and aquatic habitats will depend to a large degree on how intensively they are managed for timber and other uses in the future. The Northwest Forest Plan brought major improvements in streamside protections on federal lands. The recent development of the Washington Forest and Fish Agreement has improved the outlook for this habitat type on private lands. However, riparian habitats that were altered and degraded in the past due to logging and road building need restoration.

Wetlands and Riparian Areas

Wetlands and riparian areas are impacted from logging, agriculture, and residential development that affect shorelines, water quality, water quantity, and overall habitat continuity and complexity. This leads to increased erosion, which in turn, increases sedimentation. Uncontrolled livestock grazing compacts soil, contributes to stream bank destabilization, affects compositions of riparian plant communities, and slows recovery of damaged riparian habitat. This loss of riparian vegetation results in greater summer heating and winter cooling of stream temperature, soil instability, reductions in water quantity and quality, and changes in bank, channel and instream structure. All of these habitat changes affect the distribution and abundance of aquatic species.

Hydropower Dams

Hydropower dams on major rivers such as the Skagit, Stillaguamish, Snohomish and Nooksack present a daunting challenge to the upstream and downstream migration of anadromous fish species. Millions of dollars have been and continue to be spent by public agencies and hydropower users to ensure passage of salmon, sturgeon and lamprey through the dams and to otherwise mitigate for the loss of unimpeded migration corridors and habitat. Unless dams are removed from large rivers, which is highly unlikely, the most pressing problems for migrating fish will continue to be caused by the dams, including inadequate fish ladders on some mainstem dams, predation within the mainstem reservoirs from walleye and other fish, nitrogen loading and mortality to downstream migrating juveniles from turbines.

Hydrological diversions and control of natural flooding regimes results in reduced stream flows and reduction of overall area of riparian habitat, loss of vertical stratification in riparian vegetation, and lack of recruitment of young cottonwoods, ash, willows, etc. Hydro projects also destabilize streambanks, narrow stream channels, reduce the flood zone, and reduce the extent of riparian vegetation.

Transportation Systems

Transportation systems impact animals in several ways: roadkill, habitat loss and fragmentation, and hindrance or barrier to movement and migration. When populations are low, roadkill mortality is significant, especially for slow moving turtles and salamanders and wide-ranging carnivores that have to cross many roads. In a fragmented landscape, animals have to move from one patch of habitat to another. When highways fragment landscapes, they divide wildlife populations into smaller, isolated units that are more susceptible to extirpation. Many small roads were built with inadequate culverts that became barriers to fish migration.

Invasive Alien Plants and Animals

Invasive alien plants and animals are a significant threat to biodiversity, second only to habitat loss. They are introduced in a number of ways, including hitchhiking on horses, boats, cars, and trucks, travel on ocean currents, being imported in horticultural products and the pet/aquarium trade, and accidental releases from research institutions and laboratories. Invasive plants displace native vegetation, resulting in the loss of habitat diversity and function. They can severely impact native plant and animal communities and alien grasses and shrubs can add significantly to the fire fuel load, resulting in hotter wildfires that increase damage to native vegetation. The number and abundance of introduced species in an ecoregion is an indicator of declining ecosystem health.

The following additional habitat and species conservation problems have been identified in the North Cascades Ecoregion:

Wildlife species and population problems: includes disease, pathogens, competition, food scarcity, predation, overharvest, and limited population size and distribution.

- Populations of grizzly bear, gray wolf, fisher, lynx, common loon, bald eagle and peregrine falcon have declined to the point that they are listed as endangered, threatened or state sensitive.
- Small population size and loss of genetic diversity are problems for grizzly bear, wolverine, lynx, elk (Nooksack herd, mixed), Beller's ground beetle and long-horned leaf beetle, and are a concern in other species reduced to isolated populations, including Salish sucker.
- Illegal persecution and harvest occurs for bald eagle, gray wolf, grizzly bear, elk (Nooksack herd) and migrating and spawning fish species of concern.
- Bull trout are susceptible to overharvest.

Lack of biological information on species and habitats:

- Adequate information is lacking on the population status of state candidate species including Townsend's big-eared bat, wolverine, northern goshawk, golden eagle, Vaux's swift, pileated woodpecker, western toad, Columbia spotted frog, river lamprey, bull trout, Beller's ground beetle, long-horned leaf beetle and Johnson's hairstreak butterfly.
- Information is needed on habitat associations, demography, and/or food habits for fisher, lynx, pileated woodpecker and Beller's ground beetle.
- Additional distributional data are needed for western toad, bull trout and Beller's ground beetle.

- Information is needed on the causes of decline for elk (Nooksack herd, mixed), western toad, river lamprey and Pacific lamprey.
- Taxonomic relationships between long-horned leaf beetle and closely related species are uncertain.
- Impacts of various land use practices are not understood for Columbia spotted frog.
- Better information is needed on the amount of gene flow among bull trout populations.
- There is a shortage of adequate spatial inventory and assessment data on most habitat types.
- There is an absence of baseline data on the habitat values and functions of natural wetlands and a poor understanding of the status of resident macroinvertebrates in aquatic systems.

<u>Habitat loss, conversion, fragmentation and degradation</u>:

- Only 3% of western Washington forest is currently in the old growth age class, and nearly all of it is in high elevation national forests or national parks. Maintenance of old growth forest across the landscape is important for at least 1,000 species. Loss and fragmentation of late-successional coniferous forests negatively impacts fisher, northern goshawk, marbled murrelet, northern spotted owl, pileated woodpecker and Johnson's hairstreak butterfly.
- Grassy and herbaceous balds are rare patch habitats distributed in low and high elevation forests. They often have associated rare species that are vulnerable to certain forest practices and recreation.
- Bald eagle, golden eagle, and gray wolf suffer from prey declines linked to habitat loss, degradation and fragmentation.
- Suburban sprawl is a concern for resource managers, as indicated by the growing number of ranchettes and residential subdivisions in previous managed forest and cropland. Development often occurs near lakes or streams and poses an increased threat of fire and impacts to water quality.
- Shoreline timber harvest and development may destroy nesting, foraging, or roosting sites for common loon, great blue heron and bald eagle.
- Human development may negatively impact forest habitat for northern goshawk, wintering habitat for elk (Nooksack herd, mixed), and riverine habitat used by Salish sucker.
- Catastrophic large-scale fires reduce the habitat available for lynx.
- Forest clearing may degrade habitat for Townsend's big-eared bat.
- Reclamation of abandoned mines may destroy critical maternity roosts and hibernacula for Townsend's big-eared bat.
- Degradation of bogs harms Beller's ground beetle and long-horned leaf beetle.
- Degradation and elimination of oak groves due to encroachment by Douglas-fir reduces habitat for Propertius' duskywing butterfly.
- Degradation of streams and rivers due to inappropriate forest management, agricultural practices and human development is harmful to bull trout.

<u>Incompatible land management practices</u>:

- Various timber cutting, snag removal and replanting practices have degraded or eliminated habitat for a variety of species including lynx, bald eagle, marbled murrelet, northern spotted owl, Vaux's swift and pileated woodpecker.
- The spraying of forests with BTk to kill tussock moths and budworms has caused population losses in Johnson's hairstreak butterfly.

- Improperly managed grazing has widened stream channels, raised water temperatures, and reduced understory cover.

Alien and invasive plant and animal species:

- Reed canary grass thrives in reservoirs and wetland stream outlets where water levels fluctuate and directly affects habitats that support 27 Washington state-listed plant species. A number of native fish, amphibians and other animals are not well adapted to spawn or reproduce in reed canary grass thickets. Many infestations of reed canary grass have been identified at Ross Lake, ranging from individual plants to five-acre patches.
- There is considerable evidence of competition for nesting territories between northern spotted owl and expanding populations of barred owl.
- Predation by introduced bullfrogs and fish negatively impacts Columbia spotted frog.
- Introduced carp and mosquitofish degrade habitat for Columbia spotted frogs.
- Non-native fish such as brook trout pose a threat to bull trout through competition, hybridization and predation.

Human disturbance and recreational impacts:

- Backcountry recreation such as motorized vehicles, hiking, and skiing may disturb or displace grizzly bear, wolverine, lynx, golden eagle and peregrine falcon.
- Recreational boating and fishing may disturb or displace nesting or foraging birds including common loon, great blue heron and bald eagle.
- Human disturbance and vandalism may disrupt the maternity roosts and hibernacula of Townsend's big-eared bat located in caves and mines.
- Encroachment of human development can force golden eagles from suitable nesting sites.
- Nesting peregrine falcons are vulnerable to disturbance from human activities, such as blasting and timber cutting.
- Recreational activities such as offroad recreational vehicles, horses, mountain bikes, and even hikers can create unauthorized trails that disturb soil and allow invasive plants to establish.
- The nature and timing of farm disturbances are increasingly hazardous to wildlife. Tilling, planting and harvesting are more synchronous, widespread and intense, thus stressing wildlife during critical periods of nesting, rearing and dispersal.

Environmental contaminants:

- Ingestion of lead fishing sinkers by common loon and lead shot by bald eagle and golden eagle results in lead poisoning.

Incompatible transportation and energy development:

- Large highway corridors (including Highways 20, 2, and I-90) and associated development fragment suitable habitat and create barriers or impediments to movement for gray wolf, wolverine and lynx.
- Roads may facilitate winter competition between lynx and coyote.
- Roads placed near great blue heron rookeries may result in site abandonment.
- Roads located near breeding sites cause highway mortality in western toad.
- Golden eagle and other raptors can be electrocuted on power lines.

Inadequate water quantity and quality:

- Altered hydrology eliminates habitat for Columbia spotted frog, inland redband trout, Beller's ground beetle and long-horned leaf beetle.
- Increased water temperature and sedimentation caused by logging, agriculture and other activities may harm inland redband trout.
- Dams and other passage barriers limit the movement of river lamprey, Pacific lamprey and bull trout.

CONSERVATION ACTIONS

Conserve and recover wildlife species and populations: includes population management, protect known populations, augmentation and reintroduction of populations, control and monitor mortality, and enhance food/prey.

- Implement recovery actions for grizzly bear, gray wolf, lynx, marbled murrelet, fisher and bull trout.
- Implement the Northwest Forest Plan for managing northern spotted owl habitat.
- Develop management plans for state sensitive species including common loon and peregrine falcon.
- Complete the Washington Bat Conservation Plan.
- Prepare interagency management response guidelines for wolves to document sightings and address conflicts.
- Reduce potential mortality in grizzly bear from accidental shooting by conducting programs to educate bear hunters on proper identification of black bear and grizzly bear.
- Conduct translocations of fisher and elk (Nooksack herd, mixed) into areas of appropriate habitat if indicated by recovery plans and feasibility studies.
- Implement salmon recovery strategies to enhance the prey base for bald eagle.
- Establish and implement fisheries management objectives that are compatible with bull trout recovery.

Conduct research, assessment and monitoring: includes species and habitat distribution, abundance, limiting factors, suitable habitat, and population trends.

- Monitor populations of lynx, grizzly bear, gray wolf, northern spotted owl and bull trout to determine whether recovery objectives are being met.
- Determine the status of candidate species including Townsend's big-eared bat, wolverine, northern goshawk, golden eagle, Vaux's swift, pileated woodpecker, western toad, Columbia spotted frog, river lamprey, Beller's ground beetle, long-horned leaf beetle and Johnson's hairstreak butterfly.
- Monitor the abundance of Townsend's big-eared bat, northern goshawk, Columbia spotted frog, Salish sucker, Beller's ground beetle, long-horned leaf beetle and Johnson's hairstreak butterfly.
- Monitor post-downlisted populations of peregrine and bald eagle for signs of decline that could result from bioaccumulation of contaminants or other factors.
- Seek and verify reports of incidental sightings of grizzly bear and gray wolf.
- Identify roost sites and hibernacula of Townsend's big-eared bat.
- Conduct habitat selection studies at multiple spatial scales for marbled murrelet, Vaux's swift, Columbia spotted frog, river lamprey, Pacific lamprey and Salish sucker.
- Identify the limiting factors in populations of river lamprey and Pacific lamprey.
- Improve identification methods to distinguish between river lamprey and Pacific lamprey.
- Develop survey protocols to monitor the abundance of great blue heron and Salish sucker.
- Monitor any colonizing wolves to determine establishment of packs and habitat use.
- Evaluate whether existing forest management prescriptions are adequate to maintain populations of lynx and pileated woodpeckers.
- Determine the amount of genetic diversity and gene flow among bull trout populations.
- Investigate the taxonomy of western toad and long-horned leaf beetle using genetic techniques and other analyses.

- Assess and map important habitats and areas of high biodiversity in the ecoregion using ecoregional assessments, local habitat assessments, Interagency Vegetation Mapping Project and other habitat inventories and plans. Update Ecoregional Assessments every five years.
- Develop statewide land cover and threats data layers to improve connectivity between priority conservation areas.
- Identify and assess key connectivity areas and wildlife corridors between fragmented habitats and between protected areas. Restore habitat connectivity and wildlife corridors where appropriate on both public and private lands.
- Improve understanding of the ecological processes of seeps, bogs, wet meadows, forested wetlands, marshes, springs and other wetlands and how they are impacted by human development.
- Conduct hydrologic studies that include water quantity and chemical budgets at wetlands known to be supporting rare and endangered species. Use this information to inform wetland management.
- Inventory and prioritize riparian habitat types and attributes needing protection and conservation.
- Identify important habitats for restoration and assess the feasibility of successfully restoring these sites. Include an evaluation of current and projected land use in and adjacent to potential restoration sites.

Protect, restore and connect habitats:

- Protect rare habitat types such as grassy and herbaceous balds, snag patches, caves, cliffs and talus.
- Maintain mature and late-successional coniferous forests from harvest to protect fisher, northern goshawk, marbled murrelet, northern spotted owl, Vaux's swift and Johnson's hairstreak butterfly.
- Provide input on timber harvest and fire management activities on state, private, and federal lands to perpetuate adequate amounts and distribution of denning and foraging habitats for lynx, and nesting habitat for marbled murrelet.

- Maintain alpine areas and suitable nesting and foraging habitats for golden eagle.
- Protect and restore riparian areas for inland redband trout and bull trout.
- Protect important roost sites and hibernacula for ***Townsend's big-eared bat.***
- Protect suitable breeding lakes for common loon from development and recreational pressure.
- Protect ponds, lakes, creeks and wetland margins used by Columbia spotted frog.
- Protect sites with known populations of Columbia spotted frog.
- Protect land near large great blue heron colonies and known marbled murrelet nesting areas through acquisitions, conservation easements and agreements and management plans.
- Preserve bogs occupied by Beller's ground beetle and long-horned leaf beetle through land purchase, conservation easements and management programs.
- Protect important areas of ungulate winter range through acquisitions, easements and agreements to provide adequate prey populations for gray wolves.
- Manage small fish populations in lakes with nesting common loon.
- Conserve prey populations of golden eagle by reducing deliberate control programs.

- Maintain and enforce Forest Practice rules protecting bald eagle roost sites and nests.
- Continue to require bald eagle habitat plans that require retention of trees.
- Fence fragile bog vegetation to protect populations of Beller's ground beetle and long-horned leaf beetle.
- Maintain oak woodland and understory for Propertius' duskywing butterfly.
- Prioritize conservation areas using ecoregional assessments and other biological assessments. Protect important habitat types, biodiversity areas and environmentally sensitive lands that should not be altered through a variety of techniques including acquisitions, conservation easements, life estates and cooperative agreements with willing landowners.
- Coordinate with local land trusts, conservation districts and other conservation organizations and agencies to conserve important habitat on both public and private land. Focus limited resources in regionally significant areas. Identify all possible acquisition and restoration grants and coordinate applications.
- Work with the USDA Forest Service and other public landowners to protect existing roadless areas and expand the roadless area network where justified for habitat protection and connectivity.
- Protect key connectivity areas and wildlife corridors between fragmented habitats and between protected areas through a variety of techniques including acquisitions, conservation easements, life estates and cooperative agreements with willing landowners. Use statewide land cover and threats data layers to improve connectivity between priority conservation areas.
- Restore native habitats, habitat connectivity and wildlife corridors where appropriate on both public and private lands. Consider restoring lands adjacent to existing protected areas to increase their effective size and function as wildlife habitat.
- Purchase water rights from willing sellers in unregulated tributaries; use these water rights to restore and maintain adequate year-round flows for both instream and out-of-stream riparian fish and wildlife habitat.
- Rehabilitate and restore stream channels, floodplain functions, riparian habitat and connectivity where streams have been diverted, fragmented or degraded. Use livestock exclusions, instream structures, bank modifications and other methods.
- Preserve and/or restore buffer areas in appropriate locations along tributaries and mainstem waterways to a condition that is adequate to maintain healthy, functioning riparian zones for the ecoregion's rivers and estuaries.

Improve land management practices:

General

- Restore mature and late-successional coniferous forests by encouraging longer harvest rotations and maintaining snags, large trees with cavities, and coarse woody debris to enhance populations of northern goshawk, marbled murrelet and northern spotted owl.
- Promote forest management practices that improve habitat connectivity and facilitate dispersal for grizzly bear, gray wolf, wolverine and lynx.
- Manage land use activities in riparian areas used by inland redband trout.
- Allow natural disturbances and successional functions and processes to occur on conserved wetlands.
- Manage undeveloped publicly-owned land for conservation of priority habitats and species.

Forest management

- Work with the Forest Practices Board and both public and private forest landowners to properly design and implement current forest practices rules, including the Forests and Fish Agreement to protect fish, wildlife and habitat.
- Protect remaining old growth hardwood and conifer stands to benefit late successional species, and manage some stands on long rotation (>200 years).
- Work through the Washington Forest Practices Board and directly with forest landowners to implement forest management prescriptions, including prescribed burns, which will maintain and enhance biodiversity and natural ecosystem function. Encourage modified silvicultural prescriptions that promote local topographic, soil and vegetative conditions. Retain snags, downed woody debris and a complement of live trees in harvested areas. Sensitive areas such as wetlands, remnant old growth and wildlife breeding sites should not be disturbed.
- Encourage the development of selective harvest policies and guidelines on both public and private forestland that will leave adequate components of old growth habitat such as large trees, snags and downed wood as habitat for associated wildlife such as northern goshawk, marbled murrelet, northern spotted owl, Vaux's swift, black-backed woodpecker and pileated woodpecker.
- Minimize logging roads and decommission them after the period of entry. Ensure that all logging and forest access roads are located in stable, non-erodible areas and outside riparian management zones.
- Ensure the integrity of riparian habitat by maintaining adequate riparian management zones along streams in all logging sites, on both public and private land
- Encourage public and private forest landowners to manage forested watersheds that maintain an appropriate mix of successional stages and provide connectivity of riparian and upland vegetation as protected travel corridors for wildlife.

Grazing and agricultural practices

- Work with public and tribal and management agencies to fence or otherwise protect riparian zones from livestock grazing and unauthorized offroad vehicle use. Consider retirement rather than renewal of grazing leases on sensitive lands.
- Work with conservation districts, Natural Resource Conservation Service, USDA Forest Service and private landowners to implement best management practices in riparian areas and associated upland habitat in conjunction with the Conservation Reserve Program, Wetland Reserve Program and other Farm Bill programs.
- Use the Comprehensive Resource Management Plan process for large landscapes with a mix of public and private landowners to modify grazing regimes and improve grassland and understory conditions and enhance biodiversity.
- Assist private landowners in securing funding to fence riparian zones on private land. In areas where it is impractical to exclude livestock, protect habitat quality by controlling the timing and intensity of livestock grazing through regulation and landowner agreements.
- Work with private and public landowners to minimize the impacts on habitat and wildlife from modern agriculture, including agrochemical use, water use, grazing and soil erosion.

<u>Control and prevent introduction of alien species</u>:

- Develop a regional plan for the detection, rapid response and eradication of invasive species.

- Evaluate the role of timber harvest in promoting the range expansion of barred owl, which interact negatively with northern spotted owl.
- Develop methods to control or otherwise mitigate impacts of introduced bullfrogs and fish on Columbia spotted frog.
- Avoid introduction of non-native fish in fishless lakes and where species of conservation concern occur such as bull trout, westslope cutthroat trout, Columbia spotted frogs and other native amphibians and reptiles. Avoid introduction of rainbow trout or only introduce sterile fish where westslope cutthroat are found. Avoid introduction of non-native trout to protect bull trout from hybridization, competition, and predation.
- Monitor lakes, streams and wetlands for illegal fish introductions.
- Work with other public agencies and private agricultural organizations such as the Farm Bureau and Washington Grange to develop basic techniques for mapping and monitoring the spread of invasive plant species over time.
- Participate in federal and state agency partnerships to develop and implement weed control strategies for impacted sites and ecosystems. Promote adequate funding and coordination of weed control efforts on both public and private lands using environmentally sound methods.
- Develop educational and public information materials to increase public awareness of the ways that invasive alien species are introduced to sensitive ecosystems.
- Provide funding, incentives and technical assistance to private landowners to eliminate undesirable invasive plant species in riparian zones and to restore native plants that provide important habitat for native fish and wildlife. Use integrated pest management practices to control currently established invasive species with help from volunteers.
- Participate in federal and state agency partnerships to develop and implement weed control strategies for impacted sites and ecosystems.

<u>Control and monitor disturbance</u>:

- Limit disruptive types of recreational activity in roadless, wilderness, and primitive areas to prevent disturbance of grizzly bear and wolverine.
- Limit access to roost sites and hibernacula used by Townsend's big-eared bat.
- Minimize disturbance of great blue heron, bald eagle, golden eagle and peregrine falcon nests from human activities such as development, logging, boating, and other recreational activity by restricting access to public lands as needed, working with permitting agencies to reduce levels of disturbance, and informing the public of sensitive areas and periods.
- Eliminate vehicular access and campsites in conservation areas identified as sensitive habitats such as montane wetlands and bogs.
- In sensitive habitats, manage both land and water access by using fencing, trails, elevated boardwalks, railings, seasonal restrictions, signage and livestock restrictions.
- Reduce the amount and impact of unauthorized recreational access and use on important wildlife habitat through better enforcement of existing laws, more fencing and posting of critical habitat areas, selective road closures and increased public education and information for recreational users and user groups.
- Protect nesting golden eagle, bald eagle and peregrine falcon through use and access restrictions on public lands as needed, and work with private landowners and permitting agencies to prevent blasting or construction disturbance during nesting. Inform rock climbers of sensitive periods and locations to reduce disturbance of nesting peregrine and golden eagle.

Control and prevent environmental contamination:

- Protect common loon, bald eagle and golden eagle from lead poisoning by advocating the use of non-toxic fishing sinkers and steel shot.
- Restrict the use of fish piscicides such as rotenone in waters with common loon.
- Work with other agencies to decrease and remediate sources of contamination to protect bald eagle and peregrine falcon.
- Work with governmental and nonprofit agencies to develop an ecoregion-wide strategy for identified toxins and other pollutants: their sources, destinations and effects, and ways to reduce their discharge.
- Work with other agencies, industry and private landowners to encourage use of integrated pest management techniques and phase out the use of pesticides and herbicides.
- Clean up contaminated sites and sediments whenever possible, and prevent further toxic contamination of areas, including unconfined spoil disposal sites.
- Reduce the use of hazardous chemicals by continuing to implement the persistent bioaccumulative toxins strategy and by using a variety of best management practices and improved treatment methods.

Improve transportation and energy development:

- Power lines near breeding and foraging areas should be built or modified to reduce the occurrence of golden eagle and other raptor electrocutions.
- Highway overpasses and underpasses should be constructed to facilitate access to suitable habitats for ***grizzly bear,*** gray wolf and wolverine.
- Reduce road mortality in western toad by providing road crossings near breeding sites.
- Avoid road building near breeding sites for western toad.
- Work with the Washington Department of Transportation to locate highways away from important wildlife habitats and biodiversity areas. If impacts are unavoidable, design adequate mitigation such as underpasses, overpasses and fencing to accommodate wildlife that need passage, such as elk (Nooksack herd, mixed) and western toad.

Improve water quantity and quality:

- Provide floating nest platforms for common loon at lakes with fluctuating water levels.
- Conserve beaver populations, beaver ponds and dynamic stream processes in areas with Columbia spotted frogs.
- Reduce the impacts of land use practices that increase water temperature and sedimentation that may harm inland redband trout.
- Identify dams and other passage barriers that limit the movement of river lamprey and Pacific lamprey, and develop methods of passage past such barriers.

- Manage wetland areas on public land for both high water quality and habitat value. Ensure that the water quality of inflow does not lead to deterioration of the wetland habitat.
- Where possible restore or rehabilitate the hydrology, water quality and native plant communities in degraded and disturbed wetlands. Methods should emphasize creating or restoring natural wetland functions such as conserving beaver populations and dynamic stream processes to benefit species like western toad, Columbia spotted frog and Beller's ground beetle. Manage runoff from highways according to the updated highway runoff manual. Improve the road drainage network in riparian zones by removing unnecessary culverts, increasing the size of inadequate culverts, or replacing culverts with bridges.
- Reduce the harm from stormwater runoff by working to improve the effectiveness of the National Pollutant Discharge Elimination System stormwater permit programs.
- Assist local jurisdictions in finding solutions to increase landowner compliance with onsite sewage system maintenance and animal waste management practices through education and regulated inspection. Work to reduce the number and volume of combined sewer overflow events.

Improve coordination, planning, permitting and mitigation:

- Implement the federal recovery plan for the marbled murrelet.
- Strengthen the Shoreline Management Act to protect bald eagle nesting and roosting sites.
- Provide credible scientific information on priority habitats and species and biodiversity areas, their significance, management needs and compatible land uses to decision-makers at site, local and regional scales.
- Provide technical assistance to counties in using fish and wildlife and biodiversity information to update comprehensive land use plans, community or watershed plans, Shoreline Master Plan, etc.
- Assist counties in developing and updating county ordinances and incentives that help to mitigate or control development in areas with resource and conservation values and that encourage environmentally-sensitive development in growth areas.
- Work with local governments and conservation organizations to identify and protect areas of important habitat and biodiversity through existing environmental laws and other local programs.
- Encourage floodplain management and shoreline zoning protection programs.
- Develop a coordinated conservation vision and strategy for conservation of large landscapes using a structured process like The Nature Conservancy's 5-S Project Management System or the Cascade Dialogs.
- Review state and federal land management plans to ensure adequate protection for priority habitats and species, biological diversity and ecosystem health.
- Develop site management plans for protected areas.
- Work with public and tribal land management agencies to protect important habitat and areas of high biodiversity from loss and fragmentation as well as degradation.
- Coordinate and integrate species recovery and management plans with land management and watershed plans using regulatory and voluntary approaches.
- Participate in Growth Management Act, Shoreline Management Act, Forest Protection Act and Federal Energy Regulatory Commission permitting processes for new or expanded residential, recreational or hydropower development on private land.
- Use information from ecoregional assessments to illustrate important habitats and areas of high biodiversity. Encourage permitting agencies to designate and protect these areas from residential and recreational development, and to require mitigation for habitat conversion and fragmentation where it occurs.

- Work closely with the USDA Forest Service and other land management agencies to prevent or mitigate potential adverse impacts to fish and wildlife habitat from proposed recreational or hydropower development on public lands.
- Work with regulatory agencies to design effective mitigation strategies for projects that result in wildlife impacts or direct conversion or fragmentation of habitat.
- Represent WDFW's conservation interest on interagency recovery teams and working groups.

Improve enforcement of laws and regulations:

- Enforce existing protections for grizzly bear, gray wolf and bald eagles through vigorous investigation and prosecution.
- Enforce fishing regulations, seasons and stream closures to protect bull trout from fishing pressure.
- Enforce recreational access restrictions on public lands and aquatic areas.

Improve landowner assistance:

- Work with landowners to maintain sufficient foraging habitat, travel corridors and denning sites for lynx.
- Develop, periodically update, and provide WDFW Priority Habitats and Species management recommendations to assist landowners in conserving priority habitats and species.
- Work with large and small timber companies and landowners to accomplish habitat conservation through non-regulatory approaches such as landowner incentives, conservation easements, habitat conservation plans and acquisition of critical habitat from willing landowners.
- Secure state and federal tax incentives that discourage habitat fragmentation and destruction and that encourage landowners to protect and manage their land to benefit wildlife habitat.
- Work with local government to implement the Public Benefit Rating System and encourage effective use of open space tax incentives for landowners.
- Work with private landowners to identify and protect areas with important habitats and biodiversity and protect these areas through landowner incentives and other nonregulatory programs. This would assist species such as elk (Nooksack herd, mixed), great blue heron, bald eagle, Vaux's swift, pileated woodpecker, western toad, ***Columbia spotted frog*** and Beller's ground beetle.

- Provide educational materials to private landowners that describe management techniques for maintaining and restoring various wildlife habitats.
- Work with private landowners to identify and protect important wetland habitats and buffers by providing adequate water, controlling invasive plants, reducing disturbance to nesting wildlife, and fencing or otherwise keeping livestock out of wetlands and associated upland habitat.
- Influence the application of federal Farm Bill funds, including the Conservation Reserve Program and the WDFW Landowner Incentive Program, on private agricultural lands most critical for wildlife movement and most suitable for restoration of native wetlands, shrub-steppe and grassland habitat.

- Promote grant programs to assist landowners with implementation of management plans.

Improve wildlife conservation education: includes outreach, volunteer and watchable wildlife programs.

- Conduct outreach and education programs to engage the public in conservation programs for many species, including gray wolf and grizzly bear. Continue volunteer programs for monitoring common loon activity at lakes.
- Education programs are needed to curtail recreational pressure on common loon and redhead at suitable breeding lakes.
- Provide educational materials to hunters to prevent accidental mortality and harassment of lynx.
- Engage and involve local and tribal governments, state and federal agencies, organizations and citizens in efforts to protect and restore priority habitats and species through a variety of outreach projects, programs and education efforts.
- Increase the use of citizen science for the collection of data, monitoring, restoration and conservation of important habitats and associated wildlife species. Coordinate volunteer monitoring and involvement.
- Promote and maintain public information and education efforts that focus on endangered species, habitat loss, ecological function, biological diversity and environmentally aware lifestyle practices. Emphasize the connection between habitat and environmental quality and human health and welfare.
- Expand conservation education programs for both adults and children to emphasize the critical nature and vulnerability of sensitive habitats such as wetlands, oak and grassland habitats and associated wildlife.
- Connect with user groups through education to make them part of the conservation solution in areas that have high recreation values.
- Work with large corporations to increase awareness and develop financial support for conservation of biodiversity.

WEST CASCADES ECOREGION

PHYSIOGRAPHY AND FISH AND WILDLIFE DIVERSITY

Geography

The West Cascades ecoregion extends west from the Cascade crest to the Puget lowlands and from Snoqualmie Pass southward to the Columbia Gorge. The Washington portion of the ecoregion encompasses approximately eight percent of the state. As of 1991, less than two percent of the Washington portion of the ecoregion had been converted to urban and/or agricultural use.

Geology

The West Cascades ecoregion consists mostly of highlands modified by montane glaciers and associated riverine valleys. The typical elevation range is 1,000 to 7,000 feet above sea level, with the highest peaks rising to more than 14,000 feet on Mount Rainier and the lowest elevations in the Columbia River Gorge at 50 feet. Isolated volcanic peaks such as Mount St. Helens and associated high plateaus rise above surrounding steep mountain ridges. These mountain peaks were formed primarily from extrusive volcanic activity. Small, steep-gradient streams feed major rivers. Natural lakes are frequent, and most were created by glacial processes and landslides.

Climate

The climate of this ecoregion is wet and relatively mild. Average annual precipitation ranges from about 55 to 140 inches. Most precipitation accumulates from October through April. High elevations in the mountains are continuously covered with snow for months. Middle elevations have significant snow pack that fluctuates over the course of the winter with rain-on-snow events. The lowest elevations accumulate little snow and generally have a transient snow pack.

Habitat and Plant Associations

Conifer forests dominate the vegetation of the West Cascades ecoregion. Douglas-fir/western hemlock forests are typical at low elevations. Middle elevations characteristically have Pacific silver fir, western hemlock, Douglas-fir, and noble fir. High elevations have mountain hemlock/silver fir forests and subalpine parklands. Higher elevations on volcanic peaks support alpine heath, meadows, and fellfields (stony habitats with low mat and cushion plants) among glaciers and rock. Special habitats include riparian areas dominated by broadleaf species, wetlands, grassy balds, and oak woodlands. Areas surrounding Mount Rainier support a few endemic rare plant species, as does the Columbia River Gorge. Both are areas of high plant diversity. The Columbia River Gorge has added biogeographic significance because of the mixing of coastal and interior plant species.

Although portions have been extensively managed for timber harvest, the biodiversity of the West Cascades ecoregion is relatively intact and dominated by natural or semi-natural vegetation. One of Washington's highest concentrations of rare plants occurs in the ecoregion, in the Columbia River Gorge. The southern portion of the ecoregion contains fescue grasslands that attract the mardon skipper, a federal candidate butterfly more commonly associated with the Puget Trough ecoregion.

Fish and Wildlife Diversity

Species richness is not as high in the West Cascades ecoregion as it is in other temperate conifer forests, but the ecoregion is notable for comparatively high amphibian species endemism. Five of the ecoregion's 11 endemic species are amphibians and include the coastal giant salamander, Cascades torrent salamander, Larch Mountain salamander, Van Dyke's salamander and the Cascades frog. Most of these species are closely associated with fast-moving, cold mountain streams. Some of the larger carnivores have been extirpated from the ecoregion, including gray wolf and grizzly bear, while others such as the mountain lion and black bear persist. Mammal species of concern in the ecoregion are the fisher, western gray squirrel, and wolverine. Other important inhabitants include more than 7,000 species of arthropods, as well as terrestrial snails.

Several other species that occur in the West Cascades ecoregion, including the Cascades torrent salamander, chinook salmon, bull trout, northern spotted owl and marbled murrelet, have been the focus of conservation attention because of their close association with declining habitat types such as aquatic areas, seeps, talus slopes, and old growth and riparian forests.

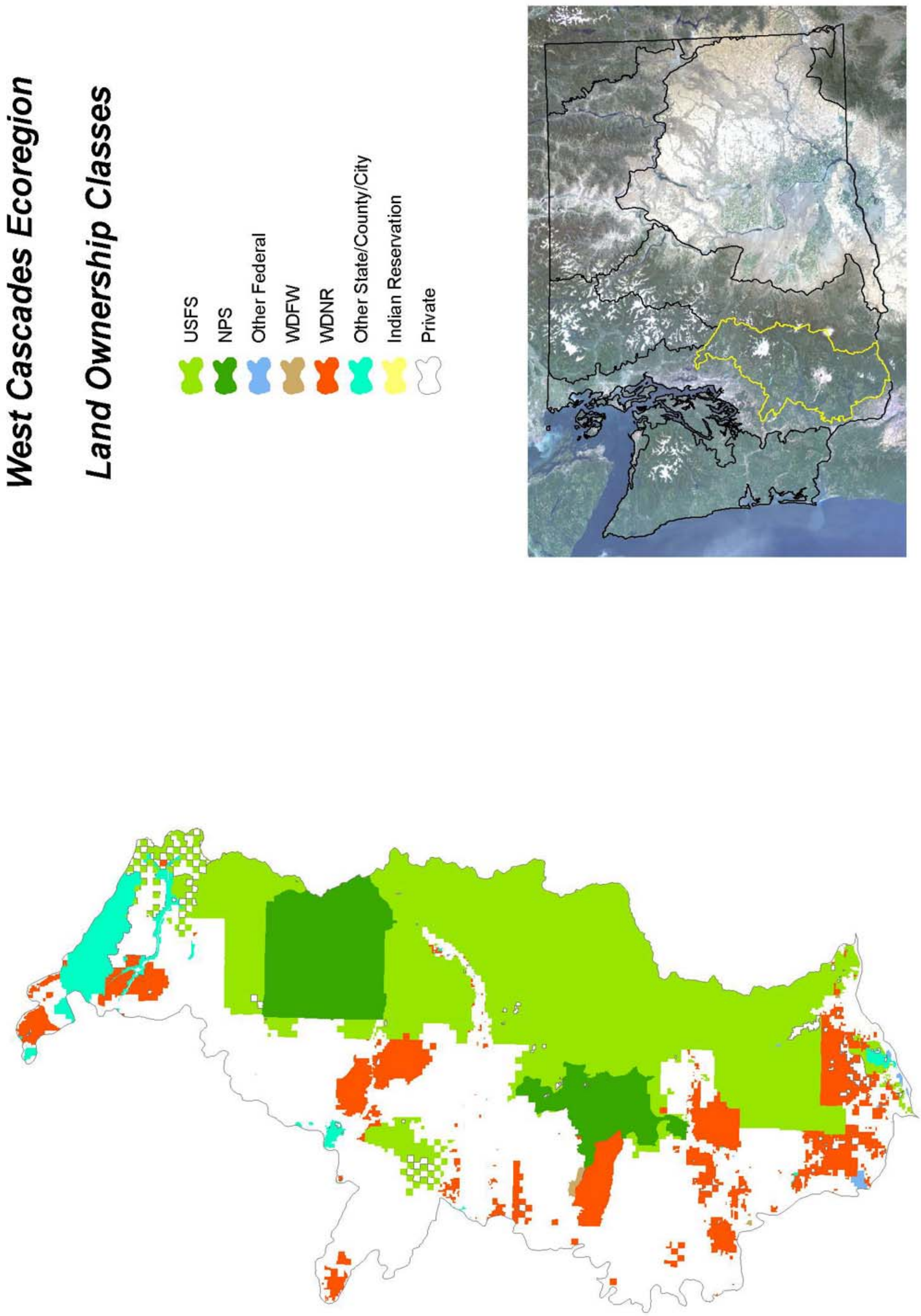
LAND USE AND OWNERSHIP

Approximately 65 percent of the West Cascades ecoregion is publicly owned. The U.S. Forest Service manages approximately 87 percent of the public land, within the Gifford Pinchot National Forest, the Mt. Baker-Snoqualmie National Forest and the Mount St. Helens Volcanic Monument. A significant percentage of the Gifford Pinchot National Forest is within designated wilderness. The Bureau of Land Management manages another seven percent, and the National Park Service another six percent within Mt. Rainier National Park. Most of the remaining public land is managed by the Washington Department of Natural Resources. Outside the Interstate 5 corridor and the greater Vancouver metropolitan area, private timber companies own much of the private land in the West Cascades ecoregion.

"Protected" sites in this ecoregion are primarily contained within the remaining intact habitat blocks discussed above, as well as several late-succession forest reserves administratively protected under the Northwest Forest plan for the northern spotted owl.

Land uses range from intensive forestry to municipal supply watersheds to wilderness. The ecoregion contains Mt. Rainier National Park, Mount St. Helens National Volcanic Monument, and several designated scenic and recreation areas. Lowest elevations frequently are in industrial forest management and small areas of non-industrial private forestry. Small rural communities and dispersed settlements are located in the river valleys. The valleys are also grazed by livestock, produce hay and other crops, and are major travel corridors for tourists and commerce. Figure 23 below maps land ownership classes for the West Cascades ecoregion.

Figure 23.



West Cascades Ecoregion
Land Ownership Classes
USFS
NPS
Other Federal
WDFW
WDNR
Other State/County/City
Indian Reservation
Private

ECOREGIONAL CONSERVATION PARTNERSHIPS

Effective conservation of fish, wildlife and biodiversity in Washington requires close coordination and cooperation with many public and private conservation partners. Major partners in the West Cascades ecoregion include:

- National Park Service (Mt. Rainier National Park)
- U.S. Fish and Wildlife Service (Pierce and Franz Lake National Wildlife Refuges)
- U.S. Forest Service (Gifford Pinchot, Mt. Baker-Snoqualmie National Forests, Mount St. Helens National Volcanic Monument, Columbia Gorge National Scenic Area)
- U.S. Army Corps of Engineers
- Washington Department of Natural Resources (WDNR)
- Washington State Parks and Recreation Commission
- King, Pierce, Lewis, Skamania and Cowlitz Counties

The Washington Department of Fish and Wildlife also works closely on conservation projects with private conservation partners such as The Nature Conservancy, , Audubon Washington, Ducks Unlimited, the Pacific Coast Joint Venture, and a growing number of fisheries enhancement groups and local land trusts.

<u>Major Plans and Assessments</u>

A number of ongoing or completed planning efforts involving WDFW and its public and private partners guide the conservation and management of fish and wildlife resources statewide and in the West Cascades ecoregion. Important planning efforts affecting conservation in the West Cascades ecoregion include:

- Cowlitz and Lewis Subbasin Plans (2004)
- Northwest Forest Plan (1994)
- USFWS Draft Bull Trout Coastal/Puget Sound DPS Recovery Plan (2004)
- USFWS Draft Northern Spotted Owl Recovery Plan (1992)
- USFWS Marbled Murrelet Recovery Plan (1997)
- Washington Forest Practices Board Wildlife Strategy (in progress)
- Washington Forests and Fish Agreement (1999)
- WDFW Bald Eagle Status Report (2001)
- WDFW Bull Trout and Dolly Varden Management Plan (2000)
- WDFW Draft West Cascades Regional Wildlife Area Management Plan
- WDFW Fisher Recovery Plan (2005)
- WDFW Game Management Plan (2003)
- WDFW Larch Mountain Salamander Status Report (1993)
- WDFW Marbled Murrelet Status Report (1993)
- WDFW Mardon Skipper Status Report (1999)
- WDFW Outline for Salmon Recovery Plans (2003)
- WDFW Peregrine Falcon Status Report (2002)
- WDFW Western Gray Squirrel Recovery Plan (2005)
- WDFW Western Pond Turtle Recovery Plan (1999)
- West Cascades Ecoregional Assessment

Supporting references to these and other important statewide planning documents are included at the end of this chapter and/or in Appendices 6 and 7.

SPECIES AND HABITATS OF GREATEST CONSERVATION NEED

This section provides a short summary of priority species and associated habitats for the Washington portion of the West Cascades ecoregion.

<u>Species of Greatest Conservation Need</u>

The following species list for the West Cascades ecoregion is a regional subset of the statewide Species of Greatest Conservation Need (SGCN) list shown in Appendices 1 and 2. The process and criteria used to develop the statewide SGCN list are provided in Volume Two: Approach and Methods, as well as in Appendix 3. Species listed below are found in the West Cascades ecoregion for all or part of their lifecycle. Supporting tables and information for these species and habitats can be found in Chapter IV and in Appendices 1, 2, 8, 9, 10 and 14.

	Population Size/Status						Population Trend					
COMMON NAME	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown	State Status*	WNHP
Mammals												
Townsend's big-eared bat			x							x	C	S3
Western gray squirrel			x				x				T	S2
Fisher	x							x			E	SH
Wolverine		x						x			C	S1
Birds												
Common loon			x					x			S	S2
Western grebe			x				x				C	S3
Great blue heron			x							x	M	S4
Northern pintail					x		x				G	S3
Lesser scaup				x			x				G	S4
Bald eagle				x					x		T	S4
Northern goshawk			x							x	C	S3
Golden eagle			x							x	C	S3
Peregrine falcon			x						x		S	S2
Marbled murrelet			x				x				T	S3
Yellow-billed cuckoo	?									x	C	SH
Northern spotted owl			x				x				E	S1
Vaux's swift			x				x				C	S3
Pileated woodpecker				x						x	C	S4
Slender-billed white-breasted nuthatch		x					x				N	S1

	Population Size/Status						Population Trend					
COMMON NAME	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown	State Status*	WNHP
Western bluebird			x				x				M	S3
Reptiles												
Western pond turtle			x						x		E	S1
California mountain kingsnake			x							x	C	S1
Amphibians												
Larch Mountain salamander			x							x	S	S3
Van Dyke's salamander			x							x	C	S3
Cascade torrent salamander				x						x	C	S3
Western toad				x			x				C	S3
Fish												
River lamprey						x				x	C	S2
Pacific lamprey						x				x	N	S3
Green sturgeon				x			x				G	S2
Bull trout						x				x	C	G3
Lower Columbia steelhead											C	G5
Lower Columbia coho											G	G4
Pygmy whitefish						x				x	S	S1
Eulachon		?								x	C	S4
Leopard dace						x				x	C	S2
Mountain sucker						x				x	C	S2
Salish sucker						x				x	M	S1
Invertebrates												
Propertius' duskywing (butterfly)			x				x				M	S3
Mardon skipper (butterfly)		x								x	E	S1
Chinquapin hairstreak (butterfly)			x							x	C	S1
Johnson's hairstreak (butterfly)						x				x	C	S2
Puget Sound fritillary (butterfly)						x	x				N	S3
Valley silverspot (butterfly)			x				x				C	S2
Taylor's checkerspot (butterfly)		x					x				C	S1
Pacific clubtail (dragonfly)			x							x	N	S1
Winged floater (bivalve)			x				x				N	G3
Oregon floater (bivalve)			x				x				N	S3
Western ridged mussel			x				x				N	S2

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
Western pearlshell				x			x				N	S4
Bluegray taildropper (slug)		x					x				N	S4
Oregon megomphix (snail)			x				x				N	G2

* Status Codes	** WNHP Codes (S = state, G = global)
E = endangered	1 = critically imperiled
T = threatened	2 = imperiled
S = sensitive	3 = vulnerable to extirpation or extinction
C = candidate	4 = apparently secure
M = monitor	5 = demonstrably widespread, abundant and secure

Species Conservation in the West Cascades Ecoregion

Species of Greatest Conservation Need (SGCN) found in the West Cascades ecoregion (see table above) include those classified by WDFW as Endangered, Threatened, Candidate or Monitor species, as well as species identified by WDFW as needing additional research or funding attention. Conservation actions are recommended for these species at both the statewide and ecoregional levels. These recommended conservation actions are summarized in a series of matrices included in Chapter IV and as Appendices 9 and 10. These matrices also display the life history, population status and distribution of these species.

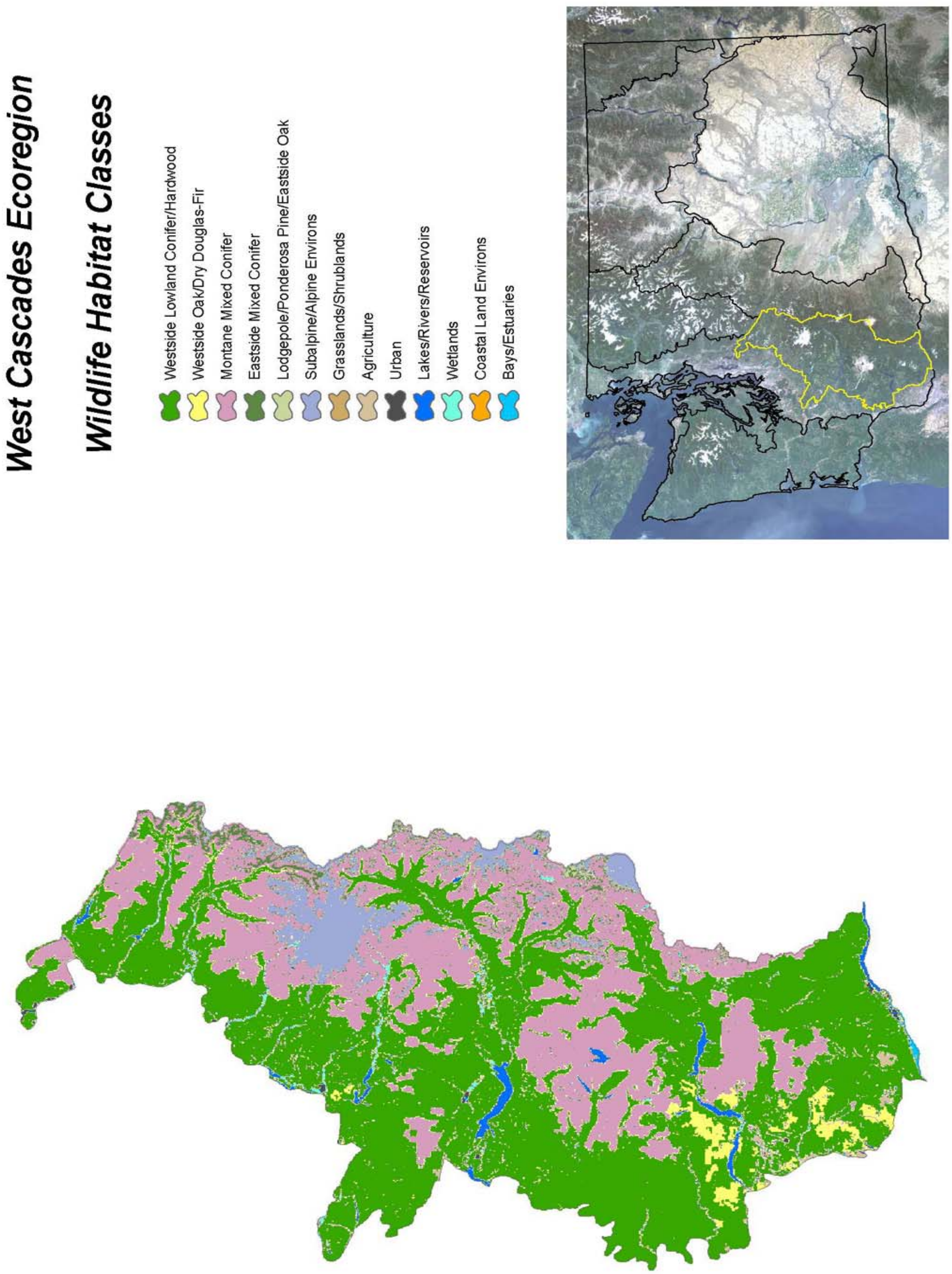
Ecoregional Habitat Overview

The most widespread low elevation forest type (below approximately 3,300 feet) is dominated by Douglas-fir and western hemlock. Some of the lower valleys contain bottomland hardwoods and oak savannas, but these special community types have suffered serious declines. Western red cedar is common in river drainages. Many of the waterways are flanked with broadleaf hardwood species such as bigleaf maple, black cottonwood, and red alder. If not converted to agriculture or urban development, most of these communities have been degraded by alien species. Many of these areas are now being dominated by Douglas-fir forest. Silver fir and mountain hemlock dominate most forests at mid-elevations. At high elevations, parklands and alpine meadows and barrens predominate. Mountain glaciers persist on many of the higher volcanic peaks, including Mount Rainier and Mt. St. Helens. Figure 24 below maps wildlife habitat classes in the West Cascades ecoregion.

The following major habitat types classified, coded and described in Wildlife and Habitat Relationships in Oregon and Washington (WHROW), are present in the West Cascades ecoregion. In the next section, descriptions are provided for priority habitats associated with Species of Greatest Conservation Need found in this ecoregion.

- Westside Lowlands Conifer-Hardwood Forest
- Westside Oak and Dry Douglas-fir Forest and Woodlands
- Montane Mixed Conifer Forest
- Eastside (Interior) Mixed Conifer Forest
- Lodgepole Pine Forest and Woodlands
- Ponderosa Pine and Eastside White Oak Forest and Woodlands
- Subalpine Parkland
- Alpine Grasslands and Shrublands
- Westside Grasslands
- Agriculture, Pasture and Mixed Environs
- Urban and Mixed Environs
- Open Water: Lakes, Rivers, Streams
- Herbaceous Wetlands
- Westside Riparian-Wetlands
- Montane Coniferous Wetlands

Figure 24


West Cascades Ecoregion
Wildlife Habitat Classes
Westside Lowland Conifer/Hardwood
Westside Oak/Dry Douglas-Fir
Montane Mixed Conifer
Eastside Mixed Conifer
Lodgepole/Ponderosa Pine/Eastside Oak
Subalpine/Alpine Environs
Grasslands/Shrublands
Agriculture
Urban
Lakes/Rivers/Reservoirs
Wetlands
Coastal Land Environs
Bays/Estuaries

Priority Habitats in the West Cascades Ecoregion

The following four habitat types have been identified as the highest priority for current conservation action in the West Cascades ecoregion. Selection of these habitats as a priority was determined by their importance to regional Species of Greatest Conservation Need, as well as priorities outlined in the West Cascades Ecoregional Assessment and the subbasin plans listed in the "Major Plans" section above. More discussion on the selection of priority habitats is included in Chapter III: Statewide Overview and in Volume Two, Approach and Methods.

- Westside Lowlands Conifer-Hardwood Forest
- Westside Oak and Dry Douglas-fir Forest and Woodlands
- Westside Grasslands (Herbaceous Balds)
- Westside Riparian-Wetlands

Westside Lowlands Conifer-Hardwood Forest

Westside lowland conifer-hardwood forests comprise the major low montane forests of the West Cascades ecoregion. This habitat type occurs throughout low-elevation areas, except on extremely dry sites. These forests occur in moist to wet habitats and microhabitats and are characterized by more moisture-loving undergrowth species, wet to nearly saturated soils, high abundance of shade- and moisture-tolerant canopy trees, and higher stand productivity. Topography ranges from relatively flat glacial till plains to steep mountainous terrain. This is the most extensive forest in the lowlands on the west side of the Cascades. Other habitat types, especially riparian-wetlands, occur as patches within conifer-hardwood forests.

Lowland conifer-hardwood forests are also found on alluvial floodplains that are confined by valleys and inlets. Dominant broadleaf species are bigleaf maple, red alder, black cottonwood, Sitka willow, red-osier dogwood, and Oregon ash. Conifers tend to increase with succession (i.e. over time) in the absence of major disturbance. Conifer-dominated floodplains are now very rare and not well described; grand fir, Douglas-fir, Sitka spruce and western redcedar are important. Riverine flooding and the succession that occurs after major flooding events are the major natural processes that drive this system. Very early successional stages can be sparsely vegetated or dominated by herbaceous vegetation.

The river bottom valleys and low-elevation forests where conifer-hardwood habitats are found are mostly absent from the existing network of conservation lands. The major exception is the Columbia River Gorge, where a national scenic area managed by the USDA Forest Service includes habitat for high numbers of rare and endemic species.

The West Cascades ecoregion contains one of the few remaining concentrations of old growth conifer-hardwood forest in the state. Old growth forests are of national and global importance because they provide some of the last refugia for species dependent on this habitat type, and perform vital ecological roles, including sequestration of carbon, cleansing of atmospheric pollutants, and maintenance of hydrological regimes.

Selected Species Closely Associated with
Western Lowlands Conifer-Hardwood Forest
in the West Cascades Ecoregion

Northern spotted owl
Fisher
Marbled murrelet
Bluegray taildropper (slug)
Oregon megomphix (snail)

Westside Oak and Dry Douglas-fir Forest and Woodlands

Westside oak and dry Douglas-fir habitat is associated with dry sites or sites with a low-intensity fire regime that was more common before European settlement. The dry sites are typically either shallow bedrock soils or deep gravelly glacial outwash soils. Originally, the vegetation was a woodland or forest dominated by deciduous broadleaf trees, mostly Oregon white oak. This habitat varies between small patch and large patch in its dynamics. Succession in the absence of fire tends to favor increased shrub dominance in the understory, increased tree density, and increased importance of conifers, with the end result being conversion to a conifer forest.

Selected Species Closely Associated with
Western Oak and Dry Douglas-fir
in the West Cascades Ecoregion

Western gray squirrel
Pileated woodpecker
Propertius' duskywing butterfly
Johnson's hairstreak butterfly

Westside Grasslands (Herbaceous Balds)

Herbaceous balds are the driest environmental settings within the ecoregion that support continuous vegetation: generally south- to west-facing slopes on shallow or sandy/gravelly soils. They typically occur as isolated sites within a forest matrix. Fire was probably an important process historically on most of these sites, and some of them are threatened by invasion of trees in the absence of disturbance. Vegetation is dominated by perennial bunch grasses, forbs, and mosses. Scattered trees, especially Douglas-fir, are often present. These balds are often rimmed by Oregon white oak stands and provide important transitional habitat for a variety of bird and butterfly species.

Selected Species Closely Associated
with Westside Grasslands
in the West Cascades Ecoregion

Western bluebird
California mountain kingsnake
Puget Sound fritillary butterfly
Valley silverspot butterfly
Mardon skipper butterfly

Westside Riparian-Wetlands

In the West Cascades ecoregion, this habitat is often interspersed within a mosaic of Westside Lowlands Conifer-Hardwood Forest. This habitat also can include Herbaceous Wetlands and occur adjacent to Open Water habitats. Riparian-wetland habitats are a conservation priority because of their importance for a wide range of terrestrial and aquatic species.

Riparian habitats in the West Cascades ecoregion are composed of vegetation in various stages of development depending on the time since the last disturbance. Riparian plant communities vary depending on the upland plant communities, stream gradient, elevation, soil, aspect, topography, and water quality and quantity. In many cases, riparian corridors in agricultural and urbanized settings within previously forested environments are highly altered. Typically, they appear as narrow strips of shrubs and deciduous trees in non-forested landscapes. Many natural streams have been channelized into drainage or irrigation ditches. Where trees have been removed, banks and channels are often choked with reed canary grass, an aggressive alien plant that reduces plant and wildlife diversity and blocks streams, which can impede fish passage.

Selected Species Closely Associated with
Westside Riparian-Wetlands
in the West Cascades Ecoregion

Western toad	Van Dyke's salamander
Great blue heron	Cascade torrent salamander
Western pond turtle	Fisher

CONSERVATION PROBLEMS

The majority of the protected lands in the West Cascades ecoregion occur at higher elevations. Most of the natural ecosystems found at lower elevations have been largely destroyed or degraded. Dispersed development in the valleys and the spread of alien species are other significant threats to the conifer-hardwood forests of the West Cascades.

Past Forest Management Practices

Past forest management practices and related land uses have disrupted or distorted many natural ecosystem functions, which in turn have affected the value and functions of these forests as wildlife habitat. The future condition and value of the ecoregion's terrestrial and aquatic habitats will depend to a large degree on how intensively they are managed for timber and other uses in the future. The Northwest Forest Plan brought major improvements in streamside protections on federal lands. The recent Washington Forest and Fish Agreement has improved the outlook for this habitat type on private lands. However, riparian habitats that were altered and degraded in the past due to logging and road building need restoration.

Habitat Fragmentation

Habitat fragmentation in the West Cascades ecoregion is generally greatest in the lower elevations and on private lands. Ownership of lower elevation forests is patchy, hindering coordinated management of public and private lands to address conservation needs.

Past timber harvest has reduced the structural complexity of these forests and reduced the abundance of large woody debris, as well as facilitated introduction of invasive plant species.

In the Columbia Gorge, widespread conversion of oak savannas and woodlands has been severe, and many of them have already been destroyed or degraded. Oak savannas and woodlands are likely to continue to decline because of the difficulties involved in restoring natural fire regimes and because privately owned areas are under considerable threat from further logging, conversion to agriculture, and residential development.

Invasive Alien Plans and Animals

Invasive alien plants and animals are a significant threat to biodiversity, second only to habitat loss. They are introduced in a number of ways, including hitchhiking on horses, boats, cars, trucks, being imported in horticultural products and the pet/aquarium trade, through accidental releases from research institutions and laboratories. Invasive plants displace native vegetation, resulting in the loss of habitat diversity and function. They can severely impact native plant and animal communities and alien grasses and shrubs can add significantly to the fire fuel load, resulting in hotter wildfires that increase damage to native vegetation. The number and abundance of introduced species in an ecoregion is an indicator of declining ecosystem health.

Transportation Systems

Transportation systems impact animals in several ways: roadkill, habitat loss and fragmentation, and hindrance or barrier to movement and migration. When populations are low, roadkill mortality is significant, especially for slow moving turtles and salamanders and wide-ranging carnivores that have to cross many roads. In a fragmented landscape animals have to move from one patch of habitat to another. When highways fragment landscapes, they divide wildlife populations into smaller, isolated units that are more susceptible to extirpation. Historically, construction of logging roads near streams or across wetlands was often extremely destructive to fish and wildlife habitat. Although modern forest practices under state and federal rules are much more likely to provide some protection for wetlands, there are still potential adverse impacts from construction and operation of logging roads. This occurs even when they are located along benches and ridgelines away from riparian zones. Improperly located, constructed or maintained logging roads may trigger or accelerate slope failure, erode stream channels, block fish migration and deposit sediment into streams and wetlands.

Hydropower Dams

Hydropower dams on major rivers present a daunting challenge to the upstream and downstream migration of anadromous fish species. Millions of dollars have been and continue to be spent by public agencies and hydropower users to ensure passage of salmon, sturgeon and lamprey through the dams and to otherwise mitigate for the loss of unimpeded migration corridors and habitat. Unless dams are removed from large rivers, which is highly unlikely, the most pressing problems for migrating fish will continue to be caused by the dams, including inadequate fish ladders on some mainstem dams, predation within the mainstem reservoirs from walleye and other fish, nitrogen loading and mortality to downstream migrating juveniles from turbines.

Hydrological diversions and control of natural flooding regimes results in reduced stream flows and reduction of overall area of riparian habitat, loss of vertical stratification in riparian vegetation, and lack of recruitment of young cottonwoods, ash, willows, etc. Hydro projects also destabilize streambanks, narrow stream channels, reduce the flood zone, and reduce the extent of riparian vegetation. The loss of riparian vegetation has resulted in greater summer heating and winter cooling, soil instability, reductions in water quantity and quality, and changes in bank, channel and instream structure.

The following additional habitat and species conservation problems have been identified in the West Cascades Ecoregion:

Wildlife species and population problems: includes disease, pathogens, competition, food scarcity, predation, overharvest, limited population size and distribution.

- Populations of western pond turtle, fisher, grizzly bear, gray wolf, marbled murrelet, northern spotted owl, and mardon skipper, have declined to the point where they are listed as threatened or endangered. Fisher, grizzly bear, and gray wolf are believed to be extinct in the West Cascades.
- Recovery plans are needed to guide conservation actions for threatened or endangered species including gray wolf and mardon skipper.

- Wolves are expected to re-colonize forested parts of the state, and interagency management response guidelines are needed.
- Management plans are needed for the sensitive species including common loon, peregrine falcon, Larch Mountain salamander and pygmy whitefish. State sensitive species need to be managed to avoid becoming threatened or endangered.
- Many species are only found at a small number of isolated sites and are at risk of local extinction or loss of genetic diversity, including wolverine, western pond turtle, California mountain kingsnake, Larch Mountain salamander, Van Dyke's salamander, mardon skipper, pygmy whitefish, Taylor's checkerspot, Pacific clubtail, and blue-gray taildropper.
- Overharvest is a problem for green sturgeon and bull trout. Quantitative stock assessment and annual estimate of the total stock size of eulachon is needed in order to estimate the harvest rate.
- Sudden oak death syndrome may become established in Washington, threatening oak woodlands and many oak-dependent wildlife species.
- Illegal persecution and harvest occurs for bald eagle, California mountain kingsnake, and migrating and spawning fish species of concern.

<u>Lack of biological information on species and habitats</u>:

- Data are needed on population trend in state threatened and endangered species including western gray squirrel, western pond turtle, northern spotted owl, marbled murrelet, and mardon skipper.
- Information is needed about the status of populations of state candidate species including Townsend's big-eared bat, wolverine, Vaux's swift, pileated woodpecker, slender-billed white-breasted nuthatch, northern goshawk, golden eagle, California mountain kingsnake, western toad, Van Dyke's salamander, Cascade torrent salamander, mountain sucker, leopard dace, river lamprey, bull trout, eulachon, chinquapin hairstreak, Taylor's checkerspot, Johnson's hairstreak, valley silverspot and yellow-billed cuckoo.
- Information is needed on the current distribution and abundance of Salish sucker, green sturgeon, Pacific lamprey, Propertius' duskywing, Puget Sound fritillary, Pacific clubtail, winged floater, Oregon floater, western ridged mussel, western pearlshell, blue-gray taildropper, and Oregon megomphix.
- Research is needed on habitat needs, limiting factors, demographics and dispersal in Taylor's checkerspot and mardon skipper to facilitate reintroductions.
- Populations of the peregrine falcon, which has been downlisted to sensitive, and bald eagle, which may soon be downlisted to sensitive, need to be monitored to confirm their continued recovery.
- Suitable ponds for reintroductions of western pond turtle need to be identified.
- Taxonomic and/or genetic work needs include: formally describe Salish sucker; western toad taxonomy is uncertain; thus one or more taxa may be in greater decline; data is needed on genetic diversity and gene flow in bull trout populations.
- Information is needed on the population dynamics and the impact of dredging on the spawning grounds, incubating eggs, and larvae of eulachon.
- The causes of decline of western toad and eulachon are unknown.
- There is a shortage of adequate spatial inventory and assessment data on most habitat types.
- There is an absence of baseline data on the habitat values and functions of natural wetlands and a poor understanding of the status of resident macroinvertebrates in aquatic systems.

Habitat loss, conversion, fragmentation and degradation:

- Only 3% of western Washington forest is currently in the old growth age class, and nearly all of it is in high elevation national forests or national parks. Maintenance of old growth forest across the landscape is important for at least 1,000 species.
- Grassy and herbaceous balds are rare patch habitats distributed in low and high elevation forests. They often have associated rare species that are vulnerable to certain forest practices and recreation.
- Grassland conversion, recreational use, and rural development may result in loss or degradation of habitat of mardon skipper, Taylor's checkerspot, Puget Sound fritillary, and valley silverspot.
- Loss, fragmentation and degradation of oak and mixed oak/conifer habitats to encroachment by conifers and development affect Propertius' duskywing, slender-billed white-breasted nuthatch, and other oak-dependent wildlife.
- Suburban sprawl is a concern for resource managers, as indicated by the growing number of ranchettes and residential subdivisions in previous managed forest and cropland. Development often occurs near lakes or streams and poses an increased threat of fire and impacts to water quality.
- Degradation of shorelines by residential development can eliminate nesting habitat for common loon and bald eagle.
- Larch Mountain salamander are vulnerable to disturbance to rock and talus, woody debris, and moisture regime
- Closing off of abandoned mines may destroy hibernacula and roost sites of Townsend's big-eared bat.

Incompatible land management practices:

- Logging of mature/old timber and reduction in abundance of snags negatively impacts populations of northern spotted owl, marbled murrelet, northern goshawk, Vaux's swift and pileated woodpecker.
- Blue-gray taildropper and Oregon megomphix have apparently declined due to degradation of moist forest floor conditions and loss of coarse woody debris in stands of bigleaf maple or mixed hardwood-conifer stands.
- Logging of old growth and reduction in occurrence of mistletoe likely affects Johnson's hairstreak.
- Improperly managed grazing may impact habitat of mardon skipper, Taylor's checkerspot, valley silverspot and Puget Sound fritillary.
- Lack of fire on grassland allows invasion by Douglas-fir, shrubs, and non-native vegetation, degrading habitat of mardon skipper, Taylor's checkerspot, Puget Sound fritillary and valley silverspot.
- Logging, agriculture, road building or other activities that elevate temperature, alter hydrology and increased sedimentation may degrade habitat of Cascade torrent salamander, pygmy whitefish, mountain sucker, Salish sucker, leopard dace, and bull trout.
- Reduction of snags in clearcuts, ecotones and oak savannah affects western bluebird.
- Removal of overstory from talus and loss of large woody debris may destroy Larch Mountain salamander and Van Dyke's salamander habitat; overstory removal and roading may isolate populations.

- Logging, conversion to conifers, and firewood cutting in oak habitats may negatively impact Propertius' duskywing, slender-billed white-breasted nuthatch and other oak-dependent species.
- Spraying of BTk can impact butterflies such as Johnson's hairstreak; if meadows receive overspray, mardon skipper, Puget Sound fritillary, and valley silverspot are impacted.
- Modern agricultural practices often reduce the quality, patch size and connectivity of wildlife habitat in farmlands.

<u>Alien and invasive plant and animal species</u>:

- Reed canary grass thrives in reservoirs and wetland stream outlets where water levels fluctuate and directly affects habitats that support 27 Washington state-listed plant species. A number of native fish, amphibians and other animals are not well adapted to spawn or reproduce in reed canary grass thickets.
- Alien grasses and weeds affect habitat of mardon skipper, Taylor's checkerspot, Puget Sound fritillary, and valley silverspot.
- Non-native trout such as brook trout compete with, and may hybridize with, bull trout.
- Western gray squirrel are negatively affected by competition from non-native eastern gray and fox squirrel.
- Predation by bullfrogs and/or introduced predatory fish negatively impact western pond turtle; predation by non-native predator fish have eliminated some populations of pygmy whitefish.
- Non-native turtles threaten western pond turtle through competition and the potential for introduced disease.
- Filbert worms and other alien pests affect acorns needed by western gray squirrel and other wildlife species.
- Barred owl have expanded their range and are replacing northern spotted owl in many locations.
- Nutria have expanded their range into the West Cascades ecoregion and can cause extensive wetland vegetation damage.

<u>Human disturbance and recreational impacts</u>:

- Human disturbance can be a significant problem for certain nest sites of peregrine falcon, bald eagle, and golden eagle, and at breeding or maternity roosts and hibernacula of Townsend's big-eared bat.
- Backcountry skiers, heli-skiers, snowmobiles and other motorized vehicles can disturb or displace wolverine.
- Recreational activities such as offroad recreational vehicles, horses, mountain bikes, and even hikers can create unauthorized trails that disturb soil and allow invasive plants to establish and can adversely impact mardon skipper, Taylor's checkerspot, Puget Sound fritillary and valley silverspot habitat.
- The nature and timing of agricultural practices are increasingly hazardous to wildlife. Tilling, planting and harvesting are becoming more synchronous, widespread and intense, thus stressing wildlife during critical periods of nesting, rearing and dispersal.
- Recreational boating can create disturbance problems for common loon and foraging bald eagle; eagles often avoid foraging in water around stationary boats.

Environmental contaminants:

- Concentration of DDE, PCBs, and dioxins from prey causes reduced reproduction of bald eagle on Columbia River. Eagles and peregrine falcon concentrate persistent chemicals such as DDE and PCBs that can cause eggshell thinning, making them vulnerable to any persistent toxic chemical.
- Loons are poisoned by lead fishing sinkers.
- Piscicides used to eradicate unwanted fish have eliminated some populations of pygmy whitefish.

Incompatible transportation and energy development:

- Roads may isolate populations of Van Dyke's and Larch Mountain salamanders.
- Destruction of talus for road building affects Larch Mountain salamanders and rare snails.
- Dams and other passage barriers negatively affect bull trout, green sturgeon, river lamprey and Pacific lamprey, and water level manipulations from hydroelectric dams can affect common loon.
- Eagles and other raptors are susceptible to electrocution on powerlines.
- Western pond turtle and western toad are susceptible to roadkill mortality.
- Highway corridors and development (including Highways 20, 2, 12, and I-90) fragment suitable habitat and create barriers or impediments to movement for wolverine, grizzly bear, gray wolf and other mammals.

Inadequate water quantity and quality:

- Logging, road construction, improperly managed grazing, and development may contribute to sedimentation, increases in water temperature, and pollution runoff, and may affect bull trout, pygmy whitefish, green sturgeon, leopard dace, mountain sucker, Salish sucker, Pacific clubtail, winged floater, Oregon floater, western ridged mussel, and western pearlshell.

CONSERVATION ACTIONS

Conserve and recover wildlife species and populations: includes population management, protect known populations, augmentation and/or reintroduction of populations, control and monitor mortality and enhance food/prey.

- Implement recovery actions for the grizzly bear, western gray squirrel, fisher, northern spotted owl, marbled murrelet, and western pond turtle and bull trout.
- Develop or finalize recovery plans for the gray wolf, northern spotted owl, bull trout, and mardon skipper.
- Develop management plans for the state sensitive species: common loon, peregrine falcon, Larch Mountain salamander, and pygmy whitefish.
- Continue head starting, captive breeding, and reintroductions of western pond turtle.
- Assess the feasibility of augmenting populations of western gray squirrel, Taylor's checkerspot and mardon skipper and conduct translocations as needed.
- Participate in the North Cascades Grizzly Bear Subcommittee to implement recovery actions.
- Prepare interagency management response guidelines for gray wolf to document sightings and address conflicts.
- After evaluating the success of reintroduction of fishers to Olympic Mountains, reintroduce fishers into the southern Cascades.
- Evaluate other species for possible addition to the state candidate list.
- Implement and enforce restricted harvest regulations for green sturgeon and bull trout.
- Implement eulachon management plan to control harvest. Develop a method to determine the abundance of each year's run size so that harvest may be appropriately scaled to the anticipated run size.
- Complete the Washington Bat Conservation Plan.

Conduct research, assessment and monitoring: includes species and habitat distribution, abundance, limiting factors, suitable habitat and population trends.

- Monitor population trends of western gray squirrel, grizzly bear, western pond turtle, northern spotted owl, mardon skipper, and bull trout to determine whether recovery objectives are being met.
- Determine the status of candidate species including Townsend's big-eared bat, wolverine, Vaux's swift, pileated woodpecker, northern goshawk, golden eagle, slender-billed white-breasted nuthatch, yellow-billed cuckoo, California mountain kingsnake, western toad, Van Dyke's salamander, Cascade torrent salamander, eulachon, mountain sucker, leopard dace, river lamprey, chinquapin hairstreak, Taylor's checkerspot, Johnson's hairstreak, and valley silverspot.
- Monitor any colonizing wolves to determine establishment of packs and habitat use.
- Conduct periodic surveys of sensitive species including Larch Mountain salamander, common loon, and pygmy whitefish.
- Monitor post-downlisted populations of peregrine and bald eagle for signs of decline that could result from bioaccumulation of contaminants or other factors.
- Investigate limiting factors, the impacts of land management, demographics, and dispersal of western pond turtle, Taylor's checkerspot and mardon skipper.
- Determine the current distribution and abundance of Salish sucker, green sturgeon, Pacific lamprey, winged floater, Oregon floater, western ridged mussel, and western

pearlshell, Puget Sound fritillary, Propertius' duskywing, Pacific clubtail, blue-gray taildropper and Oregon megomphix. Research effective sampling techniques.
- Identify potential reintroduction sites for western pond turtle.
- Determine appropriate levels of grazing for mardon skipper sites.
- Document and follow up on potential occurrences of western gray squirrel in the ecoregion.
- Conduct studies to identify factors that are responsible for the recent declines in eulachon and western toad.
- Investigate the relationship between oceanic regimes and other ocean occurrences and eulachon run strength.
- Research habitat needs and limiting factors, predation and trophic relationships of river lamprey and Pacific lamprey.
- Develop efficient survey methods for river lamprey and Pacific lamprey; develop methods to differentiate between species of lamprey; identify potential obstacles to lamprey, green sturgeon, and bull trout and develop methods to pass barrier.
- Evaluate effect of timber harvest at landscape scale on occupancy of habitat by northern spotted owl and barred owl.

- Investigate the systematics of western toad, ***Salish sucker***, winged floater, Oregon floater, western ridged mussel, and western pearlshell using DNA or other techniques.
- Assess and map important habitats and areas of high biodiversity in the ecoregion using ecoregional assessments, local habitat assessments, Interagency Vegetation Mapping Project, and other habitat inventories and plans. Update ecoregional assessments every five years.
- Develop statewide land cover and threats data layers to improve connectivity between priority conservation areas.
- Identify and assess key connectivity areas and wildlife corridors between fragmented habitats and between protected areas. Restore habitat connectivity and wildlife corridors where appropriate on both public and private lands.
- Improve understanding of the ecological processes of seeps, bogs, wet meadows, forested wetlands, marshes, springs and other wetlands, and how they are impacted by human development.
- Conduct hydrologic studies that include water quantity and chemical budgets at wetlands known to be supporting rare and endangered species. Use this information to inform wetland management.
- Inventory and prioritize riparian habitat types and attributes needing protection and conservation.
- Identify important habitats for restoration and assess the feasibility of successfully restoring these sites. Include an evaluation of current and projected land use in and adjacent to potential restoration sites.
- Develop a cohesive, priority-driven research program for westside grassland habitats that integrates university, agency and private researchers. Inventory of important

grassy and herbaceous balds. Work with land management agencies and private land owners to protect these habitats from disturbance and development.

Protect, restore and connect habitats:

- Identify and protect essential habitat through management agreements, easements, or acquisitions as needed to recover listed species including western pond turtle and mardon skipper.
- Protect oak habitats for western gray squirrel, slender-billed white-breasted nuthatch, Propertius' duskywing, and other oak-dependent wildlife species.
- Protect grassland habitats of Puget Sound fritillary, mardon skipper, Taylor's checkerspot and valley silverspot from residential and recreational development through management plans, conservation agreements, easements, or acquisition.
- Protect sites where blue-gray taildropper, Oregon megomphix occur.
- Protect hydrology of known sites and restore wet meadows and wetlands for western pond turtle and other wetland species through incentives, management programs, or acquisitions; conserve beaver populations and dynamic stream processes.
- Reduce mortalities of eagles and other raptors through modification of electric transmission and distribution lines.
- Continue to require bald eagle habitat plans that include retention of trees. Enforce and strengthen Shoreline Management Act.
- Identify and protect preferred roost and hibernacula sites for Townsend's big-eared bat and limit access to these areas.
- Protect rare habitat types such as grassy and herbaceous balds, aspen stands, snag patches, caves, cliffs, and talus.
- Prioritize conservation areas using ecoregional assessments and other biological assessments. Protect important habitat types, biodiversity areas, and environmentally sensitive lands that should not be altered through a variety of techniques including acquisitions, conservation easements, life estates and cooperative agreements with willing landowners.
- Coordinate with local land trusts, conservation districts and other conservation organizations and agencies to conserve important habitat on both public and private land. Focus limited resources in regionally significant areas. Identify all possible acquisition and restoration grants and coordinate applications.
- Work with the USDA Forest Service and other public landowners to protect existing roadless areas and expand the roadless area network where justified for habitat protection and connectivity.
- Protect key connectivity areas and wildlife corridors between fragmented habitats and between protected areas through a variety of techniques including acquisitions, conservation easements, life estates and cooperative agreements with willing landowners. Use statewide land cover and threats data layers to improve connectivity between priority conservation areas.
- Restore native habitats, habitat connectivity and wildlife corridors where appropriate on both public and private lands. Consider restoring lands adjacent to existing protected areas to increase their effective size and function as wildlife habitat.
- Purchase water rights from willing sellers in unregulated tributaries; use these water rights to restore and maintain adequate year-round flows for both instream and out-of-stream riparian fish and wildlife habitat.
- Rehabilitate and restore stream channels, floodplain functions, riparian habitat and connectivity where streams have been diverted, fragmented, or degraded. Use livestock exclusions, instream structures, bank modifications and other methods.

- Preserve and/or restore buffer areas in appropriate locations along tributaries and mainstem waterways to a condition that is adequate to maintain healthy, functioning riparian zones for the ecoregion's rivers and estuaries.

Improve land management practices:

General

- Buffer meadows and native grasslands from BTk spraying to protect Taylor's checkerspot, Puget Sound fritillary, mardon skipper, and valley silverspot.
- Conduct prescribed burns on grassland sites where and when needed and feasible for Puget Sound fritillary, mardon skipper, valley silverspot, and other rare butterflies.
- Maintain and enforce Forest Practice rules protecting northern spotted owl nests, and bald eagle roosts and nests.
- Allow natural disturbances and successional functions and processes to occur on conserved wetlands.
- Manage undeveloped publicly-owned land for conservation of priority habitats and species.

Forest management

- Protect remaining old growth conifer and hardwood stands to benefit late successional species, and manage some stands on long rotations (>200 years) for northern spotted owl, marbled murrelet, Vaux's swift, northern goshawk, pileated woodpecker, Van Dyke's salamander and Johnson's hairstreak.
- Maintain stream buffers during timber harvest and conduct proper land use management to protect Cascade torrent salamander, bull trout, mountain sucker, Salish sucker, leopard dace, pygmy whitefish and bivalves.
- Do not remove overstory from talus in range of Larch Mountain salamander.
- Evaluate effectiveness of current management practices for maintaining forest species including northern spotted owl, marbled murrelet, pileated woodpecker and Vaux's swift.
- Protect and maintain chinquapin stands in the Gifford Pinchot National Forest for the chinquapin hairstreak.
- Survey mature bigleaf maple stands before timber harvest for ***blue-gray taildropper*** and Oregon megomphix and protect moist conditions at all occurrences.

- Work with the Washington Department of Natural Resources and the Washington Forest Practices Board to develop, implement and enforce forest practices regulations to enhance biological diversity on existing state and private managed and protected areas.
- Work through the Washington Forest Practices Board and directly with forest landowners to implement forest management prescriptions, including prescribed burns, which will maintain and enhance biodiversity and natural ecosystem function. Encourage modified silvicultural prescriptions that promote local topographic, soil and vegetative conditions. Retain snags, downed woody debris and a complement of live trees in harvested areas. Sensitive areas such as wetlands, remnant old growth and wildlife breeding sites should not be disturbed.

- Encourage the development of selective harvest policies and guidelines on both public and private forestland that will leave adequate components of old growth habitat such as snags and downed wood as habitat for associated wildlife such as pileated woodpecker, Vaux's swift, and western bluebird.
- Minimize logging roads and decommission them after the period of entry. Ensure that all logging and forest access roads are located in stable, non-erodible areas and outside riparian management zones.
- Ensure the integrity of riparian habitat by maintaining adequate riparian management zones along streams in all logging sites, on both public and private land.
- Support implementation and enforcement of the Washington Forest Practices Act to accomplish habitat conservation and regeneration on both state and private forestlands.
- Encourage public and private forest landowners to manage forested watersheds that maintain an appropriate mix of successional stages and provide connectivity of riparian and upland vegetation as protected travel corridors for wildlife.
- In dry site forests, implement silvicultural practices that improve stand age-class and structural diversity, retain large, dominant oaks, ponderosa pine and Douglas-firs and standing dead and dying trees, create snags instead of removing trees, and leave fallen trees, limbs and leaf litter for foraging, nesting and denning sites. Use prescribed burns to maintain open savannah in appropriate areas.

Grazing and agricultural practices

- Work with public and tribal and management agencies to fence or otherwise protect riparian zones from livestock grazing and unauthorized offroad vehicle use. Consider retirement rather than renewal of grazing leases on sensitive lands.
- Work with conservation districts, Natural Resource Conservation Service, USDA Forest Service and private landowners to implement best management practices in riparian areas and associated upland habitat in conjunction with the Conservation Reserve Program, Wetland Reserve Program and other Farm Bill programs.
- Use the Comprehensive Resource Management Plan process for large landscapes with a mix of public and private landowners to modify grazing regimes and improve grassland understory conditions and enhance biodiversity.
- Assist private landowners in securing funding to fence riparian zones on private land. In areas where it is impractical to exclude livestock, protect habitat quality by controlling the timing and intensity of livestock grazing through regulation and landowner agreements.
- Work with private and public landowners to minimize the impacts on habitat and wildlife from modern agriculture, including agrochemical use, water use, grazing and soil erosion.
- Prevent grazing that degrades habitat for mardon skipper, Taylor's checkerspot, Puget Sound fritillary, and valley silverspot.

<u>Control and prevent introduction of alien and invasive species</u>:

- Control bullfrogs and predatory fish as needed for western pond turtle and amphibians of conservation concern.
- Remove nutria from wetlands to prevent destruction of wetland vegetation.
- Control weeds and alien grasses on native grasslands for mardon skipper, Taylor's checkerspot, Puget Sound fritillary, and valley silverspot.

- Enforce restriction on transplantation of fish, non-native turtles, bullfrogs, and other alien species to protect western pond turtle, bull trout, pygmy whitefish, Salish sucker, mountain sucker, leopard dace, and Pacific clubtail.
- Avoid introduction of non-native fish in fishless lakes and where species of conservation concern occur such as bull trout and native amphibians and reptiles. Avoid introduction of non-native trout to protect bull trout from hybridization, competition, and predation.
- Develop a regional plan for the detection, rapid response and eradication of invasive species.
- Work with other public agencies and private agricultural organizations such as the Farm Bureau and Washington Grange to develop basic techniques for mapping and monitoring the spread of invasive plant species over time.
- Participate in federal and state agency partnerships to develop and implement weed control strategies for impacted sites and ecosystems. Promote adequate funding and coordination of weed control efforts on both public and private lands using environmentally-sound methods.
- Develop educational and public information materials to increase public awareness of the ways that invasive alien species are introduced to sensitive ecosystems.
- Provide funding, incentives and technical assistance to private landowners to eliminate undesirable invasive plant species in riparian zones and to restore native plants that provide important habitat for native fish and wildlife. Use integrated pest management practices to control currently established invasive species with help from volunteers.
- Participate in federal and state agency partnerships to develop and implement weed control strategies for impacted sites and ecosystems.

Control and monitor disturbance:

- Protect Townsend's big-eared bat and nesting peregrine falcon, golden eagle and bald eagle through use and access restrictions on public lands as needed, and work with private landowners and permitting agencies to prevent blasting or construction disturbance during nesting; inform rock climbers of sensitive periods and locations to reduce disturbance of nesting ***peregrine falcon***.
- Eliminate vehicular access and campsites in conservation areas identified as sensitive habitats such as montane wetlands, bogs, prairies, and dunes.
- In sensitive habitats, manage both land and water access by using fencing, trails, elevated boardwalks, railings, seasonal restrictions, signage and livestock restrictions.
- Reduce the amount and impact of unauthorized recreational access and use on important wildlife habitat through better enforcement of existing laws, more fencing and posting of critical habitat areas, selective road closures and increased public education and information for recreational users and user groups.

Control and prevent environmental contamination:

- Facilitate use of nontoxic alternatives to fishing sinkers to protect common loon.
- Work with other agencies to reduce and remediate sources of contaminants that contribute to prey contamination for bald eagle, peregrine falcon, etc.
- Do not use pesticides to eradicate unwanted fishes in lakes with pygmy whitefish, and where other species of conservation concern may be present.
- Work with governmental and nonprofit agencies to develop an ecoregion-wide strategy for identified toxins and other pollutants: their sources, destinations and effects, and ways to reduce their discharge.
- Work with other agencies, industry and private landowners to encourage use of integrated pest management techniques and phase out the use of pesticides and herbicides.
- Clean up contaminated sites and sediments whenever possible, and prevent further toxic contamination of areas, including unconfined spoil disposal sites.
- Reduce the use of hazardous chemicals by continuing to implement the persistent bioaccumulative toxins strategy and by using a variety of best management practices and improved treatment methods.
- Continue to place a priority on actions to prevent and respond to oil and hazardous material spills.

Improve transportation and energy development:

- Reduce mortalities of eagles and other raptors through modification of electric transmission and distribution lines
- Avoid roadbuilding near breeding sites, or provide crossings for western pond turtle, western toad, Van Dyke's salamander and Larch Mountain salamander.
- Discourage use of talus for roads to prevent destruction of Larch Mountain salamander and California mountain kingsnake habitat.
- Where feasible, remove barriers to passage for bull trout, green sturgeon, river lamprey and Pacific lamprey.
- Work with the Washington Department of Transportation to locate highways away from important wildlife habitats and biodiversity areas. If impacts are unavoidable, design adequate mitigation such as underpasses, overpasses and fencing to accommodate wildlife that need passage, including gray wolf, wolverine, grizzly bear and other large mammals, and western toad and salamanders.

Improve water quantity and quality:

- Work with public and private landowners through education, planning and regulatory pathways to reduce sedimentation and pollution for bull trout, green sturgeon, Salish sucker, mountain sucker, leopard dace, pygmy whitefish, Cascade torrent salamander, winged floater, Oregon floater, western ridged mussel, and western pearlshell.
- Manage wetland areas on public land for both high water quality and habitat value. Ensure that the water quality of inflow does not lead to deterioration of the wetland habitat.
- Where possible restore or rehabilitate the hydrology, water quality and native plant communities in degraded and disturbed wetlands. Methods should emphasize creating or restoring natural wetland functions such as conserving beaver

populations and dynamic stream processes to benefit species like bull trout, Salish sucker, mountain sucker, western ridged mussel, and western pearlshell.

- Manage runoff from highways according to the updated highway runoff manual. Improve the road drainage network in riparian zones by removing unnecessary culverts, increasing the size of inadequate culverts, or replacing culverts with bridges.
- Reduce the harm from stormwater runoff by working to improve the effectiveness of the National Pollutant Discharge Elimination System stormwater permit programs.
- Assist local jurisdictions in finding solutions to increase landowner compliance with onsite sewage system maintenance and animal waste management practices through education and regulated inspection. Work to reduce the number and volume of combined sewer overflow events.

<u>Improve coordination, planning, permitting and mitigation</u>:

- Continue to require bald eagle habitat plans that require retention of trees. Enforce and strengthen Shoreline Management Act
- Protect nesting golden eagle, northern spotted owl and peregrine falcon by maintaining buffer zones of no activity during nesting.
- Provide credible scientific information on priority habitats and species and biodiversity areas, their significance, management needs and compatible land uses to decision-makers at site, local and regional scales.
- Provide technical assistance to counties in using fish and wildlife and biodiversity information to update comprehensive land use plans, community or watershed plans, Shoreline Master Plan, etc.
- Assist counties in developing and updating county ordinances and incentives that help to mitigate or control development in areas with resource and conservation values and that encourage environmentally sensitive development in growth areas.
- Work with local governments and conservation organizations to identify and protect areas of important habitat and biodiversity through existing environmental laws and other local programs.
- Encourage floodplain management and shoreline zoning protection programs.
- Develop a coordinated conservation vision and strategy for conservation of large landscapes using a structured process like The Nature Conservancy's 5-S Project Management System or the Cascade Dialogs.
- Review state and federal land management plans to ensure adequate protection for priority habitats and species, biological diversity and ecosystem health.
- Develop site management plans for protected areas.
- Work with public and tribal land management agencies to protect important habitat and areas of high biodiversity from loss and fragmentation, as well as degradation.
- Coordinate and integrate species recovery and management plans with land management and watershed plans using regulatory and voluntary approaches.
- Participate in Growth Management Act, Shoreline Management Act, Forest Protection Act and Federal Energy Regulatory Commission permitting processes for new or expanded residential, recreational or hydropower development on private land.
- Use information from ecoregional assessments to illustrate important habitats and areas of high biodiversity. Encourage permitting agencies to designate and protect these areas from residential and recreational development, and to require mitigation for habitat conversion and fragmentation where it occurs.

- Work closely with the USDA Forest Service and other land management agencies to prevent or mitigate potential adverse impacts to fish and wildlife habitat from proposed recreational or hydropower development on public lands.
- Work with regulatory agencies to design effective mitigation strategies for projects that result in wildlife impacts or direct conversion or fragmentation of habitat.
- Represent WDFW's conservation interests on interagency recovery teams and working groups.

Improve enforcement of laws and regulations:

- Protect listed wildlife through enforcement, education and outreach.
- Enforce prohibition of killing bald eagle and non-permitted possession of parts through investigation and vigorous prosecution.
- Limit access to roadless, wilderness and primitive areas; prevent disturbance of denning areas for wolverine.
- Reduce illegal capture for pet trade of ***California mountain kingsnake***.
- Enforce restriction on transplantation of fish to protect western pond turtle, bull trout, pygmy whitefish, Salish sucker, mountain sucker, leopard dace, Pacific clubtail and native amphibians.
- Enforce recreational access restrictions on public lands and aquatic areas.

Improve landowner assistance:

- Develop, periodically update, and provide WDFW Priority Habitats and Species management recommendations to assist landowners in conserving priority habitats and species.
- Work with large and small timber companies and landowners to accomplish habitat conservation through non-regulatory approaches such as landowner incentives, conservation easements, habitat conservation plans and acquisition of critical habitat from willing landowners.
- Secure state and federal tax incentives that discourage habitat fragmentation and destruction and that encourage landowners to protect and manage their land to benefit wildlife habitat.
- Work with local government to implement the Public Benefit Rating System and encourage effective use of open space tax incentives for landowners.
- Work with private landowners to identify and protect areas with important habitats and biodiversity and protect these areas through landowner incentives and other nonregulatory programs. Important habitats include balds, oak woodlands, and old growth.
- Provide educational materials to private landowners that describe management techniques for maintaining and restoring various wildlife habitats.
- Work with private landowners to identify and protect important wetland habitats and buffers by providing adequate water, controlling invasive plants, reducing disturbance to nesting wildlife, and fencing or otherwise keeping livestock out of wetlands and associated upland habitat.

- Influence the application of federal Farm Bill funds, including the Conservation Reserve Program and the WDFW Landowner Incentive Program, on private agricultural lands most critical for wildlife movement and most suitable for restoration of native wetlands and grassland habitat.
- Promote grant programs to assist landowners with implementation of management plans.

Improve wildlife conservation education: includes outreach, volunteer and watchable wildlife programs.

- Facilitate use of nontoxic alternatives to fishing sinkers to protect common loon.
- Develop or disseminate education materials to prevent introductions of alien shellfish competitors of winged floater and Oregon floater.
- Develop education program targeted to reduce disturbance of common loon and bald eagle by boaters.
- Engage and involve local and tribal governments, state and federal agencies, organizations and citizens in efforts to protect and restore priority habitats and species through a variety of outreach projects, programs and education efforts.
- Increase the use of citizen science for the collection of data, monitoring, restoration and conservation of important habitats and associated wildlife species. Coordinate volunteer monitoring and involvement.
- Promote and maintain public information and education efforts that focus on endangered species, habitat loss, ecological function, biological diversity and environmentally aware lifestyle practices. Emphasize the connection between habitat and environmental quality and human health and welfare.
- Expand conservation education programs for both adults and children to emphasize the critical nature and vulnerability of sensitive habitats such as wetlands, oak and grassland habitats and associated wildlife.
- Connect with user groups through education to make them part of the conservation solution in areas that have high recreation values.

Fisher.

EAST CASCADES ECOREGION

PHYSIOGRAPHY AND FISH AND WILDLIFE DIVERSITY

Geography

The East Cascades ecoregion in Washington lies east of the Cascade crest, from Sawtooth Ridge near Lake Chelan south to the Columbia Gorge. Its eastern border follows the montane forest – lowland shrub-steppe transition. Approximately 10 percent of Washington is included within this ecoregion. According to the Washington Gap Project, as of 1991, less than 2 percent of the Washington portion had been converted to agricultural or urban development. The development that has occurred is concentrated in the Chelan, Wenatchee, upper Yakima, and Little White Salmon valleys.

Geology

The East Cascades of Washington were shaped by alpine glaciers and landslides that created rugged ridges extending southeast to east from the Cascade crest. Broad valleys occupy the lowlands between the mountain ridges. Isolated volcanic cones appear on the steep mountain ridges, but with the exception of Mt. Adams are not as high as volcanoes in the Western Cascades. The East Cascades have a varied geology, including large serpentine areas in the Wenatchee Mountains. The typical elevation range is between 2,000 and 7,000 feet. Mt. Adams is the highest peak at 12,276 feet. The lowest elevation is in the Columbia River Gorge at 100 feet. The Wenatchee and Simcoe mountains are eastward extensions of this ecoregion.

Climate

The climate changes rapidly west to east, from cold with high precipitation (120 inches) along the Cascade crest to hot and dry with less than 20 inches per year along the foothills. Most precipitation accumulates from November through April. A snow pack develops at higher elevations.

Habitat and Plant Associations

Forests of grand fir, Douglas-fir and ponderosa pine dominate the East Cascades ecoregion. Oregon white oak woodlands appear at lower elevations in the southern half of the ecoregion, and subalpine fir, mountain hemlock and Engelmann spruce are found at higher elevations. Whitebark pine, lodgepole pine, and western larch are common components of these forests. Historically, fires occurred at irregular intervals from 10 years in the lowland foothills to 150 years or more at high elevations. Forest stand patterns on the landscape often reflect this complex fire history. In some areas, decades of fire suppression have resulted in large areas of dense, fire-prone forests. Shrub-steppe vegetation composed of big sagebrush or antelope bitterbrush and native bunchgrasses occurs along the foothills and higher south-facing slopes.

Fish and Wildlife Diversity

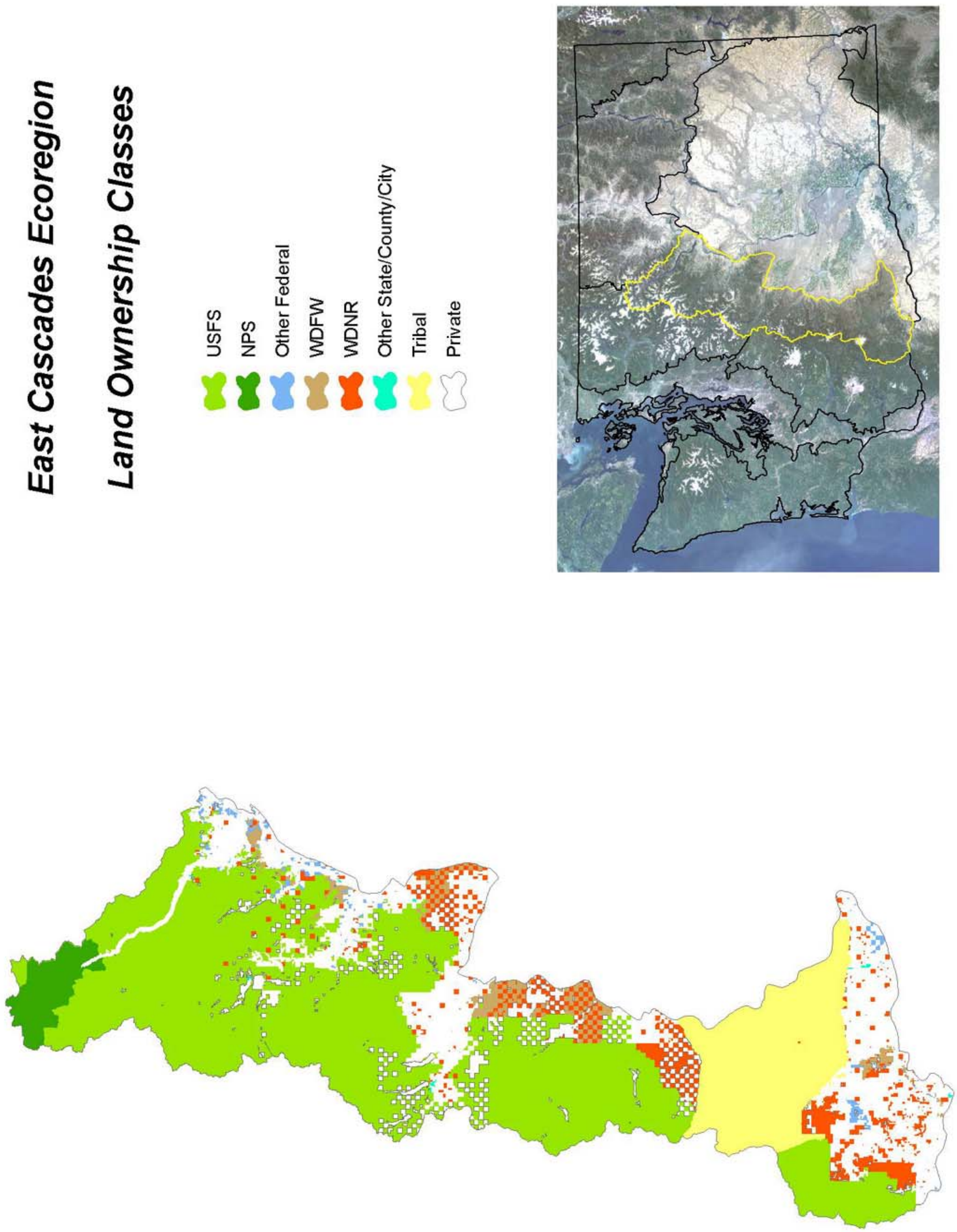
Large mammals include elk, blacktail and mule deer, cougar and black bear. Mountain goats inhabit high elevations in the central and northern part of the ecoregion, but are largely absent from the southern portion of their range. Fisher, once common in this ecoregion, are now rare or extirpated. Blue and ruffed grouse, owls, hawks, and songbirds are common. Woodpeckers and other cavity nesters are common. The wetlands are home to many waterfowl such as Canada geese, ducks, herons, and various song birds. Bald and golden eagles inhabit a small portion of their historic ranges and are very limited in distribution. The peregrine falcon is making a comeback in the ecoregion. Anadromous fish such as coho and chinook salmon and steelhead inhabit the streams and rivers, their distribution and numbers are significantly reduced. Rainbow and cutthroat trout are the common cold water inhabitants. Bull trout are found, but their occurrence is significantly restricted from historic ranges. Kokanee are particularly associated with lakes in the northern and central portions of this ecoregion.

LAND OWNERSHIP

The single largest landowner in the East Cascades ecoregion is the U.S. government. Most of the federal land is within the Wenatchee National Forest. Major landowners in the East Cascades ecoregion are the U.S. Forest Service, the Yakama Nation, Washington Department of Natural Resources, Washington Department of Fish and Wildlife, and private timber companies. The Washington Department of Fish and Wildlife manages about 113,267 acres in the ecoregion, including the Colockum, Oak Creek, L.T. Murray, Wenas, and Chelan Butte Wildlife Areas. Dominant land uses are forestry, livestock grazing, recreation and conservation. Timber companies have recently begun to sell lands for development in the non-federal, mid-elevation forest and transition zone.

Although less than 25% of the ecoregion is privately owned, nearly two-thirds of the anadromous streams, primarily lower gradient streams, are bordered by private lands along the mainstems of the Wenatchee, Naches and Yakima Rivers. Figure 25 below maps land ownership classes in the East Cascades ecoregion.

Figure 25.


East Cascades Ecoregion
Land Ownership Classes
USFS
NPS
Other Federal
WDFW
WDNR
Other State/County/City
Tribal
Private

ECOREGIONAL CONSERVATION PARTNERSHIPS

Effective conservation of fish, wildlife and biodiversity in Washington requires close coordination and cooperation with many public and private conservation partners. Major partners in the East Cascades ecoregion include:

- U.S. Bureau of Reclamation
- U.S. Bureau of Land Management
- U.S. Fish and Wildlife Service (Pierce and Conboy Lake National Wildlife Refuges)
- USDA Forest Service (Wenatchee National Forest)
- Washington Department of Natural Resources (WDNR)
- Washington State Parks and Recreation Commission
- Yakama Indian Nation

The Washington Department of Fish and Wildlife also works closely on conservation projects with private conservation partners such as The Nature Conservancy, Trust for Public Land, Rocky Mountain Elk Foundation, Audubon Washington, Ducks Unlimited and a growing number of fisheries enhancement groups and local land trusts.

Major Plans and Assessments

A number of ongoing or completed planning efforts involving WDFW and its public and private partners guide the conservation and management of fish and wildlife resources statewide and in the East Cascades ecoregion. Important planning efforts affecting conservation in the East Cascades ecoregion include:

- East Cascades Ecoregional Assessment
- Interior Columbia Basin Ecosystem Management Project
- Intermountain West Joint Venture Coordinated Bird Conservation Plan (2005)
- Northwest Forest Plan (1994)
- USFWS Draft Bull Trout Columbia River DPS Recovery Plan (2004)
- USFWS Draft Northern Spotted Owl Recovery Plan (1992)
- USFWS Grizzly Bear Recovery Plan (1993)
- Washington Forest Practices Board Wildlife Strategy (in progress)
- Washington Forests and Fish Agreement (1999)
- WDFW Bald Eagle Status Report (2001)
- WDFW Bull Trout and Dolly Varden Management Plan (2000)
- WDFW Draft East Cascades Regional Wildlife Area Management Plan
- WDFW Fisher Recovery Plan (2005)
- WDFW Game Management Plan (2003)
- WDFW Larch Mountain Salamander Status Report (1993)
- WDFW Lynx Recovery Plan (2001)
- WDFW Mardon Skipper Status Report (1999)
- WDFW Outline for Salmon Recovery Plans (2003)
- WDFW Peregrine Falcon Status Report (2002)
- WDFW Western Gray Squirrel Recovery Plan (2005)
- WDFW Western Pond Turtle Recovery Plan (1999)
- Yakima, Lake Chelan, Wenatchee and Klickitat Subbasin Plans

Supporting references to these and other important statewide planning documents are included at the end of this chapter and/or in Appendices 6 and 7.

SPECIES AND HABITATS OF GREATEST CONSERVATION NEED

This section provides a short summary of priority species and associated habitats for the Washington portion of the East Cascades ecoregion.

<u>Species of Greatest Conservation Need</u>

The following species list for the East Cascades ecoregion is a regional subset of the statewide Species of Greatest Conservation Need (SGCN) list shown in Appendices 1 and 2. The process and criteria used to develop the statewide SGCN list are provided in Volume Two, Approach and Methods, as well as in Appendix 3. Species listed below are found in the East Cascades ecoregion for all or part of their lifecycle. Supporting tables and information for these species and habitats can be found in Chapter IV and in Appendices 1, 2, 8, 9, 10 and 14.

	Population Size/Status						Population Trend					
COMMON NAME	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown	State Status*	WNHP
Mammals												
Townsend's big-eared bat			x							x	C	S3
Western gray squirrel			x				x				T	S2
Gray wolf	?									x	E	S1
Grizzly bear		x							x		E	S1
Fisher	x							x			E	SH
Wolverine		x						x			C	S1
Lynx			x							x	T	S1
Birds												
Common loon			x					x			S	S2
Bald eagle				x					x		T	S4
Northern goshawk			x							x	C	S3
Golden eagle			x							x	C	S3
Peregrine falcon			x						x		S	S2
Mountain quail			x							x	G	S1
Sandhill crane (greater)		x							x		E	S1
Flammulated owl			x							x	C	S3
Northern spotted owl			x				x				E	S1
Vaux's swift			x				x				C	S3
Lewis' woodpecker			x				x				C	S3
Acorn woodpecker		x						x			M	S1
White-headed woodpecker			x				x				C	S2
Black-backed woodpecker			x							x	C	S3

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
Pileated woodpecker				x						x	C	S4
Pygmy nuthatch			x							x	N	S3
Reptiles												
Western pond turtle			x						x		E	S1
Sharptail snake			x							x	C	S2
California mountain kingsnake			x							x	C	S1
Amphibians												
Larch Mountain salamander			x							x	S	S3
Western toad				x			x				C	S3
Oregon spotted frog			x				x				E	S1
Columbia spotted frog			x							x	C	S4
Fish												
River lamprey						x				x	C	S2
Pacific lamprey						x				x	N	S3
Westslope cutthroat				x				x			G	G4
Bull trout						x				x	C	G3
Mid-Columbia steelhead											C	G5
Yakima steelhead											G	G5
Mid-Columbia coho											G	G4
Pygmy whitefish						x				x	S	S1
Leopard dace						x				x	C	S2
Mountain sucker						x				x	C	S2
Invertebrates												
Propertius' duskywing (butterfly)			x				x				M	S3
Mardon skipper (butterfly)		x								x	E	S1
Chinquapin hairstreak (butterfly)			x							x	C	S1
Juniper hairstreak (butterfly)						x				x	C	S2

* Status Codes	** WNHP Codes (S = state, G = global)
E = endangered	1 = critically imperiled
T = threatened	2 = imperiled
S = sensitive	3 = vulnerable to extirpation or extinction
C = candidate	4 = apparently secure
M = monitor	5 = demonstrably widespread, abundant and secure

Species Conservation in the East Cascades Ecoregion

Species of Greatest Conservation Need (SGCN) found in the East Cascades ecoregion (see table above) include those classified by WDFW as Endangered, Threatened, Sensitive, Candidate or Monitor species, as well as species identified by WDFW as needing additional research or funding attention. Conservation actions are recommended for these SGCN species at both the statewide and ecoregional levels. These recommended conservation actions are summarized in a series of matrices included in Chapter IV and as Appendices 9 and 10. These matrices also display the life history, population status and distribution of these species.

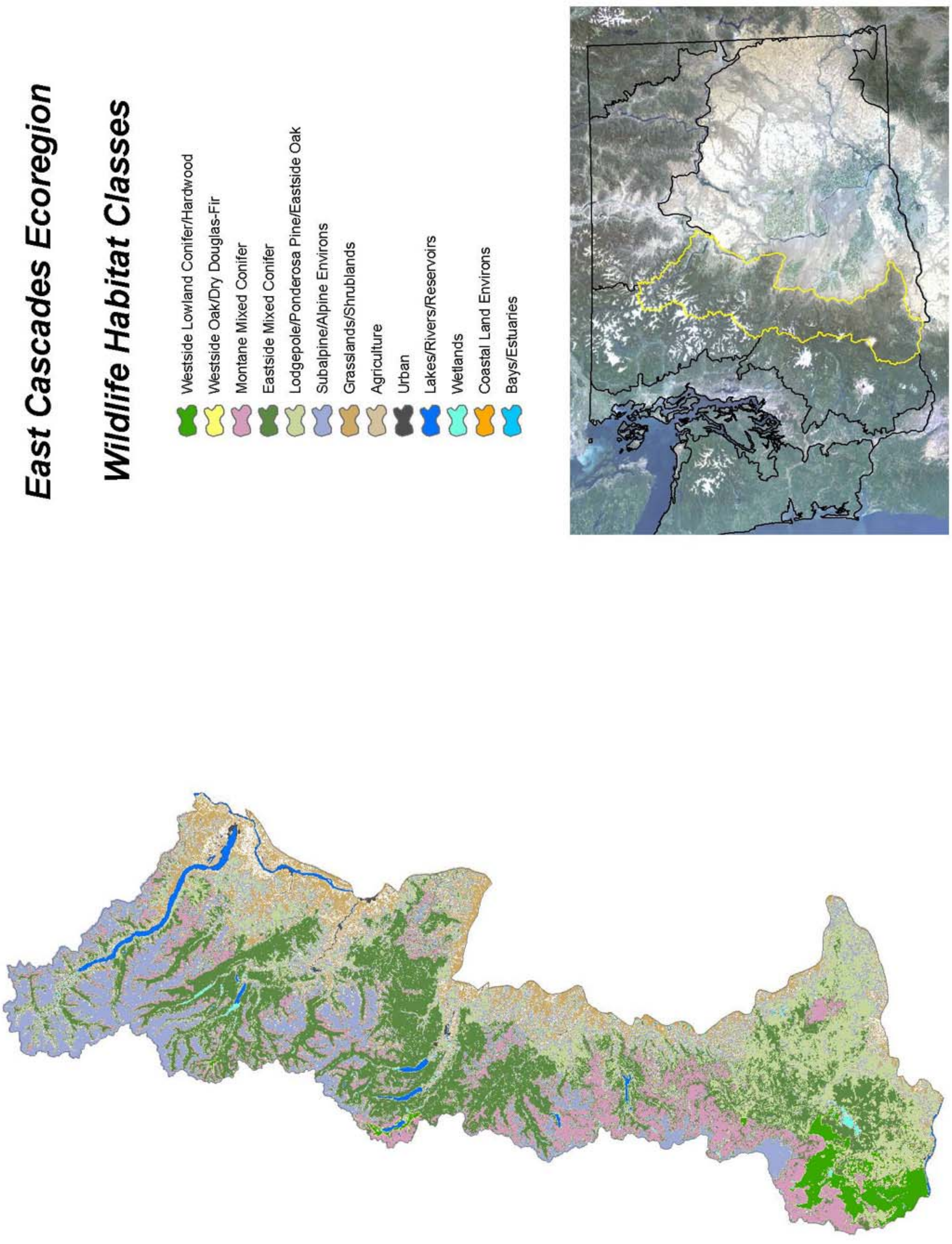
Ecoregional Habitat Overview

Most natural habitats in the East Cascades ecoregion are relatively intact and dominated by natural or semi-natural vegetation. Over a century of timber harvest however, has degraded dry forests through consistent removal of large-diameter overstory trees, particularly ponderosa pine. This ecoregion contains two of Washington's highest concentrations of rare plants, located in the Columbia River Gorge and the Wenatchee Mountains. The southern portion of the ecoregion contains fescue grasslands, which harbor the Mardon skipper, a Washington state endangered species and federal candidate butterfly.

The following major habitat types classified, coded and described in Wildlife and Habitat Relationships in Oregon and Washington (WHROW), are present in the East Cascades ecoregion. In the next section, descriptions are provided for priority habitats associated with Species of Greatest Conservation Need found in this ecoregion.

- Montane Mixed Conifer Forest
- Eastside (Interior) Mixed Conifer Forest
- Lodgepole Pine Forest and Woodlands
- Ponderosa Pine and Eastside White Oak Forest and Woodlands
- Upland Aspen Forest
- Subalpine Parkland
- Alpine Grasslands and Shrublands
- Eastside (Interior) Grasslands
- Shrub-steppe
- Dwarf Shrub-steppe
- Agriculture, Pasture and Mixed Environs
- Urban and Mixed Environs
- Open Water: Lakes, Rivers and Streams
- Herbaceous Wetlands
- Montane Coniferous Wetlands
- Eastside (Interior) Riparian-Wetlands

Figure 26.


East Cascades Ecoregion
Wildlife Habitat Classes
Westside Lowland Conifer/Hardwood
Westside Oak/Dry Douglas-Fir
Montane Mixed Conifer
Eastside Mixed Conifer
Lodgepole/Ponderosa Pine/Eastside Oak
Subalpine/Alpine Environs
Grasslands/Shrublands
Agriculture
Urban
Lakes/Rivers/Reservoirs
Wetlands
Coastal Land Environs
Bays/Estuaries

Priority Habitats in the East Cascades Ecoregion

The following five habitat types have been identified as the highest priority for current conservation action in the East Cascades ecoregion. Selection of these habitats as a priority was determined by their importance to regional Species of Greatest Conservation Need, as well as priorities outlined in the East Cascades Ecoregional Assessment and the subbasin plans listed in the “Major Plans” section above. More discussion on the selection of priority habitats is included in Chapter III: Statewide Overview and in Volume Two: Approach and Methods.

- Ponderosa Pine and Eastside White Oak Forest and Woodlands
- Montane and Interior Mixed-Conifer Old Growth Forest
- Shrub-steppe
- Montane Coniferous Wetlands
- Eastside (Interior) Riparian-Wetlands

Ponderosa Pine and Eastside White Oak Forest and Woodlands

Ponderosa pine/Oregon white oak woodland habitats are unique dry forest ecosystems in the East Cascades ecoregion, due to the rain shadow and topography of the east slope of the Cascades. Oregon white oak woodlands exist to a lesser extent than ponderosa pine in the East Cascades ecoregion, and are an important and unique habitat. Together they occupy about 16% of the ecoregion.

Ponderosa pine forms climax stands that border native grasslands and is a common member in many other forested communities. It is a drought tolerant tree that usually occupies the transition zone between grassland and forest. Climax stands are characteristically warm and dry, and occupy lower elevations throughout their range. Key understory associates in climax stands typically include grasses such as bluebunch wheatgrass and Idaho fescue, and shrubs such as bitterbrush and common snowberry.

Ponderosa pine has many fire resistant characteristics. Seedlings and saplings are often able to withstand low-intensity fires. Pole-sized and larger trees are protected from the high temperatures of fire by thick, insulating bark, and stems are protected by the surrounding needles and bud scales.
Other aspects of the pine’s growth patterns help in temperature resistance. Lower branches fall off the trunk of the tree, and fire caused by the fuels in the understory will usually not reach the upper branches. Ponderosa pine is more vulnerable to fire at more mesic sites where other conifers as Douglas-fir and Grand fir form dense understories that can carry fire upward to the overstory. Ponderosa pine seedlings germinate more rapidly when a fire has cleared the grass and the forest floor of litter, leaving only mineral rich soil.

Ponderosa pine is also shade intolerant and grows most rapidly in near full sunlight. Currently, much of this habitat has a younger tree cohort of more shade-tolerant species that gives the habitat a more closed, multi-layered canopy. For example, this habitat includes previously natural fire-maintained stands in which grand fir can eventually become the dominant canopy species. Large late-seral ponderosa pine and Douglas-fir are harvested for timber in much of this habitat. Oregon white oak is frequently cut for fuel wood, or removed during thinning as competition with desired timber species. Under most management regimes, typical tree size decreases and tree density increases in this habitat. Ponderosa pine-Oregon white oak habitats are now denser than in the past and may contain more shrubs than in pre-settlement habitats.

Selected Species Closely Associated with
Ponderosa Pine Forest and Woodlands
in the East Cascades Ecoregion

Flammulated owl	Northern goshawk
Pygmy nuthatch	Western gray squirrel
White-headed woodpecker	

Montane and Interior Mixed-Conifer Old Growth Forest

This habitat makes up most of the continuous montane forests of the inland Pacific Northwest. It contains a wide array of tree species and stand dominance patterns. Douglas-fir is the most common tree species. It is almost always present and dominates or co-dominates most overstories. Low elevations or drier sites may have ponderosa pine co-occurring with Douglas-fir in the overstory and often have other shade-tolerant tree species growing in the undergrowth. On moist sites, grand fir, western redcedar and western hemlock occur. Other conifers include western larch and western white pine.

In the Eastern Cascades ecoregion, the remaining patches of old-growth forests of ponderosa pine, western larch, and Douglas-fir are home to a variety of wildlife including goshawk, martens, and northern spotted owls. Old growth forests of ponderosa pine, western larch, and Douglas-fir in this ecoregion are threatened by logging. Old growth Ponderosa forests are now very rare.

Prior to European settlement (pre-1850), a wide variety of disturbances characterized this habitat, ranging from frequent small-scale and localized events such as treefall gaps to rare, large-scale events such as stand-replacing fires and epizootic outbreaks. Such disturbances resulted in a dynamic equilibrium between patch creation and loss. This active disturbance regime has resulted in a larger proportion of younger seral stages than in areas west of the Cascade Mountains. However, the low-elevation (2900-4900 ft) forests, which experienced frequent low-intensity fires, were predominantly (up to 90%) old growth ponderosa pine. In general, forest ecosystems in this region are adapted to more frequent fire disturbances than mesic westside forests. Fire cycles range from periodic (5-15 years) surface fires in dry and warm ponderosa pine and Douglas-fir types, to infrequent (more than 100 yrs and up to 900+ yrs) stand-replacement crown fires in mesic and cool western redcedar, western hemlock, and cedar/spruce forest types. Such disturbances played a crucial role in maintaining inland forest structure, species composition, and ecosystem processes. However, fire suppression has shifted disturbance regimes and landscape dynamics to less frequent and more intense fires, and frequent and large-scale anthropogenic disturbances such as logging have disrupted natural processes and led to declines in various ecosystem types and species.

Selected Species Closely Associated with
Montane and Interior Mixed-Conifer Forest
in the East Cascades Ecoregion

Fisher	Flammulated owl
Northern goshawk	Northern spotted owl
Pileated woodpecker	Black-backed woodpecker
Vaux's swift	

Shrub-steppe

Historically, shrub-steppe vegetation associations were commonly interspersed with one another forming a diverse mosaic at lower elevations of the East Cascades ecoregion. The combination of elevation, aspect, soil type, and proximity to surface and/or ground water contributed to the vegetation potential of any given site. Fire was likely the primary disturbance factor for native shrub-steppe communities, with intervals ranging between 50 and 200 years, depending on precipitation and elevation gradients. Large mammals such as elk, small mammals such as ground squirrels, and flooding in perennial and ephemeral streams probably contributed secondary localized disturbance roles. Shrubs and perennial bunchgrasses co-dominated the lower-elevation landscape, with a microbiotic crust of lichens, mosses, green algae, and microfungi on the surface of the soil. Because they bind soil particles together, biotic crusts are critical for protecting the soil from wind and water erosion, fixing nitrogen, accumulating nutrients used by vascular plants, and reducing encroachment by invasive species. The dominant native shrub-grass associations in the East Cascades of Washington are antelope bitterbrush, three-tip sagebrush, bluebunch wheatgrass and Idaho fescue.

Scattered throughout this dominant cover type were many other bunchgrasses including Sandberg's bluegrass, needle and thread, Thurber's needle grass, Idaho fescue, Indian rice grass, squirreltail, and Cusick's bluegrass. Scattered shrubs also included two rabbitbrush species and short-spine horsebrush, antelope bitterbrush, spiny hopsage, rigid sagebrush, basin sagebrush and three-tip sagebrush. Most of these shrub species had their own unique association with one or more bunchgrasses and dominated a portion of the landscape. For example, at higher elevations and north facing slopes three-tip sagebrush and Idaho fescue was the dominant association. On ridge tops where shallow soils were common, rigid sagebrush and Sandberg's bluegrass and/or bluebunch wheatgrass dominated. Rabbitbrush was common in areas where fires had recently burned. Within the shrub steppe landscape there also were alkaline adapted community types, usually associated with drainage bottoms, perennial and ephemeral streams, or seeps and springs. This vegetation association, more common to the Great Basin than the Cascades, included black greasewood, basin wildrye, and inland saltgrass.

It has been estimated that only 40 percent remains of the roughly 10.4 million acres of shrub-steppe that once existed in Washington prior to the 1850s, substantially reducing the amount of habitat available for shrub-steppe-associated wildlife. The greater sage grouse, for example, requires large landscapes for cover and forage. Bunchgrasses conceal nests and provide cover for broods. Pre-nesting hens and young chicks consume forbs and associated insects. The Brewer's sparrow needs dense sagebrush for nesting and post-fledging success. Although they do not require large landscapes typically associated with sage grouse, breeding success has been shown to decrease as patch size decreases. Mule deer migrate to shrub-steppe habitat in fall and winter, depending on a variety of native shrubs, forbs, and grasses.

The loss of once extensive shrub-steppe communities has reduced substantially the habitat available to a wide range of shrub-steppe associated wildlife, including several birds found only in this community type. More than 100 bird species forage and nest in sagebrush communities, and at least four of them--the greater sage-grouse, sage thrasher, sage sparrow and Brewer's sparrow--are obligates.

Selected Species Closely Associated with
with Shrub-steppe
in the East Cascades Ecoregion

Townsend's big-eared bat	American badger
Townsend's ground squirrel	Mardon skipper butterfly

Eastside (Interior) Riparian-Wetlands

In the East Cascades ecoregion, riparian forest habitats are critical to the structure and function of rivers and to the fish and wildlife populations dependent on them. The density and diversity of wildlife in these riparian areas is high relative to other habitat types. Riparian habitats are strongly influenced by associated stream dynamics and hydrology; to remain viable, they require appropriate flooding regimes and specific substrate conditions for native riparian vegetation. Historically, annual flood cycles and associated groundwater dynamics created thermal conditions that were conducive to riparian habitat and wildlife use throughout the season. Fire also influenced riparian habitat structure in most areas, but was nearly absent in colder regions or on topographically protected streams. River meander patterns, ice and log jams, sediment dynamics and flood debris deposits also provided spatial and temporal changes in habitat condition. Abundant beaver activity in riparian zones cropped younger cottonwoods and willows, dammed side channels, and created diverse and complex habitat interactions.

Healthy forested riparian wetland habitat has an abundance of snags and downed logs that are critical to many cavity nesting birds, mammals, reptiles and amphibians. Cottonwood, alder and willow are commonly dominant tree species in riparian wetland areas from the Cascades down through the valley portion of the ecoregion. This habitat is often characterized by relatively dense understory and overstory vegetation. Riparian wetland habitats also function as travel corridors between, and provide connectivity to breeding, feeding and seasonal ranges.

Although riparian-wetland habitats are usually forested, they also contain important habitat components such as marshes and ponds that provide critical habitat for a number of wildlife species. Broad floodplain mosaics consisting of cottonwood gallery forests, shrub lands, marshes, side channels, and upland grass areas contain diverse wildlife assemblages. The importance of riparian wetland habitats is increased when adjacent habitats are of sufficient quality and quantity to provide cover for nesting, roosting, and foraging.

Riparian conditions in the East Cascades ecoregion are varied, ranging from severely degraded to nearly pristine. Good riparian habitat generally is found along forested, headwater reaches, whereas degraded stream channels and riparian habitat is concentrated in the valleys, where it is frequently associated with residential development, grazing and agricultural activity. Recreational development is also having an increasing impact, especially along the upper Yakima River in the critical reach from the city of Cle Elum to Easton Dam.

Selected Species Closely Associated with
Eastside (Interior) Riparian Wetlands
in the East Cascades Ecoregion

Columbia spotted frog
Western toad
Great blue heron

Montane Coniferous Wetlands

In the forest zone of the East Cascades ecoregion, montane coniferous wetlands provide important ecological and hydrologic function disproportionate to their size on the landscape. They are positioned at the headwaters of many important river tributaries and aid in the collection and slow delivery of snowmelt to the region's rivers and streams. These wetlands also provide critical habitat for many specialized plant and animal species.

This habitat is typified as forested wetlands or floodplains with a persistent winter snow pack, and the topography includes everything from steep mountain slopes to nearly flat valley bottoms. Subsurface water flow within the rooting zone of these wetlands is common on slopes with impermeable soil layers, and flooding regimes range from saturated to seasonally and temporarily flooded. Seeps and springs are common.

These wetlands occur along stream courses or as small patches within a matrix of montane mixed conifer forest, or less commonly, eastside mixed conifer forest or lodgepole pine forest and woodlands. They also can occur adjacent to and intermixed with other wetland habitats, particularly riparian wetlands and herbaceous wetlands, and occur within a forest or woodland dominated by evergreen conifer trees. Deciduous broadleaf trees are occasionally co-dominant, and the understory is dominated by shrubs (most often deciduous and relatively tall), forbs or grasses. Areas of herbaceous vegetation may occur in forested wetlands, often with conifers encroaching along the edges of wet meadows and wetlands.

Selected Species Closely Associated with
Montane Coniferous Wetlands
in the East Cascades Ecoregion

Wolverine
Columbia spotted frog
Western toad

CONSERVATION PROBLEMS

A number of human activities pose potential threats to the integrity of wildlife habitat. These activities include incompatible forest and grazing practices, conversion of habitat to agriculture, urbanization, dispersed residential development, pollution, overfishing and overhunting, water extraction, incompatible mining, hydropower and energy developments and transportation systems. These developments disturb and displace wildlife, disrupt migration corridors, and encourage the establishment of invasive plant and animal species.

Habitat Loss and Fragmentation

Ponderosa pine habitats are in major decline in the East Cascades ecoregion of Washington State, especially mature pine forests. In fact, it is estimated that 99% of the mature ponderosa pine forest has been lost to a number of factors, including direct habitat loss from rural residential and recreational development; encroachment of mixed conifer forest into mature ponderosa pine forests; and loss of old forest overstory due to logging. Weeds are an issue in some areas where extensive road networks have led to the establishment of knapweed and other aliens. Improperly managed grazing in some portions of the dry forest causes extensive damage to wet areas, including springs and small streams.

Forest practices that include improperly built and managed logging roads, timber harvest, and altered fire regimes are the principal causes of habitat diversity loss in this ecoregion. Historic conditions have been heavily altered by the selective removal of large overstory ponderosa pine and Douglas fir trees and the proliferation of shade-tolerant, mixed forest conifer species, particularly grand fir, within ponderosa pine communities. Fire suppression policies that preclude the natural, low-intensity fire cycles favored by ponderosa pine and Oregon white oak are the most serious cause of this unintentional recruitment of other species. 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. Late seral forests of ponderosa pine and Douglas-fir are now essentially gone. Early seral forest abundance is similar to that found historically but lacks snags and other old growth features.

The replacement of mixed conifer stands, as well as high-intensity wildfires in these stands, has resulted in an attendant reduction in ponderosa pine habitat-obligate wildlife species. 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 wildlife species.

The direct loss and fragmentation of habitat from improperly managed grazing, agricultural development, residential and recreational development and off-road recreational activities is the most significant conservation problem in shrub-steppe habitat in the East Cascades ecoregion. The loss of migration corridors is a particularly severe problem for shrub-steppe dependent wildlife in the East Cascades ecoregion.

Invasive Alien Plant and Animal Species

The invasion of cheatgrass and other alien plant species, brought on primarily by improperly managed grazing, destruction of microbiotic soil crusts and the alteration of natural fire regimes, is the second most important problem in shrub-steppe habitat. Alien species displace native grasses and understory vegetation, resulting in the loss of habitat diversity and function. This is a problem on both public and private lands. Improperly managed grazing has a doubly adverse impact, not only eliminating native grasses but also breaking down and destroying the soil crust of mosses and lichens that supports native grasses and shrubs.

<u>Hydropower</u>

Dams on major rivers present a daunting challenge to the upstream and downstream migration of anadromous fish. Millions of dollars have been and continue to be spent by public agencies and hydropower users to ensure passage of salmon, sturgeon and lamprey through the dams and to otherwise mitigate for the loss of unimpeded migration corridors and habitat. Unless dams are removed from large rivers, which is highly unlikely, the most pressing problems for migrating fish will continue to be caused by the dams, including inadequate fish ladders on some mainstem dams, predation within the mainstem reservoirs from walleye and other fish, nitrogen loading and mortality to downstream migrating juveniles from turbines.

Hydrological diversions and control of natural flooding regimes results in reduced stream flows and reduction of overall area of riparian habitat, loss of vertical stratification in riparian vegetation, and lack of recruitment of young cottonwoods, ash, willows, etc. Hydro projects also destabilize streambanks, narrow stream channels, reduce the flood zone, and reduce the extent of riparian vegetation. The loss of riparian vegetation has resulted in greater summer heating and winter cooling, soil instability, reductions in water quantity and quality, and changes in bank, channel and instream structure.

Riparian-wetlands have been lost or degraded on a large scale in the East Cascades ecoregion. The most severe long-term problem, on a regional scale, is the direct conversion and fragmentation of riparian habitat to homes, commercial buildings, and other permanent structures. The construction of levees and streambank armoring also results in a permanent loss of habitat in most cases. Once streamside habitat is lost to concrete or lawn, it is usually gone forever, and once a riparian corridor is fragmented by development its utility for wildlife movement is severely compromised or eliminated.

Other problems include improperly managed grazing, channelization, gravel mining, unauthorized roading and off-road recreational use, dumping, and the elimination of beaver from overtrapping and habitat loss. This, coupled with poor habitat quality and fragmentation of existing vegetation, has resulted in extirpation or significant reductions in riparian habitat-obligate wildlife species.

Flooding, debris flow, fire and wind are the major natural disturbances to montane wetlands. Many of these areas are seasonally or temporarily flooded, and heavy floods reshape stream channels and riparian surfaces, which in turn create opportunities for recruitment and redistribution of woody debris. Montane wetland habitats are commonly invaded by undesirable alien plant species due to improperly managed grazing, altered fire frequencies and off-road vehicle use, as well as altered hydrology due to poorly designed roads, culverts and unregulated off-road vehicle use. These factors also encourage the encroachment of trees into herbaceous wetland habitats. The vegetative condition of riparian wetlands and meadows has been degraded, resulting in impaired hydrologic functions, especially those occurring in unregulated tributaries.

Transportation Systems

Transportation systems impact animals in several ways: roadkill, habitat loss and fragmentation, and hindrance or barrier to movement and migration. When populations are low, roadkill mortality is significant, especially for slow moving turtles and salamanders and wide-ranging carnivores that have to cross many roads. In a fragmented landscape, animals have to move from one patch of habitat to another. When highways fragment landscapes, they divide wildlife populations into smaller, isolated units that are more susceptible to extirpation. Historically, construction of logging roads near streams or across wetlands was often extremely destructive to fish and wildlife habitat. Although modern forest practices under state and federal rules are much more likely to provide some protection for wetlands, there are still potential adverse impacts from construction and operation of logging roads. This occurs even when they are located along benches and ridgelines away from riparian zones. Improperly located, constructed or maintained logging roads may trigger or accelerate slope failure, erode stream channels, block fish migration and deposit sediment into streams and wetlands.

The following additional habitat and species conservation problems have been identified in the East Cascades ecoregion:

Wildlife species and population problems: includes disease, pathogens, competition, food scarcity, predation, overharvest and limited population size/distribution.

- Populations of western gray squirrel, lynx, fisher, grizzly bear, gray wolf, northern spotted owl, greater sandhill crane, western pond turtle, Oregon spotted frog and mardon skipper have declined to the point where they are listed as threatened or endangered.
- Recovery plans are needed to guide conservation actions for threatened or endangered species including gray wolf, mardon skipper and Oregon spotted frog.
- Wolves are expected to re-colonize forested parts of Washington and interagency management response guidelines are needed.
- Management plans are needed for the sensitive species such as common loon, peregrine falcon, Larch Mountain salamander and pygmy whitefish.
- Small population sizes and loss of genetic diversity is a problem in western gray squirrel and may be a concern in wolverine, mountain quail, sharp-tailed snake, California mountain kingsnake, acorn woodpecker, bull trout, pygmy whitefish and several other species. Fisher and gray wolf are virtually extinct in the East Cascades.
- Mange is a major mortality factor for the western gray squirrel.
- Sudden oak death syndrome may become established in Washington and would threaten oak woodlands, and many of its dependent wildlife species.
- Illegal persecution and harvest occurs for bald eagle, California mountain kingsnake and migrating and spawning fish species of concern.

Lack of biological information on species and habitats:

- Data are needed on population trends for state threatened and endangered species including western gray squirrel, lynx, northern spotted owl, greater sandhill crane, western pond turtle, Oregon spotted frog and mardon skipper.
- There is a lack of information about the status of populations of state candidate species including Townsend's big-eared bat, wolverine, Vaux's swift, white-headed woodpecker, pileated woodpecker, Lewis' woodpecker, black-backed woodpecker, flammulated owl, northern goshawk, golden eagle, California mountain kingsnake,

sharp-tailed snake, western toad, Columbia spotted frog, bull trout, mountain sucker, leopard dace, river lamprey, chinquapin hairstreak and juniper hairstreak.
- Data are needed on habitat needs and limiting factors, demographics and dispersal in western gray squirrel, Oregon spotted frog, golden eagle and mardon skipper.
- A better understanding of the interactions between barred owl and northern spotted owl is needed.
- Taxonomy of the western toad is uncertain, which means that one or more taxa may be in greater decline. Causes of decline are not well understood; distributional data is needed.
- Additional information is needed on the current distribution and abundance of pygmy nuthatch, mountain quail, Pacific lamprey, Propertius' duskywing and chinquapin hairstreak.
- Data are needed on genetic diversity and gene flow in bull trout.
- There is a shortage of adequate spatial inventory and assessment data on most habitat types.
- There is an absence of baseline data on the habitat values and functions of natural wetlands and a poor understanding of the status of resident macroinvertebrates in aquatic systems.

Habitat loss, conversion, fragmentation and degradation:

- Only 15% of eastern Washington forest is currently in the old growth age class, and nearly all of it is in high elevation national forests or national parks. Maintenance of old growth forest across the landscape is important for at least 1,000 species.
- Grassy and herbaceous balds are rare patch habitats distributed in low and high elevation forests. They often have associated rare species that are vulnerable to certain forest practices and recreation.
- Loss, fragmentation and degradation of oak and mixed oak/conifer habitats to logging, encroachment by conifers and rural development affects western gray squirrel, Lewis' woodpecker, and Propertius' duskywing.
- Remnant stands of old and mature timber that support northern spotted owl, pileated woodpecker and other species are at risk of stand replacement fires.
- Loss of juniper to development and nectar plant destruction from land management practices affects juniper hairstreak.
- Sharp-tailed snake and Larch Mountain salamander are vulnerable to disturbance to rock and talus, woody debris and moisture regime.
- Rural residential development may negatively affect habitat of western gray squirrel and other species.
- The loss and fragmentation of shrub-steppe habitat has resulted in the direct loss and reduced population viability of remaining populations of sage-grouse, Brewer's sparrows and other shrub-steppe obligate wildlife.
- Closing off abandoned mines causes habitat loss of critical maternity roosts and hibernacula for Townsend's big-eared bats.
- Wetland drainage, altered hydrology or succession of wetlands can eliminate habitat of greater sandhill crane, Oregon spotted frog and Columbia spotted frog.
- Mountain quail habitat has been lost or degraded by improperly managed grazing and herbicide use, and development.
- Suburban sprawl is a concern for resource managers, as indicated by the growing number of ranchettes and residential subdivisions in previously managed forest and cropland. Development often occurs near lakes or streams and poses an increased threat of fire and impacts to water quality.

Incompatible land management practices:

- Logging and fire suppression, which has created overly dense stands at risk of crown fire, have reduced the quantity and degraded quality of mature ponderosa pine habitat of white-headed woodpecker, Lewis' woodpecker, pygmy nuthatch, flammulated owl and other species.
- Logging, conversion to conifers, and firewood cutting in oak habitats have all negatively impacted western gray squirrels.
- Logging of mature/old timber and reduction in abundance of snags may negatively impacts populations of flammulated owl, northern spotted owl, northern goshawk, Vaux's swift, pileated woodpecker, and black-backed woodpecker.
- Removal of overstory from talus may destroy Larch Mountain salamander habitat.
- Wetlands and meadows may be harmed by improperly managed grazing, haying and water management practices.
- Mowing and haying can disturb nesting greater sandhill cranes and may accidentally destroy nests and crane chicks.
- Improperly managed grazing and herbicide use have degraded mountain quail habitat in some areas.
- Logging, agriculture, road building or other activities that may elevate water temperature, may also alter hydrology, increase sedimentation, and degrade habitat of bull trout, pygmy whitefish, mountain sucker, leopard dace, inland redband trout and westslope cutthroat.
- Improper grazing of meadows and spraying of BTk to control spruce budworm and tussock moth my adversely affect the mardon skipper by destroying host plants.
- Modern agricultural practices often reduce the quality, patch size and connectivity of wildlife habitat in farmlands.

Alien and invasive plant and animal species:

- Reed canary grass thrives in reservoirs and wetland stream outlets where water levels fluctuate and directly affects habitats that support 27 Washington state-listed plant species. A number of native fish, amphibians and other animals are not well adapted to spawn or reproduce in reed canary grass thickets.
- Non-native trout introduced as sportfish readily hybridize with native bull trout and westslope cutthroat.
- Western gray squirrels are negatively affected by competition from non-native eastern gray and fox squirrels.
- Predation by bullfrogs and/or introduced predatory fish negatively impact western pond turtle, Oregon spotted frog and Columbia spotted frog; predation by non-native predator fish have eliminated some populations of pygmy whitefish.
- Non-natives turtle threaten native western pond turtles through competition and introduced disease.
- Filbert worms and other alien pests affect acorns needed by western gray squirrel, acorn woodpecker and other wildlife species.
- Alien grasses and weeds affect mardon skipper by reducing availability of native host plants.
- Barred owls have expanded their range into Washington and threaten northern spotted owl through competition for prey and nest sites, hybridization and possibly predation.

Human disturbance and recreational impacts:

- Recreational activities such as offroad recreational vehicles, horses, mountain bikes and even hikers can create unauthorized trails that disturb soil and allow invasive plants to establish.
- The nature and timing of farm disturbances may be increasingly hazardous to wildlife. Tilling, planting and harvesting are becoming more synchronous, widespread and intense, potentially stressing wildlife during critical periods of nesting, rearing and dispersal.
- Backcountry skiers, heli-skiers, snowmobiles and motorized vehicles can disturb or displace wolverine, grizzly bear, and lynx.
- Human disturbance can be a significant problem for certain nest sites of peregrine falcon, bald eagle, greater sandhill crane and golden eagle, and at breeding or maternity roosts, and hibernacula of Townsend's big-eared bat.
- Recreational boating can create disturbance problems for common loon and foraging bald eagle; eagles often avoid foraging in water around stationary boats.

Environmental contaminants:

- Concentrations of DDE, PCBs and dioxins from prey causes reduced reproduction of bald eagle on Columbia River. Eagles, peregrine falcon and prairie falcon concentrate persistent chemicals such as DDE and PCBs that can cause eggshell thinning, making them vulnerable to any persistent toxic chemical.
- Common loons are poisoned by lead fishing sinkers; bald eagle and golden eagle are occasionally poisoned after eating dead or injured waterfowl or other game animals that contain lead shot or bullets.
- Piscicides used to eradicate unwanted fish have eliminated some populations of pygmy whitefish.

Incompatible transportation and energy development:

- Dams and other passage barriers negatively affect bull trout, river lamprey and Pacific lamprey, and water level manipulations from hydroelectric dams can affect common loon.
- Golden and bald eagles and other raptors are susceptible to electrocution on powerlines.
- Western gray squirrel, western toad and western pond turtle are susceptible to roadkill mortality.
- Highway corridors and development (including Highways 20, 2, 12, and I-90) fragment suitable habitat and create barriers or impediments to movement for wolverine, grizzly bear, lynx, wolves and other mammals.
- Destruction of talus for roads and by roads affects Larch Mountain salamander, sharp-tailed snake and rare snails.
- Wind energy projects may cause mortalities to many species of birds and bats.

Inadequate water quantity and quality:

- Water level fluctuations sometimes negatively impact greater sandhill crane nests and Oregon spotted frogs.

CONSERVATION ACTIONS

Conserve and recover wildlife species and populations: includes population management, protect known populations, augment/reintroduce populations, control and monitor mortality and enhance food/prey.

- Implement recovery actions for western gray squirrel, lynx, fisher, sandhill crane, western pond turtle, northern spotted owl, grizzly bear and bull trout.
- Develop or finalize recovery plans for the gray wolf, northern spotted owl, Oregon spotted frog, bull trout and mardon skipper.
- Develop management plans for the state sensitive species such as common loon, peregrine falcon, Larch Mountain salamander and pygmy whitefish.
- Continue head starting, captive breeding and reintroductions of western pond turtles.
- Assess feasibility of augmenting populations of western gray squirrel, Oregon spotted frog and mardon skipper and conduct translocations as needed.
- Participate in the North Cascades Grizzly Bear Subcommittee to implement recovery actions.
- Prepare interagency management response guidelines for wolves to document sightings and address conflicts.
- Complete the Washington Bat Conservation Plan.
- After evaluating success of fisher reintroduction to the Olympic Peninsula, conduct additional reintroductions into the Cascades.
- Monitor the impacts of mange on western gray squirrel populations.
- Assess other species for possible addition to the state candidate list.
- Consider adding winter dens of snakes to protected wildlife code.
- Monitor population trends of the western gray squirrel, western pond turtle, northern spotted owl, greater sandhill crane, Oregon spotted frog, mardon skipper and bull trout to determine whether recovery objectives are being met.
- Determine the status of candidate species including Townsend's big-eared bat, wolverine, Vaux's swift, white-headed woodpecker, pileated woodpecker, Lewis' woodpecker, black-backed woodpecker, flammulated owl, northern goshawk, golden eagle, California mountain kingsnake, sharp-tailed snake, western toad, Columbia spotted frog, mountain sucker, leopard dace, river lamprey, chinquapin hairstreak and juniper hairstreak.
- Monitor any colonizing wolves to determine establishment of packs and habitat use.
- Conduct periodic surveys of sensitive species including Larch Mountain salamander, common loon and pygmy whitefish.
- Conduct post-downlisting surveys and monitor peregrine and bald eagle populations for signs of decline that could result from bioaccumulation of contaminants.
- Investigate limiting factors, impacts of land management, demographics and dispersal of western gray squirrel, Oregon spotted frog, sandhill crane, western pond turtle and mardon skipper.
- Determine the abundance and distribution of pygmy nuthatch, acorn woodpecker, mountain quail, Propertius' duskywing, westslope cutthroat, inland redband trout and Pacific lamprey.
- Develop efficient survey methods for river lamprey and Pacific lamprey, develop methods to differentiate between species of lamprey, and identify potential obstacles and develop methods to pass barriers.
- Evaluate effect of timber harvest at landscape scale on occupancy of habitat by northern spotted owl and barred owl.
- Investigate the systematics of western toad using DNA techniques.
- Investigate the genetic diversity of western gray squirrel populations as needed for translocations.

- Investigate the genetic diversity and gene flow in bull trout populations.
- Assess and map important habitats and areas of high biodiversity in the ecoregion using ecoregional assessments, local habitat assessments, Interagency Vegetation Mapping Project, and other habitat inventories and plans. Update Ecoregional Assessments every five years.
- Develop statewide land cover and threats data layers to improve connectivity between priority conservation areas.
- Identify and assess key connectivity areas and wildlife corridors between fragmented habitats and between protected areas. Restore habitat connectivity and wildlife corridors where appropriate on both public and private lands.
- Improve understanding of the ecological processes of seeps, bogs, wet meadows, forested wetlands, marshes, springs and other wetlands, and how they are impacted by human development.
- Conduct hydrologic studies that include water quantity and chemical budgets at wetlands known to be supporting rare and endangered species. Use this information to inform wetland management.
- Inventory and prioritize riparian habitat types and attributes needing protection and conservation.
- Identify important habitats for restoration and assess the feasibility of successfully restoring these sites. Include an evaluation of current and projected land use in and adjacent to potential restoration sites.

<u>Protect, restore and connect habitats</u>:

- Identify and protect essential habitat through management agreements, easements, or acquisitions as needed to recover listed species including western gray squirrel, greater sandhill crane, Oregon spotted frog and western pond turtle.
- Preserve and restore wet meadows and wetlands for greater sandhill crane, western pond turtle, Oregon spotted frog and Columbia spotted frog through incentives, management programs, or acquisitions. Conserve beaver populations and dynamic stream processes.
- Protect habitat of sharp-tailed snake, California mountain kingsnake and ***juniper hairstreak*** from residential and recreational development through livestock fencing, easements, conservation agreements, management plans and acquisitions.

- Identify, protect and restore oak and pine habitats of western gray squirrel and other listed and candidate species from incompatible logging, residential and recreational development through management agreements, easements and acquisitions.
- Reduce mortalities of eagles and other raptors through modification of electric transmission and distribution lines.
- Continue to require bald eagle habitat plans that include retention of trees. Enforce/strengthen Shoreline Management Act
- Identify and protect preferred roost and hibernacula sites for Townsend's big-eared bat and limit access to these areas.
- Identify and restore habitat for mountain quail.
- Protect rare habitat types such as grassy and herbaceous balds, aspen stands, snag patches, caves, cliffs and talus.

- Prioritize conservation areas using ecoregional assessments and other biological assessments. Protect important habitat types, biodiversity areas, and environmentally sensitive lands that should not be altered through a variety of techniques including acquisitions, conservation easements, life estates and cooperative agreements with willing landowners.
- Coordinate with local land trusts, conservation districts and other conservation organizations and agencies to conserve important habitat on both public and private land. Focus limited resources in regionally significant areas. Identify all possible acquisition and restoration grants and coordinate applications.
- Work with the USDA Forest Service and other public landowners to protect existing roadless areas and expand the roadless area network where justified for habitat protection and connectivity.
- Protect key connectivity areas and wildlife corridors between fragmented habitats and between protected areas through a variety of techniques including acquisitions, conservation easements, life estates and cooperative agreements with willing landowners. Use statewide land cover and threats data layers to improve connectivity between priority conservation areas.
- Restore native habitats, habitat connectivity and wildlife corridors where appropriate on both public and private lands. Consider restoring lands adjacent to existing protected areas to increase their effective size and function as wildlife habitat.
- Purchase water rights from willing sellers in unregulated tributaries; use these water rights to restore and maintain adequate year-round flows for both instream and out-of-stream riparian fish and wildlife habitat.
- Rehabilitate and restore stream channels, floodplain functions, riparian habitat and connectivity where streams have been diverted, fragmented, or degraded. Use livestock exclusions, instream structures, bank modifications and other methods.
- Preserve and/or restore buffer areas in appropriate locations along tributaries and mainstem waterways to a condition that is adequate to maintain healthy, functioning riparian zones for the ecoregion's rivers and estuaries.

Improve land management practices:

General

- Allow natural disturbances and successional functions and processes to occur on conserved wetlands.
- Manage undeveloped publicly-owned land for conservation of priority habitats and species.

Fire management

- Work with public agencies and private landowners to reduce the potential destructive impact of wildfires on native habitats by incorporating measures such as fire breaks and prescribed burning into wildlife and land management plans.
- Coordinate with public land managers on the use of controlled fire regimens and stand management practices. Attempt to simulate natural disturbance regime and restore proper ecological function. Consider impacts to local wildlife in each burn plan, including timing, size and location of the burn.

Forest management

- Work with the Forest Practices Board and both public and private forest landowners to properly design and implement current forest practices rules, including the Forests and Fish Agreement to protect fish, wildlife and habitat.
- Protect existing old growth, nesting sites, large snags and forest stand age and structure as needed for spotted owl, Vaux's swift, northern goshawk, western gray squirrel, pileated woodpecker, Lewis' woodpecker, and black-backed woodpecker.
- Maintain mature and old-growth ponderosa pine and restore degraded pine forests by thinning dense understory fir and return natural fire regime where feasible for white-headed woodpecker, Lewis' woodpecker, flammulated owl and pygmy nuthatch.
- Maintain stream buffers during timber harvest and conduct proper land-use management to protect mountain sucker, bull trout, inland redband trout, leopard dace, and pygmy whitefish.
- Do not remove overstory from talus in range of Larch Mountain salamander
- Protect and maintain chinquapin stands in the Gifford Pinchot National Forest.
- Maintain and enforce Forest Practice rules protecting bald eagle nests and roost sites, and northern spotted owl nest sites.
- Protect remaining old growth conifer and hardwood stands to benefit late successional species, and manage some stands on long rotations (>200 years).
- Work with the Department of Natural Resources and the State Forest Practices Board to develop, implement and enforce forest practices regulations to enhance biological diversity on existing state and private managed and protected areas.
- Work through the State Forest Practices Board and directly with forest landowners to implement forest management prescriptions, including prescribed burns, which will maintain and enhance biodiversity and natural ecosystem functions. Encourage modified silvicultural prescriptions that promote local topographic, soil and vegetative conditions. Retain snags, downed woody debris and a complement of live trees in harvested areas. Sensitive areas such as wetlands, remnant old growth and wildlife breeding sites should not be disturbed.
- Encourage the development of selective harvest policies and guidelines on both public and private forest land that will leave adequate components of old growth habitat such as snags and downed wood and some live trees as habitat for associated wildlife such as pileated woodpecker, Vaux's swift, flammulated owl and white-headed woodpecker.
- Minimize logging roads and decommission them after the period of entry. Ensure that all logging and forest access roads are located in stable, non-erodible areas and outside riparian management zones.
- Ensure the integrity of riparian habitat by maintaining adequate riparian management zones along streams in all logging sites, on both public and private land.
- Support implementation and enforcement of the Washington Forest Practices Act to accomplish habitat conservation and regeneration on both state and private forest lands.
- Encourage public and private forest landowners to manage forested watersheds that maintain an appropriate mix of successional stages and provide connectivity of riparian and upland vegetation as protected travel corridors for wildlife.
- In dry site forests, implement silvicultural practices that improve stand age-class and structural diversity. Retain large dominant oaks, ponderosa pine and Douglas fir and standing dead and dying trees, create snags instead of removing trees, and leave fallen trees, limbs and leaf litter for foraging, nesting and denning sites. Use prescribed burns to maintain open savannah in appropriate areas.

Grazing and agricultural practices

- Work with public and tribal and management agencies to fence or otherwise protect riparian zones from livestock grazing and unauthorized offroad vehicle use. Consider retirement rather than renewal of grazing leases on sensitive lands.
- Work with conservation districts, Natural Resource Conservation Service, USDA Forest Service and private landowners to implement best management practices in riparian areas and associated upland habitat in conjunction with the Conservation Reserve Program, Wetland Reserve Program and other Farm Bill programs.
- Use the Comprehensive Resource Management Plan process for large landscapes with a mix of public and private landowners to modify grazing regimes and improve grassland and shrub-steppe understory conditions and enhance biodiversity.
- Assist private landowners in securing funding to fence riparian zones on private land. In areas where it is impractical to exclude livestock, protect habitat quality by controlling the timing and intensity of livestock grazing through regulation and landowner agreements.
- Do not disturb nesting sandhill cranes with haying or grazing or drain wet meadows.
- Prevent grazing and forest practices that are incompatible with conserving mountain quail habitat.
- Ensure that grazing leases on state lands comply with HB1309 “Ecosystem Management Standards” to maintain fish and wildlife habitat.

<u>Control and prevent introduction of alien and invasive species</u>:

- Develop a regional plan for the detection, rapid response and eradication of invasive species.
- Conduct limited control of eastern gray and fox squirrels that compete with ***western gray squirrel***.

- Control bullfrogs and predatory fish as needed for western pond turtle, Oregon spotted frog and Columbia spotted frog.
- Control weeds and alien grasses negatively affecting mardon skipper and juniper hairstreak habitat.
- Enforce restriction on transplantation and release of fish, non-native turtles, bullfrogs, etc. to protect western pond turtle, Oregon spotted frog, Columbia spotted frog and pygmy whitefish.
- Avoid introduction of non-native fish in fishless lakes and where species of conservation concern occur such as bull trout and westslope cutthroat trout and native amphibians and reptiles. Avoid introduction of rainbow trout or only introduce sterile fish where westslope cutthroat are found. Avoid introduction of non-native trout to protect bull trout from hybridization, competition and predation.
- Work with other public agencies and private agricultural organizations such as the Farm Bureau and Washington Grange to develop basic techniques for mapping and monitoring the spread of invasive plant species over time.
- Participate in federal and state agency partnerships to develop and implement weed control strategies for impacted sites and ecosystems. Promote adequate funding and coordination of weed control efforts on both public and private lands using environmentally sound methods.
- Develop educational and public information materials to increase public awareness of the ways that invasive alien species are introduced to sensitive ecosystems.

- Provide funding, incentives and technical assistance to private landowners to eliminate undesirable invasive plant species in riparian zones and to restore native plants that provide important habitat for native fish and wildlife. Use integrated pest management practices to control currently established invasive species with help from volunteers.
- Participate in federal and state agency partnerships to develop and implement weed control strategies for impacted sites and ecosystems.

Control and monitor disturbance:

- Protect Townsend's big-eared bat and nesting peregrine falcon, golden eagle and bald eagle through use and access restrictions on public lands as needed. Work with private landowners and permitting agencies to prevent blasting or construction disturbance during nesting. Inform rock climbers of sensitive periods and locations to reduce disturbance of nesting peregrines falcons.
- Limit access to roost and hibernacula sites for Townsend's big-eared bat.
- Eliminate vehicular access and campsites in conservation areas identified as sensitive habitats such as montane wetlands, bogs and prairies.
- In sensitive habitats, manage both land and water access by using fencing, trails, elevated boardwalks, railings, seasonal restrictions, signage and livestock restrictions.
- Reduce the amount and impact of unauthorized recreational access and use on important wildlife habitat through better enforcement of existing laws, more fencing and posting of critical habitat areas, selective road closures and increased public education and information for recreational users and user groups.

Control and prevent environmental contamination:

- Facilitate use of nontoxic alternatives to fishing sinkers to protect common loons.
- Work with other agencies to reduce and remediate sources of contaminants that contribute to prey contamination for bald eagle, peregrine falcon, etc.
- Do not use piscicides to eradicate unwanted fish in lakes with pygmy whitefish.
- Work with governmental and nonprofit agencies to develop an ecoregion-wide strategy for identified toxins and other pollutants: their sources, destinations and effects, and ways to reduce their discharge.
- Work with other agencies, industry and private landowners to encourage use of integrated pest management techniques and phase out the use of pesticides and herbicides.
- Clean up contaminated sites and sediments whenever possible, and prevent further toxic contamination of areas, including unconfined spoil disposal sites.
- Reduce the use of hazardous chemicals by continuing to implement the persistent bioaccumulative toxins strategy and by using a variety of best management practices and improved treatment methods.
- Continue to place a priority on actions to prevent and respond to oil and hazardous material spills.

Improve transportation and energy development:

- Prevent construction of roads and buildings within 0.5 mile of greater sandhill crane nesting territories.
- Minimize density of logging roads in habitat of grizzly bear.
- Discourage use talus for roads to prevent destruction of Larch Mountain salamander, California mountain kingsnake and sharp-tailed snake habitat.
- Reduce mortalities of eagles and other raptors through modification of electric transmission and distribution lines.
- Monitor and minimize wildlife mortalities from wind turbines.
- Work with the Washington Department of Transportation to locate highways away from important wildlife habitats and biodiversity areas. If impacts are unavoidable, design adequate mitigation such as underpasses, overpasses and fencing to accommodate wildlife that need passage, such as gray wolf, wolverine, lynx, grizzly bear and other large mammals, western pond turtle, western toad and western gray squirrel.

Improve water quantity and quality:

- Discourage water projects that impact nesting habitat of greater sandhill cranes.
- Reduce sedimentation and pollution to conserve bull trout, pygmy whitefish, mountain sucker, leopard dace, westslope cutthroat, inland redband trout, river lamprey and ***Pacific lamprey***.

- Manage wetland areas on public land for both high water quality and habitat value. Ensure that the water quality of inflow does not lead to deterioration of wetland habitat.
- Where possible, restore or rehabilitate the hydrology, water quality and native plant communities in degraded and disturbed wetlands. Methods should emphasize creating or restoring natural wetland functions such as conserving beaver populations and dynamic stream processes to benefit species like Oregon spotted frog, western toad and Columbia spotted frog.
- Manage runoff from highways according to the updated highway runoff manual. Improve the road drainage network in riparian zones by removing unnecessary culverts, increasing the size of inadequate culverts, or replacing culverts with bridges.
- Reduce the harm from stormwater runoff by working to improve the effectiveness of the National Pollutant Discharge Elimination System stormwater permit programs.
- Assist local jurisdictions in finding solutions to increase landowner compliance with onsite sewage system maintenance and animal waste management practices through education and regulated inspection. Work to reduce the number and volume of combined sewer overflow events.

Improve coordination, planning, permitting and mitigation:

- Continue to require bald eagle habitat plans that require retention of trees. Enforce/strengthen Shoreline Management Act
- Protect nesting northern spotted owl, golden eagle and greater sandhill crane by maintaining buffer zones of no activity during nesting.
- Provide credible scientific information on priority habitats and species and biodiversity areas, their significance, management needs and compatible land uses to decision-makers at site, local and regional scales.

- Provide technical assistance to counties in using fish and wildlife and biodiversity information to update comprehensive land use plans, community or watershed plans, Shoreline Master Plan, etc.
- Assist counties in developing and updating county ordinances and incentives that help to mitigate or control development in areas with resource and conservation values and that encourage environmentally sensitive development in growth areas.
- Work with local governments and conservation organizations to identify and protect areas of important habitat and biodiversity through existing environmental laws and other local programs.
- Encourage floodplain management and shoreline zoning protection programs.
- Develop a coordinated conservation vision and strategy for conservation of large landscapes using a structured process like The Nature Conservancy's 5-S Project Management System or the Cascade Dialogs.
- Review state and federal land management plans to ensure adequate protection for priority habitats and species, biological diversity and ecosystem health.
- Develop site management plans for protected areas.
- Work with public and tribal land management agencies to protect important habitat and areas of high biodiversity from loss and fragmentation as well as degradation.
- Coordinate and integrate species recovery and management plans with land management and watershed plans using regulatory and voluntary approaches.
- Participate in Growth Management Act, Shoreline Management Act, Forest Protection Act and Federal Energy Regulatory Commission permitting processes for new or expanded residential, recreational or hydropower development on private land.
- Use information from ecoregional assessments to illustrate important habitats and areas of high biodiversity. Encourage permitting agencies to designate and protect these areas from residential and recreational development, and to require mitigation for habitat conversion and fragmentation where it occurs.
- Work closely with the USDA Forest Service and other land management agencies to prevent or mitigate potential adverse impacts to fish and wildlife habitat from proposed recreational or hydropower development on public lands.
- Work with regulatory agencies to design effective mitigation strategies for projects that result in wildlife impacts or direct conversion or fragmentation of habitat.
- Represent WDFW's conservation interest on interagency recovery teams and working groups.

<u>Improve enforcement of laws and regulations</u>:

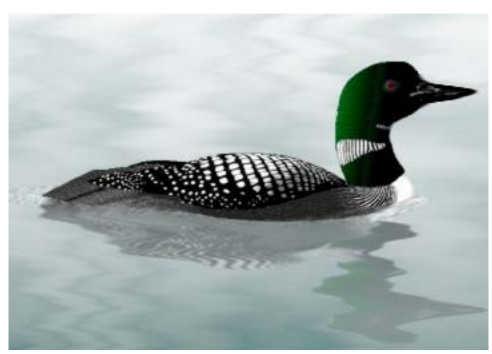
- Protect northern spotted owl, grizzly bear, gray wolf and other listed wildlife through enforcement, education and outreach.
- Enforce prohibition of killing bald eagle and non-permitted possession of parts through investigation and vigorous prosecution.
- Limit access to roadless, wilderness and primitive areas; prevent disturbance of grizzly bear, lynx and denning areas for wolverine.
- Reduce illegal capture for pet trade of California mountain kingsnake
- Enforce nontoxic shot requirements for waterfowl hunting to protect bald eagle and peregrine falcon.
- Enforce restriction on transplantation of fishes to protect Oregon spotted frog, Columbia spotted frogs and other native amphibians, and pygmy whitefish, leopard dace and mountain sucker.
- Enforce harvest restrictions for bull trout.
- Enforce recreational access restrictions on public lands and aquatic areas.

Improve landowner assistance:

- Work with large and small timber companies and landowners to accomplish habitat conservation through nonregulatory approaches such as landowner incentives, conservation easements, habitat conservation plans and acquisition of critical habitat from willing landowners.
- Secure state and federal tax incentives that discourage habitat fragmentation and destruction and that encourage landowners to protect and manage their land to benefit wildlife habitat.
- Work with local government to implement the Public Benefit Rating System and encourage effective use of open space tax incentives for landowners.
- Work with private landowners to identify and protect areas with important habitats and biodiversity, such as wet meadows, moist talus and oak woodland, and protect these areas through landowner incentives and other nonregulatory programs.
- Provide educational materials to private landowners that describe management techniques for maintaining and restoring various wildlife habitats.
- Work with private landowners to identify and protect important wetland habitats and buffers by providing adequate water, controlling invasive plants, reducing disturbance to nesting wildlife, and fencing or otherwise keeping livestock out of wetlands and associated upland habitat.
- Influence the application of federal Farm Bill funds, including the Conservation Reserve Program and the WDFW Landowner Incentive Program, on private agricultural lands most critical for wildlife movement and most suitable for restoration of native wetlands, shrub-steppe and grassland habitat.
- Promote grant programs to assist landowners with implementation of management plans.
- Develop, periodically update, and provide WDFW Priority Habitats and Species management recommendations to assist landowners in conserving priority habitats and species.

Improve wildlife conservation education: includes outreach, volunteer and watchable wildlife programs.

- Develop or disseminate education materials about food and garbage to avoid conflicts with grizzly bear.
- Disseminate education materials to avoid accidental shooting of grizzly bear due to mistaken identity.
- Reduce the amount of illegal capture of California mountain kingsnake for pets.
- Develop education programs targeted to reduce disturbance of nesting ***common loon*** and bald eagle by boaters.



- Engage and involve local and tribal governments, state and federal agencies, organizations and citizens in efforts to protect and restore priority habitats and species through a variety of outreach projects, programs and education efforts.
- Increase the use of citizen science for the collection of data, monitoring, restoration and conservation of important habitats and associated wildlife species. Coordinate volunteer monitoring and involvement.
- Promote and maintain public information and education efforts that focus on endangered species, habitat loss, ecological function, biological diversity and

environmentally-aware lifestyle practices. Emphasize the connection between habitat and environmental quality and human health and welfare.

- Expand conservation education programs for both adults and children to emphasize the critical nature and vulnerability of sensitive habitats such as wetlands, oak and grassland habitats and associated wildlife.
- Connect with user groups through education to make them part of the conservation solution in areas that have high recreation values.
- Work with large corporations to increase awareness and develop financial support for conservation of biodiversity.

Acorn woodpecker.

OKANOGAN ECOREGION

PHYSIOGRAPHY AND FISH AND WILDLIFE DIVERSITY

Geography

The Washington portion of the Okanogan ecoregion extends from the Cascade crest in the North Cascades east to the Selkirk Mountains. It includes the Methow and Okanogan valleys, the Okanogan Highlands, and the Colville and Spokane valleys. Roughly 14 percent of Washington is within this ecoregion.

Geology

The Okanogan is considered to be a transitional ecoregion because it encompasses the meeting place of very distinct and dissimilar adjacent areas. The north Okanogan is the highest and most rugged part of the ecoregion, with peaks rising to more than 8,900 feet. The high mountains give way to a series of valleys with the lowest elevations around 750 feet. To the east, the mountains are more rounded and include the Kettle Range and Huckleberry Mountains as prominent features. Continental and alpine glaciers played a major role in shaping the landforms of this ecoregion.

Climate

This ecoregion has the coldest climate in the state. The western portion is in the rain shadow of the Cascade Mountains, while the eastern portion is in a zone of increasing precipitation created by the Rocky Mountains. The ecoregion is influenced by the extremes of hot, dry air from the Columbia Basin in the summer and cold, dense arctic air in the winter. Annual precipitation is variable, from less than 12 inches in the Okanogan Valley to 50 to 90 inches in the Cascades. Most of the ecoregion falls within a 14- to 24-inch precipitation zone. There are fairly steep temperature and precipitation gradients from the mountains to the valleys within this ecoregion.

Habitat and Plant Associations

Coniferous forests dominate the mountain ridges and low hills, while valleys and lowlands are often non-forested. Compared to forests west of the Cascade crest and in the Canadian Rockies, the Okanogan conifer forests are more open and less continuous, consisting of smaller stands. Douglas-fir and ponderosa pine are characteristic of the ecoregion's forests.

They transition to shrub-steppe in the Okanogan and Methow Valleys, and to native grasslands in the low valleys of the eastern part. Subalpine fir and Engelmann spruce forests occur at higher elevations. Whitebark pine, lodgepole pine, and subalpine larch form parklands in the highest elevations, often associated with dry alpine or subalpine meadows. The moister mid-elevation forests are dominated by Douglas-fir, with western larch, western white pine or quaking aspen as common components.

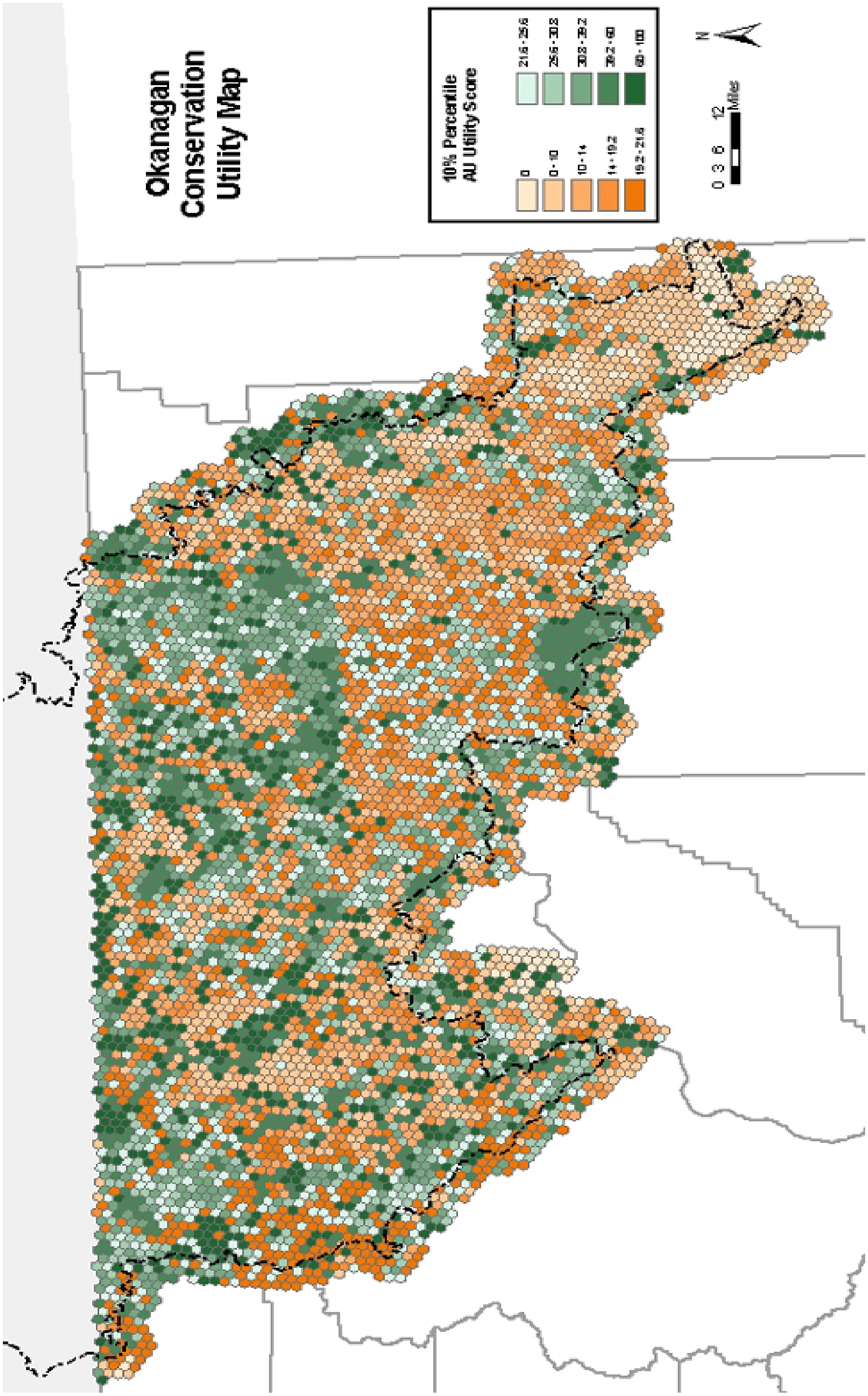
The landscape of the Washington portion of the Okanogan ecoregion is considered to be relatively intact, dominated by natural or semi-natural vegetation. It contains high concentrations of rare plant species and is important for wide-ranging listed carnivore species, including grizzly bear, gray wolf, lynx and wolverine. The low elevations of the Okanogan and Similkameen river valleys, where dry climate and desert-like habitats are northern extensions of the Great Basin, are particularly important for shrub-steppe species. The Okanogan ecoregion is the only conduit for wildlife movement between the dry native grasslands of the British Columbia interior and the desert areas of the western United States. This area of rich biodiversity is of international importance.

Fish and Wildlife Diversity

Wildlife in the Okanogan ecoregion is relatively diverse. Due to the warm, dry summers, cold winters, variety of landforms, and proximity to the Columbia Plateau, the ecoregion contains about 100 distinct wildlife habitat types. Mammal species include several herbivores, such as California bighorn sheep, mountain goat, and mule deer as well as snowshoe hare and northern flying squirrel. The pallid bat, widespread in the Great Basin, also extends its range into the drier portions of the ecoregion. Native bird species diversity is tremendous, ranging from alpine species such as spruce grouse, ptarmigan and great gray owls to grassland species such as sharp-tailed grouse and long-billed curlews, as well as species indigenous to the Great Basin, such as sage thrashers and burrowing owls. Abundant water systems provide for a high population of waterfowl, osprey, and bald eagle. Other uncommon species include harlequin duck in higher elevation rivers and bobolinks in agricultural lands. Some species that occur in the Washington portion are listed species in Canada, such as the yellow-breasted chat, western screech owl, and white-headed woodpecker. Amphibians and reptiles exhibit considerable variability in the ecoregion. Reptiles include western painted turtles, western rattlesnakes, and western yellow-bellied racers, while western toads, Great Basin spade foot toads, and tiger salamanders are among the amphibians.

While the CWCS focuses on wildlife diversity, the ecoregional assessments address the full range of Washington's biological diversity. One product of the ecoregional assessment, the conservation utility map, depicts the relative biodiversity value of landscapes or watersheds within the ecoregion. A sample map, titled Conservation Utility Scores, is shown below for the Northwest Coast ecoregion (Figure 12). The utility scores indicate both the biodiversity value of an assessment unit (AU) and its suitability for conservation. The AU varies by ecoregion and is either a hexagon or a watershed. The scores are generated with a computer algorithm under the assumption that all AUs are not equally suitable for conservation (a suitability index was used). For instance, lands adjacent to intensive agriculture or residential development are considered less suitable for conservation than lands adjacent to undisturbed forest. The algorithm assigns a high utility score to AUs that contain rare targets (species or communities), contain a large amount of a target (i.e., has high representation of a target), or has a high number of targets (i.e., has high richness). When a set of AUs have similar biological contents, the algorithm uses the suitability index to choose the best AU from the set. AUs with a score of 100 are either irreplaceable or are the most suitable place to conserve particular targets. Refer to Appendix 12 for a description of how these maps were developed.

Figure 27.


Okanagan Conservation Utility Map
10% Percentile AU Utility Score
0
0 - 10
10 - 14
14 - 19.2
19.2 - 21.6
21.6 - 25.6
25.6 - 30.8
30.8 - 39.2
39.2 - 60
60 - 100
0 3 6 12 Miles
N

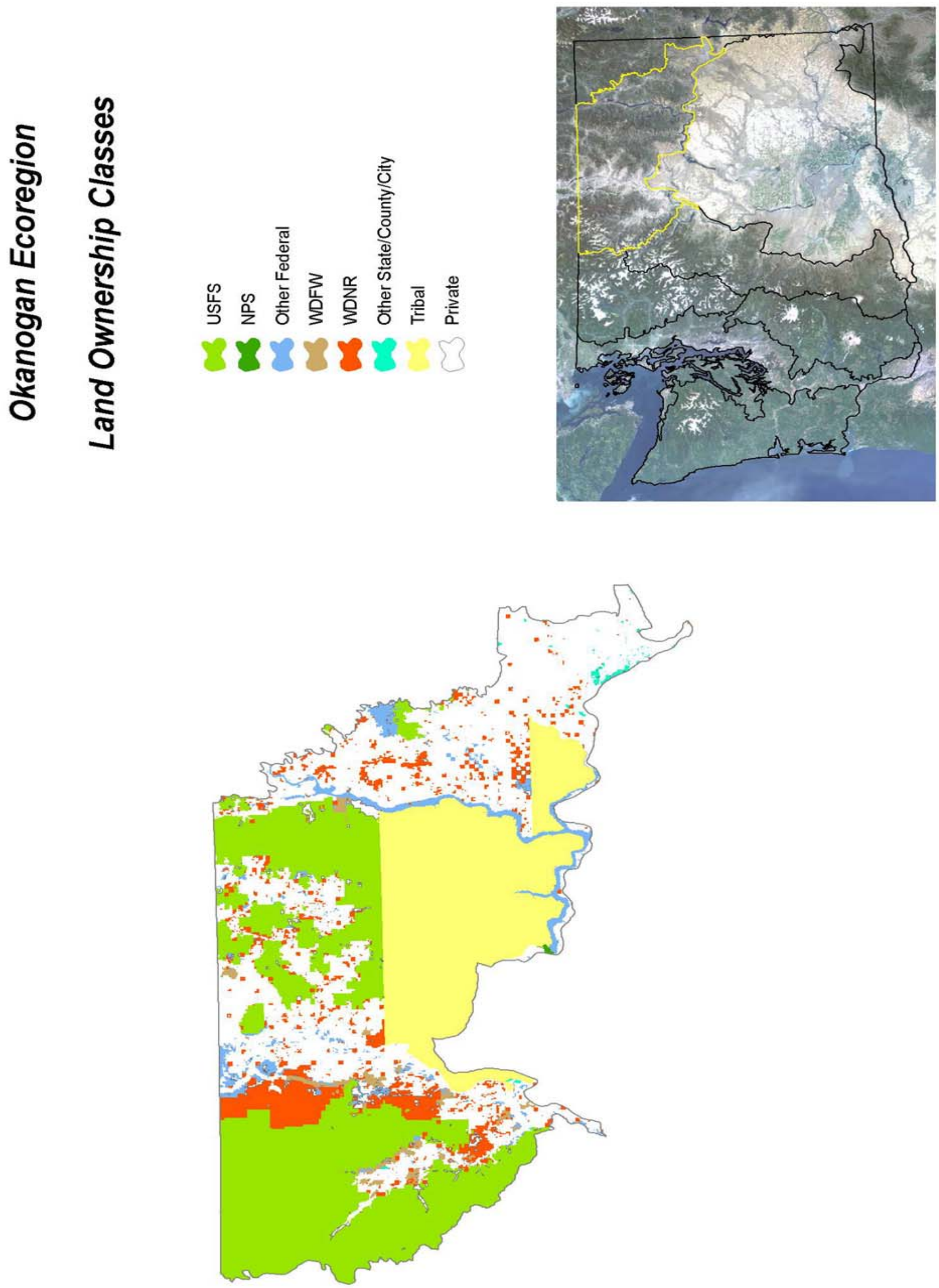
LAND OWNERSHIP

The Okanogan region in Washington is sparsely populated. Okanogan County, which makes up most of the ecoregion in Washington, is the third largest county in the continental United States, yet it has a population of only 39,134 people. The only large urban area in the Washington portion of the ecoregion is Spokane, located on the southeast edge of the ecoregion. Outside of Spokane, most development is agricultural and/or concentrated near Colville, Winthrop, Omak and other towns in the Colville, Methow and Okanogan valleys.

Human land use, like vegetation, tends to follow an elevational gradient in the Okanogan ecoregion. In the higher elevations, particularly the alpine and subalpine zones, human activities partially reflect recreation and wildlife values. Simultaneously, mineral exploration and development continues to be relatively extensive throughout the ecoregion. In the southern portion of the ecoregion, woodland grazing, forestry, hunting and recreation are also prevalent in the higher elevations. Forestry and agriculture occur in the lower, warmer zones. Grazing, forage production, orchards, water-oriented recreation, and tourism represent the major lower elevation activities.

Approximately 43 percent of the Okanogan ecoregion in Washington is in federal or state ownership. The largest federal owner is the US Forest Service, with holdings in the Wenatchee-Okanogan and Colville National Forests of almost 3,100 square miles, or 32% of the Washington portion of the ecoregion. The Washington Department of Natural Resources is the second-largest public landowner, with 735 square miles under its management and control. The Washington Department of Fish and Wildlife manages about 100 square miles, including the Methow and Sinlahekin Wildlife Areas, both of which were originally purchased as mule deer range, but which are now managed as habitat for a variety of fish and wildlife species and recreational pursuits. WDFW is also currently working with other Canadian and American partners to protect and manage the cross-border Okanogan-Similkameen corridor, which is the only conduit for wildlife movement between the dry native grasslands of interior British Columbia and the Great Basin areas of Washington and other western states. The Colville and Spokane Indian reservations, which include both tribal and private ownership, total 2,100 square miles, or 22% of the entire ecoregion. Figure 28 maps land ownership classes for the Okanogan ecoregion.

Figure 28.



Okanogan Ecoregion
Land Ownership Classes
USFS
NPS
Other Federal
WDFW
WDNR
Other State/County/City
Tribal
Private

ECOREGIONAL CONSERVATION PARTNERSHIPS

Effective conservation of fish, wildlife and biodiversity in Washington requires close coordination and cooperation with many public and private conservation partners. Major partners in the Okanogan ecoregion include:

- Colville Confederated Tribes
- Okanogan, Ferry and Stevens Counties
- Spokane Indian Tribe
- U.S. Bureau of Land Management
- U.S. Bureau of Reclamation
- U.S. Fish and Wildlife Service
- USDA Forest Service (Wenatchee-Okanogan and Colville National Forests)
- Washington Department of Natural Resources (WDNR)
- Washington State Parks and Recreation Commission

The Washington Department of Fish and Wildlife also works closely on conservation projects with private conservation partners such as The Nature Conservancy, Rocky Mountain Elk Foundation, Audubon Washington, and a growing number of fisheries enhancement groups and local land trusts.

Major Plans and Assessments

A number of ongoing or completed planning efforts involving WDFW and its public and private partners guide the conservation and management of fish and wildlife resources statewide and in the Okanogan ecoregion. Important planning efforts affecting conservation in the Okanogan ecoregion include:

- Interior Columbia Basin Management Project
- Methow, Okanogan, Upper Columbia, Sanpoil and Spokane Subbasin Plans (2004)
- Northwest Forest Plan (1994)
- USFWS Draft Bull Trout Columbia Basin DPS Recovery Plan (2002)
- USFWS Grizzly Bear Recovery Plan (1993)
- Washington Forest Practices Board Wildlife Strategy (in progress)
- Washington Forests and Fish Agreement (1999)
- WDFW Bald Eagle Status Report (2001)
- WDFW Bull Trout and Dolly Varden Management Plan (2000)
- WDFW Draft Okanogan Regional Wildlife Area Management Plan
- WDFW Ferruginous Hawk Recovery Plan (1996)
- WDFW Fisher Recovery Plan (2005)
- WDFW Game Management Plan (2003)
- WDFW Lynx Recovery Plan (2001)
- WDFW Northern Leopard Frog Status Report (1999)
- WDFW Outline for Salmon Recovery Plans (2003)
- WDFW Peregrine Falcon Status Report (2002)
- WDFW Pygmy Whitefish Status Report (1998)
- WDFW Sandhill Crane Recovery Plan (2002)
- WDFW Sharp-tailed Grouse Management Plan (1995)
- WDFW Sharp-tailed Grouse Status Report (1998)
- WDFW Western Gray Squirrel Recovery Plan (2005)

Supporting references to these and other important statewide planning documents are included at the end of this chapter and/or in Appendices 6 and 7.

SPECIES AND HABITATS OF GREATEST CONSERVATION NEED

This section provides a short summary of priority species and associated habitats for the Washington portion of the Okanogan ecoregion.

Species of Greatest Conservation Need

The following species list for the Okanogan ecoregion is a regional subset of the statewide Species of Greatest Conservation Need (SGCN) list shown in Appendices 1 and 2. The process and criteria used to develop the statewide SGCN list are provided in Volume Two, Approach and Methods, as well as in Appendix 3. Species listed below are found in the Okanogan ecoregion for all or part of their lifecycle. Supporting tables and information for these species and habitats can be found in Chapter IV and in Appendices 1, 2, 8, 9, 10 and 14.

	Population Size/Status						Population Trend					
COMMON NAME	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown	State Status*	WNHP
Mammals												
Townsend's big-eared bat			x							x	C	S3
White-tailed jackrabbit			x				x				C	S2
Western gray squirrel			x				x				T	S2
Gray wolf	?									x	E	S1
Grizzly bear		x							x		E	S1
Fisher	x							x			E	SH
Wolverine		x						x			C	S1
American badger			x				x				G	S4
Lynx			x							x	T	S1
Birds												
Common loon			x					x			S	S2
Western grebe			x				x				C	S3
American white pelican			x						x		E	S1
Great blue heron			x							x	M	S4
Trumpeter swan			x						x		G	S3
Northern pintail					x		x				G	S3
Redhead			x					x			G	S3
Bald eagle				x					x		T	S4
Northern goshawk			x							x	C	S3
Golden eagle			x							x	C	S3
Peregrine falcon			x						x		S	S2

	Population Size/Status						Population Trend					
COMMON NAME	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown	State Status*	WNHP
Prairie falcon			x							x	M	S3
Sharp-tailed grouse			x				x				T	S2
Sandhill crane (greater)		x							x		E	S1
Flammulated owl			x							x	C	S3
Burrowing owl			x				x				C	S2
Great gray owl			x							x	M	S2
Vaux's swift			x				x				C	S3
Lewis' woodpecker			x				x				C	S3
White-headed woodpecker			x				x				C	S2
Black-backed woodpecker			x							x	C	S3
Pileated woodpecker				x						x	C	S4
Pygmy nuthatch			x							x	N	S3
Sage thrasher			x				x				C	S3
Loggerhead shrike			x				x				C	S3
Sage sparrow			x				x				C	S3
Reptiles												
Pygmy horned lizard				x						x	N	S3
Sagebrush lizard			x				x				C	S2
Amphibians												
Tiger salamander				x						x	M	S3
Western toad				x			x				C	S3
Northern leopard frog			x				x				E	S1
Columbia spotted frog			x							x	C	S4
Fish												
Westslope cutthroat				x				x			G	G4
Upper Columbia steelhead											C	G5
Inland redband trout						x				x	G	G5
Bull trout						x				x	C	G3
Upper Columbia fall chinook											G	G5
Pygmy whitefish						x				x	S	S1
Leopard dace						x				x	C	S2
Invertebrates												
Silver-bordered fritillary (butterfly)			x							x	C	S3
Subarctic darner (dragonfly)			x							x	N	S2

	Population Size/Status						Population Trend					
COMMON NAME	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown	State Status*	WNHP
Boreal whiteface (dragonfly)		x								x	N	S1
Subarctic bluet (dragonfly)			x							x	N	S2
California floater (bivalve)			x				x				C	S1
Winged floater (bivalve)			x				x				N	G3
Oregon floater (bivalve)			x				x				N	S3
Western ridged mussel			x				x				N	S2

* Status Codes	** WNHP Codes (S = state, G = global)
E = endangered	1 = critically imperiled
T = threatened	2 = imperiled
S = sensitive	3 = vulnerable to extirpation or extinction
C = candidate	4 = apparently secure
M = monitor	5 = demonstrably widespread, abundant and secure

Species Conservation in the Okanogan Ecoregion

Species of Greatest Conservation Need (SGCN) found in the Okanogan ecoregion (see table above) include those classified by WDFW as Endangered, Threatened, Candidate or Monitor species, as well as species identified by WDFW as needing additional research or funding attention. Conservation actions are recommended for these species at both the statewide and ecoregional levels. These recommended conservation actions are summarized in a series of matrices included in Chapter IV and as Appendices 9 and 10. These matrices also display the life history, population status and distribution of these species.

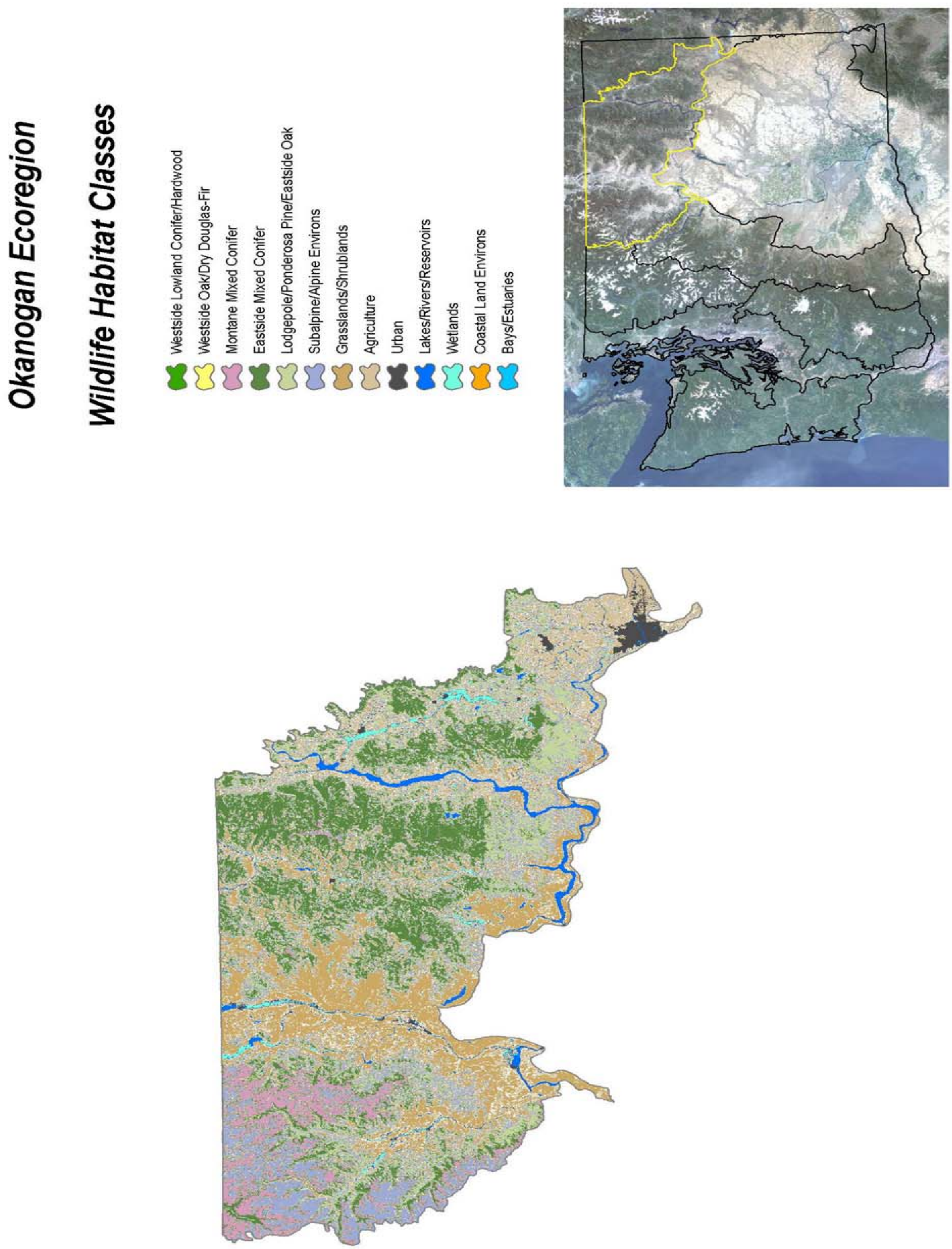
Ecoregional Habitat Overview

Vegetation in the Okanogan ecoregion varies along an elevational gradient. Engelmann spruce, subalpine fir and lodgepole pine generally dominate subalpine areas. Lower elevation forests typically support quaking aspen and Douglas-fir associated with pine grass understories. In the valley bottoms, Douglas-fir, ponderosa pine, and pine grass grow in a matrix of bluebunch wheat grass, Idaho fescue and sagebrush. Additionally, native grasslands and shrub-steppe can be found in the driest areas and include such species as bluebunch wheat grass, blue grass, sagebrush, rabbitbrush, antelope bush and big sagebrush. This ecoregion contains the northern continental range extensions of many species of reptiles, amphibians, insects and plants. Figure 29 maps wildlife habitat classes for the Okanogan ecoregion.

The following habitat types classified, coded and described in Wildlife and Habitat Relationships in Oregon and Washington (WHROW), are present in the Okanogan ecoregion. In the next section, descriptions are provided for priority habitats associated with Species of Greatest Conservation Need found in this ecoregion.

- Montane Mixed Conifer Forest
- Eastside (Interior) Mixed Conifer Forest
- Lodgepole Pine Forest and Woodlands
- Ponderosa Pine Forest and Woodlands
- Upland Aspen Forest
- Subalpine Parkland
- Alpine Grasslands and Shrublands
- Eastside (Interior) Grasslands
- Shrub-steppe
- Dwarf Shrub-steppe
- Agriculture, Pasture and Mixed Environs
- Urban and Mixed Environs
- Open Water: Lakes. Rivers, Streams
- Herbaceous Wetlands
- Montane Coniferous Wetlands
- Eastside (Interior) Riparian-Wetlands

Figure 29.



Okanogan Ecoregion
Wildlife Habitat Classes
Westside Lowland Conifer/Hardwood
Westside Oak/Dry Douglas-Fir
Montane Mixed Conifer
Eastside Mixed Conifer
Lodgepole/Ponderosa Pine/Eastside Oak
Subalpine/Alpine Environs
Grasslands/Shrublands
Agriculture
Urban
Lakes/Rivers/Reservoirs
Wetlands
Coastal Land Environs
Bays/Estuaries

Priority Habitats in the Okanogan Ecoregion

The following three habitat types have been identified as the highest priority for current conservation action in the Okanogan ecoregion. Selection of these habitats as a priority was determined by their importance to regional Species of Greatest Conservation Need, as well as priorities outlined in the Okanogan Ecoregional Assessment and the subbasin plans listed in the “Major Plans” section above. More discussion on the selection of priority habitats is included in Chapter III: Statewide Overview and in Volume Two: Approach and Methods.

- Lodgepole Pine Forest and Woodlands
- Ponderosa Pine Forest and Woodlands
- Upland Aspen Forest
- Shrub-steppe and Eastside (Interior) Grasslands
- Eastside (Interior Riparian-Wetlands)

Lodgepole Pine Forest and Woodlands

Lodgepole pine forest, under natural conditions, originates with fire and forms single-canopied early to mid-seral stands, but it is also associated with other montane conifers. This habitat generally includes grassy undergrowth and occurs at 3,000 to 9,000 feet elevation. Because lodgepole pine cannot reproduce under its own canopy, old unburned stands are replaced by shade-tolerant conifers. Fire suppression has left many lodgepole pine habitats unburned to develop into more multilayered stands.

Lodgepole pine is important for lynx because the young, regenerating stands with high stem densities are optimal habitat for snowshoe hare, the main prey of the threatened lynx. Because the Okanogan is the heart of lynx range in Washington, most of the public and private forests have lynx management plans that theoretically provide for maintaining suitable habitat through time. Fire, succession, wind, insects, harvest, road construction, livestock grazing and recreational development all change the character of the landscape and must be taken into account when attempting to manage wildlife habitat for wide-ranging species.

Selected Species Closely Associated with Lodgepole Pine Forest and Woodlands in the Okanogan Ecoregion

Gray wolf	Grizzly bear
Lynx	Black-backed woodpecker
Great gray owl	Northern goshawk

Ponderosa Pine Forest and Woodlands

Historically, old-growth ponderosa pine forests occupied large areas between the shrub-steppe zone and moister forest types at higher elevations. Large, widely spaced, fire-resistant trees and an understory of forbs, grasses, and shrubs characterized these forests. Periodic fires maintained this habitat type. With human settlement, most of the old pines were harvested for timber, and frequent fires have been suppressed. As a result, much of the original forest has been replaced by dense second growth of Douglas-fir and ponderosa pine with little understory. Large, mature ponderosa pine and Douglas-fir are harvested in much of this habitat type. Under most management regimes, typical tree size decreases and tree density increases. In some areas, patchy tree establishment at forest-steppe boundaries has created new woodlands, replacing shrub-steppe in the presence of long-term fire suppression.

Selected Species Closely Associated with Ponderosa Pine Forest and Woodlands in the Okanogan Ecoregion

Flammulated owl	Northern goshawk
Great gray owl	Pygmy nuthatch
White-headed woodpecker	Western gray squirrel

Upland Aspen Forest

Quaking aspen groves are a limited habitat type in Washington but have high wildlife use. They occur on well-drained mountain slopes and in seral stands in the lower Eastside Mixed Conifer Forest and on riparian and poorly drained soils within Ponderosa Pine Forest. Aspen stands are typically two-tiered with a tree layer growing over forb, grass or low-shrub undergrowth. Because aspen is not shade tolerant, conifers can invade these stands.

Fire plays an important role in maintaining this habitat. Aspen sprouts after fire and spreads into large clonal or multi-clonal stands. With fire suppression aspen stands are less common than they were before 1900. The aspen sprouts, leaf buds and catkins are nutritious food for a variety of wildlife including sharp-tailed grouse, western gray squirrel, songbirds and deer.

Selected Species Closely Associated with Upland Aspen Forest in the Okanogan Ecoregion

Sharp-tailed grouse	Grizzly bear
Northern goshawk	Western toad

Shrub-Steppe and Eastside (Interior) Grasslands

Historically, a mosaic of shrub or grass-dominated steppe vegetation occurred throughout the driest areas of the ecoregion. Shrublands were co-dominated by shrubs and perennial bunchgrasses with a microbiotic crust of lichens and mosses on the surface of the soil. This crust provides stability to shifting soils caused by natural erosion. Today, the arid steppe vegetation zone occupies the central portion of the Okanogan ecoregion. The average shrub cover is generally between 5% and 20%.

Dominant shrubs were sagebrush and bitterbrush. Bunchgrasses were mostly bluebunch wheatgrass, Idaho fescue, needle and thread grass, and Sandberg's bluegrass. Soils, climate and topography created distinct plant communities that paired shrub species with specific bunchgrasses across the landscape.

Selected Species Closely Associated with Shrub-steppe and Eastside (Interior) Grasslands in the Okanogan Ecoregion

Burrowing owl	Sagebrush lizard
Sharp-tailed grouse	Prairie falcon
White-tailed jackrabbit	Sage sparrow
Sage thrasher	Pygmy horned lizard

Eastside (Interior) Riparian-Wetlands

Historically, riparian-wetland habitat was characterized by a mosaic of plant communities occurring at irregular intervals along streams and dominated by various combinations of grass-forbs, shrub thickets, and mature forests with tall deciduous trees. Beaver activity and natural flooding increased the quality and distribution of riparian-wetlands. Today, shallow water habitats are typically connected to the mainstem of the river via culverts or small channels and provide special wildlife values.

Natural flooding regimes, which promote important ecological process in riparian areas, were altered by the development of hydropower on the Columbia River. In general, there has been a decline in the extent and diversity of riparian habitats.

Riparian zones play many essential roles in maintaining ecosystem health and integrity. They provide connectivity between aquatic and upland habitats, moderate stream temperature through shading, maintain water quality by filtering pollutants and stabilizing banks, and supply in-stream nutrients through insect and vegetative inputs. Additionally, riparian zones act to “meter” water delivery by holding water in plant root wads and soils, gradually releasing that moisture as humidity and groundwater. Riparian zones also assist in recruitment of large woody debris, which creates instream pools and channel complexity. In addition to the role riparian zones play in moderating and improving overall habitat conditions, many species of fish and wildlife depend directly on riparian zones to provide cover and forage.

Selected Species Closely Associated with Eastside (Interior) Riparian-Wetlands in the Okanogan Ecoregion

Great blue heron	Columbia spotted frog
Northern leopard frog	Sandhill crane
Silver-bordered fritillary butterfly	Tiger salamander

CONSERVATION PROBLEMS

Timber harvest, urbanization, flood control, water extraction, and agriculture have been the major causes of habitat alteration. These activities often result in loss or degradation of wildlife habitat through construction of roads, dispersed residential developments, reduced wildlife access to streams, and changes to vegetative communities.

Forest Practices

Forest practices including extensive timber harvest in sections of the Okanogan ecoregion have negatively impacted both fish and wildlife habitat in the ecoregion's watersheds. Timber harvest changes upland and riparian vegetative cover and influences snow accumulation and melt rates. It also contributes to fragmentation of habitat, soil erosion, sediment delivery to creeks and streams, and channel simplification from loss of large woody debris recruitment within the riparian zone. Native plant communities may be replaced by alien species following timber harvest. Road building associated with timber harvest further exacerbates erosion, habitat fragmentation, and creates barriers to fish passage if culverts are impassable.

Alteration of Natural Fire Regimes

Human activities have increased the number of fire starts, but historic fire control policies have kept the size of fires small, resulting in a buildup of fuel in the forested uplands of the ecoregion. Occasional intense, stand-replacing fires occur instead of historically frequent, low-intensity fires. This change in the fire regime has resulted in changes in the composition of the forest and plant communities (especially the spread and proliferation of mixed-forest conifer species within ponderosa pine communities), and in the related capacity for forest soils to store and transport water.

Agricultural Practices

Conversion of shrub-steppe and native grasslands to agricultural uses and improperly managed livestock grazing reduce habitat diversity and function through removal of steppe vegetation, resulting in invasion of alien vegetation. Annual grasses and noxious weeds such as cheatgrass and knapweeds either supplant and/or radically alter entire native bunchgrass communities, significantly reducing wildlife habitat quality. Cheatgrass spreads after wildfires eliminate sagebrush.

Riparian areas in the Okanogan ecoregion have been lost or degraded because of logging, agriculture, improperly managed grazing and residential development that affects stream banks, water quality, water quantity, and overall habitat continuity and complexity. This leads to increased erosion, which in turn, increases sedimentation. Improperly managed livestock grazing compacts soil, contributes to stream bank destabilization, affects compositions of riparian plant communities, and slows recovery of damaged riparian habitat. Undesirable forb species, such as stinging nettle and horsetail, increase with livestock use. Riparian habitat losses also contribute to higher water temperatures in summer months and lower temperature in winter months.

Residential Development

Residential development is rapidly expanding into natural landscapes and is among the most significant long-term threats to conservation targets in the Okanogan ecoregion. Many conservation lands are owned and managed by public agencies, but a significant portion of low-elevation valleys and woodlands, riparian areas and montane grasslands are in private ownership and available for development.

The following additional habitat and species conservation problems have been identified in the Okanogan ecoregion:

Wildlife species and population problems: includes disease, pathogens, competition, food scarcity, predation, overharvest, and limited population size and distribution.

- Populations of western gray squirrel, grizzly bear, gray wolf, fisher, lynx, common loon, American white pelican, bald eagle, peregrine falcon, sharp-tailed grouse, greater sandhill crane, northern leopard frog, and pygmy whitefish have declined to the point that they are listed as endangered, threatened, or state sensitive.
- Small population sizes and loss of genetic diversity are problems in grizzly bear, wolverine, and lynx, and are a concern in other species reduced to isolated populations, including western gray squirrel, sharp-tailed grouse, sagebrush lizard, subarctic darner, boreal whiteface, subarctic bluet, California floater, winged floater, and Oregon floater.
- Tularemia and other diseases may be involved in the decline of white-tailed jackrabbits.
- The expansion of West Nile Virus into Washington poses a threat to sharp-tailed grouse.
- Illegal persecution and harvest occurs for gray wolf, grizzly bear, American white pelican, bald eagle, and migrating and spawning fish species of concern.
- Redhead, northern pintail, and bull trout are susceptible to overharvest.
- Capture as pets reduces the abundance of pygmy horned lizard.
- Capture of larva for use as fish bait hurts tiger salamander populations.
- Declines of native fish populations that serve as hosts for the parasitic larval stages of some bivalves has negatively impacted California floater, winged floater, and Oregon floater.
- Taxonomic relationships of California floater, winged floater, Oregon floater, and western ridged mussel need additional study.

Lack of biological information on species and habitats:

- Adequate information is lacking on the population status of state candidate species, including Townsend’s big-eared bat, white-tailed jackrabbit, wolverine, western grebe, northern goshawk, golden eagle, flammulated owl, burrowing owl, Vaux’s swift, Lewis’ woodpecker, white-headed woodpecker, black-backed woodpecker, pileated woodpecker, sage thrasher, loggerhead shrike, sage sparrow, sagebrush lizard, western toad, Columbia spotted frog, bull trout, leopard dace, and silver-bordered fritillary.
- Additional information is needed on abundance of American badger, pygmy horned lizard, and western ridged mussel.
- Information is needed on habitat associations, demography, food habits, or other aspects of ecology of lynx, American badger, fisher, great gray owl, Lewis’ woodpecker, pileated woodpecker, loggerhead shrike, sage sparrow, California floater, winged floater, Oregon floater, and western ridged mussel.

- Additional distributional data are needed for American badger, white-headed woodpecker, pygmy nuthatch, pygmy horned lizard, sagebrush lizard, western toad, bull trout, California floater, winged floater, Oregon floater, and western ridged mussel.
- Information is needed on the causes of decline for American badger, white-tailed jackrabbit, western toad, subarctic darner, boreal whiteface, and subarctic bluet.
- Conservation needs of northern leopard frog are poorly understood.
- Impacts of various land use practices are not understood for sage thrasher and Columbia spotted frog.
- Better information is needed on the amount of gene flow among bull trout populations.
- There is a shortage of adequate spatial inventory and assessment data on most habitat types.
- There is an absence of baseline data on the habitat values and functions of natural wetlands and a poor understanding of the status of resident macroinvertebrates in aquatic systems.

<u>Habitat loss, conversion, fragmentation and degradation:</u>

- Only 15% of eastern Washington forest is currently in the old growth age class and nearly all of it is in high elevation national forests or national parks. Maintenance of old growth forest across the landscape is important for at least 1,000 species.
- Loss and fragmentation of late-successional coniferous forests negatively impacts fisher, northern goshawk, white-headed woodpecker, and pileated woodpecker.
- Conversion of forests for residential and commercial development eliminates habitat for western gray squirrel, northern goshawk, Lewis' woodpecker, and pygmy nuthatch.
- Forest loss due to timber harvest and fires may eliminate habitat for western gray squirrel, lynx, great gray owl, and Lewis' woodpecker.
- Loss and fragmentation of shrub-steppe and other more open habitats due to agriculture and development may harm populations of Townsend's big-eared bat, American badger, white-tailed jackrabbit, prairie falcon, sharp-tailed grouse, burrowing owl, sage thrasher, loggerhead shrike, sage sparrow, pygmy horned lizard, and sagebrush lizard.
- Degradation of shrub-steppe and other open habitats by improperly managed grazing and wildfire reduces habitat quality for white-tailed jackrabbit, prairie falcon, sharp-tailed grouse, sage thrasher, loggerhead shrike, and sage sparrow.
- Shoreline timber harvest and development may destroy nesting, foraging, or roosting sites for common loon, great blue heron, and bald eagle.
- Continued loss and degradation of shallow wetlands, wet meadows, bogs, and adjacent upland areas because of changing land use eliminates habitat for trumpeter swan, northern pintail, redhead, greater sandhill crane, and silver-bordered fritillary.
- Reclamation of abandoned mines may destroy critical maternity roosts and hibernacula for Townsend's big-eared bat.
- Bald eagle, golden eagle, prairie falcon, and gray wolf suffer from prey declines linked to habitat loss, degradation, and fragmentation.
- Sedimentation of aquatic environments eliminates habitat for California floater, winged floater, Oregon floater, and western ridged mussel.
- Degradation of streams and rivers due to inappropriate forest management and agricultural practices and human development is harmful to bull trout.
- Suburban sprawl is a concern for resource managers, as indicated by the growing number of ranchettes and residential subdivisions in previous managed forest and

cropland. Development often occurs near lakes or streams and poses an increased threat of fire and impacts to water quality.

Incompatible land management practices:

- Various timber harvest, snag removal, and replanting practices have degraded or eliminated habitat for a variety of species, including lynx, bald eagle, flammulated owl, great gray owl, Lewis' woodpecker, Vaux's swift, black-backed woodpecker, pileated woodpecker, and pygmy nuthatch.
- Flammulated owls experience declining food availability after the application of forest pesticides that kills non-target moths.
- Improperly managed grazing has degraded open ponderosa pine forests for Lewis' woodpecker and pygmy nuthatch.
- Fire suppression has degraded open ponderosa pine forests and other coniferous forests used by Lewis' woodpecker and black-backed woodpecker.
- Changes in fire regimes reduce the quality of nest sites and availability of food for pygmy nuthatches.
- Modern agricultural practices often reduce the quality, patch size and connectivity of wildlife habitat in farmlands.

Alien and invasive plant and animal species:

- Reed canary grass thrives in reservoirs and wetland stream outlets where water levels fluctuate and directly affects habitats that support 27 Washington state-listed plant species. A number of native fish, amphibians and other animals are not well adapted to spawn or reproduce in reed canary grass thickets.
- Non-native fox squirrels potentially compete with western gray squirrels.
- European starlings compete with Lewis' woodpecker for nest cavities.
- Competition from introduced clams such as the Asian clam and other aquatic invaders affects California floater, winged floater, and Oregon floater.
- Shrub-steppe degradation through cheatgrass invasion and resulting increases in fire frequency negatively impacts sage thrasher, sage sparrow, and sagebrush lizard.
- Predation by introduced bullfrogs, bass, and other fish negatively impacts tiger salamander, northern leopard frog, Columbia spotted frog, and pygmy whitefish.
- Introduced carp and mosquitofish degrade habitat for northern leopard frog and Columbia spotted frog.
- Non-native fish, such as brook trout and rainbow trout, pose a threat to bull trout and westslope cutthroat through competition, hybridization, and predation.

Human disturbance and recreational impacts:

- Backcountry recreation such as motorized vehicles, hiking, and skiing may disturb or displace grizzly bear, wolverine, lynx, golden eagle, and peregrine falcon.
- Recreational boating and fishing may disturb or displace nesting or foraging birds, including common loon, western grebe, great blue heron, redhead, and bald eagle.
- Human disturbance and vandalism may disrupt the maternity roosts and hibernacula of Townsend's big-eared bat located in caves and mines.
- Encroachment of human development can force golden eagle, prairie falcon, and greater sandhill crane from suitable nesting sites.
- Nesting peregrine falcons are vulnerable to disturbance from human activities, such as blasting and timber cutting.
- Mowing may accidentally destroy the nests and chicks of greater sandhill crane.

- Recreational activities such as off-road recreational vehicles, horses, mountain bikes, and even hikers can create unauthorized trails that disturb soil and allow invasive plants to establish.
- The nature and timing of agricultural practices may be increasingly hazardous to wildlife. Tilling, planting and harvesting are becoming more synchronous, widespread and intense, thus stressing wildlife during critical periods of nesting, rearing and dispersal.

Environmental contaminants:

- Ingestion of lead fishing sinkers by common loons and lead shot by bald eagle and golden eagle results in lead poisoning.
- Contamination from agricultural chemicals, mercury, or other pollutants and associated declines in prey are harmful to American white pelican, burrowing owl, sage thrasher, northern leopard frog, California floater, winged floater, Oregon floater, and western ridged mussel.
- Piscicides such as rotenone used for eliminating undesirable fish species from lakes and streams also kill pygmy whitefish.

Incompatible transportation and energy development:

- Large highway corridors (including Highways 20, 21, 97, and 395) and associated development fragment suitable habitat and create barriers or impediments to movement for gray wolf, wolverine, and lynx.
- Roads may facilitate winter competition between lynx and coyote.
- Roads placed near great blue heron rookeries may result in site abandonment.
- Roads located near breeding sites cause highway mortality in western toad.

- Golden eagle and other raptors can be electrocuted on power lines.
- Development of wind energy projects may be harmful to sharp-tailed grouse.

Inadequate water quantity and quality:

- Altered hydrology eliminates habitat for Columbia spotted frog and inland redband trout.
- Fluctuating water levels caused by dams may hurt the survival and reproduction of California floater, winged floater, and Oregon floater.
- Fluctuating water levels in wet meadows caused by drainage and damming projects may reduce the breeding success of greater sandhill crane.
- Increased water temperature and sedimentation caused by logging, agriculture and other activities may harm inland redband trout and pygmy whitefish.
- Declining beaver populations in some areas and the subsequent loss of beaver ponds has reduced habitat for Columbia spotted frog.
- Dams and other passage barriers limit the movement of bull trout.

CONSERVATION ACTIONS

Conserve and recover wildlife species and populations: includes population management, protect known populations, augment and reintroduce populations, control and monitor mortality and enhance food/prey.

- Implement recovery actions for grizzly bear, gray wolf, lynx, greater sandhill crane, and bull trout.
- Prepare or finalize recovery plans for northern leopard frog and bull trout.
- Develop management plans for state sensitive species, including common loon, peregrine falcon, and pygmy whitefish.
- Complete the Washington Bat Conservation Plan.
- Prepare interagency management response guidelines for gray wolf to document sightings and address conflicts.
- Reduce potential mortality in grizzly bear from accidental shooting by conducting programs to educate bear hunters on proper identification of black bear and grizzly bear.
- Develop habitat management recommendations for the silver-bordered fritillary.
- Continue translocations of sharp-tailed grouse to increase population size.
- Conduct translocations of western gray squirrel, white-tailed jackrabbit, fisher, northern leopard frog, California floater, winged floater, Oregon floater, and western ridged mussel into areas of appropriate habitat if indicated by recovery plans and feasibility studies.
- Implement salmon recovery strategies to enhance the prey base for bald eagle.
- Establish and implement fisheries management objectives that are compatible with bull trout recovery.

Conduct research, assessment and monitoring: includes species and habitat distribution, abundance, limiting factors, suitable habitat and population trends.

- Determine the status of candidate species, including Townsend's big-eared bat, white-tailed jackrabbit, wolverine, western grebe, northern goshawk, golden eagle, flammulated owl, burrowing owl, Vaux's swift, Lewis' woodpecker, white-headed woodpecker, black-backed woodpecker, pileated woodpecker, sage thrasher, loggerhead shrike, sage sparrow, sagebrush lizard, western toad, Columbia spotted frog, bull trout, leopard dace, and silver-bordered fritillary.
- Monitor the abundance of Townsend's big-eared bat, American badger, northern goshawk, pygmy horned lizard, sagebrush lizard, Columbia spotted frog, pygmy whitefish, leopard dace, silver-bordered fritillary, subarctic darner, boreal whiteface, subarctic bluet, California floater, winged floater, Oregon floater, and western ridged mussel.
- Monitor populations of lynx, western gray squirrel, gray wolf, grizzly bear, fisher, sharp-tailed grouse, greater sandhill crane, American white pelican, northern leopard frog, and bull trout to determine whether recovery objectives are being met.
- Monitor bald eagle and peregrine falcon populations to watch for declines that may indicate new contaminant problems.
- Seek and evaluate reports of incidental sightings of grizzly bear and gray wolf.
- Gather distribution data on Townsend's big-eared bat, white-tailed jackrabbit, pygmy nuthatch, pygmy horned lizard, sagebrush lizard, western toad, northern leopard frog, Columbia spotted frog, bull trout, leopard dace, subarctic darner, boreal whiteface, subarctic bluet and western ridged mussel.
- Identify roost sites and hibernacula of Townsend's big-eared bat.

- Conduct habitat selection studies at multiple spatial scales for flammulated owl, great gray owl, Vaux's swift, Lewis' woodpecker, white-headed woodpecker, black-backed woodpecker, and Columbia spotted frog.
- Investigate use of shrub-steppe patches in landscapes of differing patchiness and connectivity to design conservation strategies for sage thrasher, loggerhead shrike, and sage sparrow.
- Evaluate the population demography or other aspects of the life history of flammulated owl, Lewis' woodpecker, California floater, winged floater, Oregon floater, and western ridged mussel.
- Track habitat availability for western gray squirrel, American badger, black-backed woodpecker, California floater, winged floater, and Oregon floater using remote sensing or other appropriate techniques.
- Develop survey protocols to monitor the abundance of great blue herons, white-tailed jackrabbits, and ***American badger***.

- Evaluate whether existing forest management prescriptions are adequate to maintain populations of lynx and pileated woodpecker.
- Evaluate habitat suitability and develop habitat management recommendations for northern leopard frog.
- Monitor the expansion of West Nile Virus into areas occupied by sharp-tailed grouse.
- Monitor any colonizing wolves to determine establishment of packs and habitat use.
- Investigate the limiting factors and causes of decline among populations of white-tailed jackrabbit, American badger, subarctic darner, boreal whiteface, and subarctic bluet.
- Determine the amount of genetic diversity and gene flow among bull trout populations.
- Investigate the taxonomy of western toad, California floater, winged floater, Oregon floater, and western ridged mussel using genetic techniques and other analyses.
- Assess and map important habitats and areas of high biodiversity in the ecoregion using ecoregional assessments, local habitat assessments, Interagency Vegetation Mapping Project, and other habitat inventories and plans. Update ecoregional assessments every five years.
- Develop statewide land cover and threats data layers to improve connectivity between priority conservation areas.
- Identify and assess key connectivity areas and wildlife corridors between fragmented habitats and between protected areas. Restore habitat connectivity and wildlife corridors where appropriate on both public and private lands.
- Improve understanding of the ecological processes of seeps, bogs, wet meadows, forested wetlands, marshes, springs and other wetlands, and how they are impacted by human development.
- Conduct hydrologic studies that include water quantity and chemical budgets at wetlands known to be supporting rare and endangered species. Use this information to inform wetland management.
- Inventory and prioritize riparian habitat types and attributes needing protection and conservation.
- Identify important habitats for restoration and assess the feasibility of successfully restoring these sites. Include an evaluation of current and projected land use in and adjacent to potential restoration sites.

Protect, restore and connect habitats:

- Maintain mature and late-successional coniferous forests from harvest to protect fisher, northern goshawk, flammulated owl, Vaux's swift and black-backed woodpecker.
- Develop a conservation strategy that addresses management of pine and other coniferous forests, including maintaining and recruiting suitable snags as nesting sites for great gray owl and white-headed woodpecker.
- Provide input on timber harvest and fire management activities on state, private, and federal lands to perpetuate adequate amounts and distribution of denning and foraging habitats for lynx.
- Protect forests with concentrations of western gray squirrel nests from timber harvest and provide protective buffers around trees with nests.
- Maintain and restore open ponderosa pine forests to enhance populations of golden eagle, Lewis' woodpecker, and pygmy nuthatch.
- Maintain and restore mature cottonwood riparian forests with large diameter snags for Lewis' woodpecker.
- Work with county planners to establish reserve areas of open forests and woody riparian corridors for Lewis' woodpecker.
- Maintain and restore important areas of shrub-steppe and native grasslands, restore ecological functions of degraded areas, and protect important sites through acquisitions, easements, and agreements to protect white-tailed jackrabbit, prairie falcon, burrowing owl, loggerhead shrike, sage thrasher, pygmy horned lizard, and sagebrush lizard.
- Protect and enhance meadow-steppe, riparian habitats, and deciduous forests, including the restoration of low elevation wintering sites, for sharp-tailed grouse.
- Protect and restore riparian areas for inland redband trout and bull trout.
- Protect important roost sites and hibernacula used by Townsend's big-eared bat.
- Protect suitable breeding lakes for common loon and redhead from development and recreational pressure.
- Protect ponds, lakes, creeks, bogs, wetlands and their margins, and adjoining areas of steppe and ponderosa pine used by tiger salamander, Columbia spotted frog, subarctic darner, boreal whiteface, and subarctic bluet.
- Protect land near large great blue heron colonies and greater sandhill crane nesting sites through acquisitions, conservation easements and agreements and management plans.
- Preserve wintering habitat for trumpeter swan, northern pintail, and redhead on agricultural lands and wetlands through land purchase, conservation easements, and management programs.
- Protect important areas of ungulate winter range through acquisitions, easements, and agreements to provide adequate prey populations for gray wolf.
- Conserve prey populations of golden eagle, prairie falcon, and burrowing owl by reducing deliberate control programs.
- Manage small fish populations in lakes with nesting common loon.
- Maintain and enforce Forest Practice rules protecting bald eagle roost sites and nests.
- Continue to require bald eagle habitat plans that require retention of trees.
- Reduce sedimentation of aquatic habitats used by California floater, winged floater, Oregon floater, and western ridged mussel.
- Protect rare habitat types such as aspen stands, snag patches, caves, cliffs, and talus.

- Prioritize conservation areas using ecoregional assessments and other biological assessments. Protect important habitat types, biodiversity areas, and environmentally sensitive lands that should not be altered through a variety of techniques including acquisitions, conservation easements, life estates and cooperative agreements with willing landowners.
- Coordinate with local land trusts, conservation districts and other conservation organizations and agencies to conserve important habitat on both public and private land. Focus limited resources in regionally significant areas. Identify all possible acquisition and restoration grants and coordinate applications.
- Work with the USDA Forest Service and other public landowners to protect existing roadless areas and expand the roadless area network where justified for habitat protection and connectivity.
- Protect key connectivity areas and wildlife corridors between fragmented habitats and between protected areas through a variety of techniques including acquisitions, conservation easements, life estates and cooperative agreements with willing landowners. Use statewide land cover and threats data layers to improve connectivity between priority conservation areas.
- Restore native habitats, habitat connectivity and wildlife corridors where appropriate on both public and private lands. Consider restoring lands adjacent to existing protected areas to increase their effective size and function as wildlife habitat.
- Purchase water rights from willing sellers in unregulated tributaries; use these water rights to restore and maintain adequate year-round flows for both instream and out-of-stream riparian fish and wildlife habitat.
- Rehabilitate and restore stream channels, floodplain functions, riparian habitat and connectivity where streams have been diverted, fragmented, or degraded. Use livestock exclusions, instream structures, bank modifications and other methods.
- Preserve and/or restore buffer areas in appropriate locations along tributaries and mainstem waterways to a condition that is adequate to maintain healthy, functioning riparian zones for the ecoregion's rivers and estuaries.
- Work with public and private landowners to reestablish and restore native shrub-steppe and grassland plant communities in selected public and private habitat areas to support species at risk and increase species richness.

<u>Improve land management practices</u>:

General

- Restore degraded ponderosa pine forests by thinning dense understory fir, encouraging longer harvest rotations, returning to natural fire regimes, and maintaining snags to enhance populations of northern goshawk, flammulated owl, Lewis' woodpecker, and pygmy nuthatch.
- Promote forest management practices that improve habitat connectivity and facilitate dispersal for grizzly bear, gray wolf, wolverine, and lynx.
- Allow wildfires to burn in some forests to create suitable habitat for black-backed woodpecker.
- Exclude cattle from grazing in riparian forests to protect habitat for Lewis' woodpecker.
- Manage land use activities in riparian areas used by inland redband trout.
- Allow natural disturbances and successional functions and processes to occur on conserved wetlands.
- Manage undeveloped publicly-owned land for conservation of priority habitats and species.

Fire management

- Work with public agencies and private landowners to reduce the potential destructive impact of wildfires on native habitats by incorporating measures such as fire breaks and prescribed burning into wildlife and land management plans.
- Coordinate with public land managers on the use of controlled fire regimens and stand management practices. Attempt to simulate natural disturbance regime and restore proper ecological function. Consider impacts to local wildlife in each burn plan, including timing, size and location of the burn.

Forest management

- Protect remaining old growth conifer and hardwood stands to benefit late successional species, and manage some stands on long rotations (>200 years).
- Work with the Washington Department of Natural Resources and the Washington Forest Practices Board to develop, implement and enforce forest practices regulations to enhance biological diversity on existing state and private managed and protected areas.
- Work through the State Forest Practices Board and directly with forest landowners to implement forest management prescriptions, including prescribed burns, which will maintain and enhance biodiversity and natural ecosystem function. Encourage modified silvicultural prescriptions that promote local topographic, soil and vegetative conditions. Retain snags, downed woody debris and a complement of live trees in harvested areas. Sensitive areas such as wetlands, remnant old growth and wildlife breeding sites should not be disturbed.
- Encourage the development of selective harvest policies and guidelines on both public and private forestland that will leave adequate components of old growth habitat such as snags and downed wood as habitat for associated wildlife such as northern goshawk, Vaux's swift, flammulated owl, Lewis' woodpecker, black-backed woodpecker, pileated woodpecker, and ***pygmy nuthatch***.
- Minimize logging roads and decommission them after the period of entry. Ensure that all logging and forest access roads are located in stable, non-erodible areas and outside riparian management zones.
- Ensure the integrity of riparian habitat by maintaining adequate riparian management zones along streams in all logging sites, on both public and private land.
- Support implementation and enforcement of the Washington Forest Practices Act to accomplish habitat conservation and regeneration on both state and private forestlands.
- Encourage public and private forest landowners to manage forested watersheds that maintain an appropriate mix of successional stages and provide connectivity of riparian and upland vegetation as protected travel corridors for wildlife.

Grazing and agricultural practices

- Work with public and tribal and management agencies to fence or otherwise protect riparian zones from livestock grazing and unauthorized offroad vehicle use. Consider retirement rather than renewal of grazing leases on sensitive lands.
- Work with conservation districts, Natural Resource Conservation Service, USDA Forest Service and private landowners to implement best management practices in riparian areas and associated upland habitat in conjunction with the Conservation Reserve Program, Wetland Reserve Program and other Farm Bill programs.
- Use the Comprehensive Resource Management Plan process for large landscapes with a mix of public and private landowners to modify grazing regimes and improve grassland and shrub-steppe understory conditions and enhance biodiversity.
- Assist private landowners in securing funding to fence riparian zones on private land. In areas where it is impractical to exclude livestock, protect habitat quality by controlling the timing and intensity of livestock grazing through regulation and landowner agreements.
- Work with private and public landowners to minimize the impacts on habitat and wildlife from modern agriculture, including agrochemical use, water use, grazing and soil erosion.
- Ensure that grazing leases on state lands comply with HB1309 "Ecosystem Management Standards" to maintain fish and wildlife habitat.

<u>Control and prevent introduction of alien and invasive species</u>:

- Develop a regional plan for the detection, rapid response and eradication of invasive species.
- Control the spread of cheatgrass in shrub-steppe to prevent the degradation of habitat for sage thrasher, sage sparrow, and sagebrush lizard.
- Develop methods to control or otherwise mitigate impacts of introduced bullfrogs and fish on northern leopard frog and Columbia spotted frog.
- Avoid introduction of non-native fish in fishless lakes and where species of conservation concern occur such as bull trout, westslope cutthroat trout, native amphibians and reptiles; avoid introduction of rainbow trout or only introduce sterile fish where westslope cutthroat are found. Avoid introduction of non-native trout to protect bull trout from hybridization, competition, and predation.
- Monitor lakes, streams and wetlands for illegal fish introductions and prohibit legal introductions to protect tiger salamander, northern leopard frog, Columbia spotted frog, and pygmy whitefish.
- Control fox squirrels over limited areas as needed to benefit western gray squirrels.
- Determine extent of competition for cavities between Lewis' woodpecker and European starling and, if necessary, control starlings.
- Control and monitor the introductions of non-native bivalves and other aquatic invasives through enforcement and education to protect California floater, winged floater, and Oregon floater.
- Conduct genetic work to determine the extent of hybridization between native and non-native subspecies of tiger salamander and, if necessary, prohibit the use of non-native subspecies as fishing bait.
- Work with other public agencies and private agricultural organizations such as the Farm Bureau and Washington Grange to develop basic techniques for mapping and monitoring the spread of invasive plant species over time.
- Participate in federal and state agency partnerships to develop and implement weed control strategies for impacted sites and ecosystems. Promote adequate funding and

coordination of weed control efforts on both public and private lands using environmentally sound methods.

- Develop educational and public information materials to increase public awareness of the ways that invasive alien species are introduced to sensitive ecosystems.
- Provide funding, incentives and technical assistance to private landowners to eliminate undesirable invasive plant species in riparian zones and to restore native plants that provide important habitat for native fish and wildlife. Use integrated pest management practices to control currently established invasive species with help from volunteers.
- Participate in federal and state agency partnerships to develop and implement weed control strategies for impacted sites and ecosystems.

Control and monitor disturbance:

- Limit disruptive types of recreational activity in roadless, wilderness, and primitive areas to prevent disturbance of grizzly bear and wolverine.
- Limit access to roost sites and hibernacula used by Townsend's big-eared bat.
- Minimize disturbance of great blue heron, bald eagle, ***golden eagle***, prairie falcon, and peregrine falcon nests from human activities such as development, logging, boating, and other recreational activity by restricting access to public lands as needed, working with permitting agencies to reduce levels of disturbance, and informing the public of sensitive areas and periods.

- Establish wake-free zones near breeding colonies of western grebe to minimize boater disturbance.
- Prevent construction of roads and buildings within ½ mile of greater sandhill crane territories and discourage detrimental mowing practices during sensitive nesting periods.
- Eliminate vehicular access and campsites in conservation areas identified as sensitive habitats such as montane wetlands, bogs, prairies, and dunes.
- In sensitive habitats, manage both land and water access by using fencing, trails, elevated boardwalks, railings, seasonal restrictions, signage and livestock restrictions.
- Reduce the amount and impact of unauthorized recreational access and use on important wildlife habitat through better enforcement of existing laws, more fencing and posting of critical habitat areas, selective road closures and increased public education and information for recreational users and user groups.
- Protect nesting golden eagle, bald eagle, peregrine falcon and prairie falcon through use and access restrictions on public lands as needed, and work with private landowners and permitting agencies to prevent blasting or construction disturbance during nesting; inform rock climbers of sensitive periods and locations to reduce disturbance of nesting peregrine, golden eagle, and prairie falcon.

Control and prevent environmental contamination:

- Protect common loon, bald eagle, and golden eagle from lead poisoning by advocating the use of non-toxic fishing sinkers and steel shot.
- Evaluate the need for contaminant studies in northern leopard frogs.

- Restrict the use of piscicides such as rotenone in waters with common loon and pygmy whitefish.
- Work with other agencies to decrease and remediate sources of contamination to protect bald eagle, peregrine falcon, California floater, winged floater, Oregon floater, and western ridged mussel.
- Prohibit spraying of toxic chemicals near the burrows of burrowing owls and monitor compliance.
- Work with governmental and nonprofit agencies to develop an ecoregion-wide strategy for identified toxins and other pollutants: their sources, destinations and effects, and ways to reduce their discharge.
- Work with other agencies, industry and private landowners to encourage use of integrated pest management techniques and phase out the use of pesticides and herbicides.
- Clean up contaminated sites and sediments whenever possible, and prevent further toxic contamination of areas, including unconfined spoil disposal sites.
- Reduce the use of hazardous chemicals by continuing to implement the persistent bioaccumulative toxins strategy and by using a variety of best management practices and improved treatment methods.
- Continue to place a priority on actions to prevent and respond to oil and hazardous material spills.

Improve transportation and energy development:

- Power lines near breeding and foraging areas should be built or modified to reduce the occurrence of golden eagle and other raptor electrocutions.
- Prohibit construction of wind energy projects in areas important for sharp-tailed grouse.
- Highway overpasses/underpasses should be constructed to facilitate access to suitable habitats for grizzly bear, gray wolf, and wolverine.
- Reduce road mortality in western toad by providing road crossings near breeding sites.
- Avoid road building near breeding sites for ***western toad***.
- Work with the Washington Department of Transportation to locate highways away from important wildlife habitats and biodiversity areas. If impacts are unavoidable, design adequate mitigation such as underpasses, overpasses and fencing to accommodate wildlife, such as western toads, that need passage.

Improve water quantity and quality:

- Provide floating nest platforms for common loon at lakes with fluctuating water levels.
- Conserve beaver populations, beaver ponds, and dynamic stream processes in areas with Columbia spotted frog.
- Reduce the impacts of land use practices that increase water temperature and sedimentation, thereby harming inland redband trout and pygmy whitefish.
- Improve water quality at potential northern leopard frog recovery areas.

- Manage wetland areas on public land for both high water quality and habitat value. Ensure that the water quality of inflow does not lead to deterioration of the wetland habitat.
- Where possible restore or rehabilitate the hydrology, water quality and native plant communities in degraded and disturbed wetlands. Methods should emphasize creating or restoring natural wetland functions such as conserving beaver populations and dynamic stream processes, to benefit species such as tiger salamander, northern leopard frog, Columbia spotted frog, and silver-bordered fritillary.
- Manage runoff from highways according to the updated highway runoff manual. Improve the road drainage network in riparian zones by removing unnecessary culverts, increasing the size of inadequate culverts, or replacing culverts with bridges.
- Reduce the harm from stormwater runoff by working to improve the effectiveness of the National Pollutant Discharge Elimination System stormwater permit programs.
- Assist local jurisdictions in finding solutions to increase landowner compliance with onsite sewage system maintenance and animal waste management practices through education and regulated inspection. Work to reduce the number and volume of combined sewer overflow events.

<u>Improve coordination, planning, permitting and mitigation</u>:

- Strengthen the Shoreline Management Act to protect bald eagle nesting and roosting sites.
- Develop a critical habitat rule and work with counties to conserve habitat for western gray squirrel.
- Provide credible scientific information on priority habitats and species and biodiversity areas, their significance, management needs and compatible land uses to decision-makers at site, local and regional scales.
- Provide technical assistance to counties in using fish and wildlife and biodiversity information to update comprehensive land use plans, community or watershed plans, Shoreline Master Plan, etc.
- Assist counties in developing and updating county ordinances and incentives that help to mitigate or control development in areas with resource and conservation values and that encourage environmentally sensitive development in growth areas.
- Work with local governments and conservation organizations to identify and protect areas of important habitat and biodiversity through existing environmental laws and other local programs.
- Encourage floodplain management and shoreline zoning protection programs.
- Develop a coordinated conservation vision and strategy for conservation of large landscapes using a structured process like The Nature Conservancy's 5-S Project Management System or the Cascade Dialogs.
- Review state and federal land management plans to ensure adequate protection for priority habitats and species, biological diversity and ecosystem health.
- Develop site management plans for protected areas.
- Work with public and tribal land management agencies to protect important habitat and areas of high biodiversity from loss and fragmentation, as well as degradation.
- Coordinate and integrate species recovery and management plans with land management and watershed plans using regulatory and voluntary approaches.
- Participate in Growth Management Act, Shoreline Management Act, Forest Protection Act and Federal Energy Regulatory Commission permitting processes for new or expanded residential, recreational or hydropower development on private land.

- Use information from ecoregional assessments to illustrate important habitats and areas of high biodiversity. Encourage permitting agencies to designate and protect these areas from residential and recreational development, and to require mitigation for habitat conversion and fragmentation where it occurs.
- Work closely with the USDA Forest Service and other land management agencies to prevent or mitigate potential adverse impacts to fish and wildlife habitat from proposed recreational or hydropower development on public lands.
- Work with regulatory agencies to design effective mitigation strategies for projects that result in wildlife impacts or direct conversion or fragmentation of habitat.
- Assist federal agencies in implementing the Interior Columbia Basin Ecosystem Management Strategy.
- Represent WDFW's conservation interest on interagency recovery teams and working groups.

<u>Improve enforcement of laws and regulations</u>:

- Enforce existing protections for grizzly bear, gray wolf, and bald eagle through vigorous investigation and prosecution.
- Enforce fishing regulations, seasons, and stream closures to protect bull trout from fishing pressure.
- Maintain conservative hunting regulations for northern pintail and redhead.
- Enforce recreational access restrictions on public lands and aquatic areas.

<u>Improve landowner assistance</u>:

- Work with landowners to maintain sufficient foraging habitat, travel corridors, and denning sites for lynx.
- Develop, periodically update, and provide WDFW Priority Habitats and Species management recommendations to assist landowners in conserving priority habitats and species.
- Work with large and small timber companies and landowners to accomplish habitat conservation through non-regulatory approaches such as landowner incentives, conservation easements, habitat conservation plans and acquisition of critical habitat from willing landowners.
- Secure state and federal tax incentives that discourage habitat fragmentation and destruction and that encourage landowners to protect and manage their land to benefit wildlife habitat.
- Work with local government to implement the Public Benefit Rating System and encourage effective use of open space tax incentives for landowners.
- Work with private landowners to identify and protect areas with important habitats and biodiversity and protect these areas through landowner incentives and other nonregulatory programs. This would assist species such as great blue heron, trumpeter swan, northern pintail, redhead, bald eagle, flammulated owl, Vaux's swift, Lewis' woodpecker, pileated woodpecker, pygmy nuthatch, sage thrasher, loggerhead shrike, sage sparrow, pygmy horned lizard, sagebrush lizard, western toad, northern leopard frog, Columbia spotted frog, and silver-bordered fritillary.
- Provide educational materials to private landowners that describe management techniques for maintaining and restoring various wildlife habitats.
- Work with private landowners to identify and protect important wetland habitats and buffers by providing adequate water, controlling invasive plants, reducing disturbance to nesting wildlife, and fencing or otherwise keeping livestock out of wetlands and associated upland habitat.

- Influence the application of federal Farm Bill funds, including the Conservation Reserve Program and the WDFW Landowner Incentive Program, on private agricultural lands most critical for wildlife movement and most suitable for restoration of native wetlands, shrub-steppe and grassland habitat.
- Promote grant programs to assist landowners with implementation of management plans.

Improve wildlife conservation education: includes outreach, volunteer and watchable wildlife programs.

- Conduct outreach and education programs to engage the public in conservation programs for many species, including gray wolf and grizzly bear.
- Continue volunteer programs for monitoring common loon activity at lakes.
- Education programs are needed to curtail recreational pressure on common loons and redheads at suitable breeding lakes.
- Discourage the capture of pygmy horned lizards as pets.
- Discourage the capture of larval tiger salamanders as fish bait.
- Provide educational materials to hunters to prevent accidental mortality and harassment of lynx.
- Engage and involve local and tribal governments, state and federal agencies, organizations and citizens in efforts to protect and restore priority habitats and species through a variety of outreach projects, programs and education efforts.
- Increase the use of citizen science for the collection of data, monitoring, restoration and conservation of important habitats and associated wildlife species. Coordinate volunteer monitoring and involvement.
- Promote and maintain public information and education efforts that focus on endangered species, habitat loss, ecological function, biological diversity and environmentally aware lifestyle practices. Emphasize the connection between habitat and environmental quality and human health and welfare.
- Expand conservation education programs for both adults and children to emphasize the critical nature and vulnerability of sensitive habitats such as wetlands, oak and grassland habitats and associated wildlife.
- Connect with user groups through education to make them part of the conservation solution in areas that have high recreation values.
- Work with large corporations to increase awareness and develop financial support for conservation of biodiversity.

Greater sandhill cranes.

CANADIAN ROCKY MOUNTAINS ECOREGION

PHYSIOGRAPHY AND FISH AND WILDLIFE DIVERSITY

Geography

The Canadian Rocky Mountains ecoregion includes about four percent of Washington in the far northeastern corner of the state. The rest of the ecoregion extends through adjacent British Columbia and Idaho and continues into Alberta and Montana. This ecoregion contains some of the most diverse wildlands remaining south of Canada, providing sanctuary for a host of threatened or endangered species.

The Selkirk Mountains and the north-flowing Pend Oreille River are the two dominant features of this ecoregion in Washington. The Selkirks are transitional between the rolling Okanogan highlands to the west and the higher Rocky Mountain ridges and mountains interlaced with wide valleys to the east.

Geology

Historically, the Washington portion of the ecoregion was almost completely glaciated, and now displays ice-carved, U-shaped moraine valleys and isolated, ice-sculpted mountain peaks. Elevations range from 1,300 feet along the Columbia River to greater than 7,000 feet in the Salmo-Priest Wilderness area.

Climate

Climate in the ecoregion is varied. The northern portion is characterized by cool, boreal weather, with rainfall around 80 inches in the Salmo-Priest Wilderness Area. The rest of the ecoregion experiences more moderate climate conditions; maritime weather patterns extend inland from the Pacific Ocean and influence the climate in all but the easternmost part of the ecoregion in Washington. Although annual precipitation is less than 18 inches along the Columbia River south of Northport, Washington, most of the ecoregion lies within a 24- to 34-inch precipitation zone. Significant snowpack develops in mid- and upper elevations of the Selkirks.

Habitat and Plant Associations

Coniferous forests dominate this ecoregion, although forest composition reflects variations in moisture, temperature and elevation. Douglas-fir/ponderosa pine forests tend to occur at lower elevations, while grand fir/western hemlock/western redcedar forests are characteristic of mid-montane elevations. Subalpine fir/Engelmann spruce forests are usually found at higher elevations along with parklands of whitebark pine, lodgepole pine and subalpine larch. Valley rivers and streams are often lined with riparian stands of willows and cottonwoods. Native grasslands occur along the foothills and on higher elevation, south-facing slopes. These grasslands are variously dominated by green fescue, Idaho fescue or rough fescue. Fire has played a significant role in the development and evolution of the forests in this ecoregion.

Fish and Wildlife Diversity

The rugged wilderness and varied topography of the Canadian Rocky Mountains ecoregion harbor a variety of wildlife, and some of the most rare and imperiled species in Washington, including woodland caribou, grizzly bear, gray wolf, wolverine, fisher and lynx. The region is also known for its healthy populations of large game species such as bighorn sheep, mule deer, white-tail deer, black bear, Rocky Mountain elk and moose. The ecoregion’s extensive watershed systems support significant freshwater biodiversity, including burbot, white sturgeon, rainbow trout, dolly varden, bull trout, mountain whitefish, mottled sculpin, cutthroat trout and, formerly, anadromous salmon.

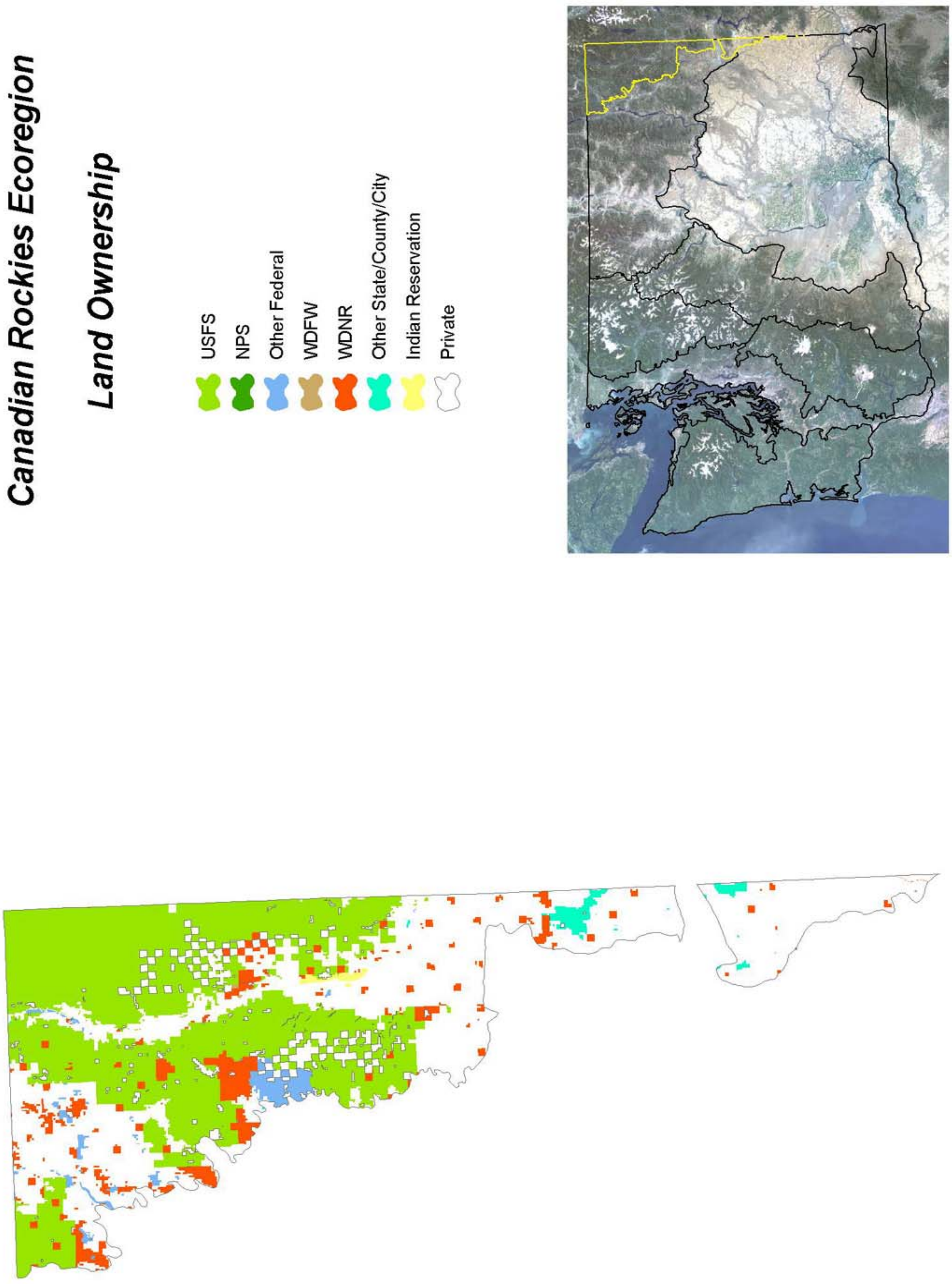
LAND OWNERSHIP

Most of the Washington portion of the ecoregion is public land managed by federal and state agencies such as the USDA Forest Service, U.S. Fish and Wildlife Service, and the Washington Department of Natural Resources. Aside from a few mining claims in the mountains, most private lands are located in the valley bottoms, which also include the best soils and access to water.

In Washington, there is an extensive system of smaller public and private reserves throughout the ecoregion. Of these reserves, about 3 percent are protected from commercial logging, and 21% have moderate protection.

The Washington section of the ecoregion has experienced relatively rapid population growth and changes in land use over the last 50 years. Traditional industries and occupations such as forestry and mining are still important, but tourism, including skiing, hiking, hunting, fishing and water sports, has shown substantial growth, resulting in increased commercial/recreational developments and associated vacation home/retirement communities. Since the 1970s, the development of hydroelectric power projects such as Boundary Dam on the Washington-British Columbia border has also had a major impact on both the regional economy and the landscape. Figure 30 maps land ownership classes in the Canadian Rocky Mountains ecoregion.

Figure 30.


Canadian Rockies Ecoregion
Land Ownership
USFS
NPS
Other Federal
WDFW
WDNR
Other State/County/City
Indian Reservation
Private

ECOREGIONAL CONSERVATION PARTNERSHIPS

Effective conservation of fish, wildlife and biodiversity in Washington requires close coordination and cooperation with many public and private conservation partners. Major partners in the Canadian Rockies ecoregion include:

- Pend Oreille, Stevens and Spokane Counties
- U.S. Bureau of Land Management
- U.S. Fish and Wildlife Service (Little Pend Oreille National Wildlife Refuge)
- U.S. Forest Service (Colville National Forest, Washington portion of Idaho Panhandle National Forest)
- Washington Department of Natural Resources (WDNR)
- Washington State Parks and Recreation Commission

The Washington Department of Fish and Wildlife also works closely on conservation projects with private conservation partners such as The Nature Conservancy, Trust for Public Land, Rocky Mountain Elk Foundation, Audubon Washington, Ducks Unlimited and a growing number of fisheries enhancement groups and local land trusts.

Major Plans and Assessments

A number of ongoing or completed planning efforts involving WDFW and its public and private partners guide the conservation and management of fish and wildlife resources statewide and in the Canadian Rockies ecoregion. Important planning efforts affecting conservation in the Canadian Rockies ecoregion include:

- Canadian Rockies Ecoregional Assessment
- Pend Oreille, Spokane, and Columbia Upper Subbasin Plans (2004)
- Selkirk Mountains Woodland Caribou Herd Augmentation in Washington Cooperative Interagency Plan (1996)
- USFWS Draft Bull Trout Columbia River DPS Recovery Plan (2002)
- USFWS Grizzly Bear Recovery Plan (1993)
- USFWS Northern Rocky Mountain Wolf Recovery Plan (1991)
- USFWS Selkirk Mountains Woodland Caribou Recovery Plan (1994)
- Washington Forest Practices Board Wildlife Strategy (in progress)
- Washington Forests and Fish Agreement (1999)
- WDFW Bald Eagle Status Report (2001)
- WDFW Bull Trout and Dolly Varden Management Plan (2000)
- WDFW Common Loon Status Report (2000)
- WDFW Fisher Recovery Plan (2005)
- WDFW Fisher Status Report (1998)
- WDFW Game Management Plan (2003)
- WDFW Le Clerc Wildlife Area Plan (2006)
- WDFW Lynx Recovery Plan (2001)
- WDFW Northern Leopard Frog Status Report (1999)
- WDFW Outline for Salmon Recovery Plans (2003)
- WDFW Peregrine Falcon Status Report (2002)
- WDFW Pygmy Whitefish Status Report (1998)

Supporting references to these and other important statewide planning documents are included at the end of this chapter and/or in Appendices 6 and 7.

SPECIES AND HABITATS OF GREATEST CONSERVATION NEED

This section provides a short summary of priority species and associated habitats for the Washington portion of the Canadian Rockies ecoregion.

Species of Greatest Conservation Need

The following species list for the Canadian Rockies ecoregion is a regional subset of the statewide Species of Greatest Conservation Need (SGCN) list shown in Appendices 1 and 2. The process and criteria used to develop the statewide SGCN list are provided in Volume Two: Approach and Methods, as well as in Appendix 3. Species listed below are found in the Canadian Rocky Mountains ecoregion for all or part of their lifecycle. Supporting tables and information for these species and habitats can be found in Chapter IV and in Appendices 1, 2, 8, 9, 10 and 14.

	Population Size/Status						Population Trend					
COMMON NAME	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown	State Status*	WNHP
Mammals												
Townsend's big-eared bat			x							x	C	S3
Gray wolf	?									x	E	S1
Grizzly bear		x							x		E	S1
Fisher	x							x			E	SH
Wolverine		x						x			C	S1
American badger			x				x				G	S4
Lynx			x							x	T	S1
Woodland caribou		x					x				E	S1
Birds												
Common loon			x					x			S	S2
Great blue heron			x							x	M	S4
Northern pintail					x		x				G	S3
Redhead			x					x			G	S3
Lesser scaup				x			x				G	S4
Bald eagle				x					x		T	S4
Northern goshawk			x							x	C	S3
Golden eagle			x							x	C	S3
Peregrine falcon			x						x		S	S2
Flammulated owl			x							x	C	S3
Vaux's swift			x				x				C	S3
Lewis' woodpecker			x				x				C	S3

	Population Size/Status						Population Trend					
COMMON NAME	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown	State Status*	WNHP
Black-backed woodpecker			x							x	C	S3
Pileated woodpecker				x						x	C	S4
Pygmy nuthatch			x							x	N	S3
Amphibians												
Western toad				x			x				C	S3
Northern leopard frog			x				x				E	S1
Columbia spotted frog			x							x	C	S4
Fish												
Westslope cutthroat				x				x			G	G4
Inland redband trout						x				x	G	G5
Bull trout						x				x	C	G3
Pygmy whitefish						x				x	S	S1
Invertebrates												
Silver-bordered fritillary (butterfly)			x							x	C	S3

* Status Codes	** WNHP Codes (S = state, G = global)
E = endangered	1 = critically imperiled
T = threatened	2 = imperiled
S = sensitive	3 = vulnerable to extirpation or extinction
C = candidate	4 = apparently secure
M = monitor	5 = demonstrably widespread, abundant and secure

Species Conservation in the Canadian Rockies Ecoregion

Species of Greatest Conservation Need (SGCN) found in the Canadian Rockies ecoregion (see table above) include those classified by WDFW as Endangered, Threatened, Candidate or Monitor species, as well as species identified by WDFW as needing additional research or funding attention. A range of conservation actions is recommended for these SGCN species at both the statewide and ecoregional levels. These recommended conservation actions are summarized in a series of matrices included in Chapter IV and as Appendices 9 and 10. These matrices also display the life history, population status and distribution of these species.

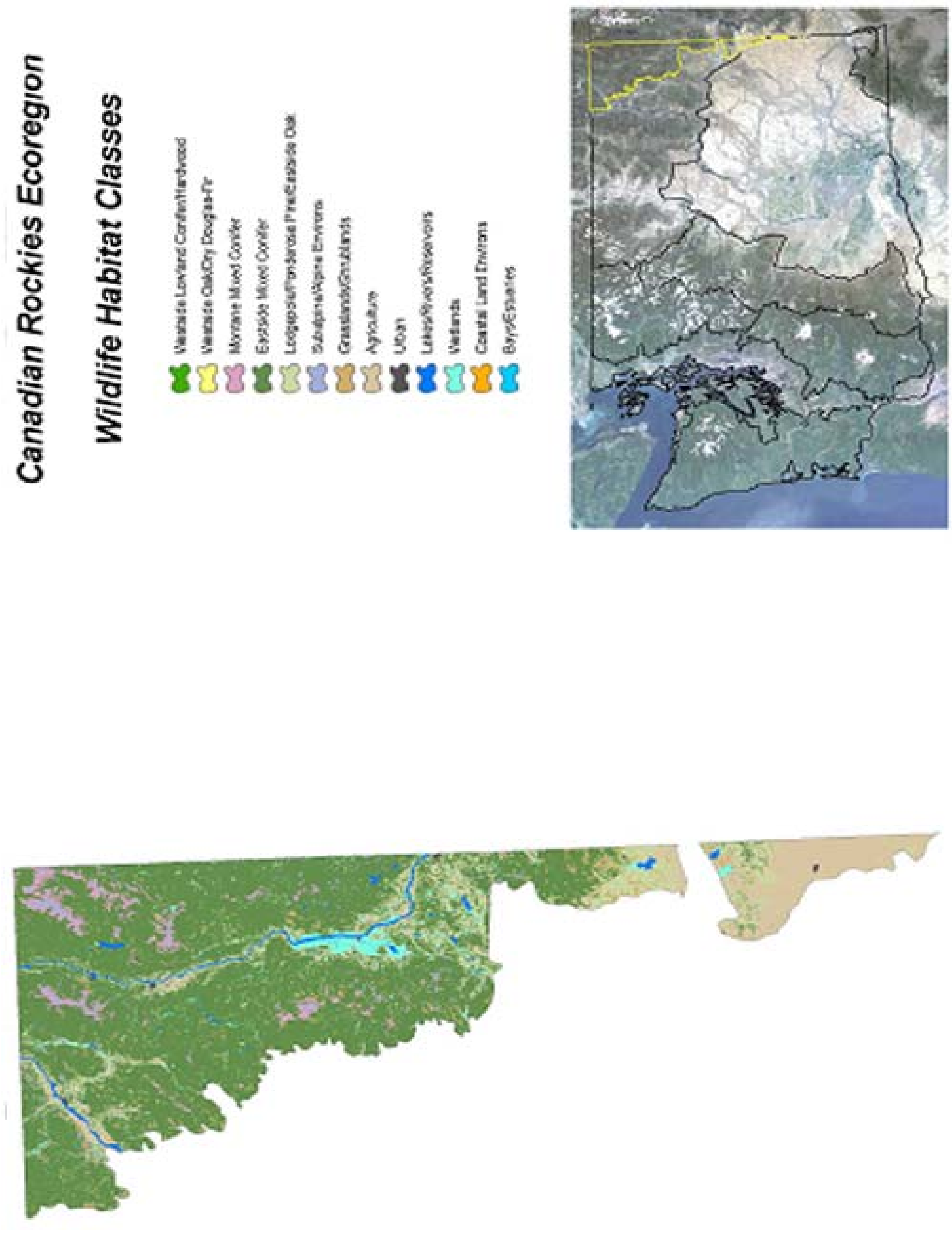
Ecoregional Habitat Overview

In addition to expansive conifer forests, the Canadian Rockies ecoregion contains several other vegetation communities. Mountain meadows, riparian woodlands, upper treeline/alpine communities and scattered foothill grasslands exist throughout the ecoregion. The ecoregion is characterized by dramatic vertical zonation of vegetation and associated wildlife species. This zonation is a consequence of abrupt elevational gradients between flatlands and mountains. Secondary climatic effects of topographic relief (e.g. rain shadow effects, exposure to or shelter from prevailing winds and thermal inversions) likewise influence zonation. Figure 31 maps wildlife habitat classes for the Canadian Rocky Mountains ecoregion.

The following major habitat types classified, coded and described in Wildlife and Habitat Relationships in Oregon and Washington (WHROW), are present in the Canadian Rockies ecoregion. In the next section, descriptions are provided for priority habitats associated with Species of Greatest Conservation Need found in this ecoregion.

- Montane Mixed Conifer Forest
- Eastside (Interior) Mixed Conifer Forest
- Lodgepole Pine Forest and Woodlands
- Ponderosa Pine Forest and Woodlands
- Upland Aspen Forest
- Subalpine Parkland
- Eastside (Interior) Grasslands
- Agriculture, Pasture and Mixed Environs
- Urban and Mixed Environs
- Open Water: Lakes, Rivers and Streams
- Herbaceous Wetlands
- Montane Coniferous Wetlands
- Eastside (Interior) Riparian-Wetlands

Figure 31.


Canadian Rockies Ecoregion
Wildlife Habitat Classes
Westside Lowland Conifer/Hardwood
Westside Oak/Dry Douglas-Fir
Montane Mixed Conifer
Eastside Mixed Conifer
Lodgepole/Ponderosa Pine/Eastside Oak
Subalpine/Alpine Environs
Grasslands/Shrublands
Agriculture
Urban
Lakes/Rivers/Reservoirs
Wetlands
Coastal Land Environs
Bays/Estuaries

Priority Habitats in the Canadian Rockies Ecoregion

The following three habitat types have been identified as the highest priority for current conservation action in the Washington portion of the Canadian Rockies ecoregion. Selection of these habitats as a priority was determined by their importance to regional Species of Greatest Conservation Need, as well as priorities outlined in the Canadian Rockies Ecoregional Assessment and the subbasin plans listed in the "Major Plans" section above. More discussion on the selection of priority habitats is included in Chapter III: Statewide Overview and in Volume Two: Approach and Methods.

- Upland Forests and Woodlands
- Herbaceous and Montane Coniferous Wetlands
- Eastside (Interior) Riparian-Wetlands

Upland Forests and Woodlands

Upland mixed conifer forests contain a wide array of tree species and stand dominance patterns. Douglas-fir is the most common tree species. Lower elevations or drier sites have ponderosa pine and often have other shade-tolerant tree species growing in the undergrowth. On moist sites, grand fir, western redcedar and/or western hemlock are dominant. Other conifers include western white pine on mesic sites and subalpine fir on colder sites, as well as lodgepole pine, and ponderosa pine. Undergrowth vegetation varies from open to nearly closed shrub thickets with one to many layers. Herbaceous broadleaf plants are important indicators of site productivity and disturbance.

Timber harvest has been a primary land use in the ecoregion for over a century, resulting in the elimination of most mature and old growth stands and their replacement with stands of younger age and less complex structure. With timber management and increased population of the area, fire suppression became a standard practice. Effects of fire suppression include changes in successional stages and species composition of the forest stands. In general, early successional-stage forests of western larch, lodgepole pine, ponderosa pine and western white pine have decreased, while shade-tolerant species such as Douglas-fir and grand fir have increased.

Selected Species Closely Associated with Upland Forests and Woodlands in the Canadian Rockies Ecoregion

Gray wolf	Lynx
Grizzly bear	Fisher
Lewis' woodpecker	Wolverine
Pileated woodpecker	Woodland caribou
Black-backed woodpecker	Northern goshawk

Herbaceous Wetlands and Montane Coniferous Wetlands

Herbaceous wetlands are widely distributed across the ecoregion and are often associated with rivers, lakes and streams. Seasonally to semi-permanently flooded wetlands are found where standing freshwater is present through part of the growing season and the soil stays saturated throughout the season. Herbaceous wetlands are found in all terrestrial habitats in the ecoregion except subalpine parkland and alpine grasslands, and commonly form a mosaic with Eastside riparian-wetlands and montane coniferous wetland habitats along stream corridors.

Montane coniferous wetlands are forest wetlands or floodplains with a persistent winter snow pack, ranging from moderately to very deep. Flooding regimes include saturated, seasonally flooded and temporarily flooded. Seeps and springs are common. This habitat occurs along stream courses or as small patches within a matrix of montane mixed conifer forest or adjacent to other wetland habitats.

Selected Species Closely Associated with Herbaceous and Montane Coniferous Wetlands in the Canadian Rockies Ecoregion

Western toad	Silver-bordered fritillary butterfly
Vaux's swift	

Eastside (Interior) Riparian-Wetlands

Mountain alder/willow riparian shrublands are major habitats in the forested zones of Washington's portion of this ecoregion. Eastside lowland willow and other riparian shrublands are the major riparian types at lower elevations. Black cottonwood riparian habitats occur throughout the ecoregion at low to middle elevations. Quaking aspen wetlands and riparian habitats are widespread, but rarely a major component. Ponderosa pine/Douglas-fir riparian habitat occurs only in the lower montane forests.

Riparian habitats occur along perennial and intermittent rivers, streams, wetlands and along lakes and ponds. Black cottonwood and willow riparian habitats occupy warm montane and adjacent valley and plain riparian environments. Riparian forests also appear on sites subject to temporary flooding during spring runoff. Irrigation of streamsides and toeslopes provides more water than precipitation and has become important in the development of this habitat in the ecoregion. Scrub-shrub and forested wetlands, seasonally flooded fields, persistently flooded emergent wetlands, shallow riverine sloughs, and ponds are present within and adjacent to floodplains.

Selected Species Closely Associated with Eastside (Interior) Riparian-Wetlands in the Canadian Rockies Ecoregion

Columbia spotted frog	Great blue heron
Northern leopard frog	Bald eagle

CONSERVATION PROBLEMS

A number of human activities pose potential threats to the integrity of wildlife habitat. These activities include incompatible forest and grazing practices, conversion of habitat to agriculture, dispersed residential development, pollution, overfishing and overhunting, water extraction, incompatible mining, hydropower and energy developments and transportation systems. These developments may disturb and displace wildlife, disrupt migration corridors, and encourage the establishment of invasive plant and animal species.

Forest Practices

Logging on both public and private land had a major impact on fish and wildlife habitat in the past and some forest practices have contributed to a decline in forest health through changed forest composition and the introduction of damaging diseases, insects and vegetation. While some harvest prescriptions are ecologically beneficial, in other instances the inappropriate use of downed wood harvests, even-age management and single-species selective harvests have contributed to the reduction of forest diversity throughout the ecoregion. Small areas of the ecoregion in Washington still exhibit intact forests of native tree species, but historical and current logging practices have eliminated most old growth forests, particularly of ponderosa pine, Douglas-fir and mixed coniferous forests.

Fire Suppression

In the fire-adapted ecosystems of the Canadian Rockies, fire is the dominant process in terrestrial systems, influencing vegetation patterns, habitats and ultimately, species composition. Fire management practices interact with several other threats to wildlife conservation areas; for example, altered natural fire regimes can lead to invasion by non-native fire-adapted plants or forests that are more prone to insect and disease impacts. Fire suppression in the interior Northwest region has profound ecological implications, including alteration of water, nitrogen and carbon cycles. Fire suppression has also resulted in overcrowded forests, which are less diverse, less vigorous and more susceptible to insect outbreaks, large forest fires and disease.

Invasive Alien Plant and Animal Species

Invasive plant and animal species are a significant threat to biodiversity, second only to habitat loss. They are introduced in a number of ways, including hitchhiking on horses, boats, cars and trucks. Invasive plants displace native vegetation, resulting in the loss of habitat diversity and function. They can severely impact native forest and animal communities, and alien grasses and shrubs can add significantly to the fire fuel load, resulting in hotter wildfires that increase damage to native vegetation. The number and abundance of introduced species in an ecoregion is an indicator of declining ecosystem health.

Residential Development

Residential development and expansion of dispersed residential areas into natural landscapes are among the most significant long-term threats to conservation targets in the Canadian Rockies ecoregion. Many conservation lands are owned and managed by the Forest Service and other public agencies, but a significant portion of low-elevation valleys and woodlands, riparian areas and montane grasslands are in private ownership and available for residential development.

Wetlands and riparian areas may be impacted from logging, agriculture and residential development that affect shorelines, water quality, water quantity and overall habitat continuity and complexity. This leads to increased erosion, which in turn increases sedimentation. Improperly managed livestock grazing compacts soil, contributes to stream bank destabilization, affects compositions of riparian plant communities, and slows recovery of damaged riparian habitat. This loss of riparian vegetation results in greater summer heating and winter cooling of stream temperature, soil instability, reductions in water quantity and quality, and changes in bank, channel and instream structure. All of these habitat changes affect the distribution and abundance of aquatic wildlife species.

Recreational Development

As the population of Spokane and northeast Washington grows, so does the demand for outdoor recreation, both natural and developed. Conversion of forest and woodland habitat for golf courses, ski areas (both new and expanded), and other development will continue as the population and demand grows. The tourism sector, including skiing, hiking, hunting, fishing, water sports, off-road vehicle use, snowmobiling, and biking, has shown the most substantial growth, resulting in increased commercial/recreational developments and associated home/retirement communities.

Transportation Systems

Transportation systems impact animals in several ways: roadkill, habitat loss and fragmentation and hindrance or barrier to movement and migration. When populations are low, roadkill mortality is significant, especially for slow-moving turtles and salamanders and wide-ranging carnivores that have to cross many roads. In a fragmented landscape animals have to move from one patch of habitat to another. When highways fragment landscapes, they divide wildlife populations into smaller, isolated units that are more susceptible to extirpation. Historically, construction of logging roads near streams or across wetlands was often extremely destructive to fish and wildlife habitat. Although modern forest practices under state and federal rules and regulations are much more likely to provide some protection for wetlands, there are still potential adverse impacts from construction and operation of logging roads. This occurs even when they are located along benches and ridgelines away from riparian zones. Improperly located, constructed or maintained logging roads may trigger or accelerate slope failure, erode stream channels, block fish migration and deposit sediment into streams and wetlands.

Rock and Gravel Mining

Rock mining and gravel mining historically and currently occur throughout the Canadian Rockies ecoregion. There are numerous active or abandoned mines in the region, many of which have degraded downstream aquatic and riparian ecosystems. Gravel mining destroys riparian vegetation and alters hydrology. While mining activities are a direct threat to aquatic targets, the habitat fragmentation and weed invasion that occurs along access roads impact many large-scale ecological systems. Bank sloughing has also reduced the extent of riparian vegetation along some river reaches.

The following additional habitat and species conservation problems have been identified in the Canadian Rocky Mountains ecoregion:

Wildlife species and population problems: includes disease, pathogens, competition, food scarcity, predation, overharvest, limited population size and distribution.

- Populations of grizzly bear, gray wolf, fisher, lynx, woodland caribou, common loon, bald eagle, peregrine falcon, northern leopard frog and pygmy whitefish have declined to the point that they are listed as endangered, threatened or state sensitive.
- Small population sizes and loss of genetic diversity are problems for grizzly bear, wolverine, lynx and woodland caribou, and are a concern for other species reduced to isolated populations such as the northern leopard frog.
- Illegal persecution and harvest occurs for gray wolf, grizzly bear, bald eagle and migrating and spawning fish species of concern.
- Woodland caribou appear excessively vulnerable to predation, especially by cougar.
- Bull trout are susceptible to overharvest.

Lack of biological information on species and habitats:

- Adequate information is lacking on the population status of state candidate species including Townsend's big-eared bat, wolverine, northern goshawk, golden eagle, flammulated owl, Vaux's swift, Lewis' woodpecker, black-backed woodpecker, pileated woodpecker, western toad, Columbia spotted frog, bull trout and silver-bordered fritillary.
- Information is needed on habitat associations, demography, or food habits for lynx, fisher, Lewis' woodpecker and pileated woodpecker.
- Conservation needs of northern leopard frogs are poorly understood.
- Additional distribution data are needed for pygmy nuthatch, western toad and bull trout.
- Information is needed on the causes of decline for western toads.
- Impacts of various land use practices are not understood for the Columbia spotted frog.
- Better information is needed on the amount of gene flow among bull trout populations.
- There is a shortage of adequate spatial inventory and assessment data on most habitat types.
- There is an absence of baseline data on the habitat values and functions of natural wetlands and a poor understanding of the status of resident macroinvertebrates in aquatic systems.

Habitat loss, conversion, fragmentation and degradation:

- Habitat fragmentation is a major problem. A number of transportation corridors interrupt migration passage for large mammals, and many of the intermountain valleys have been degraded or are threatened with new construction, mines and timber harvesting.
- Only 15% of eastern Washington forests are currently in the old growth age class, and nearly all of it is in high elevation national forests or national parks. Maintenance of old growth forest across the landscape is important for at least 1,000 species.

- Grassy and herbaceous balds are rare patch habitats distributed in low and high elevation forests. They often have associated rare species that are vulnerable to certain forest practices and recreation.
- Loss and fragmentation of late seral coniferous forests negatively impacts fisher, woodland caribou, northern goshawk and pileated woodpecker.
- Bald eagle, golden eagle and gray wolf suffer from prey declines linked to habitat loss, degradation and fragmentation.
- Shoreline timber harvest and development may destroy nesting, foraging or roosting sites for common loon, great blue heron and bald eagle.
- Conversion of forests for residential and commercial development may eliminate habitat for northern goshawk, Lewis' woodpecker and pygmy nuthatch.
- Catastrophic large scale fires reduce the habitat available for lynx.
- Continued loss and degradation of shallow wetlands eliminates habitat for redhead and silver-bordered fritillary.
- Reclamation of abandoned mines may destroy critical maternity roosts and hibernacula for Townsend's big-eared bats.
- Degradation of streams and rivers due to inappropriate forest management, agricultural practices and human development is harmful to bull trout.
- Suburban sprawl is a concern for resource managers as indicated by the growing number of ranchettes and residential subdivisions in previously managed forest and cropland. Development often occurs near lakes or streams and poses an increased threat of fire and impacts to water quality.

<u>Incompatible land management practices</u>:

- Fire suppression has degraded open ponderosa pine forests and other coniferous forests used by Lewis' woodpecker and black-backed woodpecker.
- Various timber cutting, snag removal and replanting practices have degraded or eliminated habitat for a variety of species including lynx, bald eagle, flammulated owl, Lewis' woodpecker, Vaux's swift, black-backed woodpecker, pileated woodpecker and pygmy nuthatch.
- Grazing has degraded open ponderosa pine forests for Lewis' woodpecker and pygmy nuthatch.
- Flammulated owls experience declining food availability after the application of forest pesticides that kill non-target moths.
- Changes in fire regime reduce the quality of nest sites and availability of food for pygmy nuthatches.
- Modern agricultural practices often reduce the quality, patch size and connectivity of wildlife habitat in farmlands.

<u>Alien and invasive plant and animal species</u>:

- Predation by introduced bullfrogs, bass and other fish negatively impacts pygmy whitefish, northern leopard frog and Columbia spotted frog.
- Introduced carp and mosquitofish degrade habitat for northern leopard frog and Columbia spotted frog.
- European starlings compete with Lewis' woodpecker for nest cavities.
- Non-native fish such as brook trout and rainbow trout may pose a threat to bull trout and westslope cutthroat through competition, hybridization and predation.
- Reed canary grass thrives in reservoirs, wetlands and stream outlets where water levels fluctuate, and directly affects habitats that support 27 Washington state-listed plant species. A number of native fish, amphibians and other wildlife species are not well adapted to spawn or reproduce in reed canary grass thickets.

Human disturbance and recreational impacts:

- Backcountry recreation such as motorized vehicles, hiking and skiing may disturb or displace grizzly bear, wolverine, lynx, woodland caribou, golden eagle and peregrine falcon.
- Recreational boating and fishing disturbs or displaces nesting or foraging birds such as common loon, great blue heron, redhead and bald eagle.
- Human disturbance and vandalism disrupt the maternity roosts and hibernacula of Townsend's big-eared bats located in caves and mines.
- Encroachment of human residential and recreational development can force golden eagles from suitable nesting sites.
- Nesting peregrine falcons are vulnerable to disturbance from human activities such as blasting and timber cutting.
- Recreational activities such as offroad recreational vehicles, horses, mountain bikes, and even hikers can create unauthorized trails that disturb soil and allow invasive plants to establish.
- The nature and timing of agricultural practices may be increasingly hazardous to wildlife. Tilling, planting and harvesting are becoming more synchronous, widespread and intense, thus potentially stressing wildlife during critical periods of nesting, rearing and dispersal.

Environmental contaminants:

- Ingestion of lead fishing sinkers by common loons and lead shot by bald eagles and golden eagles results in lead poisoning.
- Runoff of agricultural chemicals into wetlands is harmful to northern leopard frogs.
- Improper application of pesticides such as rotenone used for eliminating undesirable fish species from lakes and streams may also kill pygmy whitefish.

Incompatible transportation and energy development:

- Large highway corridors such as Highways 20 and 31 and associated development fragment suitable habitat and create barriers or impediments to movement for grizzly, gray wolf, wolverine and lynx.
- Roads may facilitate winter competition between lynx and coyotes.
- Roads placed near great blue heron rookeries may result in site abandonment.
- Roads located near breeding sites may cause highway mortality in western toads.
- Golden eagles and other raptors can be electrocuted on power lines.

Inadequate water quantity and quality:

- Altered hydrology may eliminate habitat for Columbia spotted frog and inland redband trout.
- Declining beaver populations in some areas and the subsequent loss of beaver ponds has reduced habitat for Columbia spotted frogs.
- Increased water temperature and sedimentation caused by improperly managed logging, agriculture and other activities may harm inland redband trout and pygmy whitefish.
- Dams and other passage barriers limit the movement of bull trout.

CONSERVATION ACTIONS

Conserve and recover wildlife species and populations: includes population management, protection of known populations, population augmentation and or reintroduction, control and monitoring mortality, enhancement of food sources/prey.

- Implement recovery actions for grizzly bear, gray wolf, lynx, woodland caribou and bull trout.
- Prepare recovery plans for the northern leopard frog and gray wolf.
- Complete the Washington Bat Conservation Plan.
- Develop management plans for state sensitive species such as common loon, peregrine falcon and pygmy whitefish.
- Prepare interagency management response guidelines for wolves to document sightings and address conflicts.
- Develop habitat management recommendations for the silver-bordered fritillary.
- Work with Canadian authorities to translocate woodland caribou in to the Selkirk Mountains.
- Reduce potential mortality in grizzly bears from accidental shooting by conducting programs to educate bear hunters on proper identification of black bears and grizzly bears.
- Conduct translocations of fisher and northern leopard frog into areas of appropriate habitat if indicated by recovery plans and feasibility studies.
- Increase harvest of cougars in and adjacent to recovery areas for woodland caribou if needed.
- Implement salmon recovery strategies to enhance the prey base for bald eagles.
- Establish and implement fisheries management objectives that are compatible with bull trout recovery.

Conduct research, assessment and monitoring: includes species and habitat distribution, abundance, limiting factors, suitable habitat and population trends.

- Determine the status of candidate species including Townsend’s big-eared bat, wolverine, northern goshawk, golden eagle, flammulated owl, Vaux’s swift, Lewis’ woodpecker, black-backed woodpecker, pileated woodpecker, western toad, Columbia spotted frog and silver-bordered fritillary.
- Monitor populations of grizzly bear, gray wolf, lynx and bull trout to determine whether recovery objectives are being met.
- Monitor post-downlisted populations of peregrine and bald eagles for signs of decline that could result from bioaccumulation of contaminants or other factors.
- Seek reports of incidental sightings of grizzly bear and gray wolf.
- Gather distribution and abundance data on Townsend’s big-eared bat, pygmy nuthatch, northern goshawk, western toad, northern leopard frog and Columbia spotted frog.
- Identify roost sites and hibernacula of Townsend’s big-eared bat.
- Conduct habitat selection studies at multiple spatial scales for flammulated owl, Vaux’s swift, Lewis’ woodpecker, black-backed woodpecker and Columbia spotted frog.
- Evaluate the population demography of flammulated owl and Lewis’ woodpecker.
- Track habitat availability for black-backed woodpecker using remote sensing techniques.
- Develop survey protocols to monitor the abundance of great blue herons.
- Evaluate whether existing forest management prescriptions are adequate to maintain populations of lynx and pileated woodpeckers.

- Evaluate habitat suitability and develop habitat management recommendations for northern leopard frogs.
- Determine the amount of genetic diversity and gene flow among bull trout populations. Monitor any colonizing wolves to determine establishment of packs and habitat use.
- Investigate the taxonomy of western toad using genetic techniques and other analyses.
- Assess and map important habitats and areas of high biodiversity in the ecoregion using ecoregional assessments, local habitat assessments, Interagency Vegetation Mapping Project, and other habitat inventories and plans. Update ecoregional assessments every five years.
- Develop statewide land cover and threats data layers to improve connectivity between priority conservation areas.
- Identify and assess key connectivity areas and wildlife corridors between fragmented habitats and between protected areas. Restore habitat connectivity and wildlife corridors where appropriate on both public and private lands.
- Improve understanding of the ecological processes of seeps, bogs, wet meadows, forested wetlands, marshes, springs and other wetlands, and how they are impacted by human development.
- Conduct hydrologic studies that include water quantity and chemical budgets at wetlands known to be supporting rare and endangered species. Use this information to inform wetland management.
- Inventory and prioritize riparian habitat types and attributes needing protection and conservation.
- Identify important habitats for restoration and assess the feasibility of successfully restoring these sites. Include an evaluation of current and projected land use in and adjacent to potential restoration sites.

<u>Protect, restore and connect habitats</u>:

- Protect rare habitat types such as grassy and herbaceous balds, aspen stands, snag patches, caves, cliffs and talus.
- Maintain mature and late successional coniferous forests from harvest to protect fisher, woodland caribou, northern goshawk, flammulated owl, Vaux's swift and black-backed woodpecker.
- Provide input on timber harvest and fire management activities on state, private and federal lands to perpetuate adequate amounts and distribution of denning and foraging habitats for ***lynx***.
- Maintain and restore open ponderosa pine forest to enhance populations of golden eagle, Lewis' woodpecker and pygmy nuthatch.
- Maintain and restore mature cottonwood riparian forests with large diameter snags for Lewis' woodpeckers.
- Protect and restore riparian areas for inland redband trout and bull trout.
- Protect important calving sites for woodland caribou.
- Protect important roost sites and hibernacula for Townsend's big-eared bats.

- Protect suitable breeding lakes for common loons and redheads from development and recreational pressure.
- Protect ponds, lakes, creeks and wetland margins with known populations of Columbia spotted frogs.
- Protect land near large great blue heron colonies through fee title land purchases or conservation easements.
- Work with county planners to establish reserve areas of open forests and woody riparian corridors for Lewis' woodpecker.
- Protect important areas of ungulate winter range through acquisitions, easements and agreements to provide adequate prey populations for gray wolves.
- Conserve prey populations of golden eagles by reducing deliberate control programs.
- Manage small fish populations in lakes with nesting common loon.
- Work with the Washington Department of Natural Resources to maintain and enforce Forest Practice rules protecting bald eagle roost sites and nests.
- Continue to require bald eagle habitat plans that require retention of trees.
- Prioritize conservation areas using ecoregional assessments and other biological assessments. Protect important habitat types, biodiversity areas and environmentally sensitive lands that should not be altered through a variety of techniques including acquisitions, conservation easements, life estates and cooperative agreements with willing landowners.
- Coordinate with local land trusts, conservation districts and other conservation organizations and agencies to conserve important habitat on both public and private land. Focus limited resources in regionally significant areas. Identify all possible acquisition and restoration grants and coordinate applications.
- Work with the USDA Forest Service and other public landowners to protect existing roadless areas and expand the roadless area network where justified for habitat protection and connectivity.
- Protect key connectivity areas and wildlife corridors between fragmented habitats and between protected areas through a variety of techniques including acquisitions, conservation easements, life estates and cooperative agreements with willing landowners. Use statewide land cover and threats data layers to improve connectivity between priority conservation areas.
- Restore native habitats, habitat connectivity and wildlife corridors where appropriate on both public and private lands. Consider restoring lands adjacent to existing protected areas to increase their effective size and function as wildlife habitat.
- Purchase water rights from willing sellers in unregulated tributaries; use these water rights to restore and maintain adequate year-round flows for both instream and out-of-stream riparian fish and wildlife habitat.
- Rehabilitate and restore stream channels, floodplain functions, riparian habitat and connectivity where streams have been diverted, fragmented or degraded. Use livestock exclusions, instream structures, bank modifications and other methods.
- Preserve and/or restore buffer areas in appropriate locations along tributaries and mainstem waterways to a condition that is adequate to maintain healthy, functioning riparian zones for the ecoregion's rivers.

Improve land management practices:

General

- Restore degraded ponderosa pine forests by thinning dense understory fir, encouraging longer harvest rotations, returning to natural fire regimes and maintaining snags to enhance populations of northern goshawk, flammulated owl, Lewis' woodpecker and pygmy nuthatch.

- Promote forest management practices that improve habitat connectivity and facilitate dispersal for grizzly bear, gray wolf, wolverine, lynx and woodland caribou.
- Allow wildfires to burn in some forests to create suitable habitat for black-backed woodpeckers.
- Encourage and assist landowners to exclude cattle from grazing in riparian forests to protect habitat for Lewis' woodpecker, inland redband trout and other riparian-dependent wildlife.
- Allow natural disturbances and successional functions and processes to occur on conserved wetlands.
- Work with public land management agencies to manage publicly-owned land for conservation of Species of Greatest Conservation Need and associated priority habitats.

Fire management

- Work with public agencies and private landowners to reduce the potential destructive impact of wildfires on native habitats by incorporating measures such as fire breaks and prescribed burning into wildlife and land management plans.
- Coordinate with public land managers on the use of controlled fire regimens and stand management practices. Attempt to simulate natural disturbance regimes and restore proper ecological functions. Consider impacts to local wildlife in each burn plan, including timing, size and location of the burn.

Forest practices

- Work with public and private landowners to protect remaining old growth conifer and hardwood stands to benefit late successional species and manage some stands on long rotations (>200 years).
- Work with the Forest Practices Board and both public and private forest landowners to properly design and implement current forest practices rules, including the Forests and Fish Agreement to protect fish, wildlife and habitat.
- Work with the Department of Natural Resources and the State Forest Practices Board to develop, implement and enforce forest practices regulations to enhance biological diversity on existing state and private managed and protected areas.
- Work through the Forest Practices Board and directly with forest landowners to implement forest management prescriptions, including prescribed burns, which will maintain and enhance biodiversity and natural ecosystem functions. Encourage modified silvicultural prescriptions that promote local topographic, soil and vegetative conditions. Retain snags, downed woody debris and a complement of live trees in harvested areas. Sensitive areas such as wetlands, remnant old growth and wildlife breeding sites should not be disturbed.
- Encourage the development of selective harvest policies and guidelines on both public and private forest land that will leave adequate components of old growth habitat such as snags and downed wood and some live trees as habitat for associated wildlife such as northern goshawk, Vaux's swift, flammulated owl, Lewis' woodpecker, black-backed woodpecker and pileated woodpecker.
- Work through the Forest Practices Board and public and private landowners to minimize logging roads and decommission them after the period of entry. Ensure that forest practices rules are followed by locating logging and forest access roads in stable, non-erodible areas and outside riparian management zones.
- Work to ensure that forest practices rules are followed by maintaining adequate riparian management zones along streams in all logging sites, on both public and private land.

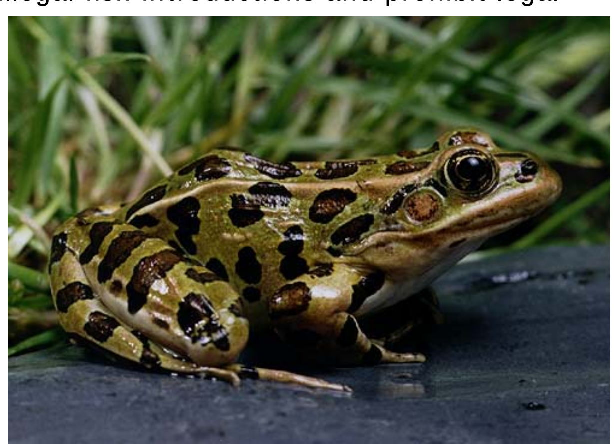
- Support implementation and enforcement of the Washington Forest Practices Act to accomplish habitat conservation and regeneration on both state and private forest lands.
- Encourage public and private forest landowners to manage forested watersheds that maintain an appropriate mix of successional stages and provide connectivity of riparian and upland vegetation as protected travel corridors for wildlife.

Grazing and agricultural practices

- Work with public, tribal and management agencies to fence or otherwise protect riparian zones from livestock grazing and unauthorized offroad vehicle use. Consider retirement rather than renewal of grazing leases on sensitive lands. Work through the Forest Practices Board and public and private landowners to minimize logging roads and decommission them after the period of entry. Ensure that forest practices rules are followed by locating logging and forest access roads in stable, non-erodible areas and outside riparian management zones.
- Work to ensure that forest practices rules are followed by maintaining adequate riparian management zones along streams in all logging sites, on both public and private land.
- Work with conservation districts, Natural Resource Conservation Service, USDA Forest Service and private landowners to implement best management practices in riparian areas and associated upland habitat in conjunction with the Conservation Reserve Program, Wetland Reserve Program and other Farm Bill Programs.
- Use the Comprehensive Resource Management Plan process for large landscapes with a mix of public and private landowners to modify grazing regimes and improve grassland understory conditions and enhance biodiversity.
- Assist private landowners in securing funding to fence riparian zones on private land. In areas where it is impractical to exclude livestock, protect habitat quality by controlling the timing and intensity of livestock grazing through regulation and landowner agreements.
- Work with private and public landowners to minimize the impacts on habitat and wildlife from modern agriculture, including agrochemical use, water use and soil erosion.

<u>Control and prevent introduction of alien and invasive species</u>:

- Develop methods to control or otherwise mitigate impacts of introduced bullfrogs and fish on ***northern leopard frog*** and Columbia spotted frog.
- Monitor lakes, streams and wetlands for illegal fish introductions and prohibit legal introductions to protect pygmy whitefish, northern leopard frog and Columbia spotted frog.
- Avoid introduction of non-native fish in fishless lakes and where species of conservation concern occur such as bull trout, westslope cutthroat trout, native amphibians and reptiles, avoid introduction of rainbow trout or only introduce sterile fish where westslope cutthroat are found. Avoid introduction of non-native trout to protect bull trout from hybridization, competition and predation.



- Determine extent of competition for cavities between Lewis' woodpeckers and European starlings, and control starlings if necessary.
- Develop a regional plan for the detection, rapid response and eradication of invasive species.
- Work with other public agencies and private agricultural organizations such as the Farm Bureau and Washington Grange to develop basic techniques for mapping and monitoring the spread of invasive plant species over time.
- Participate in federal and state agency partnerships to develop and implement weed control strategies for impacted sites and ecosystems. Promote adequate funding and coordination of weed control efforts on both public and private lands using environmentally sound methods.
- Develop educational and public information materials to increase public awareness of the ways that invasive alien species are introduced to sensitive ecosystems.
- Provide funding, incentives and technical assistance to private landowners to eliminate undesirable invasive plant species in riparian zones and to restore native plants that provide important habitat for native fish and wildlife. Use integrated pest management practices to control currently established invasive species with help from volunteers.
- Participate in federal and state agency partnerships to develop and implement weed control strategies for impacted sites and ecosystems.

Control and monitor disturbance:

- Limit disruptive types of recreational activity in roadless, wilderness and primitive areas to prevent disturbance of grizzly bear, wolverine and ***woodland caribou***.
- Limit access to roost and hibernacula sites for Townsend's big-eared bat.
- Minimize disturbance of great blue heron, bald eagle, golden eagle and peregrine falcon nests from human activities such as development, logging, boating and other recreational activity by restricting access to public lands as needed, working with permitting agencies to reduce levels of disturbance and informing the public of sensitive areas and periods.
- Eliminate vehicular access and campsites in conservation areas identified as sensitive habitats, such as montane wetlands and bogs.
- In sensitive habitats, manage both land and water access by using fencing, trails, elevated boardwalks, railings, seasonal restrictions, signage and livestock restrictions.
- Reduce the amount and impact of unauthorized recreational access and use on important wildlife habitat through better enforcement of existing laws, more fencing and posting of critical habitat areas, selective road closures and increased public education and information for recreational users and user groups.

- Protect nesting golden eagles, bald eagles, peregrine falcons and prairie falcons through use and access restrictions on public lands as needed, and work with private landowners and permitting agencies to prevent blasting or construction disturbance during nesting. Inform rock climbers of sensitive periods and locations to reduce disturbance of nesting peregrines, golden eagles and prairie falcons.

Control and prevent environmental contamination:

- Protect common loon, bald eagle and golden eagle from lead poisoning by advocating the use of nontoxic fishing sinkers and steel shot.
- Evaluate the need for contaminant studies in northern leopard frogs.
- Restrict the use of fish pesticides such as rotenone in waters with common loon and pygmy whitefish.
- Work with other agencies to reduce and remediate sources of contaminants that contribute to prey contamination for bald eagles, peregrine falcons, etc.
- Work with governmental and nonprofit agencies to develop an ecoregion-wide strategy for identified toxins and other pollutants: their sources, destinations and effects, and ways to reduce their discharge.
- Work with other agencies, industry and private landowners to encourage use of integrated pest management techniques and phase out the use of pesticides and herbicides.
- Clean up contaminated sites and sediments wherever possible and prevent further toxic contamination of areas, including unconfined spoil disposal sites.
- Reduce the use of hazardous chemicals by continuing to implement the persistent bioaccumulative toxins strategy and by using a variety of best management practices and improved treatment methods.
- Continue to place a priority on actions to prevent and respond to oil and hazardous material spills.
- Facilitate use of nontoxic alternatives to lead shot and lead fishing sinkers.

Improve transportation and energy development:

- Power lines near breeding and foraging areas should be built or modified to reduce the occurrence of golden eagle and other raptor electrocutions.
- Highway overpasses and underpasses should be constructed to facilitate access to suitable habitats for grizzly bear, gray wolf and wolverine.
- Reduce road mortality in western toads by providing road crossings near breeding sites.
- Work with the Washington Department of Transportation to locate highways way from important wildlife habitats and biodiversity areas. If impacts are unavoidable, design adequate mitigation such as underpasses, overpasses and fencing to accommodate wildlife such as western toads that need passage.

Improve water quantity and quality:

- Provide floating nest platforms for common loons at lakes with fluctuating water levels.
- Conserve beaver populations, beaver ponds and dynamic stream processes in areas with Columbia spotted frogs.
- Reduce the impacts of land use practices that increase water temperature and sedimentation, thereby harming inland redband trout and pygmy whitefish.
- Improve water quality at potential northern leopard frog recovery areas.

- Manage wetland areas on public land for both high water quality and habitat value. Ensure that the water quality of inflow does not lead to deterioration of the wetland habitat.
- Where possible, restore or rehabilitate the hydrology, water quality and native plant communities in degraded and disturbed wetlands. Methods should emphasize creating or restoring natural wetland functions such as beaver populations and dynamic stream processes to benefit species such as the northern leopard frog, Columbia spotted frog and silver-bordered fritillary.
- Manage runoff from highways according to the updated highway runoff manual. Improve the road drainage network in riparian zones by removing unnecessary culverts, increasing the size of inadequate culverts or replacing culverts with bridges.
- Reduce the harm from stormwater runoff by working to improve the effectiveness of the National Pollutant Discharge Elimination System stormwater permit programs.
- Assist local jurisdictions in finding solutions to increase landowner compliance with onsite sewage system maintenance and animal waste management practices through education and regulated inspection. Work to reduce the number and volume of combined sewer overflow events.

Improve coordination, planning, permitting and mitigation:

- Strengthen the Shoreline Management Act to protect bald eagle nesting and roosting sites.
- Provide credible scientific information on priority habitats and species and biodiversity areas, their significance, management needs and compatible land uses to decision-makers at site, local and regional scales.
- Provide technical assistance to counties in using fish and wildlife and biodiversity information to update comprehensive land use plans, community or watershed plans, Shoreline Master Plan, etc.
- Assist counties in developing and updating county ordinances and incentives that help to mitigate or control development in areas with resource and conservation values and that encourage environmentally sensitive development in growth areas.
- Work with local governments and conservation organizations to identify and protect areas of important habitat and biodiversity through existing environmental laws and other local programs.
- Encourage floodplain management and shoreline zoning protection programs.
- Develop a coordinated conservation vision and strategy for conservation of large landscapes using a structured process like The Nature Conservancy's 5-S Project Management System or the Cascade Dialogs.
- Represent WFW conservation interests on interagency recovery teams and working groups.
- Review state and federal land management plans to ensure adequate protection for priority habitats and species, biological diversity and ecosystem health.
- Develop site management plans for protected areas.
- Work with public and tribal land management agencies to protect important habitat and areas of high biodiversity from loss and fragmentation as well as degradation.
- Coordinate and integrate species recovery and management plans with land management and watershed plans using regulatory and voluntary approaches.
- Participate in Growth Management Act, shoreline Management Act, Forest Protection Act and Federal Energy Regulatory Commission permitting processes for new or expanded residential, recreational or hydropower development on private land.
- Use information from ecoregional assessments to illustrate important habitats and areas of high biodiversity. Encourage permitting agencies to designate and protect

these areas from residential and recreational development, and to require mitigation for habitat conversion and fragmentation where it occurs.

- Work closely with the USDA Forest Service and other land management agencies to prevent or mitigate potential adverse impacts to fish and wildlife habitat from proposed recreational or hydropower development on public lands.
- Work with regulatory agencies to design effective mitigation strategies for projects that result in wildlife impacts or direct conversion or fragmentation of habitat.
- Assist federal agencies in implementing the Interior Columbia Basin Ecosystem Management Strategy.

<u>Improve enforcement of laws and regulations</u>:

- Enforce existing protections for grizzly bear, gray wolf and bald eagle through vigorous investigation and prosecution.
- Enforce fishing regulations, seasons and stream closures to protect bull trout from fishing pressure.
- Maintain conservative hunting regulations for redhead.
- Enforce recreational access restrictions on public lands and aquatic areas.

<u>Improve landowner assistance</u>:

- Work with landowners to maintain sufficient foraging habitat, travel corridors and denning sites for lynx.
- Work with large and small timber companies and landowners to accomplish habitat conservation through nonregulatory approaches such as landowner incentives, conservation easements, habitat conservation plans and acquisition of critical habitat from willing landowners.
- Secure state and federal tax incentives that discourage habitat fragmentation and destruction and that encourage landowners to protect and manage their land to benefit wildlife habitat.
- Work with local government to implement the Public Benefit Rating System and encourage effective use of open space tax incentives for landowners.
- Work with private landowners to identify and protect areas with important habitats and biodiversity and protect these areas through landowner incentives and other nonregulatory programs. This would assist species such as great blue heron, northern pintail, redhead, bald eagle, flammulated owl, Vaux's swift, Lewis' woodpecker, western toad, northern leopard frog, Columbia spotted frog and ***silver-bordered fritillary.***

- Provide educational materials to private landowners that describe management techniques for maintaining and restoring various wildlife habitats.
- Work with private landowners to identify and protect important wetland habitats and buffers by providing adequate water, controlling invasive plants, reducing disturbance to nesting wildlife and fencing or otherwise keeping livestock out of wetlands and associated upland habitat.
- Influence the application of federal Farm Bill funds, including the Conservation Reserve Program and the WDFW Landowner Incentive Program, on private

agricultural lands most critical for wildlife movement and most suitable for restoration of native wetlands and grassland habitat.

- Promote grant programs to assist landowners with implementation of management plans.
- Develop, periodically update and provide WDFW Priority Habitats and Species management recommendations to assist landowners in conserving priority habitats and species.

Improve wildlife conservation education: includes outreach, volunteer and watchable wildlife programs.

- Conduct outreach and education programs to engage the public in conservation programs for many species such as gray wolf, grizzly bear, lynx and bull trout.
- Continue to support volunteer programs for monitoring common loon activity at lakes.
- Implement education programs to curtail recreational pressure on common loons and redheads at suitable breeding lakes.
- Provide educational materials to hunters to prevent accidental mortality and harassment of lynx, gray wolf, caribou and grizzly bear.
- Engage and involve local and tribal governments, state and federal agencies, organizations and citizens in efforts to protect and restore priority habitats and species through a variety of outreach projects, programs and education efforts.
- Increase the use of citizen science for the collection of data, monitoring, restoration and conservation of important habitats and associated wildlife species. Coordinate volunteer monitoring and involvement.
- Promote and maintain public information and education efforts that focus on endangered species, habitat loss, ecological function, biological diversity and environmentally-aware lifestyle practices. Emphasize the connection between habitat and environmental quality and human health and welfare.
- Expand conservation education programs for both adults and children to emphasize the critical nature and vulnerability of sensitive habitats such as wetlands, oak and grassland habitats and associated wildlife.
- Connect with user groups through education to make them part of the conservation solution in areas that have high recreation values.
- Work with large corporations to increase awareness and develop financial support for conservation of biodiversity.

Gray wolves.

BLUE MOUNTAINS ECOREGION

PHYSIOGRAPHY AND FISH AND WILDLIFE DIVERSITY

Geography

The Blue Mountains ecoregion extends from adjacent Idaho and Oregon into the southeast corner of Washington. It includes the Grande Ronde and Snake River canyons northward to just south of Clarkston. Approximately one percent of Washington is within this ecoregion. This overall area has experienced relatively low human impact; agricultural and urban development has concentrated along the Grande Ronde River.

Geology

The Blue Mountains were formed by the uplifting of Columbia River basalt flows. The Grande Ronde and Snake Rivers incised deep canyons to form the dramatic topography that characterizes the ecoregion today. Typical elevation ranges from 2,000 to 4,000 feet, with the highest peak, Mt. Misery, at 6,387 feet and the lowest elevation at 750 feet along the Snake River. Windblown silts and volcanic ash cover most of the plateaus, providing a rich soil base.

Climate

Annual precipitation ranges from less than 10 inches in the canyon of the Grande Ronde River to more than 50 inches 25 miles to the west in the Wenaha-Tucannon Wilderness Area. Most of the ecoregion is within a 14- to 24-inch precipitation zone. Much of the precipitation appears as snow, although fall and spring rains are common, often creating flood events.

Habitat and Plant Associations

The Blue Mountains ecoregion is relatively intact, dominated by natural or semi-natural vegetation. A majority of the region is covered by coniferous forest, but because of its abrupt topography and wide elevation ranges, it also supports native grasslands and shrublands along low, dry canyons, on broad plateaus and in subalpine meadows. Douglas-fir/ponderosa pine forests are found at low and middle elevations, with subalpine fir/Engelmann spruce occurring at higher elevations. Western larch, lodgepole pine and western white pine comprise mesic forests. The Blue Mountains and Snake River canyon together host a number of endemic snail species. Canyon grassland vegetation occurs on the steep slopes above the Grande Ronde and Snake Rivers and is interlaced with plateau grasslands. Dense shrublands populate the higher canyons along the Oregon-Washington border. Numerous springs are scattered throughout the ecoregion, and alpine lakes are clustered at some of the high elevations.

Fish and Wildlife Diversity

An estimated 246 wildlife species reside in the Washington portion of the Blue Mountains. Of these, 84 are closely associated with wetland habitat. Nine species are listed under the federal Endangered Species Act and 43 are listed by Washington as threatened, endangered or candidate species. Large mammals common in the Blue Mountains include Rocky Mountain elk, mule deer, black bear, cougar, bobcat and coyote. Several furbearers are common, including beaver, marten and raccoon. Golden eagles, owls and a wide assortment of songbirds and raptors inhabit cliffs and talus slopes. Cavity nesters such as woodpeckers, nuthatches, chickadees and bluebirds are distributed throughout the ecoregion. Anadromous fish include chinook and coho salmon and steelhead, but local populations are at diminished levels and many have been added to federal or state threatened or endangered species lists.

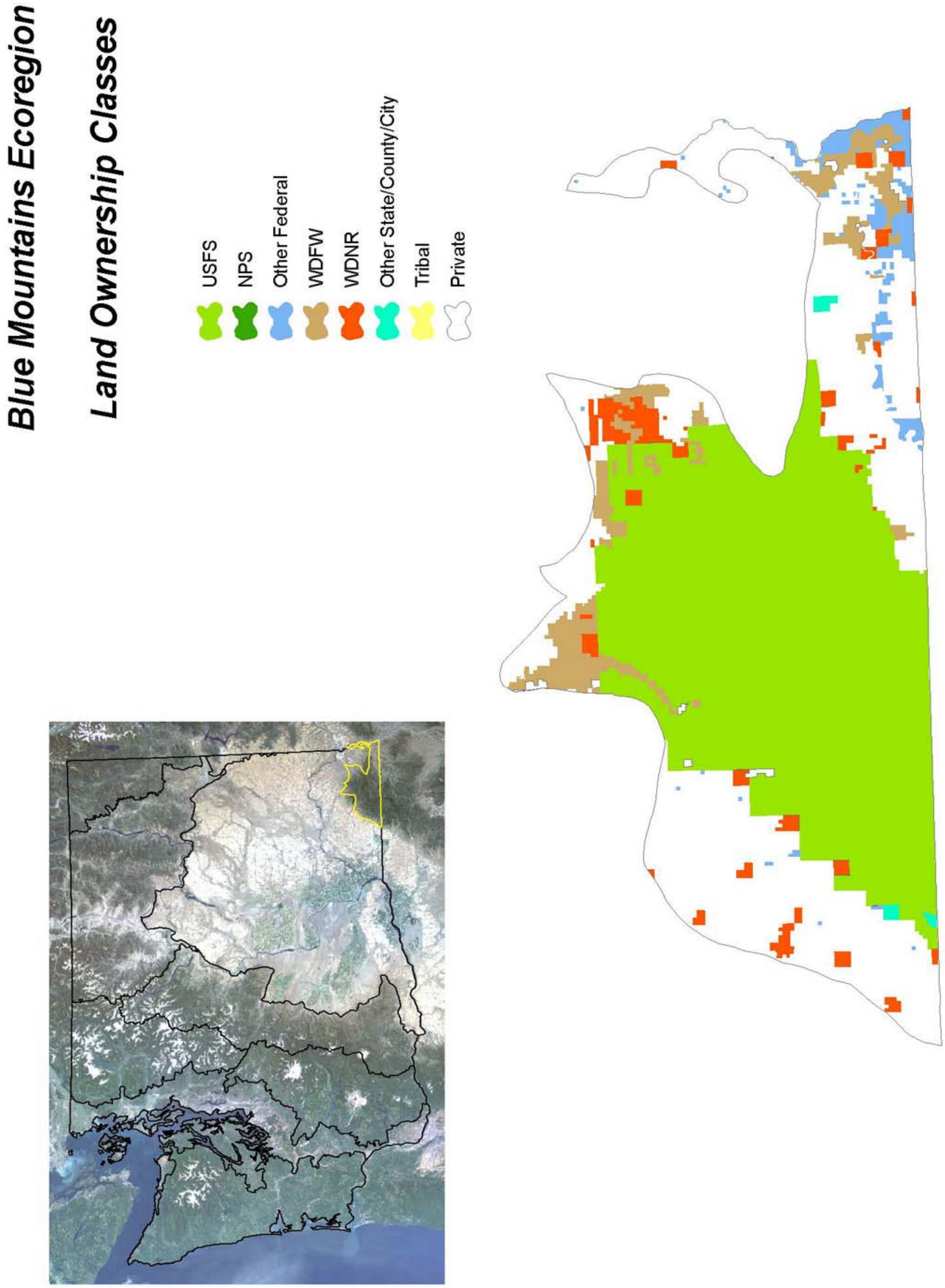
LAND OWNERSHIP

Most of the Blue Mountains ecoregion is held and managed by federal and state agencies. The Umatilla National Forest covers over half (52%) of Washington's portion of the ecoregion, while land managed by the Bureau of Land Management makes up about nine percent. The Washington Department of Fish and Wildlife manages about 32,895 acres in the foothills and canyons of the Blue Mountains, including the William T. Wooten, Asotin, and Chief Joseph Wildlife Areas.

Thirty-four percent of the ecoregion is private land. Aside from a few mining claims in the mountains, private land holdings are concentrated in the river valley bottoms, which contain the best soils and access to water. The only large industrial landowners are timber companies.

Recently, major changes have occurred in the composition of the rural population and land uses in the Blue Mountains. The region is being discovered as more and more town and city residents are seeking rural home sites. Some agricultural lands with easily eroded soils have been temporarily removed from crop production under the federal Conservation Reserve Program. Figure 32 maps land ownership classes in the Blue Mountains ecoregion.

Figure 32.


Blue Mountains Ecoregion
Land Ownership Classes
USFS
NPS
Other Federal
WDFW
WDNR
Other State/County/City
Tribal
Private

ECOREGIONAL CONSERVATION PARTNERSHIPS

Effective conservation of fish, wildlife and biodiversity in Washington requires close coordination and cooperation with many public and private conservation partners. Some major partners in the Blue Mountains ecoregion include:

- Asotin, Garfield and Columbia Counties
- U.S. Bureau of Land Management
- USDA Forest Service (Umatilla National Forest)
- Washington Department of Natural Resources (WDNR)
- Washington State Parks and Recreation Commission

The Washington Department of Fish and Wildlife also works closely on conservation projects with private conservation partners such as The Nature Conservancy, Trust for Public Land, Rocky Mountain Elk Foundation, Audubon Washington, Ducks Unlimited and a growing number of fisheries enhancement groups and local land trusts.

<u>Major Plans and Assessments</u>

A number of ongoing or completed planning efforts involving WDFW and its public and private partners guide the conservation and management of fish and wildlife resources statewide and in the Blue Mountains ecoregion. Important planning efforts affecting conservation in the Blue Mountains ecoregion include:

- Asotin, Tucannon, Walla Walla and Grande Ronde Subbasin Plans (2004)
- Blue Mountains Ecoregional Assessment
- Interior Columbia Basin Ecosystem Management Project
- Intermountain West Joint Venture Coordinated Bird Conservation Plan (2005)
- Land and Resource Management Plan (Umatilla National Forest)
- USFWS Draft Bull Trout Columbia River DPS Recovery Plan (2004)
- Washington Forest Practices Board Wildlife Strategy (in progress)
- Washington Forests and Fish Agreement (1999)
- WDFW Bald Eagle Status Report (2001)
- WDFW Bull Trout and Dolly Varden Management Plan (2000)
- WDFW Draft Blue Mountain Regional Wildlife Area Management Plan
- WDFW Game Management Plan (2003)
- WDFW Margined Sculpin Status Report (1998)
- WDFW Outline for Salmon Recovery Plans (2003)
- WDFW Peregrine Falcon Status Report (2002)

Supporting references to these and other important statewide planning documents are included at the end of this chapter and/or in Appendices 6 and 7.

SPECIES AND HABITATS OF GREATEST CONSERVATION NEED

This section provides a short summary of priority species and associated habitats for the Washington portion of the Blue Mountains ecoregion.

Species of Greatest Conservation Need

The following species list for the Blue Mountains ecoregion is a regional subset of the statewide Species of Greatest Conservation Need (SGCN) list shown in Appendices 1 and 2. The process and criteria used to develop the statewide SGCN list are provided in Volume Two: Approach and Methods, as well as in Appendix 3. Species listed below are found in the Blue Mountains ecoregion for all or part of their lifecycle. Supporting tables and information for these species and habitats can be found in Chapter IV and in Appendices 1, 2, 8, 9, 10 and 14.

	Population Size/Status						Population Trend					
COMMON NAME	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown	State Status*	WNHP**
Mammals												
Preble's shrew	?		?			x				x	N	S1
Merriam's shrew			x							x	C	S3
Townsend's big-eared bat			x							x	C	S3
Gray wolf	?									x	E	S1
American badger			x				x				G	S4
Birds												
American white pelican			x						x		E	S1
Great blue heron			x							x	M	S4
Bald eagle				x					x		T	S4
Northern goshawk			x							x	C	S3
Golden eagle			x							x	C	S3
Peregrine falcon			x						x		S	S2
Prairie falcon			x							x	M	S3
Mountain quail			x							x	G	S1
Flammulated owl			x							x	C	S3
Burrowing owl			x				x				C	S2
Great gray owl			x							x	M	S2
Vaux's swift			x				x				C	S3
Lewis' woodpecker			x				x				C	S3
White-headed woodpecker			x				x				C	S2
Black-backed woodpecker			x							x	C	S3

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP**
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
Pileated woodpecker				x						x	C	S4
Pygmy nuthatch			x							x	N	S3
Reptiles												
Pygmy horned lizard				x						x	N	S3
Sagebrush lizard			x				x				C	S2
Amphibians												
Rocky Mountain tailed frog				x			x				C	G4
Western toad				x			x				C	S3
Columbia spotted frog			x							x	C	S4
Fish												
River lamprey						x				x	C	S2
Pacific lamprey						x				x	N	S3
Margined sculpin				x						x	S	S1
Westslope cutthroat				x				x			G	G4
Snake River steelhead											C	G5
Inland redband trout						x				x	G	G5
Bull trout						x				x	C	G3
Leopard dace						x				x	C	S2
Mountain sucker						x				x	C	S2
Invertebrates												
Columbia River tiger beetle	?									x	C	S1
Mann's mollusk-eating ground beetle			x				x				C	
Shepard's parnassian (butterfly)			x							x	C	S1
Juniper hairstreak (butterfly)						x				x	C	S2
Winged floater (bivalve)			x				x				N	G3
Oregon floater (bivalve)			x				x				N	S3
Western ridged mussel			x				x				N	S2
Western pearlshell				x			x				N	S4

* Status Codes	** WNHP Codes (S = state, G = global)
E = endangered	1 = critically imperiled
T = threatened	2 = imperiled
S = sensitive	3 = vulnerable to extirpation or extinction
C = candidate	4 = apparently secure
M = monitor	5 = demonstrably widespread, abundant and secure

Species Conservation in the Blue Mountains Ecoregion

Species of Greatest Conservation Need (SGCN) found in the Blue Mountains ecoregion (see table above) include those classified by WDFW as Endangered, Threatened, Candidate or Monitor species, as well as species identified by WDFW as needing additional research or funding attention. Conservation actions are recommended for these SGCN species at both the statewide and ecoregional levels. These recommended conservation actions are summarized in a series of matrices included in Chapter IV and as Appendices 9 and 10. These matrices also display the life history, population status and distribution of these species.

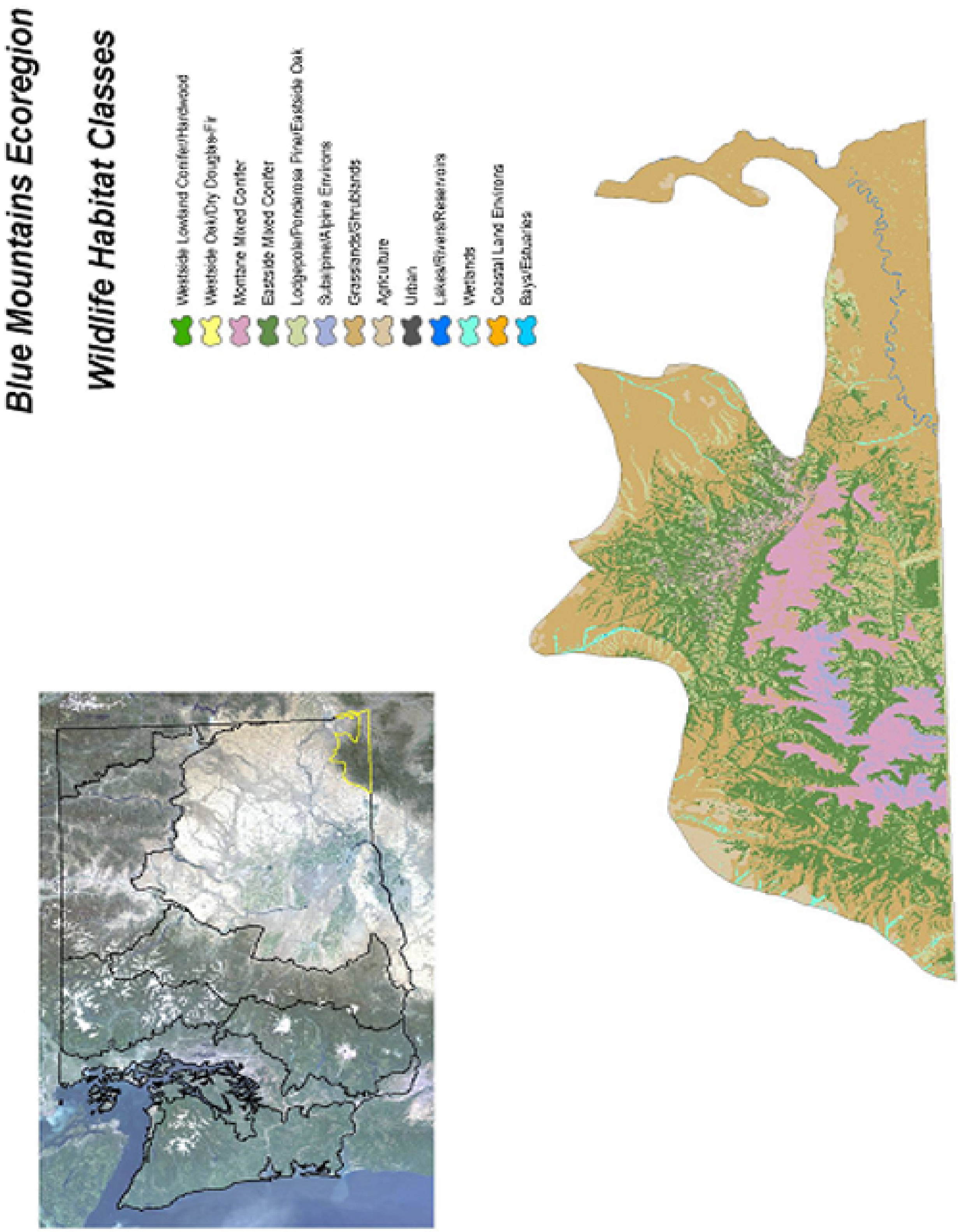
Ecoregional Habitat Overview

Dramatic changes in wildlife habitat have occurred throughout the Blue Mountains ecoregion since pre-European settlement. The most significant habitat changes include the loss of some herbaceous wetlands, ponderosa pine habitat, and Eastside (Interior) grassland habitat. Significant changes have occurred in other habitat types as well. Mixed conifer forest habitats have increased considerably over the past 150 years due to logging, wildfires, fire suppression and forest management practices, which have promoted early-succession forest conditions that favor mixed conifer forest types over ponderosa pine forests. Figure 33 maps wildlife habitat classes in the Blue Mountains ecoregion.

The following major habitat types classified, coded and described in Wildlife and Habitat Relationships in Oregon and Washington (WHROW), are present in the Blue Mountains Ecoregion. In the next section, descriptions are provided for priority habitats associated with Species of Greatest Conservation Need found in this ecoregion.

- Montane Mixed Conifer Forest
- Eastside (Interior) Mixed Conifer Forest
- Lodgepole Pine Forest and Woodlands
- Ponderosa Pine Forest and Woodlands
- Subalpine Parkland
- Eastside (Interior) Canyon Shrublands
- Eastside (Interior) Grasslands
- Shrub-steppe
- Agriculture, Pasture and Mixed Environs
- Open Water: Lakes, Rivers and Streams
- Montane Coniferous Wetlands
- Eastside (Interior) Riparian-Wetlands

Figure 33.


Blue Mountains Ecoregion
Wildlife Habitat Classes
Westside Lowland Conifer/Hardwood
Westside Oak/Dry Douglas-Fir
Montane Mixed Conifer
Eastside Mixed Conifer
Lodgepole/Ponderosa Pine/Eastside Oak
Subalpine/Alpine Environs
Grasslands/Shrublands
Agriculture
Urban
Lakes/Rivers/Reservoirs
Wetlands
Coastal Land Environs
Bays/Estuaries

Priority Habitats in the Blue Mountains Ecoregion

The following three habitat types have been identified as the highest priority for current conservation action in the Blue Mountains ecoregion. Selection of these habitats as a priority was determined by their importance to regional Species of Greatest Conservation Need, as well as priorities outlined in the Blue Mountains Ecoregional Assessment and the subbasin plans listed in the "Major Plans" section above. More discussion on the selection of priority habitats is included in Chapter III, Statewide Overview and in Volume Two, Approach and Methods.

- Ponderosa Pine Forest and Woodlands
- Eastside (Interior) Grasslands
- Eastside (Interior) Riparian-Wetlands

Ponderosa Pine Forest and Woodlands

Ponderosa pine habitat supports the highest number of vertebrate wildlife species when compared with other Eastside forest habitats. In the Blue Mountains, ponderosa pine forms climax stands that border native grasslands; it is also a common component of many other forested communities. Ponderosa pine is a drought tolerant tree that usually occupies the transition zone between grassland and forest. Mature stands are characteristically warm and dry, and occupy lower elevations throughout their range. Understory components in mature stands typically include grasses such as bluebunch wheatgrass and Idaho fescue, and shrubs such as common snowberry.

The major defining structural feature of this habitat is open canopy forest or a patchy mix of open forest, closed forest and meadows. On flat terrain, trees may be evenly spaced. On hilly terrain, the more common pattern is a mix of dry meadows and hillsides, tree clumps, closed forest in sheltered canyons and north-facing slopes, shrub patches, open forest with an understory of grass and open forest with an understory of shrubs. Without fire suppression, the common belief is that the forest would be less heterogeneous and more savanna-like with larger, more widely spaced trees and fewer shrubs.

Selected Species Closely Associated with Ponderosa Pine Forest and Woodlands in the Blue Mountains Ecoregion

Flammulated owl
Great gray owl
White-headed woodpecker
Northern goshawk
Pygmy nuthatch

Eastside (Interior) Grasslands

The Palouse region was once a continuous native prairie dominated by mid-length perennial grasses. Today, little more than one percent of these native grasslands remain. It is one of the most endangered ecosystems in the United States. Most of the Palouse occurs in the Columbia Plateau ecoregion; however, parts of it extend into the Blue Mountains ecoregion.

In this ecoregion, the Blue Mountain steppe vegetation zone occurs only in Asotin County; however, native grasslands have been replaced throughout most of the ecoregion by agricultural crops or severely altered by introduction of, and subsequent competition from, introduced weeds such as cheatgrass, knapweed and yellow starthistle. Overgrazing also results in the replacement of native vegetation with native species, especially cheatgrass and yellow starthistle. Currently, native perennial bunchgrass-shrub communities are found only on a few “eyebrows” on steep slopes surrounded by wheat fields, or in non-farmed canyon slopes and bottoms within agricultural areas. The vast majority of the ecoregion’s grassland habitat is either not protected or is afforded only low-protection status.

Selected Species Closely Associated with
Eastside (Interior) Grasslands
in the Blue Mountains Ecoregion

American badger	Merriam’s shrew
Burrowing owl	Prairie falcon

Eastside (Interior) Riparian-Wetlands

Riparian habitat covers a relatively small area in the Blue Mountains ecoregion; yet it supports a higher diversity and abundance of fish and wildlife than any other habitat, provides important fish and wildlife breeding habitat, seasonal ranges and movement corridors; is highly vulnerable to alteration; and has important social values, including water purification, flood control, recreation and aesthetics.

Riparian and wetland habitats dominated by woody plants are characteristic of the Blue Mountains ecoregion. Mountain alder-willow riparian shrublands are major habitats in the forested zones. Lowland willow and other riparian shrublands occur at low to middle elevations. Quaking aspen wetlands and riparian habitats are widespread, but rarely a major component of the Blue Mountains landscape. Riparian-wetlands structure includes shrublands, woodlands and forest communities. A typical riparian habitat would be a mosaic of forest, woodland and shrubland patches along a stream course. These woody riparian habitats have undergrowth of low shrubs or dense patches of grasses, sedges or forbs. Tall shrub communities can be interspersed with sedge meadows or moist native grasslands. Intermittently flooded riparian habitat has groundcover composed of steppe grasses and forbs. Rocks and boulders are sometimes prominent.

Selected Species Closely Associated with
Eastside (Interior) Riparian-Wetlands
in the Blue Mountains Ecoregion

Western toad	Rocky Mountain tailed frog
Columbia spotted frog	Columbia River tiger beetle
Mann’s mollusk-eating ground beetle	
Shepard’s parnassian butterfly	

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CONSERVATION PROBLEMS

A number of human activities pose potential threats to the integrity of wildlife habitat. These activities include incompatible forest and grazing practices, conversion of habitat to agriculture, urbanization, dispersed residential development, pollution, overfishing and overhunting, water extraction, incompatible mining, hydropower and energy developments and transportation systems. These developments disturb and displace wildlife, disrupt migration corridors, and encourage the establishment of invasive plant and animal species.

Wetlands and riparian areas are impacted from logging, agriculture and residential development that affect shorelines, water quality, water quantity and overall habitat continuity and complexity. This leads to increased erosion, which in turn increases sedimentation. Improperly managed livestock grazing compacts soil, contributes to stream bank destabilization, affects compositions of riparian plant communities, and slows recovery of damaged riparian habitat. This loss of riparian vegetation results in greater summer heating and winter cooling of stream temperature, soil instability, reductions in water quantity and quality, and changes in bank, channel and instream structure. All of these habitat changes affect the distribution and abundance of aquatic species.

Forest Practices

Forest practices have had significant impacts on the forests of the Blue Mountains ecoregion. Past forest management practices and related land uses have disrupted or distorted many natural ecosystem functions, which in turn have affected the value and functions of these forested habitats as wildlife habitat. The future condition and value of the ecoregion's terrestrial and aquatic habitats will depend to a large degree on how intensively they are managed for timber and other uses in the future. Coordinated site-specific alterations will mostly likely yield the best results for wildlife. In any case, the issue of forest health will continue to be central to forest conservation in the ecoregion.

Fire Suppression

Fire suppression in the ecoregion's forest habitats has resulted in the degradation of late seral ponderosa pine forest communities and, in some instances, wildlife species diversity by allowing the spread of shade-tolerant species such as Douglas-fir and grand fir and an increase in density of pines. Prior to fire suppression, wildfires kept shade-tolerant species from encroaching on established forest communities. The lack of fire within forest ecosystems has resulted in reduced habitat availability, quantity and utilization for wildlife species dependent on open ponderosa pine habitat.

Agricultural Development

Agricultural development has altered or destroyed most of the native interior grassland habitat in the lowlands. Agriculture in the ecoregion includes dry land wheat farms, irrigated agricultural row crop production and irrigated agriculture associated with livestock production (alfalfa and hay). Many wetlands have been drained for agriculture; currently, most of the region's remaining wetlands are found at higher elevations. These seasonal wet meadows provide important habitat for migrating and breeding birds. Almost all of the largest remaining blocks of these wetlands are located on private lands.

Grazing Practices

Livestock grazing (especially sheep) began in the late 1800's and rapidly expanded to a high intensity, where it remained for many decades. This led to a number of important ecological changes. Grazing pressure led to fundamental changes in natural plant community composition – so much in some areas that it allowed for alien species such as cheatgrass to rapidly invade, altering fire disturbance frequency and intensity and causing further damage to native species. There has been some rangeland recovery over recent decades, but many scars still remain. Livestock currently graze much of the remaining interior grassland habitat. Drier steppe habitats were either inter-seeded with or converted to intermediate wheatgrass or crested wheatgrass, further reducing the quality and amount of native habitat.

Invasive Alien Plant and Animal Species

Invasive plant and animal species are introduced in a number of ways, including hitchhiking on horses, boats, cars and trucks, being imported in aquaculture and horticultural products, accidental releases from research institutions and laboratories, and the pet/aquarium trade. Invasive plants displace native vegetation, resulting in the loss of habitat diversity and function. They can severely impact native plant and animal communities, and exotic grasses and shrubs can add significantly to the fire fuel load, resulting in hotter wildfires that increase damage to native vegetation. The number and abundance of introduced species in an ecoregion is an indicator of declining ecosystem health.

The following additional habitat and species conservation problems have been identified in the Blue Mountains ecoregion:

Wildlife species and population problems: includes disease, pathogens, competition, food scarcity, predation, overharvest, limited population size and distribution.

- Populations of gray wolf and American white pelican have declined to the point where they are listed as endangered. Mountain quail populations have declined significantly from historic levels.
- Recovery plans are needed to guide conservation actions for threatened or endangered species, including American white pelican and gray wolf.
- Wolves are expected to recolonize forested parts of Washington, and interagency management response guidelines are needed.
- Small population sizes and loss of genetic diversity may be a concern in species that appear to be reduced to isolated populations, including mountain quail, sagebrush lizard, margined sculpin, winged floater and Oregon floater.
- Management plans are needed for the margined sculpin and peregrine falcon, state sensitive species, to ensure that they do not become threatened or endangered.
- The populations of species that are important prey of golden eagles have declined and may impact productivity of the predator population.
- Killing or persecution is a problem for many species, including: shooting gray wolves and American white pelicans, killing bald eagles for the black market in eagle parts, poisoning ground squirrels, and shooting American badgers.
- Declines of burrowing mammals have reduced availability of burrows for nesting by burrowing owls.
- Isolated populations of Mann's mollusk-eating ground beetle are at risk of extinction.

Lack of biological information in species and habitats:

- There is a shortage of adequate spatial inventory and assessment data on most habitat types.
- Data are needed on the population trends of the American white pelican, bald eagle, and gray wolf as they recolonize former range, and for the state sensitive species, margined sculpin and peregrine falcon.
- There is a lack of information on the status of populations of state candidate species in the ecoregion, including: Townsend's big-eared bat, northern goshawk, golden eagle, flammulated owl, burrowing owl, Vaux's swift, pileated woodpecker, white-headed woodpecker, black-backed woodpecker, Lewis' woodpecker, sagebrush lizard, western toad, Rocky Mountain tailed frog, Columbia spotted frog, leopard dace, river lamprey, mountain sucker, Columbia River tiger beetle, Mann's mollusk-eating ground beetle, Shepard's parnassian, and juniper hairstreak.
- There is insufficient baseline data on the habitat values and functions of natural wetlands, including the status of resident macroinvertebrates.
- There is inadequate spatial inventory and assessment of riparian habitats as well as a lack of survey data on Neotropical migrant birds and other riparian-dependent wildlife.
- Additional information is needed on the current distribution and abundance of Preble's shrew, American badger, pygmy nuthatch, mountain quail, pygmy horned lizard, Pacific lamprey, winged floater, Oregon floater, western ridged mussel, and western pearlshell.
- Data are needed on genetic diversity and gene flow in bull trout populations.

Habitat loss, conversion, fragmentation and degradation:

- Loss, fragmentation and degradation of native grassland habitat are the likely causes of declines in many species, including Townsend's big-eared bat, American badger, golden eagle, prairie falcon, burrowing owl, and pygmy horned lizard.
- Mountain quail habitat has been degraded by overgrazing, herbicides and development.
- Permanent losses of riparian wetland habitats are occurring due to rural residential growth, suburban sprawl, ranchettes, subdivisions, subdivided cropland and floodplain encroachment.
- Grassy and herbaceous balds are rare patch habitats distributed in low and high elevation forests. They often have associated rare species that are vulnerable to certain forest practices and recreation.
- Loss of juniper to development and nectar plant destruction from land management practices affects the juniper hairstreak.
- Closing off abandoned mines excludes Townsend's big-eared bat from roosting and maternity sites.
- Wetland drainage, altered hydrology or succession of wetlands may eliminate habitat of the Columbia spotted frog.

Incompatible land management practices:

- Logging and fire suppression have created overly dense stands at risk of crown fires and have reduced the quantity and degraded the quality of mature ponderosa pine habitat of Lewis' woodpecker, pygmy nuthatch, flammulated owl and other species.
- The loss and degradation of mature forests that provide abundant and reliable seed sources, snags and nest cavities have affected all woodpeckers and secondary cavity nesters, including black-backed woodpecker, pileated woodpecker, Lewis'

woodpecker, white-headed woodpecker, pygmy nuthatch, flammulated owl, great gray owl and Vaux's swift.

- Fire suppression, grazing and selective timber harvesting have degraded open ponderosa pine forests. Cottonwood forests are also in decline.
- Improper grazing, herbicide application and other land management practices have degraded mountain quail habitat and Mann's mollusk-eating ground beetle habitat, and can affect butterflies, including the juniper hairstreak and Shepard's parnassian, by reducing the availability of nectar plants.
- Logging, agriculture, road building, or other activities that elevate temperature may alter hydrology and increased sedimentation may degrade habitat of margined sculpin, inland redband trout, Rocky Mountain tailed frog, Columbia spotted frog, bull trout, mountain sucker, leopard dace, westslope cutthroat, winged floater and Oregon floater.
- Degradation of native grasslands from cheatgrass and invasive weeds, or inappropriate use of grazing or herbicides, affects sagebrush lizard and many other grassland-dependent species.
- Mountain quail habitat has been degraded by past inappropriate use of grazing and herbicides.

Alien and invasive plant and animal species:

- Non-native species pose a threat to native species through competition, hybridization and predation. Examples include invasive plants that have reduced the habitat for Shepard's parnassian butterfly, non-native trout that hybridize and compete with native westslope cutthroat and bull trout, and non-native bullfrogs and/or introduced predatory fish that prey on Columbia spotted frogs.
- Noxious weeds such as yellow starthistle, spotted and diffuse knapweed, rush skeleton weed, leafy spurge and introduced annual grasses are pervasive and have taken over thousands of acres of grassland wildlife habitat within the ecoregion.
- Annual grasses such as cheatgrass, bulbous blue grass, medusahead and others have become naturalized throughout the ecoregion and have either completely displaced or compete heavily with native grasses and forbs in most areas.
- Reed canary grass thrives in reservoirs, wetlands and stream outlets where water levels fluctuate, and directly affects habitats that support 27 Washington state-listed plant species. A number of native fish, amphibians and other wildlife species are not well adapted to spawn or reproduce in reed canary grass thickets.

Human disturbance and recreational impacts:

- Human disturbance is a significant problem at certain nest sites of bald eagle, golden eagle, peregrine falcon and prairie falcon, and at breeding, maternity roosts or hibernacula of Townsend's big-eared bat.
- Offroad recreational vehicle use may damage vegetation, cause erosion, promote invasive plants, and disturb nesting and migrating wildlife.

Environmental contaminants:

- Bald eagles and golden eagles are occasionally poisoned after eating dead or injured waterfowl or other game animals that contain lead shot or bullets.
- Bald eagles, peregrine falcons and prairie falcons concentrate persistent chemicals (DDE, PCBs) that can cause eggshell thinning, making them vulnerable to any persistent toxic chemical.
- Agricultural chemicals potentially impact the Columbia spotted frog.

Incompatible transportation and energy development:

- Some electrocution of raptors still occurs, even though electric transmission towers are being modified.
- Dams cause passage problems for fish, including bull trout, river lamprey and Pacific lamprey, and have inundated free-flowing stream habitat of the Columbia River tiger beetle, winged floater and Oregon floater.
- Western toads may suffer roadkill mortality when moving to and from breeding sites.
- Railroad tracks along the Lower Snake River contribute to direct wildlife mortality, loss and alteration of habitat from fires, and indirect losses of wildlife and habitat from rock riprap along reservoirs.
- Wind energy projects may cause mortality to many species of birds and bats.

Inadequate water quantity and quality:

- Logging, road building, agriculture or other activities that elevate temperature, alter hydrology, water levels or increase sedimentation may degrade habitat for several aquatic species, including the Columbia spotted frog, Rocky Mountain tailed frog, inland redband trout, margined sculpin, Columbia River tiger beetle, winged floater and Oregon floater. The loss of beaver and beaver ponds may be important as well.
- The increasing number of human dwellings adjacent to waterways may impact water quality due to the increased dispersion of nutrient sources.

Inadequate enforcement and/or mitigation:

- Illegal harvest and harassment of migrating and spawning fish species is occurring in many rivers and tributaries.

CONSERVATION ACTIONS

Conserve and recover wildlife species and populations: includes population management, protection of known populations, population augmentation and or reintroduction, control and monitoring mortality, enhancement of food sources/prey.

- Develop recovery plans for the American white pelican and the gray wolf.
- Prepare interagency management response guidelines for wolves to document sightings and address conflicts.
- Implement recovery actions for the bull trout.
- Complete the Washington Bat Conservation Plan.
- Develop management plans for the state sensitive species, peregrine falcon and margined sculpin.
- Conduct translocations of mountain quail into suitable former habitat.
- Assess other species for possible addition to the state candidate list.

Conduct research, assessment and monitoring: includes species and habitat distribution, abundance, limiting factors, suitable habitat and population trends.

- Monitor any colonizing wolves to determine pack establishment and habitat use.
- Monitor population trends of American pelican, gray wolf and bull trout to determine whether recovery objectives are being met.
- Determine the status of candidate species including Preble's shrew, Townsend's big-eared bat, northern goshawk, golden eagle, flammulated owl, burrowing owl, Vaux's swift, white-headed woodpecker, black-backed woodpecker, Lewis' woodpecker, sagebrush lizard, western toad, Rocky Mountain tailed frog, Columbia spotted frog, bull trout, leopard dace, river lamprey mountain sucker, Columbia River tiger beetle, Mann's mollusk-eating ground beetle, Shepard's parnassian and juniper hairstreak.
- Conduct periodic surveys of sensitive species including margined sculpin and peregrine falcon.
- Conduct post-downlisting surveys and monitor peregrine and bald eagle populations for signs of decline that could result from bioaccumulation of contaminants.
- Assess and map important habitats and areas of high biodiversity in the ecoregion using ecoregional assessments, local habitat assessments, Interagency Vegetation Mapping Project, and other habitat inventories and plans. Update ecoregional assessments every five years.
- Develop statewide land cover and threats data layers to improve connectivity between priority conservation areas.
- Identify and assess environmentally sensitive lands and key wildlife connectivity areas and corridors between fragmented habitats and protected areas.
- Improve understanding of the ecological processes of seeps, bogs, wet meadows, forested wetlands, marshes, springs and other wetlands, and how they are impacted by human development.
- Conduct hydrologic studies that include water quantity and chemical budgets at wetlands known to be supporting rare and endangered species. Use this information to inform wetland management.
- Inventory and prioritize riparian habitat types and attributes needing protection and conservation.
- Identify important habitats for restoration and assess the feasibility of successfully restoring these sites. Include an evaluation of current and projected land use in and adjacent to potential restoration sites.

- Develop effective survey techniques and determine the abundance and distribution of American badger, pygmy nuthatch, pygmy horned lizard, winged floater, Oregon floater, western ridged mussel, western pearlshell and Pacific lamprey.
- Identify essential habitat, limiting factors and dispersal for mountain quail.
- Research habitat needs, limiting factors, environmental stressors, predation and trophic relationships for lamprey; develop methods to differentiate between species of lamprey.
- Refine and verify element occurrences and distribution data for rare communities such as native grasslands, modeled riparian communities and neotropical birds.
- Investigate the genetic diversity and gene flow in bull trout populations.

<u>Protect, restore and connect habitats</u>:

- Use ecoregional assessments and other biological assessments to prioritize conservation areas. Protect important habitat types, biodiversity areas, and environmentally sensitive lands that should not be altered through a variety of techniques including acquisitions, conservation easements, life estates and cooperative agreements with willing landowners.
- Coordinate with local land trusts, conservation districts and other conservation organizations and agencies to conserve important habitat on both public and private land. Focus limited resources in regionally significant areas. Identify all possible acquisition and restoration grants and coordinate applications.
- Work with the Forest Service and other public landowners to protect existing roadless areas and expand the roadless area network where justified for habitat protection and connectivity.
- Protect rare habitat types such as grassy and herbaceous balds, juniper savannahs, aspen stands, snag patches, caves, cliffs and talus.
- Protect key connectivity areas and wildlife corridors between fragmented habitats and between protected areas through a variety of techniques including acquisitions, conservation easements, life estates and cooperative agreements with willing landowners. Use statewide land cover and threats data layers to improve connectivity between priority conservation areas.
- Restore native habitats, habitat connectivity and wildlife corridors where appropriate on both public and private lands. Consider restoring lands adjacent to existing protected areas to increase their effective size and function as wildlife habitat.
- Purchase water rights from willing sellers in unregulated tributaries; use these water rights to restore and maintain adequate year-round flows for both instream and out-of-stream riparian fish and wildlife habitat.
- Rehabilitate and restore stream channels, floodplain functions, riparian habitat and connectivity where streams have been diverted, fragmented or degraded. Use livestock exclusions, instream structures, bank modifications and other methods.
- Preserve and/or restore buffer areas in appropriate locations along tributaries and mainstem waterways to a condition that is adequate to maintain healthy, functioning riparian zones for the ecoregion's rivers.
- Consider protection and restoration of lands adjacent to existing protected areas to increase their effective size and function as wildlife habitat.
- Identify and protect essential habitat for candidate species including Preble's shrew, Townsend's big-eared bat, northern goshawk, golden eagle, flammulated owl, burrowing owl, Vaux's swift, white-headed woodpecker, black-backed woodpecker, Lewis' woodpecker, sagebrush lizard, western toad, Rocky Mountain tailed frog, Columbia spotted frog, leopard dace, river lamprey, mountain sucker, Columbia River tiger beetle, Mann's mollusk-eating ground beetle, Shepard's parnassian, and

juniper hairstreak through livestock fencing, management agreements, easements, acquisitions and livestock fencing.

- Protect nesting sites, large snags and forest stand age and structure as needed for great gray owl, Vaux's swift, pileated woodpecker and northern goshawk.
- Maintain mature and old growth ponderosa pine and restore degraded pine forests by thinning dense understory fir and returning to natural fire regimes for white-headed woodpecker, Lewis' woodpecker and pygmy nuthatch.
- Continue to require bald eagle habitat plans that include retention of trees.
- Identify and restore habitat for mountain quail.

<u>Improve land management practices</u>:

General

- Allow natural disturbances and successional functions and processes to occur on conserved wetlands.
- Manage undeveloped publicly-owned land for conservation of priority habitats and species.

Fire management

- Work with public agencies and private landowners to reduce the potential destructive impact of wildfires on native habitats by incorporating measures such as fire breaks and prescribed burning into wildlife and land management plans.
- Work with the Washington Forest Practices Board and both public and private forest landowners to properly design and implement current forest practices rules, including the Forests and Fish Agreement to protect fish, wildlife and habitat.
- Coordinate with public land managers on the use of controlled fire regimens and stand management practices. Attempt to simulate natural disturbance regimes and restore proper ecological functions. Consider impacts to local wildlife in each burn plan, including timing, size and location of the burn.

Forest practices

- Protect existing old growth, nesting sites, large snags and mature forest stand age and structure needed for northern goshawk, great gray owl, ***flammulated owl***, Vaux's swift, pileated woodpecker, white-headed woodpecker, Lewis' woodpecker, black-backed woodpecker and pygmy nuthatch.
- Maintain mature and old growth ponderosa pine and restore degraded pine forests by thinning dense understory fir for white-headed woodpecker, Lewis' woodpecker, flammulated owl and pygmy nuthatch.
- Maintain stream buffers during timber harvest and conduct proper land use management to protect bull trout, margined sculpin, mountain sucker, inland redband trout and leopard dace.
- Maintain and enforce Forest Practices rules protecting bald eagle roost sites and nests.

- Protect remaining old growth conifer and hardwood stands to benefit late successional species and manage some stands on long rotations (>200 years).
- Work with the Department of Natural Resources and the State Forest Practices Board to develop, implement and enforce forest practices regulations to enhance biological diversity on existing state and private managed and protected areas.
- Work through the State Forest Practices Board and directly with forest landowners to implement forest management prescriptions, including prescribed burns, which will maintain and enhance biodiversity and natural ecosystem functions. Encourage modified silvicultural prescriptions that promote local topographic, soil and vegetative conditions.
- Encourage the development of selective harvest policies and guidelines on both public and private forest land that will leave adequate components of old growth habitat such as snags and downed wood and some live trees as habitat for associated wildlife.
- Work with land managers and landowners to implement forest practices that benefit mountain quail and Lewis' woodpecker.
- Minimize logging roads and decommission them after the period of entry. Ensure that all logging and forest access roads are located in stable, non-erodible areas and outside riparian management zones.
- Ensure the integrity of riparian habitat by maintaining adequate riparian management zones along streams in all logging sites, on both public and private land.
- Encourage public and private forest landowners to manage forested watersheds that maintain an appropriate mix of successional stages and provide connectivity of riparian and upland vegetation as protected travel corridors for wildlife.
- Conduct land use management of riparian areas to conserve western toad, ***Rocky Mountain tailed frog,*** Columbia spotted frog, margined sculpin, mountain sucker, inland redband trout and bivalves.

Grazing and agricultural practices

- Work with public, tribal and management agencies to fence or otherwise protect riparian zones from livestock grazing and unauthorized offroad vehicle use. Consider retirement rather than renewal of grazing leases on sensitive lands.
- Work with conservation districts, Natural Resource Conservation Service, USDA Forest Service and private landowners to implement best management practices in riparian areas and associated upland habitat in conjunction with the Conservation Reserve Program, Wetland Reserve Program and other Farm Bill Programs.
- Use the Comprehensive Resource Management Plan process for large landscapes with a mix of public and private landowners to modify grazing regimes and improve grassland understory conditions and enhance biodiversity.
- Assist private landowners in securing funding to fence riparian zones on private land. In areas where it is impractical to exclude livestock, protect habitat quality by controlling the timing and intensity of livestock grazing through regulation and landowner agreements.

- Work with private and public landowners to minimize the impacts on habitat and wildlife from modern agriculture, including agrochemical use, water use and soil erosion.
- Prevent grazing and forest practices where they are incompatible with mountain quail habitat.
- Ensure that grazing leases on state lands comply with HB1309 "Ecosystem Management Standards" to maintain fish and wildlife habitat.

<u>Control and prevent introduction of alien and invasive species</u>:

- Develop a regional plan for the detection, rapid response and eradication of invasive species.
- Work with other public agencies and private agricultural organizations such as the Farm Bureau and Washington Grange to develop basic techniques for mapping and monitoring the spread of invasive plant species over time.
- Participate in federal and state agency partnerships to develop and implement weed control strategies for impacted sites and ecosystems.
- Develop educational and public information materials to increase public awareness of the ways that invasive exotic species are introduced to sensitive ecosystems.
- Provide funding, incentives and technical assistance to private landowners to eliminate undesirable invasive plant species in riparian zones and to restore native plants that provide important habitat for native fish and wildlife. Use integrated pest management practices to control currently established invasive species with help from volunteers.
- Avoid introduction of non-native fish in fishless lakes and where species of conservation concern occur such as bull trout, westslope cutthroat trout, native amphibians and reptiles. Avoid introduction of rainbow trout or only introduce sterile fish where westslope cutthroat are found. Avoid introduction of non-native trout to protect bull trout from hybridization, competition and predation.
- Control bullfrogs and predatory fish as needed in Columbia spotted frog habitat.
- Prevent introductions of exotic competitors in winged floater and Oregon floater habitat.
- Control infestations of knapweed, rush skeleton weed and other weeds to prevent degradation of grassland habitats.

<u>Control and monitor disturbance</u>:

- Eliminate vehicular access and campsites in conservation areas identified as sensitive habitats, such as montane wetlands, bogs, prairies and dunes.
- In sensitive habitats, manage both land and water access by using fencing, trails, elevated boardwalks, railings, seasonal restrictions, signage and livestock restrictions.
- Reduce the amount and impact of unauthorized recreational access and use on important wildlife habitat through better enforcement of existing laws, more fencing and posting of critical habitat areas, selective road closures and increased public education and information for recreational users and user groups.
- Protect Townsend's big-eared bats and nesting golden eagles, bald eagles, peregrine falcons and prairie falcons through use and access restrictions on public lands as needed, and work with private landowners and permitting agencies to prevent blasting or construction disturbance during nesting. Inform rock climbers of sensitive periods and locations to reduce disturbance of nesting peregrines, golden eagles and prairie falcons.
- Limit access to roost and hibernacula sites for Townsend's big-eared bat.

Control and prevent environmental contamination:

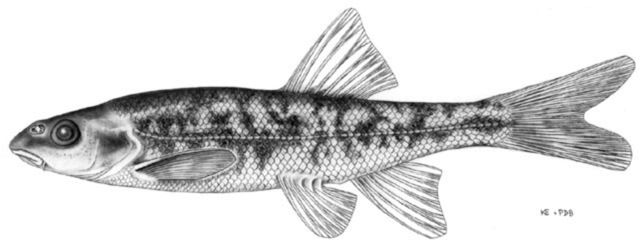
- Work with governmental and nonprofit agencies to develop an ecoregion-wide strategy for identified toxins and other pollutants: their sources, destinations and effects, and ways to reduce their discharge.
- Work with other agencies, industry and private landowners to encourage use of integrated pest management techniques and phase out the use of pesticides and herbicides.
- Clean up contaminated sites and sediments wherever possible and prevent further toxic contamination of areas, including unconfined spoil disposal sites.
- Reduce the use of hazardous chemicals by continuing to implement the persistent bioaccumulative toxins strategy and by using a variety of best management practices and improved treatment methods.
- Facilitate use of nontoxic alternatives to lead shot and lead fishing sinkers.
- Work with other agencies to reduce and remediate sources of contaminants that contribute to prey contamination for bald eagles, peregrine falcons, etc.

Improve transportation and energy development:

- Work with the Washington Department of Transportation to locate highways way from important wildlife habitats and biodiversity areas. If impacts are unavoidable, design adequate mitigation such as underpasses, overpasses and fencing to accommodate wildlife that need passage, e.g. near western toad breeding sites.
- Reduce mortalities of bald and golden eagles through modification of electric transmission and distribution lines where needed.
- Work with land management agencies, utility licensing agencies and telecommunications and energy companies to ensure that the placement of new windpower or cell towers does not negatively affect resident wildlife species, migrating birds or bats.

Improve water quantity and quality:

- Manage wetland areas on public land for both high water quality and habitat value. Ensure that the water quality of inflow does not lead to deterioration of the wetland habitat.
- Where possible, restore or rehabilitate the hydrology, water quality and native plant communities in degraded and disturbed wetlands. Methods should emphasize creating or restoring natural wetland functions e.g. conserve beaver populations and dynamic stream processes to benefit species like the Columbia spotted frog.
- Manage runoff from highways according to the updated highway runoff manual. Improve the road drainage network in riparian zones by removing unnecessary culverts, increasing the size of inadequate culverts or replacing culverts with bridges.
- Reduce the harm from stormwater runoff by working to improve the effectiveness of the National Pollutant Discharge Elimination System stormwater permit programs.
- Assist local jurisdictions in finding solutions to increase landowner compliance with onsite sewage system maintenance and animal waste management practices through education and regulated inspection. Work to reduce the number and volume of combined sewer overflow events.



- Reduce sedimentation and pollution to conserve aquatic species of concern such as bull trout, margined sculpin, mountain sucker, ***leopard dace***, westslope cutthroat, inland redband trout, river lamprey Pacific lamprey, winged floater, Oregon floater, western ridged mussel and western pearlshell.

Improve coordination, planning, permitting and mitigation:

- Provide credible scientific information on priority habitats and species and biodiversity areas, their significance, management needs and compatible land uses to decision-makers at site, local and regional scales.
- Provide technical assistance to counties in using fish and wildlife and biodiversity information to update comprehensive land use plans, community or watershed plans, Shoreline Master Plan, etc.
- Assist counties in developing and updating county ordinances and incentives that help to mitigate or control development in areas with resource and conservation values and that encourage environmentally sensitive development in growth areas.
- Work with local governments and conservation organizations to identify and protect areas of important habitat and biodiversity through existing environmental laws and other local programs.
- Encourage floodplain management and shoreline zoning protection programs.
- Develop a coordinated conservation vision and strategy for conservation of large landscapes using a structured process like The Nature Conservancy's 5-S Project Management System or the Cascade Dialogs.
- Review state and federal land management plans to ensure adequate protection for priority habitats and species, biological diversity and ecosystem health.
- Develop site management plans for protected areas.
- Work with public and tribal land management agencies to protect important habitat and areas of high biodiversity from loss and fragmentation as well as degradation.
- Coordinate and integrate species recovery and management plans with land management and watershed plans using regulatory and voluntary approaches.
- Participate in Growth Management Act, shoreline Management Act, Forest Protection Act and Federal Energy Regulatory Commission permitting processes for new or expanded residential, recreational or hydropower development on private land.
- Use information from ecoregional assessments to illustrate important habitats and areas of high biodiversity. Encourage permitting agencies to designate and protect these areas from residential and recreational development, and to require mitigation for habitat conversion and fragmentation where it occurs.
- Work closely with the USDA Forest Service and other land management agencies to prevent or mitigate potential adverse impacts to fish and wildlife habitat fro proposed recreational or hydropower development on public lands.
- Work with regulatory agencies to design effective mitigation strategies for projects that result in wildlife impacts or direct conversion or fragmentation of habitat.
- Assist federal agencies in implementing the Interior Columbia Basin Ecosystem Management Strategy.
- Represent WDFW's conservation interests on interagency recovery teams and working groups.

Improve enforcement of laws and regulations:

- Enforce laws, investigate and prosecute illegal killings of bald eagles, American white pelicans, wolves, bull trout and other endangered wildlife.
- Enforce restriction on transplantation of fishes, non-native turtles, bullfrogs, etc. to protect Columbia spotted frogs and margined sculpin.
- Enforce recreational access restrictions on public lands and aquatic areas.

Improve landowner assistance:

- Work with large and small timber companies and landowners to accomplish habitat conservation through nonregulatory approaches such as landowner incentives, conservation easements, habitat conservation plans and acquisition of critical habitat from willing landowners.
- Secure state and federal tax incentives that discourage habitat fragmentation and destruction and that encourage landowners to protect and manage their land to benefit wildlife habitat.
- Work with local government to implement the Public Benefit Rating System and encourage effective use of open space tax incentives for landowners.
- Work with private landowners to identify and protect areas with important habitats and biodiversity and protect these areas through landowner incentives and other nonregulatory programs. For example, work with landowners to restore native vegetation and conserve local populations of burrowing mammals.
- Provide educational materials to private landowners that describe management techniques for maintaining and restoring various wildlife habitats.
- Work with private landowners to identify and protect important wetland habitats and buffers by providing adequate water, controlling invasive plants, reducing disturbance to nesting wildlife and fencing or otherwise keeping livestock out of wetlands and associated upland habitat.
- Influence the application of federal Farm Bill funds, including the Conservation Reserve Program and the WDFW Landowner Incentive Program, on private agricultural lands most critical for wildlife movement and most suitable for restoration of native wetlands and grassland habitat.
- Promote grant programs to assist landowners with implementation of management plans.
- Develop, periodically update and provide WDFW Priority Habitats and Species management recommendations to assist landowners in conserving priority habitats and species.

Improve wildlife conservation education: includes outreach, volunteer and watchable wildlife programs.

- Engage and involve local and tribal governments, state and federal agencies, organizations and citizens in efforts to protect and restore priority habitats and species through a variety of outreach projects, programs and education efforts.
- Increase the use of citizen science for the collection of data, monitoring, restoration and conservation of important habitats and associated wildlife species. Coordinate volunteer monitoring and involvement.
- Promote and maintain public information and education efforts that focus on endangered species, habitat loss, ecological function, biological diversity and environmentally-aware lifestyle practices. Emphasize the connection between habitat and environmental quality and human health and welfare.

- Expand conservation education programs for both adults and children to emphasize the critical nature and vulnerability of sensitive habitats such as wetlands, oak and grassland habitats and associated wildlife.
- Connect with user groups through education to make them part of the conservation solution in areas that have high recreation values.
- Work with large corporations to increase awareness and develop financial support for conservation of biodiversity.
- Within the Blue Mountains ecoregion, conduct education and outreach programs to help recovery of American white pelicans, wolves, and other endangered wildlife; prevent introductions of exotic competitors of winged and Oregon floater; discourage control of ground squirrels and other mammalian prey of gold eagles and prairie falcons; and discourage killing of American badgers and other burrowing mammals that provide burrows for burrowing owl nests.

Prairie falcon.

COLUMBIA PLATEAU ECOREGION

PHYSIOGRAPHY AND FISH AND WILDLIFE DIVERSITY

Geography

The Columbia Plateau ecoregion includes the area in eastern Washington bounded by the Cascade, Okanogan, Blue and Rocky Mountains. Approximately one-third of Washington is within this ecoregion. More than 50 percent of the ecoregion in Washington has been converted to agriculture or development. Agriculture consists of a mixture of dryland and irrigated farming. Urban development in this ecoregion is mostly associated with rivers and lakes.

Geology

The Columbia Plateau ecoregion rests primarily on Columbia River basalt. Windblown silts and volcanic ash cover extensive areas, creating rolling, deep, productive soils. Ice-age floods carved deep canyons and coulees through the basalt. The floods also scoured some areas of soils and vegetation, leaving the basalt exposed on the surface. The ecoregion's dominant landforms include the Palouse Hills, Channeled Scablands, Yakima Fold Hills, and Pasco Basin. Elevations range from 160 feet above sea level along the Columbia River in the southwestern corner to nearly 4,000 feet above sea level on isolated hills in the Badger and Tekoa mountains.

Climate

The Columbia Plateau has the hottest and driest climate in the state. It lies in the rain shadow of the Cascade Mountains. Annual precipitation generally ranges from around 6 inches per year along the Hanford Reach of the Columbia River to 25 inches in the Palouse Hills. Most of the ecoregion receives 8 to 14 inches of precipitation. Periodic drought and natural fires are common environmental features of this ecoregion.

Habitat and Plant Associations

The ecoregion is most often characterized as shrub-steppe, dominated by various species of drought-tolerant shrubs, forbs and grasses. Much of the remaining native vegetation occurs on steep canyon sides and on the shallower soils of basalt scablands. Bitterbrush and three-tip sagebrush steppe appear along the foothills of the Cascades. Douglas-fir/ponderosa pine forests occur on moister sites near the foothills of the surrounding mountains. Special habitat elements include sand dunes, gravelly areas, basalt cliffs, steep canyons, alkali lakes and vernal pools. Although predominantly a sagebrush shrubland, this ecoregion contains other steppe plant communities such as salt desert shrub, desert playa and native grasslands.

There are 46 plant community alliances and approximately 450 plant community associations found in the Columbia Plateau ecoregion. More than 20% (105) of these plant community associations are considered vulnerable by the Washington Natural Heritage Program. Riparian and aquatic natural communities, along with associated species, are only now beginning to be classified. They represent another aspect of biological diversity that is yet to be fully documented.

Fish and Wildlife Diversity

Despite extensive habitat conversion due to agriculture and other factors, the Columbia Plateau ecoregion still has a few large expanses of wildlands and areas of high biodiversity. Land set aside and managed by the Departments of Defense and Energy (Yakima Training Center and Hanford Reservation) provides some of the best examples of remaining shrub-steppe habitat in Washington.

At least 239 plant and animal species, including approximately 72 endemic (occurring only in a specific locale) plant species, are found in the Washington portion of the Columbia Plateau ecoregion. Vulnerable species occur in all habitats and sections of the ecoregion, but they are not distributed equally across it. There are concentrations of endemic species in unique habitats and there are concentrations of vulnerable species found in habitats that have been significantly altered by human activities. Numerous species of birds of prey nest here at high densities. Invertebrates are among the most threatened species and many species are just beginning to be classified taxonomically. The Columbia River, which bisects the ecoregion and forms a portion of the border between Oregon and Washington, once sustained one of the largest salmon runs in the world and is an important component of the biodiversity of this semi-arid landscape.

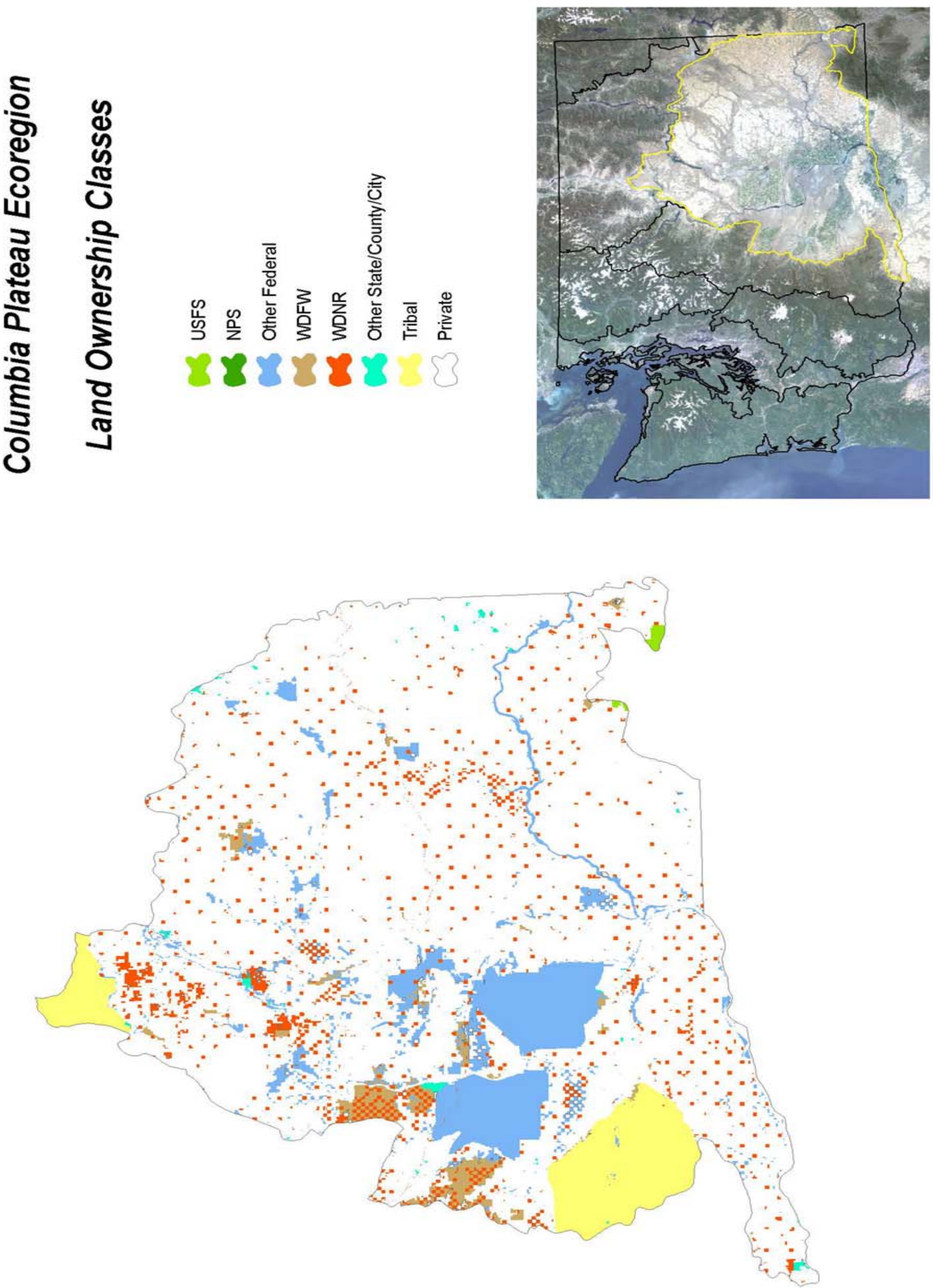
LAND OWNERSHIP AND POPULATION

The federal government owns about 10% of the Columbia Plateau ecoregion, in particular the Bureau of Reclamation and Bureau of Land Management. The Hanford Reservation in Benton County, owned by the Department of Energy, as well as the U.S. Army's Yakima Training Center in Yakima County, are critical strongholds of biodiversity in the ecoregion. The Hanford Reservation in particular contains some of the highest quality and most significant examples of sagebrush steppe ecosystems in Washington; much of the Hanford Reservation is now managed by the U.S. Fish and Wildlife Service. Nearly 865,000 acres of the Columbia Plateau are owned by Washington state agencies. The Washington Department of Fish and Wildlife manages about 241,000 acres in the ecoregion, including the Desert, Swanson Lakes, Sunnyside, and Esquatzel Coulee Wildlife Areas.

A number of other ecologically important sites are managed by the U.S. Fish & Wildlife service, including the Columbia, McNary, Saddle Mountain, Toppenish, Mid-Columbia River and Turnbull National Wildlife Refuges. Nearly half the ecoregion is in private ownership but its distribution differs considerably from public lands. Valley bottomlands, stream drainages and the arable lands are all largely in private ownership. Land conversion, mostly to foster intensive agriculture, has occurred to a considerable extent on private lands in the ecoregion.

The Columbia Plateau's economic base is firmly rooted in agriculture and commodity extraction-related businesses and industry, although there are strong indications that extractive sectors of the regional economy are declining in response to food imports under the North American Free Trade Agreement (NAFTA). Irrigated agriculture is still the most significant economic activity in the ecoregion, with crops ranging from potatoes and peas to wheat and alfalfa. As consumer demand increases and irrigation water is made available, fruit orchards and wineries are also proliferating in the region. Ranching is also an important activity throughout much of the rest of the ecoregion. In Washington, industrial development and population growth is expanding in the Tri Cities (Richland, Pasco, and Kennewick), Yakima, Wenatchee and Spokane areas, with the rest of the ecoregion retaining its rural character. The combined population of the ecoregion is about 900,000 as of 2003. Figure 34 maps the land ownership classes in the Columbia Plateau ecoregion.

Figure 34.



Columbia Plateau Ecoregion
Land Ownership Classes
USFS
NPS
Other Federal
WDFW
WDNR
Other State/County/City
Tribal
Private

ECOREGIONAL CONSERVATION PARTNERSHIPS

Effective conservation of fish, wildlife and biodiversity in Washington requires close coordination and cooperation with many public and private conservation partners. Major partners in the Columbia Plateau ecoregion include:

- U.S. Army (Yakima Training Center)
- U.S. Bureau of Land Management
- U.S. Bureau of Reclamation
- U.S. Department of Energy (Hanford Reservation)
- U.S. Fish and Wildlife Service (six National Wildlife Refuges)
- Washington Department of Natural Resources (WDNR)
- Washington State Parks and Recreation Commission
- Yakama Indian Nation
- Yakima, Grant, Benton, Klickitat, Douglas, Lincoln, Spokane, Adams, Franklin, Walla Walla, Columbia, Garfield, Asotin, and Whitman Counties.

The Washington Department of Fish and Wildlife also works closely on conservation projects with private conservation partners such as The Nature Conservancy, Trust for Public Land, Audubon Washington, Ducks Unlimited, Washington Waterfowl Association, Intermountain West Joint Venture and a growing number of fisheries enhancement groups and local land trusts.

Major Plans and Assessments

A number of ongoing or completed planning efforts involving WDFW and its public and private partners guide the conservation and management of fish and wildlife resources statewide and in the Columbia Plateau ecoregion. Important planning efforts affecting conservation in the Columbia Plateau ecoregion include:

- Columbia Plateau Ecoregional Assessment
- Interior Columbia Basin Management Project
- Intermountain West Joint Venture Coordinated Bird Conservation Plan (2005)
- U.S. Army Yakima Training Center Cultural and Natural Resource Management Plan (2002)
- USFWS Draft Bull Trout Columbia River DPS Recovery Plan (2002)
- WDFW Bald Eagle Status Report (2001)
- WDFW Bull Trout and Dolly Varden Management Plan (2000)
- WDFW Draft Columbia Plateau Regional Wildlife Area Management Plan
- WDFW Ferruginous Hawk Recovery Plan (1996)
- WDFW Game Management Plan (2003)
- WDFW Greater Sage-Grouse Recovery Plan (2004)
- WDFW Margined Sculpin Status Report (1998)
- WDFW Outline for Salmon Recovery Plans (2003)
- WDFW Peregrine Falcon Status Report (2002)
- WDFW Pygmy Rabbit Recovery Plan and Amendments (1995,2001, 2003)
- WDFW Sandhill Crane Recovery Plan (2002)
- WDFW Upland Sandpiper Recovery Plan (1995)
- Yakima, Crab Creek, Palouse, Columbia Lower and Upper Middle, Walla Walla, and Snake Lower Subbasin Plans (2004)

Supporting references to these and other important statewide planning documents are included at the end of this chapter and/or in Appendices 6 and 7.

SPECIES AND HABITATS OF GREATEST CONSERVATION NEED

This section provides a short summary of priority species and associated habitats for the Washington portion of the Columbia Plateau ecoregion.

<u>Species of Greatest Conservation Need</u>

The following species list for the Columbia Plateau ecoregion is a regional subset of the statewide Species of Greatest Conservation Need (SGCN) list shown in Appendices 1 and 2. The process and criteria used to develop the statewide SGCN list are provided in Volume Two: Approach and Methods, as well as in Appendix 3. Species listed below are found in the Columbia Plateau ecoregion for all or part of their lifecycle. Supporting tables and information for these species and habitats can be found in Chapter IV and in Appendices 1, 2, 8, 9, 10 and 14.

	Population Size/Status						Population Trend					
COMMON NAME	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown	State Status*	WNHP
Mammals												
Merriam's shrew			x							x	C	S3
Pallid Townsend's big-eared bat			x							x	C	S3
White-tailed jackrabbit			x				x				C	S2
Black-tailed jackrabbit			x				x				C	S2
Pygmy rabbit	?	x					x				E	S1
Townsend's ground squirrel ssp.			x				x				C	S3
Townsend's ground squirrel ssp.			x							x	N	S2
Washington ground squirrel			x				x				C	S2
Western gray squirrel			x				x				T	S2
Kincaid meadow vole			x							x	M	S2
American badger			x				x				G	S4
Pronghorn antelope	x							x			G	SH
Birds												
Common loon			x					x			S	S2
Western grebe			x				x				C	S3
American white pelican			x						x		E	S1
Trumpeter swan			x						x		G	S3
Redhead			x					x			G	S3
Greater scaup				x							G	S5
Lesser scaup				x			x				G	S4
Bald eagle				x					x		T	S4

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
Northern goshawk			x							x	C	S3
Ferruginous hawk			x				x				T	S2
Golden eagle			x							x	C	S3
Peregrine falcon			x						x		S	S2
Prairie falcon			x							x	M	S3
Greater sage-grouse			x					x			T	S1
Sharp-tailed grouse			x				x				T	S2
Sandhill crane (greater)		x							x		E	S1
Upland sandpiper	?	x								x	E	SH
Marbled godwit			x							x	N	S3
Flammulated owl			x							x	C	S3
Burrowing owl			x				x				C	S2
Vaux's swift			x				x				C	S3
Lewis' woodpecker			x				x				C	S3
White-headed woodpecker			x				x				C	S2
Pileated woodpecker				x						x	C	S4
Sage thrasher			x				x				C	S3
Loggerhead shrike			x				x				C	S3
Sage sparrow			x				x				C	S3
Reptiles												
Pygmy horned lizard				x						x	N	S3
Sagebrush lizard			x				x				C	S2
Sharptail snake			x							x	C	S2
Striped whipsnake			x							x	C	S1
Amphibians												
Tiger salamander				x						x	M	S3
Western toad				x			x				C	S3
Northern leopard frog			x				x				E	S1
Columbia spotted frog			x							x	C	S4
Fish												
River lamprey						x				x	C	S2
Pacific lamprey						x				x	N	S3
Margined sculpin				x						x	S	S1
Westslope cutthroat				x				x			G	G4

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
Yakima steelhead											G	G5
Mid-Columbia steelhead											C	G5
Snake River steelhead											G	G5
Inland redband trout						x				x	G	G5
Bull trout						x				x	C	G3
Mid-Columbia coho											G	G4
Leopard dace						x				x	C	S2
Mountain sucker						x				x	C	S2
Invertebrates												
Columbia River tiger beetle	?									x	C	S1
Mann's mollusk-eating ground beetle			x				x				C	
Yuma skipper (butterfly)		x								x	C	S1
Shepard's parnassian (butterfly)			x							x	C	S1
Juniper hairstreak (butterfly)						x				x	C	S2
Silver-bordered fritillary (butterfly)			x							x	C	S3
White-belted ringtail (dragonfly)		x								x	N	S1
Columbia (Lynn's) clubtail (dragonfly)			x							x	N	S1
California floater (bivalve)			x				x				C	S1
Western floater (bivalve)			x				x				N	S4
Winged floater (bivalve)			x				x				N	G3
Oregon floater (bivalve)			x				x				N	S3
Western ridged mussel (bivalve)			x				x				N	S2
Western pearlshell (bivalve)				x			x				N	S4
Columbia oregonian (snail)			x				x				N	G2

* Status Codes

E = endangered
T = threatened
S = sensitive
C = candidate
M = monitor

** WNHP Codes (S = state, G = global)

1 = critically imperiled
2 = imperiled
3 = vulnerable to extirpation or extinction
4 = apparently secure
5 = demonstrably widespread, abundant and secure

Species Conservation in the Columbia Plateau Ecoregion

Species of Greatest Conservation Need (SGCN) found in the Columbia Plateau ecoregion (see table above) include those classified by WDFW as Endangered, Threatened, Candidate or Monitor species, as well as species identified by WDFW as needing additional research or funding attention. A range of conservation actions is recommended for these SGCN species at both the statewide and ecoregional levels. These recommended conservation actions are summarized in a series of matrices included in Chapter IV and as Appendices 9 and 10. These matrices also display the life history, population status and distribution of these species.

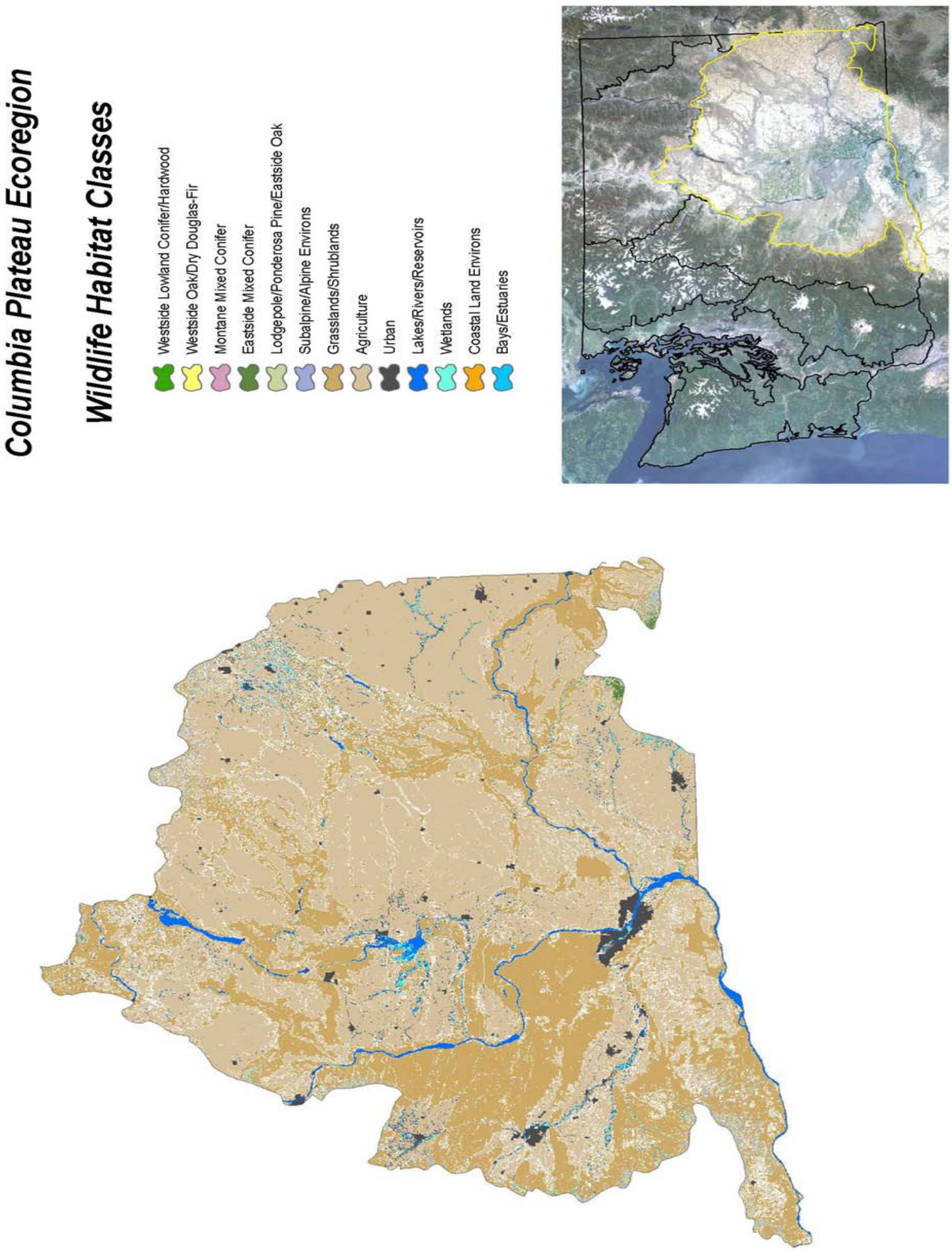
Ecoregional Habitat Overview

Figure 35 maps wildlife habitat classes in the Columbia Plateau ecoregion.

The following major habitat types classified, coded and described in Wildlife and Habitat Relationships in Oregon and Washington (WHROW), are present in the Columbia Plateau ecoregion. In the next section, descriptions are provided for priority habitats associated with Species of Greatest Conservation Need found in this ecoregion.

- Eastside (Interior) Mixed Conifer Forest
- Ponderosa Pine Forest and Woodlands
- Eastside (Interior) Canyon Shrublands
- Eastside (Interior) Grasslands
- Shrub-steppe
- Dwarf Shrub-steppe
- Desert Playa and Salt Scrub Shrublands
- Agriculture, Pasture and Mixed Environments
- Urban and Mixed Environs
- Open Water: Lakes, Rivers, Streams
- Herbaceous Wetlands
- Eastside (Interior) Riparian-Wetlands

Figure 35.



Columbia Plateau Ecoregion
Wildlife Habitat Classes
Westside Lowland Conifer/Hardwood
Westside Oak/Dry Douglas-Fir
Montane Mixed Conifer
Eastside Mixed Conifer
Lodgepole/Ponderosa Pine/Eastside Oak
Subalpine/Alpine Environs
Grasslands/Shrublands
Agriculture
Urban
Lakes/Rivers/Reservoirs
Wetlands
Coastal Land Environs
Bays/Estuaries

Priority Habitats in the Columbia Plateau Ecoregion

The following four habitat types have been identified as the highest priority for current conservation action in the Columbia Plateau ecoregion. Selection of these habitats as a priority was determined by their importance to regional Species of Greatest Conservation Need, as well as priorities outlined in the Columbia Plateau Ecoregional Assessment and the subbasin plans listed in the “Major Plans” section above. More discussion on the selection of priority habitats is included in Chapter III: Statewide Overview and in Volume Two: Approach and Methods.

- Shrub-steppe/Interior Grasslands
- Herbaceous Wetlands
- Eastside (Interior) Riparian-Wetlands
- Open Water (Lakes, Rivers, Streams)

Shrub-Steppe / Interior Grasslands

Shrub-steppe is the dominant native habitat in the Columbia Plateau. Sagebrush communities are the most widespread component of shrub-steppe habitat, occurring along stream channels, in valley bottoms and in the arid mountains up to and above the treeline. Bitterbrush shrub-steppe habitat is also an important component of shrub-steppe habitat, appearing primarily along the eastern slope of the Cascades, across north-central Washington to the Columbia Plateau.

Shrub-steppe communities support a wide diversity of wildlife. Sagebrush itself is a critical food source for many animals including the endangered pygmy rabbit, threatened sage-grouse, mule deer, and Rocky Mountain elk. Sagebrush provides benefits to the entire ecosystem. It physically protects understory plants, provides vertical structure that adds diversity to the plant community, and provides for snow retention that may benefit the water table. Bitterbrush is also an important food source for mule deer and other wildlife. Soils over much of the Columbia Plateau ecoregion are characterized by the existence of cryptobiotic (or cryptogamic) crusts—a living layer of algae, lichen, and mosses that grow upon or just beneath the soil surface. These crusts help stabilize dry soils with little vegetative cover and prevent wide scale wind and water erosion by regulating water infiltration. With blue-green algae as a common component, these crusts also fix nitrogen benefiting neighboring plants.

Grassland habitat occurs mainly on the plateau landscapes within the ecoregion, such as the Palouse, with a minor amount as canyon grasslands. Native grasslands may grow in a patchwork with shallow soil scablands or within biscuit scablands or mounded topography. Naturally occurring grasslands are not found within the range of bitterbrush and sagebrush species. Grassland habitats exist today in the shrub-steppe landscape where they have been created by brush removal, agricultural impact, or by fire. In general, this habitat is an open and irregular arrangement of grass clumps rather than a continuous sod cover. These medium-tall native grasslands often have scattered and diverse patches of low shrubs. Native grasslands in canyons are dominated by bunchgrasses.

Selected Species Closely Associated with Shrub-steppe / Interior Grasslands in the Columbia Plateau Ecoregion	
Burrowing owl	Ferruginous hawk
Prairie falcon	Sage-grouse
Sharp-tailed grouse	Washington ground squirrel
American badger	White-tailed jackrabbit
Black-tailed jackrabbit	Brewer's sparrow
Loggerhead shrike	Pygmy rabbit
Sage sparrow	Sage thrasher
Merriam's shrew	Sagebrush lizard

Herbaceous Wetlands

A variety of wetland types and sizes are distributed throughout the Columbia Plateau ecoregion. Wetlands form primarily where there is a water supply at or near the land surface; the location and persistence of the water supply depends on a number of factors, including precipitation, runoff, evaporation, topography, groundwater discharge, and irrigation which includes surface movement of water. Freshwater marshes are found naturally in the mountains and foothills and also in the plains where the hydrology and soil favor water retention. Wet meadows are found along streams and around mountain lakes and ponds.

Historic wetlands along the Columbia River have been inundated by reservoirs, while the floodplain wetlands along the Yakima River have largely been developed for agriculture. These wetland losses have been partly offset by thousands of acres of herbaceous wetlands created by irrigation runoff from the federally funded Columbia Basin Project. The combination of created wetlands, impoundments of the mainstem Columbia and Snake Rivers, and thousands of acres of grain fields in the Columbia Basin have created attractive habitat for waterfowl and other wetland-dependent migrating birds.

Selected Species Closely Associated with Herbaceous Wetlands in the Columbia Plateau Ecoregion	
Kincaid meadow vole	Common loon
Western grebe	Columbia spotted frog
Trumpeter swan	Lesser scaup
Yuma skipper butterfly	Silver-bordered fritillary butterfly

Eastside (Interior) Riparian-Wetlands

Protection of the interior riparian-wetlands habitat type may yield the greatest gains for fish and wildlife, while involving the least amount of area. While riparian habitat covers a relatively small area of the landscape it supports a high diversity and abundance of fish and wildlife. Broad floodplain mosaics consisting of cottonwood gallery forests, shrublands, marshes, side channels and upland grass areas contain diverse wildlife assemblages. Riparian habitat is year-round habitat for many species of wildlife such as beaver. Many species that dwell primarily in other habitat types such as shrub-steppe depend on riparian areas during key phases of their life history.

Fish and wildlife depend on riparian-wetlands for breeding habitat, seasonal ranges and movement corridors. Important riparian wetland sub-components such as marshes and ponds also provide critical habitat. Riparian-wetlands have other important functions, including water purification, flood control, recreation and aesthetics. The importance of riparian-wetlands habitats is increased when adjacent forest habitats are of sufficient quality and quantity to provide cover for nesting, roosting and foraging. In addition, riparian forests supply large woody debris to river systems and are thus critical to the structure and function of rivers and to the fish and wildlife populations dependent upon them.

Riparian habitat along the mainstem Columbia historically provided a critical link between drainages for many wildlife species such as western gray squirrels, mule deer, and migratory birds. Inundation of these riparian zones has resulted in the extirpation of some species, such as the yellow-billed cuckoo, and population fragmentation of threatened, endangered and sensitive species in watersheds along the Columbia River. Most of these riparian-wetlands have been inundated by hydropower reservoirs.

Selected Species Closely Associated with Eastside (Interior) Riparian-Wetlands in the Columbia Plateau Ecoregion

Pallid Townsend's big-eared bat	Western toad
Tiger salamander	Northern leopard frog
Columbia River tiger beetle	American white pelican
Mann's mollusk-eating ground beetle	

Open Water: Lakes, Rivers, Streams

The major aquatic feature of the Columbia Plateau ecoregion is the Columbia River, which flows north to south and bisects the ecoregion. With the exception of the Hanford Reach, the river has been converted from a free-flowing waterway to a series of reservoirs created by dams constructed for hydroelectric power and irrigation water. Although the hydrology and surface water habitat characteristics of the river have changed dramatically, the Columbia River is still a major migration corridor for Pacific salmon. The reservoirs also provide important resting and feeding areas for waterfowl and other migratory birds.

Major Washington tributaries draining into the Columbia River in this ecoregion include the Snake and Yakima Rivers. Other tributaries include Crab, Glade, Six Prong, Pine and Rock Creeks. Numerous other perennial secondary streams and many intermittent and ephemeral streams contribute water to the Columbia River.

Selected Species Closely Associated with Open Water Habitats in the Columbia Plateau Ecoregion

Leopard dace	Mountain sucker
Green sturgeon	River lamprey
Pacific lamprey	Margined sculpin
Westslope cutthroat	Inland redband trout
Yakima steelhead	Mid-Columbia coho
Mid-Columbia steelhead	White-belted ringtail dragonfly
Western pearlshell	Columbia clubtail dragonfly

CONSERVATION PROBLEMS

The most significant problems in protecting, restoring and enhancing remaining native shrub-steppe in the Columbia Plateau ecoregion are the direct loss and fragmentation of habitat from irrigated agricultural development, dryland wheat and past sagebrush eradication programs, as well as alteration and loss of native habitat diversity and function due to invasive cheatgrass and other alien plant species, improperly managed grazing and alteration of natural fire regimes.

Conversion to Agriculture

More than half of the native shrub-steppe and over 70% of native grassland habitat has been converted to agriculture since the turn of the century, and especially since the inception of the Columbia Basin irrigation project. New water storage projects are currently being promoted that will result in even more irrigated agriculture and more conversion of native habitat to agriculture. Shrub-steppe and interior native grasslands already converted to agricultural crops are difficult to restore to native plant communities, even if left idle for extended periods, because upper soil layers and associated mosses, lichens and microbiotic organisms are often lost to water and wind erosion and tillage practices. Wildlife species associated with shrub-steppe habitat in the Columbia Plateau ecoregion have been reduced in both abundance and distribution as a result of the loss, fragmentation and degradation of native shrub and grassland habitat.

Grazing Practices

Carefully managed grazing can be compatible with good habitat management, but improperly managed grazing on both public and private lands can eliminate native grasses and break down and destroy the microbiotic soil crust that supports native grasses and shrubs. Continued disturbance by improperly managed grazing also allows alien annual plants to invade and replace native plants that are important as wildlife habitat.

Alteration of Natural Fire Regimes

The disruption of the natural fire regime has degraded some of the vegetation communities of the Columbia Plateau ecoregion. Some shrub-steppe communities such as Wyoming big sagebrush types are fire-intolerant. Historically, the natural fire return interval often exceeded 100 years. When wildfires occur, they can eliminate sagebrush for decades and further promote the spread of alien annual grasses, particularly cheatgrass, to the detriment of native plants. Both human-caused fires and the invasion by cheatgrass have increased fire frequency in sagebrush communities, and this has dramatically degraded habitat for sagebrush-dependent species. In these communities, fire poses the biggest immediate threat to wildlife habitat. In other communities such as the Palouse prairies, regular fires historically kept native plant communities in various stages of ecological succession. Fire was important in maintaining these native grasslands by preventing woody vegetation from encroaching and for removing dry vegetation and recycling nutrients. Suppression of natural fires has allowed shrubs and trees to encroach/increase on areas once devoid of woody vegetation.

Many of the most complex resource problems facing the Columbia Plateau ecoregion in the next century revolve around water.

Habitat Loss and Impacts from Hydropower

Much of the rich floodplain alluvial soils adjacent to the Columbia and Snake Rivers are now inundated by hydropower impoundments, and the remaining riparian vegetation in the ecoregion is usually associated with tributaries and mesic (moderately moist) canyon draws. Over 40 percent of reservoir shorelines in the Columbia Plateau ecoregion are riprapped, and the combination of riprap, water fluctuation, shallow soils and steep banks precludes establishment of most new riparian plant communities and associated wildlife populations. However, some emergent wetlands appear to be increasing in size over time in backwater areas of the Columbia River reservoirs, due to sedimentation.

The dependence of many wetlands on local hydrological patterns makes them especially vulnerable to destruction and fragmentation. The total acreage of wetland habitat available for migratory waterfowl and other wetland-dependent wildlife has actually increased in the Columbia Plateau with the expansion of irrigated agriculture. However, the quality and relative abundance of intact native wetland habitat continues to decline with the expanded development of water and wetlands for agriculture and other uses, including recreation.

Riparian habitats are highly vulnerable to disturbance and alteration. Undisturbed riparian systems are rare in the Columbia Plateau ecoregion. Impacts have been greatest at low elevations such as the lower Yakima River watershed. Agricultural development has altered or eliminated vast amounts of native interior wetland habitat in the lowlands, and fragmented much of the remaining riparian/floodplain habitat within the ecoregion. Agricultural operations in riparian zones have also increased sediment loads and introduced herbicides and pesticides into streams. In lower elevations such as the Yakima River watershed, agricultural conversion, altered stream channel morphology and water withdrawal have obliterated or altered the character of streams and associated riparian areas. Losses in lower elevations include large areas once dominated by cottonwoods that contributed considerable structural diversity to riparian habitats. In higher elevations, the overharvest of beaver in the early 1800's began the gradual unraveling of stream function, which was then greatly accelerated with the introduction of livestock grazing. Woody vegetation has been extensively suppressed by improperly managed grazing in some areas, many of which continue to be grazed. Herbaceous vegetation has also been greatly altered with the introduction of Kentucky bluegrass, which has spread to many riparian areas, forming sod at the exclusion of other herbaceous species.

The mainstem Columbia River and Snake River dams present a daunting challenge to the upstream and downstream migration of anadromous fish species. Millions of dollars have been and continue to be spent by public agencies and hydropower users to ensure passage of salmon, sturgeon and lamprey through the dams and to otherwise mitigate for the loss of unimpeded migration corridors and habitat. Unless dams are removed from the mainstem Columbia and Snake Rivers, which is highly unlikely, the most pressing problems for migrating fish will continue to be caused by the dams, including inadequate fish ladders on some mainstem dams, predation within the mainstem reservoirs from walleye and other fish, nitrogen loading and mortality to downstream migrating juveniles from turbines.

The problem of fish passage does not stop with the mainstem Columbia and Snake Rivers, but includes irrigation diversion dams, unscreened culverts, disconnected stream corridors, septic contamination in urbanizing areas, pesticide pollution, sedimentation, thermal loading and low flow conditions on both major and minor tributaries all the way to upstream spawning areas.

Residential Development

Encroaching areas of residential development often occur near wooded riparian areas, lakes or streams. The increasing number of dwellings poses a risk to water quality due to the increased amount and dispersion of potential nutrient sources immediately adjacent to waterways. Residential development in riparian zones also disturbs and displaces wildlife, disrupts migration corridors and encourages the establishment of alien plant and animal species.

Environmental Contaminants

Environmental contaminants from past and current industrial and agricultural activities continue to adversely affect wildlife in the Columbia Plateau ecoregion. Pesticides, herbicides, insecticides, fungicides and rodenticides are widely used to control agricultural pests, and large amounts of fertilizer are used to replace nutrients in depleted soils. Industrial chemicals from aluminum plants and pulp mills and radioactive waste from Hanford nuclear reactors all remain in the environment and water. These contaminants can have both a lethal effect on fish and wildlife and sublethal effects such as impaired reproduction or predator avoidance. Indirect effects include alteration of habitat and reduced food resources. A chemical's capacity to harm wildlife is dependent on several factors, including the characteristics and toxicity, and the timing, duration and dose of exposure.

Recreation

Unauthorized recreational access by offroad vehicles, horses and campers may also have a detrimental effect on Columbia Plateau shrub-steppe, dune and wetland habitats by destroying the microbiotic soil crust, breaking off or uprooting native shrubs and grasses, killing or disturbing wildlife, starting fires, and spreading invasive plants into disturbed areas.

Disease and Pathogens

Usually disease is a normal part of the ecology of most fish and wildlife populations. However, with the reduction and fragmentation of habitat reducing some populations to very low levels, diseases can become a limiting factor. For example, the outbreak of plague in isolated populations of pygmy rabbits and ground squirrels may have a considerable effect as a whole. The occurrence of exotic diseases such as the mosquito-borne West Nile virus may have severe impacts to susceptible species such as sage-grouse. However, widespread environmental treatment of organisms like mosquitoes must be carefully planned and executed to avoid massive mortality of non-target species.

The following additional habitat and species conservation problems have been identified in the Columbia Plateau ecoregion:

Wildlife species and population problems: includes disease, pathogens, competition, food scarcity, predation, overharvest, limited population size and distribution.

- Populations of pygmy rabbit, American white pelican, sage-grouse, sharp-tailed grouse, ferruginous hawk, northern leopard frog, common loon, peregrine falcon and margined sculpin have declined to the point where they are listed as threatened, endangered or state sensitive.
- Small population sizes and loss of genetic diversity is a problem in pygmy rabbits, sage-grouse and sharp-tailed grouse, and may be a concern in several other species that seem to be reduced to isolated populations, including Washington ground squirrel, Townsend's ground squirrel, sagebrush lizard, northern leopard frog, bull trout, margined sculpin, California floater, winged floater, Oregon floater, Columbia clubtail, white=belted ringtail and Columbia oregonian.
- Recovery plans are needed to guide conservation actions for threatened or endangered species such as American white pelican, sharp-tailed grouse or northern leopard frog. Management plans are needed for sensitive species such as common loon, peregrine falcon and margined sculpin.
- The populations of species that are important prey of golden eagle, ferruginous hawk, peregrine falcon and prairie falcon have declined.
- The expansion of West Nile virus into Washington poses a threat to sage-grouse and sharp-tailed grouse.

- Killing or persecution is a problem for many species: poisoning ground squirrels, shooting (plinking) American badger, Townsend's and Washington ground squirrel, destruction of multi-species winter snake dens that cause mortality of striped whipsnakes, and American white pelicans may be killed because of perceived competition with fishermen.
- Illegal persecution and harvest occurs for bald eagles and migrating and spawning fish species of concern.
- Declines of burrowing mammals have reduced availability of burrows for nesting by borrowing owls.
- The taking of some amphibians and reptiles can be a problem, including the frequent mortality of pygmy horned lizards after capture for pets, and the use of tiger salamanders for fishing bait.
- Bull trout is susceptible to overharvesting.

Lack of biological information on species and habitats:

- Data are needed on population trends in state-listed species such as pygmy rabbit, American white pelican, sage-grouse, sharp-tailed grouse, ferruginous hawk and northern leopard frog.
- Information is needed about the status of populations of state candidate species including Merriam's shrew, Washington ground squirrel, Townsend's ground squirrel, white-tailed jackrabbit, black-tailed jackrabbit, golden eagle, western grebe, burrowing owl, sage thrasher, sage sparrow, loggerhead shrike, striped whipsnake, sagebrush lizard, Columbia spotted frog, bull trout, river lamprey leopard dace, mountain sucker, Mann's mollusk-eating ground beetle, Yuma skipper, juniper hairstreak, Shepard's parnassian, silver- bordered fritillary, and California floater.
- There is a lack of data on habitat needs and limiting factors, demographics and dispersal for ferruginous hawk and northern leopard frog.
- An efficient survey methodology is needed for jackrabbits.
- Additional information is needed on the current distribution and abundance of American badger, pygmy horned lizard, tiger salamander, Pacific lamprey, white-belted ringtail, Columbia clubtail and Columbia oregonian.
- Additional information is needed on the current distribution, taxonomy or demographics and biology of winged floater, western floater, Oregon floater, western ridged mussel and western pearlshell.
- Data are needed to determine whether the amount and configuration of habitat will support a viable population of pronghorn if they were to be reintroduced.
- The possible role of disease in recent declines of jackrabbits and Townsend's and Washington ground squirrel needs investigation.
- Data is needed on gene flow and genetic diversity in bull trout.
- There is a shortage of adequate spatial inventory and assessment data on most habitat types.
- There is an absence of baseline data on the habitat values and functions of natural wetlands and a poor understanding of the status of resident macroinvertebrates in aquatic systems.

Habitat loss, conversion, fragmentation and degradation:

- The Palouse grasslands are one of the most endangered ecosystems in the United States. Only one percent of the original habitat remains in highly fragmented patches, most smaller than 10 acres.
- Loss, fragmentation and degradation of shrub-steppe and native grassland habitat are the likely causes of declines in many species including greater sage-grouse,

sharp-tailed grouse, ferruginous hawk, American badger, jackrabbits, pygmy rabbit, ground squirrels, golden eagle, prairie falcon, burrowing owl, sage thrasher, loggerhead shrike, sage sparrow, pygmy horned lizard and striped whipsnake.

- Large-scale wildfires can eliminate sagebrush for over 30 years, thereby resulting in habitat loss and degradation for species dependent on sagebrush, particularly sage-grouse, pygmy rabbit, sage sparrow, sage thrasher and striped whipsnake. The resulting increase in cheatgrass in turn increases fire frequency, further degrading the vegetation and habitat value of the area.
- Rural development in canyons affects Mann's mollusk-eating ground beetle and Shepard's parnassian.
- Loss of juniper due to development and land management practices affects juniper hairstreaks.
- Wetland drainage, altered hydrology or succession of wetlands can eliminate habitat of redhead, northern leopard frog, Columbia spotted frog, silver-bordered fritillary and Columbia oregonian, and cause loss of vegetation for feeding in winter range of redhead.
- Conversion to agriculture, residential development and stabilization of dunes eliminates habitat of sagebrush lizards.
- Suburban sprawl is a concern for resources managers as indicated by the growing number of ranchettes and residential subdivisions in previously managed forest and cropland. Development often occurs near lakes or streams and poses an increased threat of fire and impacts to water quality.

<u>Incompatible land management practices</u>:

- Degradation of shrub-steppe from improperly managed grazing, cheatgrass and invasive weeds, or inappropriate use of herbicides affects pygmy rabbit, sage-grouse, sharp-tailed grouse, sage thrasher, sage sparrow, sagebrush lizard and many other species.
- The destruction of cryptobiotic crusts by livestock trampling or vehicle traffic results in an increase in erosion and invasion by cheatgrass and weeds.
- Logging, agriculture, road building, or other activities that elevate water temperature may also alter hydrology, increase sedimentation, and degrade habitat of bull trout, margined sculpin, inland redband trout, California floater, winged floater and Oregon floater.
- Livestock pose a trampling hazard and improperly managed grazing has degraded vegetation at sites with Columbia oregonian, Mann's mollusk-eating ground beetle and Yuma skipper.
- Herbicide overspray negatively impacts shrub-steppe and Conservation Reserve Program lands adjacent to cropland.
- Improper grazing and pesticide use as well as other land management practices may reduce nectar plants and affect butterflies such as the juniper hairstreak and Shepard's parnassian.
- Mining of basalt and sand for roads and construction negatively impacts reptiles such as sagebrush lizard and striped whipsnake.
- Modern agricultural practices often reduce the quality, patch size and connectivity of wildlife habitat in farmlands.

<u>Alien and invasive plant and animal species</u>:

- Predation by bullfrogs and/or introduced predatory fish negatively impact northern leopard frog, Columbia spotted frog and tiger salamanders.

Carp and mosquitofish degrade habitat of northern leopard frog, westslope cutthroat, bivalves, Columbia clubtail and white-belted ringtail.

- Non-native trout such as brook trout compete with, and may hybridize with, bull trout.
- Westslope cutthroat hybridize readily with rainbow trout, and tiger salamanders may be affected by genetic pollution with out-of-state larva used as fish bait.
- Competition from *Corbicula*, an Asian clam, may affect the California floater, winged floater and Oregon floater.
- Blackberries are degrading habitat of the Columbia oregonian.
- Noxious weeds including yellow starthistle, spotted and diffuse knapweed, rush skeletonweed, introduced wetland plants such as Russian olive, leafy spurge, tamarisk, pepperweed and purple loosestrife, and invasive annual grasses, especially cheatgrass, are pervasive and have taken over thousands of acres of wildlife habitat within the Columbia Plateau ecoregion. Most of these alien plants are unpalatable to both wildlife and livestock.
- Cheatgrass stabilizes dunes, eliminating populations of sagebrush lizards.
- Reed canary grass thrives in reservoirs and wetlands stream outlets where water levels fluctuate, and directly affects habitats that support 27 Washington state-listed plant species. A number of native fish, amphibians and other wildlife species are not well adapted to spawn or reproduce in reed canary grass thickets.

<u>Human disturbance and recreational impacts</u>:

- Human disturbance can be a significant problem for certain nest sites of ferruginous hawk, peregrine falcon, prairie falcon, bald eagle and golden eagle and at nesting colonies of American white pelicans.
- Human disturbance can be a significant problem at breeding or maternity roosts and hibernacula of Townsend's big-eared bat.
- Recreational boating can create disturbance problems for redhead, common loon, western grebe and foraging bald eagles. Eagles often avoid foraging in water around stationary boats.
- Recreational activities such as offroad recreational vehicles, horses, mountain bikes and even hikers can create unauthorized trails that may disturb soil, allow invasive plants to establish, and degrade dune habitats of sagebrush lizards.
- The nature and timing of agricultural disturbances may be increasingly hazardous to wildlife. Tilling, planting and harvesting are becoming more synchronous, widespread and intense, potentially stressing wildlife during critical periods of nesting, rearing and dispersal.
- Mortality of lesser scaup ducks from fishing lines may be significant.
- Improper use of agricultural chemicals may impact northern leopard frog and Columbia spotted frog.

<u>Environmental contaminants</u>:

- Common loons are often poisoned by lead fishing sinkers. Bald eagles and golden eagles are occasionally poisoned after eating dead or injured waterfowl or other game animals that contain lead shot or bullets.
- Concentrations of DDE, PCBs and dioxins from prey causes reduced reproduction of bald eagles on the Columbia River. Eagles, peregrines and prairie falcons concentrate persistent chemicals such as DDE and PCBs that can cause eggshell thinning, making them vulnerable to any persistent toxic chemical.
- Agricultural chemicals potentially impact northern leopard frog and Columbia spotted frog.

Incompatible transportation and energy development:

- Tall structures such as wind turbines and electrical transmission towers and lines are known to reduce or eliminate nesting by some birds in non-forested habitats. These utilities should not be located where they will substantially impact the recovery of sage-grouse and sharp-tailed grouse. These structures may also impact sage thrasher, sage sparrow, loggerhead shrike and other species.
- Oil and gas development present another set of potential issues related to disturbance of wildlife and habitat.
- Expansion of oil and gas development in the Columbia Plateau ecoregion presents another set of potential issues related to disturbance of wildlife and habitat.

CONSERVATION ACTIONS

Conserve and recover wildlife species and populations: includes population management, protection of known populations, population augmentation and or reintroduction, control and monitoring mortality, enhancement of food sources/prey.

- Implement recovery actions for pygmy rabbit, sage-grouse, sharp-tailed grouse, ferruginous hawk and bull trout.
- Develop or finalize recovery plans for the American white pelican, northern leopard frog, sharp-tailed grouse and bull trout and conduct translocations to reintroduce or augment populations as needed.
- Develop management plans for sensitive species such as margined sculpin and common loon.
- Continue to conduct translocations to augment or reintroduce populations of sharp-tailed grouse in cooperation with British Columbia and Idaho.
- Monitor the impact of West Nile virus on sage-grouse and sharp-tailed grouse.
- Consider adding pygmy horned lizard to the list of protected wildlife.
- Consider ways to reduce the killing of American badger and Townsend's ground squirrel, Washington ground squirrel and other burrowing rodents that create habitat features used by burrowing owls, reptiles, tiger salamanders and other wildlife species.
- Consider adding winter dens of snakes to protected wildlife code.
- Complete the Washington Bat Conservation Plan.

Conduct research, assessment and monitoring: includes species and habitat distribution, abundance, limiting factors, suitable habitat and population trends.

- Monitor populations of pygmy rabbit, sage-grouse, sharp-tailed grouse, ferruginous hawk, northern leopard frog and bull trout to determine whether recovery objectives are being met.
- Determine the status of candidate species including Merriam's shrew, Townsend's big-eared bat, Washington ground squirrel, Townsend's ground squirrel, white-tailed jackrabbit, black-tailed jackrabbit, golden eagle, western grebe, burrowing owl, sage thrasher, sage sparrow, loggerhead shrike, striped whipsnake, sagebrush lizard, Columbia spotted frog, river lamprey, leopard dace, mountain sucker, Mann's mollusk-eating ground beetle, Yuma skipper, juniper hairstreak, Shepard's parnassian, silver-bordered fritillary and California floater.
- Determine the abundance and distribution of American badger, Kincaid meadow vole, pygmy horned lizard, white-belted ringtail, Columbia clubtail, western floater, winged floater, Oregon floater, western ridged mussel, western pearlshell and Columbia oregonian.
- Investigate limiting factors, demographics and dispersal of northern leopard frog, ferruginous hawk, burrowing owl and golden eagle.
- Monitor post-downlisted populations of peregrine and bald eagle for signs of decline that could result from bioaccumulation of contaminants or other factors.
- Conduct genetic studies of American badger, Washington ground squirrel, Townsend's ground squirrel, white-tailed jackrabbit, black-tailed jackrabbit, golden eagle, western grebe, burrowing owl, sage thrasher, sage sparrow, loggerhead shrike, striped whipsnake, sagebrush lizard, Columbia spotted frog, river lamprey, leopard dace, mountain sucker, Mann's mollusk-eating ground beetle, Yuma skipper, juniper hairstreak, Shepard's parnassian and silver-bordered fritillary.
- Determine whether the Columbia River tiger beetle is still present in Washington.

- Conduct extensive distribution and relative abundance surveys of rare native fishes, including leopard dace, mountain sucker, and margined sculpin; research effective sampling techniques.
- Conduct feasibility study for the reintroduction of pronghorn that evaluates habitat quality, quantity and distribution.
- Investigate the role of disease in ground squirrel and rabbit populations.
- Survey and map distribution of Pacific lamprey; develop methods to differentiate between species of lamprey.
- Support taxonomic and demographic studies of western floater, California floater, winged floater, Oregon floater, western ridged mussel and western pearlshell.
- Assess and map important habitats and areas of high biodiversity in the ecoregion using ecoregional assessments, local habitat assessments, Interagency Vegetation Mapping Project, and other habitat inventories and plans. Update ecoregional assessments every five years.
- Develop statewide land cover and threats data layers to improve connectivity between priority conservation areas.
- Identify and assess key connectivity areas and wildlife corridors between fragmented habitats and between protected areas. Restore habitat connectivity and wildlife corridors where appropriate on both public and private lands.
- Improve understanding of the ecological processes of seeps, bogs, wet meadows, forested wetlands, marshes, springs and other wetlands, and how they are impacted by human development.
- Conduct hydrologic studies that include water quantity and chemical budgets at wetlands known to be supporting rare and endangered species. Use this information to inform wetland management.
- Inventory and prioritize riparian habitat types and attributes needing protection and conservation.
- Identify important habitats for restoration and assess the feasibility of successfully restoring these sites. Include an evaluation of current and projected land use in and adjacent to potential restoration sites.

Protect, restore and connect habitats:

- Identify and protect essential habitat through management agreements, easements, or acquisitions as needed to recover listed species including ***pygmy rabbit***, sage-grouse, sharp-tailed grouse, northern leopard frog, and ferruginous hawk.
- Restore degraded shrub-steppe and grassland habitat on public lands for listed and candidate species.
- Identify and protect shrub-steppe and grassland habitats used by listed and candidate species from agricultural conversion, residential and recreational development through management agreements, easements, livestock fencing, etc.
- Identify private agricultural land that is important for connectivity for shrub-steppe species and facilitate enrollment in the Conservation Reserve Program when appropriate.

- Protect areas on public and military lands with undisturbed microbiotic crusts from livestock trampling or vehicle traffic and facilitate research on its importance for shrub-steppe communities in Washington.
- Research methods of controlling cheatgrass and restoring shrub-steppe vegetation.
- Continue to require bald eagle habitat plans that include retention of trees; enforce/strengthen Shoreline Management Act.
- Map and protect essential habitat for Mann's mollusk-eating ground beetle, Shepard's parnassian, Yuma skipper and juniper hairstreak.
- Preserve wetlands for greater sandhill crane, lesser scaup, redhead, greater scaup, northern leopard frog and Columbia spotted frog through incentives, management programs, or acquisitions.
- Investigate mitigation alternatives for impacts of dams on winged floater and Oregon floater.
- Document, limit access, and protect roosting and hibernacula sites for Townsend's big-eared bat.
- Monitor habitat condition at Columbia oregonian sites and pursue the possibility of permanent protection through easements or agreements.
- Protect rare or special habitat types such as alkaline ponds, vernal pools, inland dunes, juniper savannahs, scattered conifer stands, caves, cliffs, rocky outcrops and talus.
- Prioritize conservation areas using ecoregional assessments and other biological assessments. Protect important habitat types, biodiversity areas, and environmentally sensitive lands that should not be altered through a variety of techniques including acquisitions, conservation easements, life estates and cooperative agreements with willing landowners.
- Coordinate with local land trusts, conservation districts and other conservation organizations and agencies to conserve important habitat on both public and private land. Focus limited resources in regionally significant areas. Identify all possible acquisition and restoration grants and coordinate applications.
- Work with the USDA Forest Service, U.S. Army Yakima Training Center and other public landowners to protect existing roadless areas and expand the roadless area network where justified for habitat protection and connectivity.
- Protect key connectivity areas and wildlife corridors between fragmented habitats and between protected areas through a variety of techniques including acquisitions, conservation easements, life estates and cooperative agreements with willing landowners. Use statewide land cover and threats data layers to improve connectivity between priority conservation areas.
- Restore native habitats, habitat connectivity and wildlife corridors where appropriate on both public and private lands. Consider restoring lands adjacent to existing protected areas to increase their effective size and function as wildlife habitat.
- Purchase water rights from willing sellers in unregulated tributaries; use these water rights to restore and maintain adequate year-round flows for both instream and out-of-stream riparian fish and wildlife habitat.
- Rehabilitate and restore stream channels, floodplain functions, riparian habitat and connectivity where streams have been diverted, fragmented or degraded. Use livestock exclusions, instream structures, bank modifications and other methods.
- Preserve and/or restore buffer areas in appropriate locations along tributaries and mainstem waterways to a condition that is adequate to maintain healthy, functioning riparian zones for the ecoregion's rivers and estuaries.
- Work with public and private landowners to reestablish and restore native shrub-steppe and grassland plant communities in selected public and private habitat areas to support species at risk and increase species richness.

Improve land management practices:

General

- Protect shrub-steppe from wildfires that remove sage-brush and increase cheatgrass.
- Influence grazing practices in shrub-steppe and grassland to protect habitat values for pygmy rabbit, sage-grouse, sharp-tailed grouse, sage thrasher and sage sparrow.
- Maintain stream buffers during timber harvest and conduct proper land use management to protect bull trout, mountain sucker, inland redband trout, margined sculpin, leopard dace and bivalves.
- Prevent livestock grazing on riparian habitat of Lewis' woodpecker, Mann's mollusk-eating ground beetle, Shepard's parnassian, and Columbia oregonian.
- Allow natural disturbances and successional functions and processes to occur on conserved wetlands.
- Manage undeveloped publicly-owned land for conservation of priority habitats and species.

Fire management

- Work with public agencies and private landowners to reduce the potential destructive impact of wildfires on native habitats by incorporating measures such as fire breaks and prescribed burning, where appropriate, into wildlife and land management plans.
- Reduce cheatgrass and restore native vegetation to reduce fire frequency.

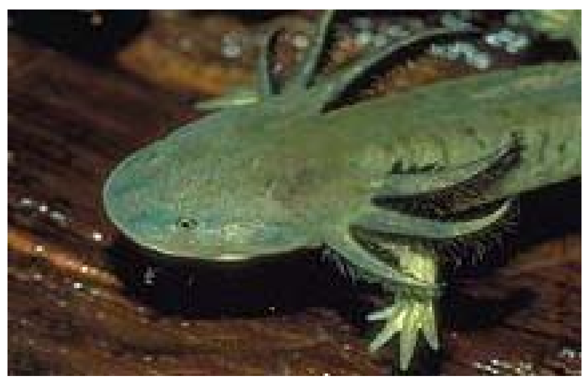
Forest management

- Protect remaining old growth conifer and hardwood stands to benefit late successional species and manage some stands on long rotations (>200 years).
- Work with the Department of Natural Resources and the State Forest Practices Board to develop, implement and enforce forest practices regulations to enhance biological diversity on existing state and private managed and protected areas.
- Work through the State Forest Practices Board and directly with forest landowners to implement forest management prescriptions, including prescribed burns, which will maintain and enhance biodiversity and natural ecosystem functions. Encourage modified silvicultural prescriptions that promote local topographic, soil and vegetative conditions.
- Encourage the development of selective harvest policies and guidelines on both public and private forest land that will leave adequate components of old growth habitat such as snags and downed wood and some live trees as habitat for associated wildlife such as flammulated owls and white-headed woodpeckers.
- Minimize logging roads and decommission them after the period of entry. Ensure that all logging and forest access roads are located in stable, non-erodible areas and outside riparian management zones.
- Ensure the integrity of riparian habitat by maintaining adequate riparian management zones along streams in all logging sites, on both public and private land.
- Support implementation and enforcement of the Washington Forest Practices Act to accomplish habitat conservation and regeneration on both state and private forest lands.
- Encourage public and private forest landowners to manage forested watersheds that maintain an appropriate mix of successional stages and provide connectivity of riparian and upland vegetation as protected travel corridors for wildlife.

Grazing and agricultural practices

- Work with public and tribal and management agencies to fence or otherwise protect riparian zones from livestock grazing and unauthorized offroad vehicle use. Consider retirement rather than renewal of grazing leases on sensitive lands.
- Work with conservation districts, Natural Resource Conservation Service, USDA Forest Service, U.S. Army and private landowners to implement best management practices in riparian areas and associated upland habitat in conjunction with the Conservation Reserve Program, Wetland Reserve Program and other Farm Bill programs.
- Use the Comprehensive Resource Management Plan process for large landscapes with a mix of public and private landowners to modify grazing regimes, improve grassland and shrub-steppe understory conditions, and enhance biodiversity.
- Assist private landowners in securing funding to fence riparian zones on private land. In areas where it is impractical to exclude livestock, protect habitat quality by controlling the timing and intensity of livestock grazing through regulation and landowner agreements.
- Work with private and public landowners to minimize the impacts on habitat and wildlife from modern agriculture, including agrochemical use, water use, grazing and soil erosion.
- Ensure that grazing leases on state lands comply with HB1309 “Ecosystem Management Standards” to maintain fish and wildlife habitat.

Control and prevent introduction of alien and invasive species:



- Control bullfrogs and predatory fish as needed to protect northern leopard frog, Columbia spotted frog and ***tiger salamander.***
- Avoid introduction of non-native fish in fishless lakes and where species of conservation concern occur such as bull trout, westslope cutthroat trout and native amphibians and reptiles. Avoid introduction of rainbow trout or only introduce sterile fish where westslope cutthroat are found. Avoid introduction of non-native trout to protect bull trout from hybridization, competition and predation.
- Prevent introductions of alien competitors of western floater, California floater, winged floater and Oregon floater through enforcement and education.
- Control blackberries affecting Columbia oregonian sites.
- Control infestations of knapweeds, rush skeleton weed, and other weeds to prevent degradation of shrub-steppe and grassland habitats.
- Develop a regional plan for the detection, rapid response and eradication of invasive species.
- Work with other public agencies and private agricultural organizations such as the Farm Bureau and Washington Grange to develop basic techniques for mapping and monitoring the spread of invasive plant species over time.
- Participate in federal and state agency partnerships to develop and implement weed control strategies for impacted sites and ecosystems. Promote adequate funding and coordination of weed control efforts on both public and private lands using environmentally sound methods.

- Develop educational and public information materials to increase public awareness of the ways that invasive alien species are introduced to sensitive ecosystems.
- Provide funding, incentives and technical assistance to private landowners to eliminate undesirable invasive plant species in riparian zones and to restore native plants that provide important habitat for native fish and wildlife. Use integrated pest management practices to control currently established invasive species with help from volunteers.
- Participate in federal and state agency partnerships to develop and implement cheatgrass and weed control strategies for impacted sites and ecosystems.
- Control alien plants such as purple loosestrife and Russian olive and prevent their proliferation on public and private land by removal, controlling livestock levels, and avoiding large-scale soil disturbances.

Control and monitor disturbance:

- Protect nesting golden eagle, bald eagle, peregrine falcon and prairie falcon through use and access restrictions on public lands as needed, and work with private landowners and permitting agencies to prevent blasting or construction disturbance during nesting. Inform rock climbers of sensitive periods and locations to reduce disturbance of nesting peregrine, golden eagle, and prairie falcon.
- Strictly control access to islands with ***American white pelican*** colonies.
- Strictly control location information for sage-grouse and sharp-tailed grouse leks and nesting sits of falcons, eagles and ferruginous hawks to prevent disturbance and trespass on private property.
- Eliminate vehicular access and campsites in conservation areas identified as sensitive habitats such as bogs, prairies, and dunes.

- In sensitive habitats, manage both land and water access by using fencing, trails, elevated boardwalks, railings, seasonal restrictions, signage and livestock restrictions.
- Reduce the amount and impact of unauthorized recreational access and use on important wildlife habitat through better enforcement of existing laws, more fencing and posting of critical habitat areas, selective road closures and increased public education and information for recreational users and user groups.

Control and prevent environmental contamination:

- Facilitate use of nontoxic alternatives to lead shot and lead fishing sinkers.
- Work with other agencies to reduce and remediate sources of contaminants that contribute to prey contamination for bald eagle, peregrine falcon, etc.
- Work with governmental and nonprofit agencies to develop an ecoregion-wide strategy for identified toxins and other pollutants: their sources, destinations and effects, and ways to reduce their discharge.

- Work with other agencies, industry and private landowners to encourage use of integrated pest management techniques and phase out the use of pesticides and herbicides.
- Clean up contaminated sites and sediments whenever possible and prevent further toxic contamination of areas, including unconfined spoil disposal sites.
- Reduce the use of hazardous chemicals by continuing to implement the persistent bioaccumulative toxins strategy and by using a variety of best management practices and improved treatment methods.
- Continue to place a priority on actions to prevent and respond to oil and hazardous material spills.

Improve transportation and energy development:

- Work with land management agencies, utility licensing agencies, and telecommunications and energy companies to ensure that the placement of new windpower or cell towers does not negatively affect sage grouse, sharp-tailed grouse, and other shrub-steppe associated wildlife species, migrating birds, or bats.
- Avoid roadbuilding or provide crossings where mortalities of striped whipsnake are a problem.
- Reduce mortalities of raptors through modification of electric transmission and distribution lines.
- Work with the Washington Department of Transportation to locate highways away from important wildlife habitats and biodiversity areas. If impacts are unavoidable, design adequate mitigation such as underpasses, overpasses and fencing to accommodate wildlife that need passage, such as American badger and western toads near breeding sites.

Improve water quantity and quality:

- Reduce sedimentation and pollution to conserve bull trout, mountain sucker, inland redband trout, margined sculpin, leopard dace, Columbia clubtail, white-belted ringtail, western floater, California floater, winged floater, Oregon floater, western ridged mussel and western pearlshell.
- Manage wetland areas on public land for both high water quality and habitat value. Ensure that the water quality of inflow does not lead to deterioration of the wetland habitat.
- Where possible, restore or rehabilitate the hydrology, water quality and native plant communities in degraded and disturbed wetlands. Methods should emphasize creating or restoring natural wetland functions such as conserving beaver populations and dynamic stream processes to benefit species.
- Manage runoff from highways according to the updated highway runoff manual. Improve the road drainage network in riparian zones by removing unnecessary culverts, increasing the size of inadequate culverts, or replacing culverts with bridges.
- Reduce the harm from stormwater runoff by working to improve the effectiveness of the National Pollutant Discharge Elimination System stormwater permit programs.
- Assist local jurisdictions in finding solutions to increase landowner compliance with onsite sewage system maintenance and animal waste management practices through education and regulated inspection. Work to reduce the number and volume of combined sewer overflow events.
- Study the effects of chemicals applied to irrigation systems on riparian habitat and wildlife. For example, irrigation waters transported in open, unlined canals can seep

into adjacent soils, eventually carrying soluble pollutants into ground or surface waters.

Improve coordination, planning, permitting and mitigation:

- Protect nesting golden eagle, ferruginous hawk and prairie falcon by maintaining buffer zones of no activity during nesting
- Provide credible scientific information on priority habitats and species and biodiversity areas, their significance, management needs and compatible land uses to decision-makers at site, local and regional scales.
- Provide technical assistance to counties in using fish and wildlife and biodiversity information to update comprehensive land use plans, community or watershed plans, Shoreline Master Plan, etc.
- Assist counties in developing and updating county ordinances and incentives that help to mitigate or control development in areas with resource and conservation values, and that encourage environmentally-sensitive development in growth areas.
- Work with local governments and conservation organizations to identify and protect areas of important habitat and biodiversity through existing environmental laws and other local programs.
- Encourage floodplain management and shoreline zoning protection programs.
- Develop a coordinated conservation vision and strategy for conservation of large landscapes using a structured process like The Nature Conservancy's 5-S Project Management System or the Cascade Dialogs.
- Review state and federal land management plans to ensure adequate protection for priority habitats and species, biological diversity and ecosystem health.
- Develop site management plans for protected areas.
- Work with public and tribal land management agencies to protect important habitat and areas of high biodiversity from loss and fragmentation, as well as degradation.
- Coordinate and integrate species recovery and management plans with land management and watershed plans using regulatory and voluntary approaches.
- Participate in Growth Management Act, Shoreline Management Act, Forest Protection Act and Federal Energy Regulatory Commission permitting processes for new or expanded residential, recreational or hydropower development on private land.
- Use information from ecoregional assessments to illustrate important habitats and areas of high biodiversity. Encourage permitting agencies to designate and protect these areas from residential and recreational development, and to require mitigation for habitat conversion and fragmentation where it occurs.
- Work closely with the USDA Forest Service and other land management agencies to prevent or mitigate potential adverse impacts to fish and wildlife habitat from proposed recreational or hydropower development on public lands.
- Work with regulatory agencies to design effective mitigation strategies for projects that result in wildlife impacts or direct conversion or fragmentation of habitat.
- Assist federal agencies in implementing the Interior Columbia Basin Ecosystem Management Strategy.
- Represent WDFW's conservation interests on interagency recovery teams and working groups.

Improve enforcement of laws and regulations:

- Protect American white pelican, bald eagle, and other endangered wildlife from killing and persecution through enforcement, education and outreach.
- Reduce the amount of illegal shooting (plinking) of ***Washington ground squirrels.***
- Enforce nontoxic shot requirements for waterfowl hunting to protect bald eagle and peregrine falcon.
- Enforce restriction on transplantation of non-native fish to protect bull trout and northern leopard frog, Columbia spotted frog, tiger salamander and other native amphibians.
- Reduce illegal harvest of bull trout.
- Enforce recreational access restrictions on public lands and aquatic areas.

Improve landowner assistance:

- Work with large and small timber companies and landowners to accomplish habitat conservation through nonregulatory approaches such as landowner incentives, conservation easements, habitat conservation plans and acquisition of critical habitat from willing landowners.
- Secure state and federal tax incentives that discourage habitat fragmentation and destruction and that encourage landowners to protect and manage their land to benefit wildlife habitat.
- Work with local government to implement the Public Benefit Rating System and encourage effective use of open space tax incentives for landowners.
- Work with private landowners to identify and protect areas with important habitats and biodiversity, and protect these areas through landowner incentives and other nonregulatory programs.
- Provide educational materials to private landowners that describe management techniques for maintaining and restoring various wildlife habitats.
- Work with private landowners to identify and protect important wetland habitats and buffers by providing adequate water, controlling invasive plants, reducing disturbance to nesting wildlife, and fencing or otherwise keeping livestock out of wetlands and associated upland habitat.
- Influence the application of federal Farm Bill funds, including the Conservation Reserve Program and the WDFW Landowner Incentive Program, on private agricultural lands most critical for wildlife movement and most suitable for restoration of native wetlands, shrub-steppe and grassland habitat.
- Promote grant programs to assist landowners with implementation of management plans.
- Develop, periodically update and provide WDFW Priority Habitats and Species management recommendations to assist landowners in conserving priority habitats and species.

Improve wildlife conservation education: includes outreach, volunteer and watchable wildlife programs.

- Discourage control of ground squirrels and other mammalian prey of golden eagle, ferruginous hawk and prairie falcon, and discourage killing of American badger and other burrowing mammals that create burrowing owl nest sites.
- Develop educational materials and programs targeted to fishermen to reduce mortality of lesser scaup from fishing line.
- Develop education program targeted to reduce disturbance of redhead, loons, bald eagles and western grebes by boaters.
- Discourage persecution of snakes in winter dens that kills striped whipsnakes and other species.
- Discourage capture of pygmy horned lizards for pets and the use of tiger salamanders as bait.
- Develop educational programs for conservation of burrowing owls in the urban and rural environments.
- Engage and involve local and tribal governments, state and federal agencies, organizations and citizens in efforts to protect and restore priority habitats and species through a variety of outreach projects, programs and education efforts.
- Increase the use of citizen science for the collection of data, monitoring, restoration and conservation of important habitats and associated wildlife species. Coordinate volunteer monitoring and involvement.
- Promote and maintain public information and education efforts that focus on endangered species, habitat loss, ecological function, biological diversity and environmentally aware lifestyle practices. Emphasize the connection between habitat and environmental quality and human health and welfare.
- Expand conservation education programs for both adults and children to emphasize the critical nature and vulnerability of sensitive habitats such as wetlands and grassland habitats and associated wildlife.
- Connect with user groups through education to make them part of the conservation solution in areas that have high recreation values.
- Work with large corporations to increase awareness and develop financial support for conservation of biodiversity.

VII. MONITORING AND ADAPTIVE MANAGEMENT

Monitoring is a key element in fulfilling the Washington Department of Fish and Wildlife's mission of preserving and perpetuating Washington's fish and wildlife resources. This is directly reflected in the 94 detailed performance measures included within WDFW's biennial strategic plan. An example of a performance measure is the number of Western pond turtles hatched in captivity and released to the wild. The performance measures are updated quarterly or annually, making the strategic plan a coarse-level tool for tracking progress of agency priorities. It summarizes data developed from more in-depth monitoring of fish, wildlife and habitat resource conditions.

WDFW engages in four general types of monitoring activities as defined below:

- *Status and Trends (extensive) monitoring* to track changes in wildlife and fish populations and their associated habitats over time, such as tracking the population status of four target species in a bioreserve.

- *Research (intensive) monitoring* to identify cause-and-effect relationships between physical habitat conditions, ecological processes, land use practices and/or conservation strategies and the animal populations of interest, such as identifying the factors contributing to a population decline in one of the target species in a bioreserve.

- *Effectiveness monitoring* to document the success of conservation actions in achieving the desired resource condition, such as determining whether a prescribed burn on the bioreserve achieved the desired result of maintaining a plant community of native prairie grasses.

- *Implementation monitoring*, or compliance monitoring, to confirm that planned conservations were implemented, such as documenting that a bioreserve was created to preserve habitat for four target species.

While the state Comprehensive Wildlife Conservation Strategy is required only to address status and trend monitoring and effectiveness monitoring, WDFW believes that research and implementation monitoring are also important in achieving success in our conservation actions. WDFW monitoring activities are therefore described by each of these four categories in turn. Monitoring programs are designed to answer specific research questions. The sampling protocols and design, including the spatial and temporal scale of the monitoring effort and the timeframe for reviewing the adequacy of the monitoring program, are thus driven by traits of the species or species group being studied, such as size and home range, reproductive strategy, life history, etc. Because of the unique methodology often required to answer specific research questions, monitoring can be very costly. Where feasible, new WDFW monitoring programs incorporate existing data and surveys and collaborate with monitoring partners.

The sections that follow provide an overview of WDFW monitoring program highlights and refer the reader to more detailed plans and programs described in the CWCS appendices. Agency tools employed to conduct monitoring programs are also described. To enhance monitoring capabilities, WDFW has relied on a great number of partnerships, which are outlined in this chapter. Finally, this chapter identifies future directions for monitoring and outlines a plan for adaptive management and future revisions of the monitoring component of the CWCS.

A. Status and Trends

Various fish and wildlife species, groups of species, and their associated habitats are currently monitored by WDFW and other conservation partners to determine changes and trends in their status over time. Development of the Comprehensive Wildlife Conservation Strategy (CWCS) in 2005 resulted in a new Species of Greatest Conservation Need (SGCN) list for Washington (Appendices 1 and 2). This also led to WDFW reexamining how it classifies and prioritizes wildlife species and associated habitats in light of new funding requirements and expectations of the State Wildlife Grants program. Monitoring activities are currently in place for some of the roughly 200 species included in the SGCN. Specific monitoring activities for each species are listed in the SGCN Population, Distribution, Problems, Strategies and Actions matrices (see Chapter IV, Species of Greatest Conservation Need). For the species for which monitoring is not currently underway, an explanation is also included in the above referenced appendices. WDFW will rely on the monitoring information compiled in Chapter IV to identify species that are currently inadequately monitored and to develop a strategy for developing a monitoring program for those species.

Species of Greatest Conservation Need and Associated Habitat

WDFW categorizes wildlife species into two broad groups to determine monitoring objectives, methods, outcomes and use of survey data. Wildlife diversity species include those species that are not hunted within the state; game wildlife is the traditional group of species that are hunted and provide consumptive recreation.

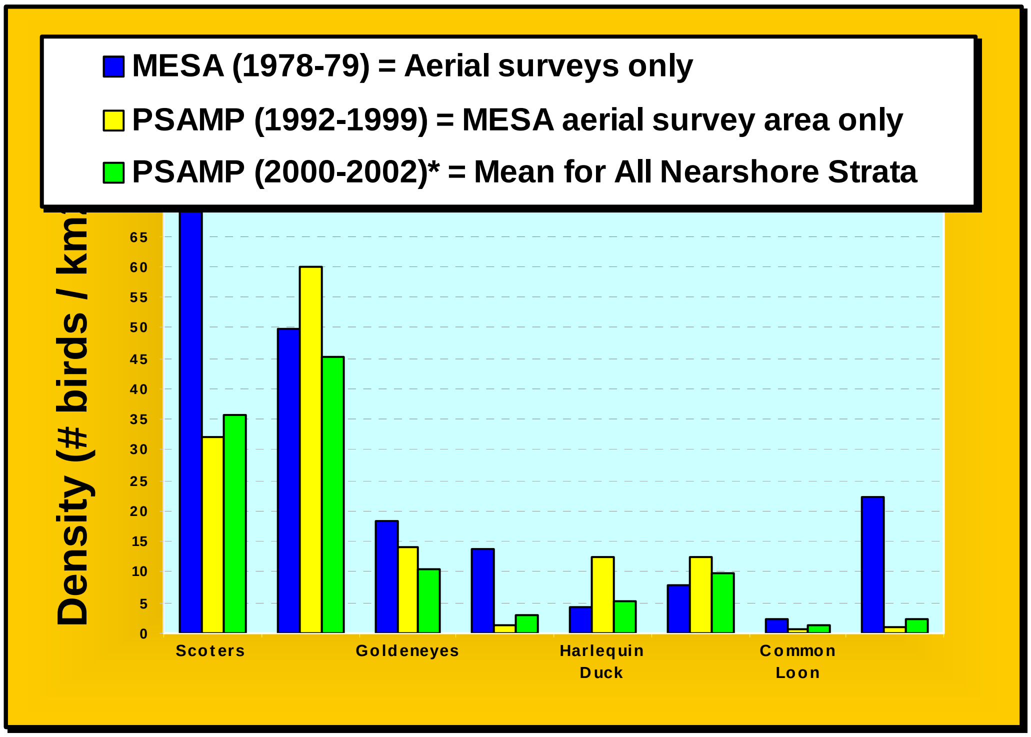
Wildlife Diversity Species Monitoring

Monitoring activities for wildlife diversity species were initiated in the 1970s within the former Washington Department of Game when interest in non-hunted species gained momentum, and the Wildlife Diversity Division was created (http://wdfw.wa.gov/wlm/diversty/diversty.htm). Baseline surveys or complete inventories are conducted to determine population numbers and distribution of wildlife species. Monitoring is structured as an annual activity or at periodic intervals of multiple years. Most of the surveys to date have concentrated on Washington species of concern—the endangered, threatened and candidate species. The objectives have been to determine status and trends of those species for the development of status review documents, recovery plans and landscape management plans such as Habitat Conservation Plans.

Population status monitoring of marine birds and waterfowl was initiated in 1992 through the Puget Sound Ambient Monitoring Program (PSAMP) (http://wdfw.wa.gov/mapping/psamp/). Aerial surveys of nearshore and offshore strata have been the primary tools used for monitoring marine birds and waterfowl throughout Washington's inner marine waters. These data, incorporated into GIS mapping systems, help describe spatial patterns in habitat use and changes in relative population indices over time. Other focus studies, concentrating on selected species and their particular demographics and habitat use, have been initiated after review of the apparent declines suggested by the aerial survey data. These efforts are helping to determine how marine avian species in the inner marine waters of Washington are responding to a changing marine environment as well as helping managers evaluate how different species depend on Washington habitats at critical stages in their life histories. This work has enabled comparisons with earlier data sets such as those collected during 1978-79 as part of the Marine Ecosystem Analysis (MESA) program administered by the National Oceanic and Atmospheric

Administration (NOAA). WDFW staff determined trends in densities over the 20-year interval for 18 species or key species groups that winter in Puget Sound (Figure 36).

Figure 36. Population status and monitoring of marine birds in Washington: Comparison of Relative Density Indices for Eight Species or Species Groups over the 1978-2002 period in Nearshore Waters of Inner Marine Waters of Washington.



Immediate needs for species protection, conservation and management have been the impetus for monitoring species such as spotted owls, marbled murrelets, sage-grouse, pygmy rabbits, peregrine falcons and bald eagles. As species such as peregrine falcons and bald eagles are delisted, their survey and monitoring needs change. For the purpose of site-specific environmental review data or management needs, baseline surveys for these species are done on an as-needed basis. More importantly, however, delisted species are monitored on a long-range plan to determine whether their populations start to decline again. The monitoring plans for peregrine falcons and bald eagles are designed to detect changes at a national level and apply sampling survey protocols that are designed to detect an established percentage of population declines that will trigger management actions.

In addition to monitoring species of concern, there is a growing need to initiate monitoring activities for the less familiar species listed in the SGCN. Baseline population status surveys for these species are hampered by a lack of knowledge of much of their biology and distribution. This is especially true for reptiles, amphibians and invertebrates. We also lack basic population information on many species that have been overlooked because they have been considered common, but may now be experiencing population declines from unknown causes. The great blue heron in western Washington, long a familiar icon of Puget Sound's rich fauna, is a good example. It has been losing nesting colonies at a steady rate.

Game Monitoring
Game species are monitored to evaluate their trends relative to the effects of different types of hunting seasons and to determine the numbers of animals that may be harvested when developing or modifying hunting seasons. Examples of these are pre- and post-hunting season big game surveys for elk, deer, bighorn sheep and moose. Breeding population surveys, midwinter counts and banding are conducted for waterfowl.

More information on game species monitoring is available in the WDFW Game Management July 2003-June 2009 and the Final Environmental Impact Statement for the Game Management Plan July 2003-June 2009, available at http://wdfw.wa.gov/wlm/game/management/.

Fish Species and Associated Habitat

Salmonids
WDFW has been monitoring Washington's wild salmonids since 1977. WDFW maps the geographic extent of spawning and rearing of salmonids throughout Washington, and data are updated on a three-year cycle. WDFW and co-manager treaty tribes conduct spawning surveys of 323 stocks of salmon and trout annually, and measure juvenile migrant production of salmon and trout at 34 locations statewide. Developing estimates of wild salmon production involves mass marking (adipose fin clipping) of an estimated 340 million hatchery salmon every year. WDFW annually monitors the status of all legally installed fish passage barrier repairs and reports the number of blockages discovered by inventory groups to assess progress in meeting state and federal salmon recovery goals.

Marine Groundfish and Forage Fish
Marine groundfish and forage fish abundance are estimated through a variety of survey types such as trawl, video and acoustics, and monitoring of catch and effort data. WDFW conducts periodic surveys on the distribution of forage fish eggs on a small percentage of spawning beaches each year to assist local governments in characterizing and protecting important nearshore habitats.

Shellfish
Shellfish (such as geoduck, razor clam and oyster) abundance is estimated through dive surveys, sampling at index sites and monitoring of catch and effort data.

B. Research Monitoring

Species of Greatest Conservation Need and Associated Habitat

A broad array of ecological research is underway at WDFW with the objective of deducing causal relationships between physical habitat, ecological processes, conservation actions and wildlife and populations. The brief summary included in this chapter lists some of the more prominent studies currently conducted by WDFW.

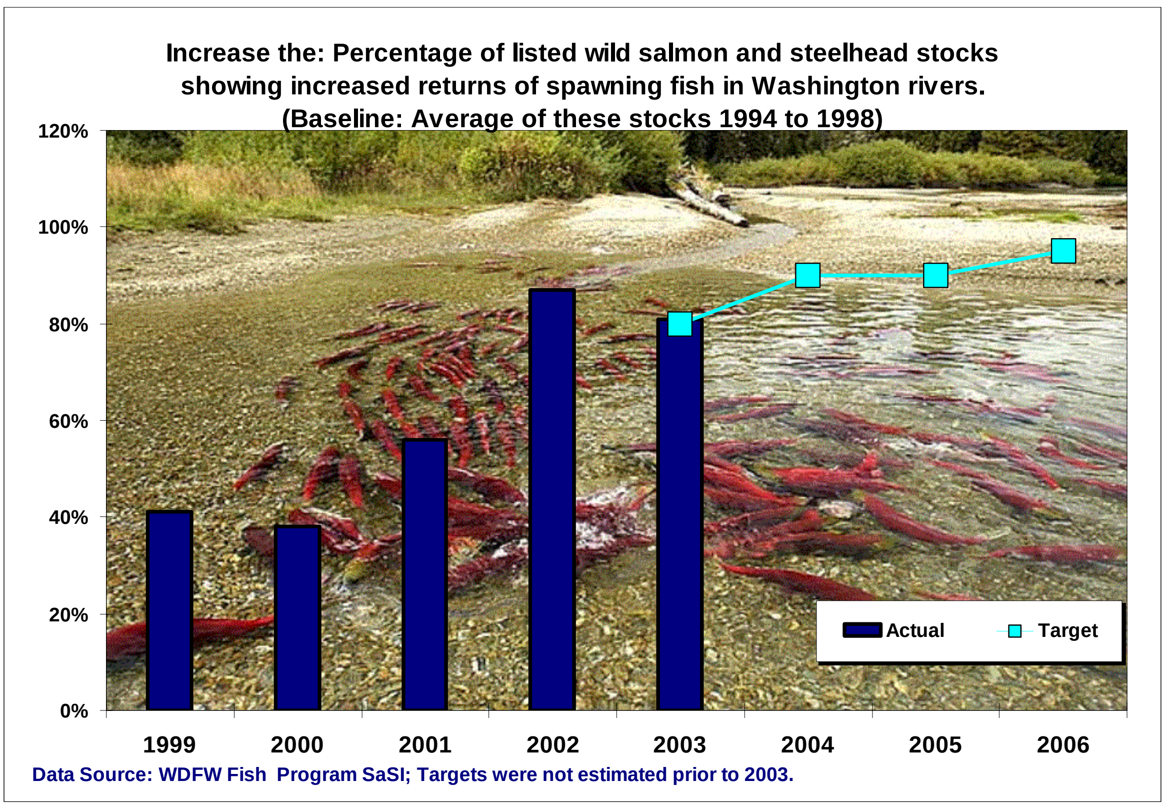
Several studies focus on the causal relationships between conservation management actions and target wildlife species. These include the impacts of the federal Conservation Reserve Program (CRP) on shrub-steppe wildlife, the reintroduction and monitoring of sharp-tailed grouse, and pygmy rabbit captive breeding. Population ecology monitoring is conducted for large raptors, mountain goats, tufted puffins, northern leopard frogs and Columbian white-tailed deer. Habitat relationship studies are carried out for Washington ground squirrels and western gray squirrels. Studies of the effects of disease and toxicology are underway for deer (notoedric mange) and marine mammals (PCBs, PBDEs) in killer whales.

Fish Species and Associated Habitat

Salmonids

Intensive research monitoring for salmonids is generally referred to as validation monitoring because the great body of knowledge surrounding anadromous salmon allows for hypothesis testing of the population response to specific management actions. WDFW conducts validation monitoring to also periodically reevaluate anadromous salmonid productivity, upon which fishery management is based (Figure 37). WDFW's hatchery program evaluates the effects of artificial production problems on wild salmonid stocks. Finally, WDFW has partnered with numerous cooperators to evaluate fish production responses to habitat and land use restoration treatments in 10 streams in western Washington in the Intensively Monitored Watershed Studies. See http://wdfw.wa.gov/fish/wild_salmon_monitor/publications/imw2004_report.htm.

Figure 37. Sample graph tracking spawning returns of listed wild salmon and steelhead stocks.



Marine Groundfish and Forage Fish

Puget Sound groundfish are surveyed using a stratified-random trawl survey. The two subbasins (northern and southern Puget Sound) are surveyed on an alternating year basis. A near-shore, quantitative video survey of rocky habitats provides information on these habitats. WDFW marine protected areas are monitored for trends in fish abundance, spawning activity and size distributions. Commercial and recreational catch are monitored. Two methods are used by WDFW to provide quantitative estimates of herring abundance: spawn deposition surveys and acoustic/trawl surveys. Using one of either of the two methods, WDFW currently estimates the abundance (spawning biomass) of each of the 18 recognized herring stocks in Puget Sound each year. Occasional assessments are conducted on the Washington coastal stock. Commercial catch and recreational catches are managed and monitored. In addition, long-term studies have been conducted regarding contaminant levels of fish in marine waters of Puget Sound.

Offshore assessment of the status of fish stocks is conducted through the Pacific Fishery Management Council (PFMC). The groundfish covered by the Council's groundfish fishery management plan (FMP) include 82 different species that, with a few exceptions, live on or near the bottom of the ocean. These stocks are now managed on a biennial cycle. Off the coast, PFMC operates triennial trawl surveys and conducts periodic stock assessments for the managed species. Highly migratory species require integrated management and assessment by a variety of nations. A variety of sources of information are integrated into the stock assessments for these fish. Coastal pelagic species also require integration of information among various states to determine the stock status for each species.

C. Effectiveness Monitoring

Effectiveness monitoring gauges the success of projects and programs in achieving their stated goals. The product of these monitoring efforts will be used to determine whether specific monitoring projects and programs should be continued, expanded, terminated or adapted to address new circumstances.

WDFW also periodically studies the effectiveness of Bonneville Power Administration habitat enhancement projects on WDFW Wildlife Areas. Game managers monitor hunting harvest and conduct polls to collect information on hunter recreational interests and feedback for hunting seasons.

Fish Species and Associated Habitat

WDFW participates in harvest monitoring through the Pacific Salmon Commission, Pacific Fisheries Management Council, North of Falcon Process, and Columbia River Compact to ensure that commercial and sport fisheries are aligned with population goals. WDFW's coded wire tagging program and its genetics laboratory also contribute to harvest monitoring. The coded wire-tagging program allows estimates of the percent contribution of Washington-origin salmon in the national and international fisheries of the North Pacific Ocean, and makes it possible to estimate marine survival and overall salmon productivity. The WDFW genetics laboratory provides information about stock composition of fishery catches in Washington and in neighboring states. In addition to harvest monitoring, WDFW evaluates the habitat and fish responses to site-specific habitat restoration actions that are conducted in the Intensively Monitored Watershed basins. WDFW contracts with landowners to monitor fish screening devices in streams to ensure they are effective in preventing the passage of fish into irrigation canals, and monitors fishways in state-owned lands to ensure the free passage of fish over dams, spillways and complex road crossings.

D. Implementation (Compliance) Monitoring

Many of the conservation strategies and actions described in the Washington CWCS will be implemented by WDFW, either alone or in cooperation with other conservation partners. Other projects may be carried out solely by other conservation partners, either as part of their own mandates and programs or through funding arrangements with WDFW. Projects that are carried out and funded by WDFW will be monitored by WDFW to ensure that the funds were properly spent and to document that the projects were effective in addressing the CWCS. WDFW uses the Contract and Project System (CAPS), a new shared database system for tracking WDFW contracts and their associated projects. CAPS is designed to provide necessary management controls and reporting capabilities and to address the various programmatic and financial accountability expectations of federal, state and local contracting and grant agencies. WDFW has successfully used CAPS for compliance monitoring on several Federal Energy Regulatory Commission (FERC) projects, as well as in projects affected by Washington Forest Practice laws.

CAPS will be evaluated by WDFW and modified or expanded as necessary to ensure that it meets the expectations and requirements of the CWCS and the State Wildlife Grants program. A second monitoring tool for tracking progress towards CWCS strategies and actions is WDFW's biennial Strategic Plan (http://wdfw.wa.gov/depinfo/strategic_plan05-07.pdf). If the combination of CAPS and the Strategic Plan does not adequately track CWCS progress, new systems will be designed or acquired to meet these needs.

E. Monitoring Tools

WDFW has many data tools to facilitate monitoring activities related to CWCS implementation. Sophisticated data management systems are already in place to accommodate CWCS monitoring, as are interactive web applications making these data more easily accessible to conservation partners and the general public.

Data Management Systems

Many of the most current and sophisticated data management systems have been developed in recent years to address the weighty issue of Northwest salmon recovery. In many cases, due to a lack of funding, the development of terrestrial wildlife data systems lags behind those developed for the salmon recovery program.

WDFW employs powerful relational databases used in conjunction with geographic information systems (GIS) for data entry, automation, management, interpretation and public distribution. WDFW uses data models and platforms that conform to up-to-date industry standards. The most significant data sets supporting wildlife and fish monitoring efforts addressed in the CWCS include the Priority Habitats and Species Program, the Salmon and Steelhead Habitat Inventory and Assessment Program, and the Salmonid Stock Inventory Database.

Some of the most significant data sets supporting wildlife and fish monitoring efforts addressed in the CWCS are summarized below and in Chapter III, State Overview. Two of these three data sets were developed for salmon management and recovery.

Priority Habitats and Species (PHS). Established in 1989, PHS maintains a list of species and habitats that are currently recognized as conservation priorities by WDFW. The PHS list served as one of the source lists for creating the SGCN list developed for the CWCS. In addition to periodically updating the list of priority species and habitats, PHS maintains mapped data on the known locations of all PHS species and habitats and develops management recommendations that summarize the best available science on the conservation needs of these species. PHS is currently the principal means by which WDFW provides important wildlife, fish and habitat information to local governments, state, tribal and federal agencies, private landowners and consultants for land use planning and conservation purposes. Many local governments incorporate PHS data directly into their Critical Areas Ordinances (CAO) required under Washington's Growth Management Act. Most of the data within PHS is derived from WDFW's Wildlife Resources Data System (WRDS). WRDS is the data engine currently supporting all WDFW wildlife data and includes survey data for Washington's species of concern, diversity and game species. (http://wdfw.wa.gov/hab/phspage.htm)

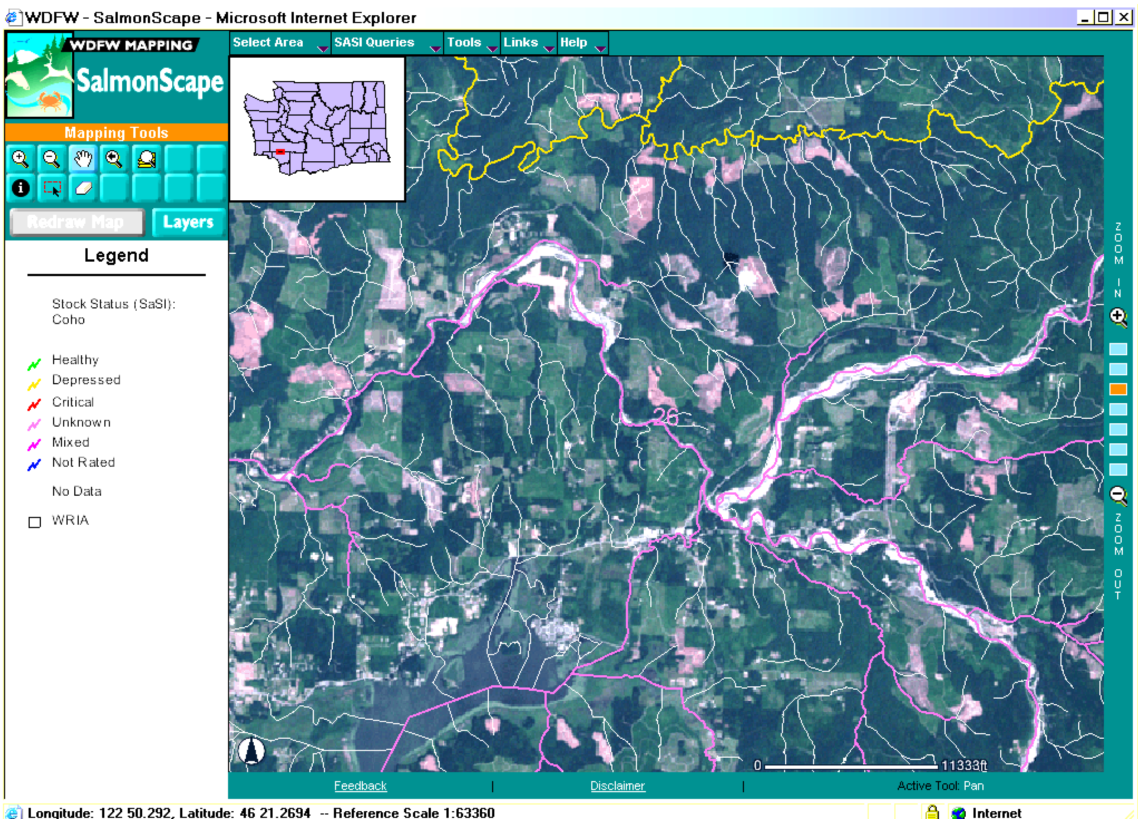
Salmon and Steelhead Habitat Inventory and Assessment Program (SSHIAP). SSHIAP supports a spatial data system that characterizes salmonid habitat conditions and distribution of salmonid stocks in Washington. WDFW and tribal co-managers initiated SSHIAP in 1995. All hydrology and data related to fish presence and use is derived from WDFW's Washington Rivers and Lakes Information System (WLRIS). WLRIS is a relational database GIS system that interlinks with the regional (Washington, Oregon, Idaho and Montana) data program StreamNet. (http://wdfw.wa.gov/hab/sshiap/)

Salmonid Stock Inventory Database (SaSI). WDFW developed SaSI in 1992 to identify changes in salmonid stock health and to prioritize recovery efforts. SaSI is a standardized, uniform approach to identifying and monitoring the status of Washington's salmonid fish stocks. The inventory is a compilation of data on all wild stocks and a scientific determination of each stock's status as healthy, depressed, critical, unknown or extinct. SaSI is a cooperative product of WDFW and tribal co-managers. (http://wdfw.wa.gov/fish/sassi/intro.htm).

Interactive Web Applications

As a public agency, WDFW strives to make data readily available to monitoring partners and the public through interactive, map-based web pages. WDFW's SalmonScape application supports interactive selection and display of spatial data sets such as salmonid distribution and use, migration barriers, preservation and restoration priorities, juvenile fish trap sites, SaSI stock status information, and stream habitat attributes housed within SSHIAP (Figure 38). These data can be displayed against many background layers, including administrative boundaries, roads, streams, major public land ownership, township/section lines, shaded relief imagery and orthophotos (http://wdfw.wa.gov/mapping/salmonscape/). WDFW plans to develop a separate application to house wildlife and fish data stored in PHS. Harvest data on recreationally harvested wildlife species is also made available through the GoHunt application (http://wdfw.wa.gov/mapping/gohunt/).

Figure 38. WDFW's SalmonScape application, depicting SaSI stock status for coho in southwestern Washington.



F. WDFW's Monitoring Partners

WDFW collaborates with several agencies at the state and federal level, tribes, and local and regional groups in prioritizing and conducting status and trends, research, and effectiveness monitoring for fish and wildlife species and their associated habitat. These include the U.S. Fish and Wildlife Service (USFWS), Bureau of Land Management (BLM), and the Washington Department of Natural Resources (WDNR) as well as Treaty Indian tribes, private forest landowners, utilities and land developers, conservation groups, and private citizen volunteers. WDFW works especially closely with WDNR's Washington Natural Heritage Program to design and implement monitoring programs for species that are a priority for both agencies.

Following the listing of several Pacific Northwest salmonids under the Endangered Species Act, more formalized partnerships have arisen relating to monitoring salmon recovery and watershed health. In 1998, the Washington legislature created the Governor's Salmon Recovery Office to coordinate and assist in the development of recovery plans for all listed salmon, steelhead and trout in Washington. Six locally driven regional groups formed to address salmon recovery with representation from local citizens and governments, tribes, state and federal agencies, and other interested parties. Each regional group has developed a draft recovery plan that includes a monitoring component; draft plans were submitted to the Governor's Salmon Recovery Office on June 30, 2005. (http://www.governor.wa.gov/gsro/regions/recovery.htm).

Several monitoring oversight groups have been convened in Washington to guide various monitoring components of wildlife and salmon recovery plans. In 1998, the Washington legislature created an Independent Science Panel to provide scientific review and oversight of salmon recovery planning efforts and specifically to provide technical advice on monitoring components of these plans. Additionally, the Independent Scientific Advisory Board was convened by the Northwest Power and Conservation Council and the National Marine Fisheries Service to provide scientific recommendations on wildlife and fish recovery programs falling under the Northwest Power Act. The Independent Scientific Review Panel reviews projects that are considered for funding under the Northwest Power and Conservation Council's Fish and Wildlife Program, including monitoring activities.

In 2001, the Washington legislature requested the development of the Washington Comprehensive Monitoring Strategy (http://www.iac.wa.gov/Documents/SRFB/Monitoring_Executive_Report_Final.pdf). This statewide monitoring strategy is focused on salmon recovery and watershed health, and has the objectives of standardizing monitoring protocols, integrating state agency efforts, and identifying gaps in monitoring programs. An action plan has been developed with full implementation scheduled for June 30, 2007.

Established by executive order in 2004, the Governor's Forum on Monitoring Salmon Recovery and Watershed Health was convened to provide a venue for ongoing cross-agency coordination on monitoring salmon recovery and watershed health, developing standardized monitoring indicators and protocols, and providing monitoring recommendations to Washington's legislature, Salmon Recovery Funding Board, the Governor's Salmon Recovery Office and appropriate state agencies.

In addition to engaging with the aforementioned groups, WDFW participates in regional monitoring forums such as the Pacific Northwest Aquatic Monitoring Partnership, Puget Sound Ambient Monitoring Program and the Collaborative System-wide Monitoring and Evaluation Project to identify consistent data sharing and sampling protocols for specific monitoring efforts. WDFW is incorporating EPA's Environmental Monitoring and Assessment Program protocols in new large-scale status and trend and research monitoring efforts involving interstate partners. A list of website links to the above referenced programs and agencies can be found at the end of this chapter.

G. Next Steps

Once the Washington CWCS is submitted and approved, WDFW will take a further look at its monitoring activities, priorities and protocols, including the PHS database, to determine what changes should be made to effectively monitor Species of Greatest Conservation Need and associated habitats identified in the CWCS. Based on this analysis, WDFW begin to will refine its monitoring activities for all Species of Greatest Conservation Need to try to match the level of effort and sophistication currently dedicated to salmon recovery. Much can be learned or adapted from systems that have been developed for salmon.

WDFW will also continue to work with other conservation partners and the Washington Biodiversity Council to further refine and develop the concept of a new Biodiversity Index, discussed below and in Chapter II, Biodiversity Conservation.

Refined Monitoring Activities

WDFW will continue to place a high priority on the recovery, management and status monitoring of all state listed endangered, threatened and sensitive species; however, WDFW will also begin to address the monitoring of other species included on the Species of Greatest Conservation Need that are not yet listed by Washington or the federal government. The intent of this process is to recover and conserve these species *before* they are state or federally listed. By law (WAC 232-12-297), WDFW must review the status of all listed species at least every five years. However, Washington's new SGCN list includes a number of species that are not listed as Washington Species of Concern, and WDFW will need to determine monitoring methods and frequency for these species. Current monitoring efforts of species on the SGCN list, including listed species, will be evaluated and broken down into the following categories:

- Species for which adequate monitoring is currently being done—those that currently receive sufficient monitoring attention to allow confident assessment of population status and trends. WDFW will seek to maintain the current level of monitoring for these species.

- Species that are currently receiving some level of monitoring but not adequate to determine with confidence any long-term changes in population size, relative abundance, distribution or habitat use. As resources permit, WDFW will expand status and trend monitoring for these species.

- Species on the SGCN list that are not currently being monitored by anyone on any predictable basis. WDFW will seek to initiate baseline surveys to assess population status and the need for additional monitoring.

- Species for which so little is known about life history and ecology that WDFW was not able to determine current status and trends to design a monitoring program. WDFW will seek to conduct basic research in ecological relationships for these species, followed by baseline surveys to assess population status and identify the need for trend or research monitoring.

Although many specific wildlife habitats are currently mapped and monitored as part of individual species management or recovery efforts, there is no coordinated statewide effort to monitor long-term habitat trends in Washington. Furthermore, while public land management agencies such as WDFW, WDNR, USFWS and USDA Forest Service monitor wildlife habitat on their own lands, there is currently no comprehensive effort designed for long-term assessment and monitoring of habitat on Washington's private lands, which comprise 60% of Washington's landscape, or on many public lands not specifically managed for fish and wildlife. In its 2003 report to the Governor and Legislature, the Washington Biodiversity Conservation Committee (now Biodiversity Council) recommended a number of actions that would improve and broaden the geographic scope of collaborative habitat monitoring. These actions include updating a statewide land use/land cover data layer. Periodic updates of the land use/land cover data would allow for trend analysis of habitat over time.

Biodiversity Index

In addition to reviewing monitoring programs for wildlife species and habitats, WDFW is proposing the adoption of a new statewide Biodiversity Index to track and measure long-term trends in Washington's biodiversity. Biodiversity conservation is one of the Six Guiding Principles of the Washington CWCS (see Chapter I, Introduction) and WDFW is committed to promoting the long-term conservation of Washington's biodiversity.

WDFW will work closely with the Washington Biodiversity Council and other partners, such as the Washington Natural Heritage Program, to establish a proposed public-private Biodiversity Monitoring Committee and to design and implement the new Biodiversity Index. This committee, if established, would be responsible for designing scientific protocols and implementing strategies that will guide the new biodiversity monitoring program. Measures of biodiversity will include species (plants and animals) and their habitats, and the protocols developed by the Committee will determine which species and habitats will be targeted for long-term biodiversity monitoring.

A key component of the proposed Biodiversity Monitoring Program would be a strong Citizen Science network to conduct data collection and reporting activities around the state. The cornerstone of this network will be the hundreds of K-12 schools in Washington, which would be used to monitor long-term biodiversity trends. Strict data collection protocols and quality control measures would be used to ensure that data are consistent and meet standards established by the Biodiversity Monitoring Committee. All biodiversity monitoring data would be centralized and reported back to the Washington State legislature as part of a formal performance agreement between WDFW, the Governor and the Legislature.

H. Adaptive Management and CWCS Review and Revision

Adaptive management is a systematic process for continually improving management strategies by monitoring the impacts of previous management actions. An adaptive management approach is particularly important in managing biological resources because of the inherent complexity and dynamism of natural systems and the scientific uncertainty associated with many natural processes. Adaptive management provisions have been successfully incorporated into regulatory mechanisms in Washington, including Washington's Forest Practices Rules, as well as long-term hydropower Habitat Conservation Plans on the Columbia River. Monitoring is essential for identifying needed changes in management strategies and thus is a critical component of adaptive management.

Washington will adopt an adaptive management approach to implement the CWCS. Through ongoing analysis of monitoring data and periodic review of the CWCS itself, WDFW will ensure that the appropriate changes will be made in the management or funding levels of monitored programs and projects to adapt to new conditions or circumstances. In reviewing the CWCS, WDFW will evaluate the SGCN and associated priority habitats, and the conservation problems, priorities and conservation actions identified at both statewide and ecoregional scales. In order to meet the monitoring requirements of the CWCS and determine the future monitoring requirements of SGCN, WDFW will consider the adequacy of all current monitoring programs, including ongoing and new collaborative efforts.

The first WDFW program review of the Washington CWCS and State Wildlife Grants program will take place in 2006. At that time, the ecoregional assessments will be completed for all nine ecoregions addressed in the CWCS, and WDFW will be able to fully integrate the information and recommendations into an update of the ecoregional chapters in the CWCS. Up to one year will have passed from the initial submittal of the CWCS to the National Advisory and Acceptance Team, allowing for a retrospective analysis. In 2006, WDFW will also develop budget recommendations for the 2007-2009 Washington biennial budget, which could be influenced by an initial review of the CWCS. Unlike the federal government, Washington agencies develop and implement their budgets on a biennial rather than annual basis; thus, the review and revision of the CWCS will be timed to coincide with the biennial budget cycle.

The next review and revision after 2006 will take place in 2008, when WDFW and other state agencies are again developing their agency budget recommendations for the 2009-2011 biennial budget. This review will not need to be as complete as the one done in 2006, nor as thorough as the first six-year program review, which will be conducted in 2012. Beginning in 2012, WDFW will do a full review of the CWCS and State Wildlife grants program in consultation with other conservation partners and affected stakeholders every six years, with a less thorough review and revision scheduled for every two years to coincide with Washington's biennial budget development cycle.

I. Conclusion

Monitoring and adaptive management are critical elements of Washington's CWCS. The status and trends, research, project effectiveness and implementation monitoring efforts described in this chapter provide the means for gauging the health of Washington wildlife and fish populations and for determining whether or not conservation projects and programs are meeting WDFW's goals. These monitoring activities also serve as the cornerstone of Washington's adaptive management approach to implementing agency conservation programs and the CWCS. Through systematic, ongoing review of conservation management strategies and monitoring programs, WDFW will ensure that Washington is effectively conserving Species of Greatest Conservation Need, associated habitats and biodiversity at both the statewide and ecoregional scales, and will ensure that the monitoring requirements of the State Wildlife Grants program are met.

Following is the list of web hotlinks to programs and agencies discussed above in Section F, WDFW's Monitoring Partners.

Collaborative System-wide Monitoring and Evaluation Project
http://www.cbfwa.org/committees/csmep/

EPA's Environmental Monitoring and Assessment Program
http://www.epa.gov/emap/

Governor's Forum on Monitoring Salmon Recovery and Watershed Health
http://www.iac.wa.gov/monitoring/default.htm

Governor's Salmon Recovery Office
http://www.governor.wa.gov/gsro/regions/recovery.htm

Independent Science Panel
http://www.governor.wa.gov/gsro/science/default.htm

Independent Scientific Advisory Board
http://www.nwcouncil.org/fw/isab/background.htm

Independent Scientific Review Panel
http://www.nwcouncil.org/fw/isrp/background.htm

Pacific Northwest Aquatic Monitoring Partnership
http://www.reo.gov/PNAMP/

Puget Sound Ambient Monitoring Program
http://www.psat.wa.gov/Programs/PSAMP.htm

Salmon Recovery Funding Board
http://www.iac.wa.gov/srfb/default.asp

Washington Comprehensive Monitoring Strategy
http://www.iac.wa.gov/Documents/SRFB/Monitoring/Executive_Report_final.pdf
http://www.iac.wa.gov/Documents/SRFB/Monitoring/Comprehensive_Strategy_Vol_2.pdf
http://www.iac.wa.gov/Documents/SRFB/Monitoring/Action_Plan.pdf
http://www.iac.wa.gov/Documents/SRFB/Monitoring/Environmental_Monitoring_Survey.pdf

VOLUME TWO: APPROACH AND METHODS

OVERVIEW

The approach and methods used by the Washington Department of Fish and Wildlife (WDFW) in developing the Comprehensive Wildlife Conservation Strategy (CWCS) were determined or influenced by a number of factors, including Congressional appropriations language, Guiding Principles from the International Association of Fish and Wildlife Agencies (IAFWA), instructions from the National Advisory and Acceptance Team (NAAT) and our own Guiding Principles, which are provided below and explained in Chapter I, Introduction and Background.

A. Identify Species of Greatest Conservation Need

Guiding Principle 1: "Leave no species behind." Address the conservation of species and habitats with identified greatest conservation need, while recognizing the importance of keeping common species common.

There are two different ways to view the conservation and management of wildlife and wildlife habitat, at any level. One is to see wildlife species and populations as the products or outputs of conservation, with habitat conservation being the primary avenue for ensuring healthy, sustainable wildlife populations. The other is to see habitat conservation as the conservation objective, with wildlife populations as a necessary function or product of good habitat conservation. Either approach or mindset can yield sound wildlife conservation, and both are observed and practiced by wildlife conservation agencies across the United States.

The Washington Department of Fish and Wildlife (WDFW) has invested in the proposition that the identification and conservation of habitat across the landscape is the best way to ensure the long-term survival and productivity of the state's fish and wildlife resources. This management philosophy began in the 1940s, when WDFW initiated a visionary program of acquiring wildlife habitat, and continues today with a strong focus on conserving important habitat on both public and private land, through both regulatory and non-regulatory means. WDFW currently owns or controls about 840,000 acres of wildlife habitat statewide. A statewide discussion of Wildlife Species Distribution, Status and WDFW Management Priorities is included in Chapter III, State Overview.

It is WDFW's considered view that Congress' intent in establishing and funding the State Wildlife Grants Program was to promote the development of species-driven state CWCS documents with emphasis on those species that are not hunted or fished and for which funding is unavailable or limited. Our interpretation is that Congress and the National Advisory and Acceptance Team (NAAT) have directed that all elements of the Washington CWCS be driven by the state Species of Greatest Conservation Need list, which was developed over a period of months by WDFW, in consultation with our public and private conservation partners.

The process of developing a Species of Greatest Conservation Need (SGCN) list began in the spring of 2004. Our initial approach was to tie together all the various fish and wildlife species included on existing priority species lists, including WDFW's Priority Habitat and Species (PHS), the Global and State species rankings adopted by the Washington Natural Heritage Program, and the various target species identified in the ecoregional assessments (EAs) being developed by WDFW, in partnership with the Washington Department of Natural Resources and The Nature Conservancy. Our reason for selecting these specific, vetted lists was that they had already undergone considerable scientific peer review and public involvement. Following is a list of sources and their descriptions:

WDFW Priority Habitats and Species (PHS): The PHS List is a catalog of habitats and species considered to be priorities for conservation and management. Priority species require protective measures for their perpetuation due to their population status, sensitivity to habitat alteration, and/or recreational, commercial, or tribal importance. Priority species include Federal Endangered and Threatened species, State Endangered, Threatened, Sensitive and Candidate species; animal aggregations considered vulnerable; and those species of recreational, commercial, or tribal importance that are vulnerable. http://wdfw.wa.gov/hab/phspage.htm

WDFW Species of Concern: This list includes only native Washington fish and wildlife species that are listed as endangered, threatened, or sensitive, or as candidates for these designations. The list also incorporates all federally listed threatened and endangered fish and wildlife species. Endangered, threatened, and sensitive species are legally established in Washington Administrative Codes. Candidate species are established by WDFW policy. Washington State monitor species are those that require management, survey, or data emphasis for one or more of the following reasons: 1) they were classified as endangered, threatened, or sensitive within the previous five years; 2) they require habitat that is of limited availability during some portion of their life cycle; 3) they are indicators of environmental quality; and 4) there are unresolved taxonomic questions that may affect their candidacy for listing as endangered, threatened or sensitive species. Go to: http://wdfw.wa.gov/wlm/diversty/soc/concern.htm

Washington Natural Heritage Program: The Washington Natural Heritage Program (WNHP) is located within the Washington Department of Natural Resources. The primary tool used by WNHP to prioritize individual plant and animal species is the global and state ranking system used by NatureServe and its member Natural Heritage programs.

The ranking system used by NatureServe and WNHP facilitates a quick assessment of a species' rarity. For individual species, the global and state ranks are used as the starting point in the process of assigning priorities. Each rated species is then assigned one of the following priority rankings:

Priority 1: These species are in danger of extinction across their range, including Washington. Their populations are critically low or their habitats are significant degraded or reduced.

Priority 2: These species may become endangered across their range or in Washington if factors contributing to their decline or habitat loss continue.

Priority 3: These species are vulnerable or declining and could become endangered or threatened throughout their range without active management or removal of threats to their existence.

New information provided by field surveys, monitoring activities, consultation and literature review improves accuracy and keeps rankings current. Each month, four to seven local data centers exchange data with NatureServe to achieve a network-wide data exchange over the course of a year. Therefore, the subnational rankings presented in NatureServe Explorer are only as current as the last data exchange with each local data center coupled with the latest site update. This data is always shown in the small print provided with each report.

For more information on NatureServe, go to NatureServe's website at http://www.natureserve.org. For more information on the Washington Natural Heritage Program, go to: http://www.dnr.wa.gov/nhp/

Ecoregional Assessments (EA): The ecoregional assessments being developed by WDFW and other public and private partners are explained in more detail later in this chapter, in Chapter VI, Washington's Ecoregional Conservation Strategy, and in Appendix 12. Animal target species for EAs were chosen from the following groups:

Imperiled species are those having a global rank of G1, G2 or G3, as determined by the Washington Natural Heritage Program.

Imperiled subspecies are those having a global rank of T1, T2 or T3, as determined by the Washington Natural Heritage Program.

Government classified are those listed as endangered or threatened or proposed for listing by the U.S. Fish and Wildlife Service or National Marine Fisheries Service.

Species of special concern include:

- Species of state concern that are 1) ranked as S1, S2 or S3 by Washington Natural Heritage Program, or 2) listed or candidates for listing as endangered or threatened by WDFW.

- Declining species that 1) have exhibited a significant, long-term decline in habitat and/or numbers, and 2) are subject to a continuing high degree of threat.
- Endemic species restricted to the ecoregion or part of the ecoregion. We defined endemic as one for at which at least 75 percent of its geographic range occurs in the ecoregion.
- Disjunct species with populations that are geographically isolated from populations in other ecoregions.
- Vulnerable species are usually abundant, may not be declining, but some aspect of their life history makes them especially vulnerable, such as habitats needed for migratory stopovers or winter range.
- Keystone species are those whose impact on a community or ecological system is disproportionately large for their abundance. They contribute to ecosystem function in a unique and significant manner through their activities. Their removal causes major changes in community composition.
- Wide-ranging species that depend on vast areas. These species include top-level predators such as the gray wolf and northern goshawk. Wide-ranging species can be especially useful in examining linkages among conservation areas in a true conservation network.
- Globally significant examples of species aggregations like migratory stopover sites or overwintering areas that contain significant numbers of individuals of many species.
- Partners in Flight (PIF) species for whom a conservation priority score for a species indicated need for special attention. This guideline applies only to birds.
- Species guilds are groups of species that share common ecological processes or patterns. It is often more practical to target such groups as opposed to each individual species of concern.

Partners In Flight (PIF): Partners In Flight is an international partnership to document and reverse the decline of Neotropical migratory birds. The Partners in Flight species assessment system uses six criteria, each scored from one to five, to rank or categorize species at the national level. These criteria are meant to assess the overall vulnerability of the species to endangerment and have bee added together to give an overall ranking. The highest possible score is 30, indicating the greatest vulnerability, and the lowest possible score is 6, which indicates a secure species. Go to: http://www.partnersinflight.org/

Process and Criteria Used to Develop the Species of Greatest Conservation Need List:

Species Ranking Criteria: In developing the Species of Greatest Conservation Need list for Washington, WDFW considered about 700 terrestrial, aquatic and marine species—both vertebrates and invertebrates—that were ranked by the five species conservation programs listed above. Then, using the expertise of WDFW staff and invited taxa experts from other agencies, an initial draft list of SGCN was produced in the form of an Excel matrix that included a number of fields, including source species lists, associated habitats and management and species recovery plans. This matrix was heavily weighted toward species that had already been recognized as being in trouble and therefore listed on federal and state lists of endangered, threatened and sensitive species lists.

This initial SGCN list was presented to the Washington CWCS Advisory Committee in a workshop held on May 27, 2004. The Advisory Committee's reaction was positive regarding the development of the matrix itself; however, they felt that the list overlooked or discounted many species for which we do not yet have adequate information, species that are underfunded for conservation, and species that have "fallen through the cracks"—in that they may be headed for trouble but have not yet been included on state or federal species of concern lists. The Advisory Committee also felt that the list did not adequately reflect one of our guiding principles: "keeping common species common".

After the May 27, 2004 meeting with the Advisory Committee, we developed a new process and new criteria for developing a Species of Greatest Conservation Need list for the Washington CWCS. The following table shows the criteria used to develop this new species list. The criteria guidelines were designed to not only consider the biological needs of fish and wildlife species, but also other factors such as the extent of current knowledge about the species, current expenditures, and conservation measures already in place to protect the species or its habitat. These new criteria were drafted by WDFW's Wildlife Program and were given a thorough peer review within WDFW and approved by members of the CWCS Advisory Committee. The criteria were then given to members of the taxa expert review teams to use as guidance in their rankings. A list of taxa committee members is included as Appendix 11.

WASHINGTON CWCS SPECIES RANKING CRITERIA

<table>
<tr><th>FACTOR</th><th>CRITERIA</th><th>NOTES</th></tr>
<tr><td colspan="3">I. CONSERVATION CONCERNS – Y AXIS (High score = high priority)</td></tr>
<tr><td>THREATS</td><td>Number of threats
Irreversibility, immediacy of threats
Rank 1 through 5

1 = Low threat
3 = Medium threat
5 = High threat

Threats are to be considered for WA only unless species is migratory and has a known limiting factor outside the state.</td><td>Threats are defined as human-caused impacts.

WA state actions may not be restricted to addressing threats within the state. For example, funds might be used to attend international conferences for the conservation of a particular species.

A species with different threats in different regions can be treated as different species in the matrix, i.e. western meadowlark (westside) and western meadowlark (eastside)</td></tr>
<tr><td>CURRENT STATUS</td><td>Degree of concern (WDFW listings, National Heritage Program global and state rankings).
Automatically calculated in spreadsheet using assigned values for each rank.

<table>
<tr><th colspan="2">WDFW</th><th colspan="2">NHP</th></tr>
<tr><td>E</td><td>3</td><td>G1</td><td>3</td></tr>
<tr><td>T</td><td>3</td><td>G2</td><td>3</td></tr>
<tr><td>S</td><td>2</td><td>G3</td><td>2</td></tr>
<tr><td>C</td><td>2</td><td>G4</td><td>1</td></tr>
<tr><td>M</td><td>1</td><td>G5</td><td>0</td></tr>
<tr><td></td><td></td><td>S1</td><td>3</td></tr>
<tr><td></td><td></td><td>S2</td><td>3</td></tr>
<tr><td></td><td></td><td>S3</td><td>2</td></tr>
<tr><td></td><td></td><td>S4</td><td>1</td></tr>
<tr><td></td><td></td><td>S5</td><td>0</td></tr>
</table>
</td><td>Where a species has dual rankings, the ranking of highest concern was chosen for consideration.

Number values for each rank were assigned by expert judgment.

Species with too little information for ranking (i.e. GU or SU) were not assigned a value. Expert judgment will be needed on a species-by-species basis.

Rank 1 through 3

1 = Low status
2 = Medium status
3 = High status</td></tr>
<tr><td>SOCIO/ ECONOMIC VALUE</td><td>Rank 1 through 3

1 = Low value
2 = Medium value
3 = High value</td><td>Cultural icon (i.e. tribal)
Commercial/game species
Non-consumptive recreational
Flagship species
Keystone species
Indicator species</td></tr>
<tr><td>VULNERABLE</td><td>Rank 1 through 5

1 = Low vulnerability
3 = Medium vulnerability
5 = High vulnerability</td><td>Vulnerability is defined through elements of life history.

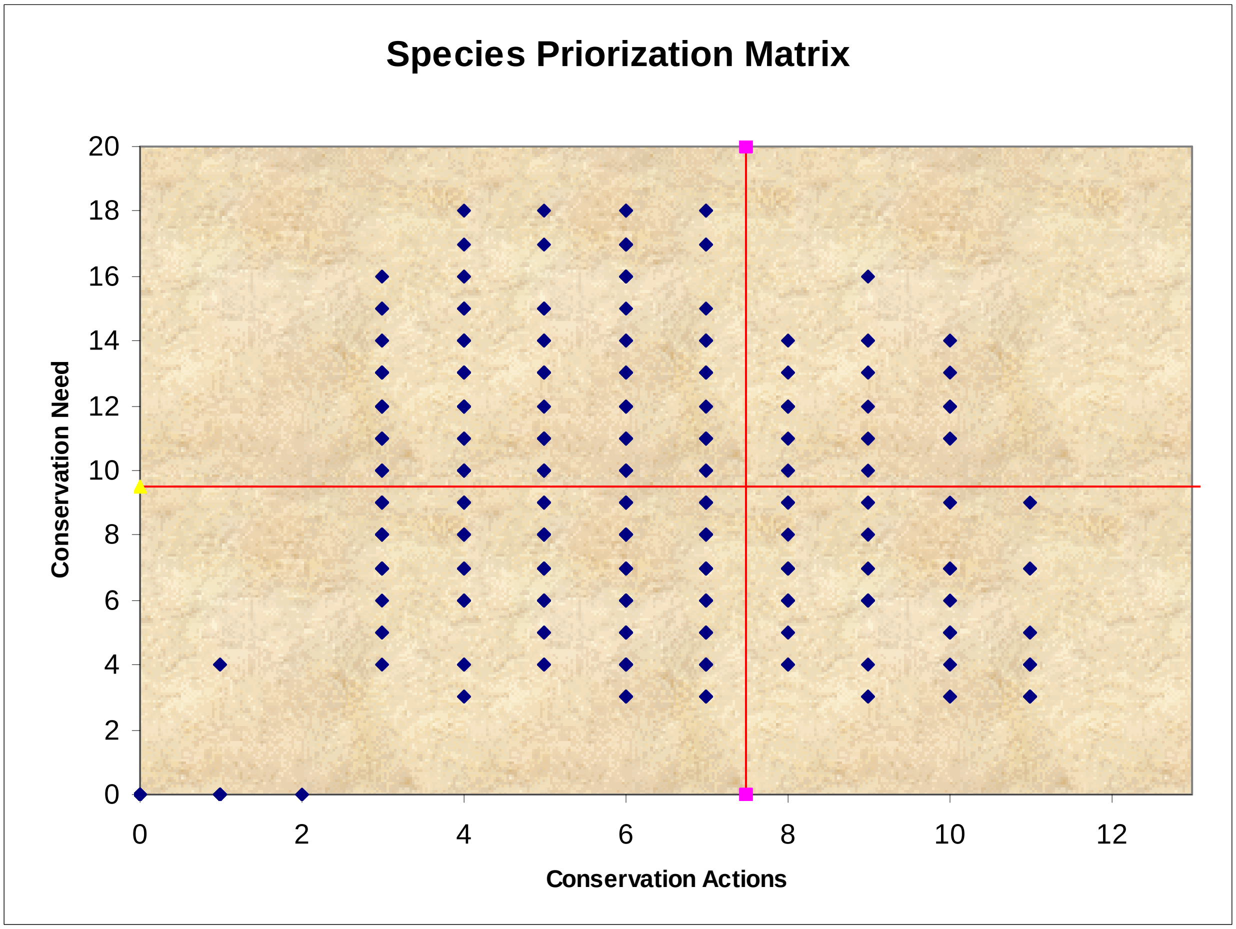
Reproductive mechanisms
Scale of endemism
Specialist
Restricted distribution
Peripheral range (breeding vs. non)</td></tr>
</table>

FACTOR	CRITERIA	NOTES
CONSERVATION ACTIONS – X AXIS (High score = low priority)		
KNOWLEDGE	**Adequate knowledge to manage species in the state of Washington.** 1 = Low knowledge in WA 2 = Medium knowledge in WA 3 = High knowledge in WA	Knowledge of species applicable to Washington populations. Example: Consider ecological relationships, limiting factors, population dynamics.
EXPENDITURES	**Non-SWG sources of funding available or being used** 1 = Inadequate 2 = Partly adequate 3 = Mostly adequate	Based on what you know, give us your opinion. Example: 1 = <$50K 2 = $50K - $500K 3 = >$500K
ADEQUACY OF CONSERVATION MEASURES IN PLACE	**Amount of current protection related to species need:** 1 = Inadequate 3 = Partly adequate 5 = Mostly adequate	Consider the following: Regulation Planning efforts Acquisition Easement Population manipulation Enforcement/compliance Education Community involvement/concern Mitigation

EXAMPLE of Conservation Measures for the Northern Spotted Owl: Resulting score would be a 3.

CONSERVATION MEASURES	INADEQUATE	PARTLY ADEQUATE	MOSTLY ADEQUATE
Regulation		x	
Planning efforts		x	
Acquisition		x	
Easement		--	
Population manipulation	x		
Enforcement/compliance	x		
Education		x	
Community involvement/concern		x	
Mitigation	x		

Points were assigned to each criterion in the “Conservation Concerns” section and in the “Conservation Actions” section of the ranking matrix. The criteria were grouped into two main categories: 1) Conservation Concerns factors related to current ecological condition of the species, and 2) Conservation Actions factors related to the level of conservation attention currently given to each species. Criteria were totaled for each main factor. Totals for Conservation Concerns factors were plotted against the totals for Conservation Actions factors. A draft threshold was selected at the mid-point of each axis to divide the species list into four quarters. Species whose total points fell **above** the cutoff number for “Concerns” and **below** the cutoff number for “Actions” (i.e., the upper left quartile on the following scatter plot) were placed on the Species of Greatest Conservation Need (SGCN) list. Final thresholds were selected by expert opinion within the WDFW Wildlife Diversity Division to ensure that a selected list of species with known high conservation concern and currently receiving significantly less than recommended conservation attention fell within the SGCN quartile.



Species Ranking Process: It took most of the rest of 2004 to assemble taxa ranking teams of species experts and have them evaluate almost 700 fish and wildlife species, invertebrates included. For anadromous salmonids, the groupings used for evaluation were genetic diversity units (GDUs) rather than species. A genetic diversity unit is a group of genetically similar stocks that is genetically distinct from other such groups within a species.

The taxa evaluation teams were comprised primarily of WDFW personnel, with several invited staff from the Department of Natural Resources' Natural Heritage Program, the Washington Department of Transportation and the Oregon Natural Heritage Program (the only beetle specialist we could find). They met as often as required to assimilate the ranking criteria and evaluate the species assigned to their taxa evaluation team. Many of the species evaluated for the SGCN list ranked high due to biological concerns such as threat and vulnerability; some were targeted because their recovery or conservation efforts were not considered to be adequately funded. Others were included because their life history or habitat relationships are poorly understood and need more research and/or management dollars directed to them. Only native animal species were considered in developing this list. No major wildlife taxon was excluded from consideration. Game and commercially harvested species were included if they met other ranking criteria, i.e., if they were on one of the source lists. There were many heated discussions among taxa team members about which species should be included or not included on the SGCN list. However, the final result is an SGCN list (see Appendices 1 and 2) that we feel not only meets the expectations of Congress, but also meets the current conservation and funding needs of Washington's native fish and wildlife resources.

The resulting Species of Conservation Concern (SGCN) list for Washington, along with rankings, habitat associations, ecoregion occurrences, management and recovery plans is attached as Appendices 1 and 2.

Species Conservation Tables: The Species of Greatest Conservation Need matrix, included as Appendices 1 and 2, includes all 600 species ranked by WDFW. In addition, a table showing information on status, distribution, life history, conservation problems, conservation strategies and monitoring activities for the SGCN is included as Chapter IV. Other enhanced matrices, which include information on status and trends, problems and actions, are included as Appendices 9 and 10.

A separate list of Species of Greatest Conservation Need was also included in each ecoregional chapter. These ecoregional species lists were not developed independently of the statewide effort, but are simply those SGCN species that are known to occur in each particular ecoregion. For each ecoregional habitat description, we also included a list of species commonly associated with that habitat, again only a subset of the ecoregional species list.

Salmon Recovery: The issue of how to treat salmon conservation and salmon recovery in the Washington CWCS was a topic of intense discussion since the beginning of the planning process. Washington's eleven species and subspecies of native salmonid fish not only have important biological, cultural, commercial and recreational value; salmon are important indicators of watershed health throughout the Pacific Northwest. More than two-thirds of WDFW's budget and staff are directly or indirectly devoted to salmon production, salmon recovery, and salmon harvest allocation. WDFW is also leading or heavily involved in the development and implementation of salmon recovery plans at many different levels, from individual watersheds to the international waters of the Pacific Ocean, Puget Sound/Georgia Basin, and the Columbia River system.

Because salmon are so important to the overall discussion of the state's fish and wildlife resources, it was decided to include them developing WDFW's Species of Greatest Conservation Need list. Although it made no sense to rank only eleven species, or to rank hundreds of salmon stocks and populations, it did work to rank salmon by GDU, and that is what senior fisheries biologists at WDFW did. A list of salmon GDUs included in Washington's Species of Greatest Conservation Need (SGCN) list is included as Appendix 2.

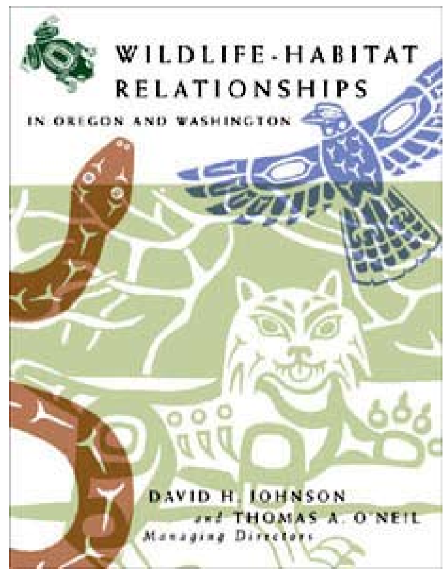
For most other discussion of salmon conservation and recovery, including statewide Habitats of Conservation of Concern, problems and strategies, it was decided to refer CWCS readers to various other salmon planning efforts and collaborative plans, a list of which is included as Appendix 7. A sense of balance was hopefully achieved between ignoring salmon, which would have been contrived, and discussing all aspects of salmon conservation, which could have overwhelmed all other discussion of species and habitat conservation in the CWCS.

B. Identify Habitats of Conservation Concern

While the State Wildlife Grants program and the CWCS guidelines are essentially species-driven, much of the conservation effort that will be directed to identified Species of Greatest Conservation Need will be habitat-related, including habitat protection, restoration, and enhancement measures carried out by WDFW and its public and private conservation partners. The NAAT guidelines not only require that we identify wildlife habitat types and communities that are essential to the conservation of Species of Greatest Conservation Need, but that we provide information on the extent and condition of these habitats.

Unlike the evaluation and ranking of species, WDFW did not consider it necessary to design new criteria or do any original analysis to determine the associated habitats essential to the Species of Greatest Conservation Need. These species-habitat associations have been well established recently through two efforts, both involving and funded by WDFW and other conservation partners:

Wildlife-Habitat Relationships of Oregon and Washington (WHROW), published by Oregon State University in 2001. The co-authors of this remarkable 736-page book (with accompanying appendices) are David H. Johnson, a wildlife biologist and WDFW employee at the time of publication, and Thomas A. O'Neil, a principle with the Northwest Habitat Institute. WHROW provided WDFW with an invaluable source of current information on species/habitat relationships. A primary emphasis of the book was to develop high-quality data sets on wildlife habitats and their associated species. This was achieved by defining, describing, and depicting various component details about wildlife habitats. This approach moves away from defining what is primary or secondary habitat for a species, and towards identifying the overall strength and context of the relationship between the wildlife species and their habitat(s). The strength of the relationship is designated as *Closely Associated, Generally Associated*, or *Present* within the wildlife habitat types or structural conditions. In addition, a confidence rating was assigned to the relationship and its strength, based on current knowledge. This approach allows for an individual species, as well as multiple species, to be assessed across habitats.



Using the data sets provided by WHROW and the Interactive Biological Information System (IBIS), described below, we were able to develop our SGCN master list and cross-reference species relationships across all defined habitats across the state. Using this data, we were then able to compare the frequency of close and general associations between Species of Greatest Conservation Need and WHROW habitats and select CWCS priority habitats based on SGCN dependence on those habitats.

Statewide and ecoregional habitat maps included in the CWCS are based on WHROW habitat source data.

Tom O'Neil and the Northwest Habitat Institute developed the Interactive Biological Information System (IBIS), an informational resource developed to promote the conservation of Northwest fish, wildlife, and their habitats through education and the distribution of timely, peer-reviewed scientific data. IBIS contains extensive information about Pacific Northwest fish, wildlife, and their habitats, and attempts to reveal and analyze the relationships among these species and their habitats. IBIS is described in more detail in Chapter III, State Overview.

A copy of *Wildlife-Habitat Relationships of Oregon and Washington (WHROW*) is included with the Washington CWCS as Appendix 13. For more information on data collection and analysis techniques used in WHROW data sets, go to: http://www.nwhi.org/ibis/home/ibis.asp

Ecoregional Assessments (EA) (described in Appendix 12): To complete the Ecoregional Assessments for Washington, expert technical teams collaborate on a series of analyses based on methods developed by The Nature Conservancy, NatureServe and other conservation organizations. These technical teams analyze terrestrial and aquatic plants, animals and ecological systems.

Each EA technical team begins their analysis by selecting the species, communities and ecological systems that would serve as the conservation targets, i.e., the elements of biodiversity that should be included in priority conservation areas. This results in the selection of terrestrial species targets, aquatic species targets, rare plant community types, and coarse filter system targets. These system targets are the major habitat types that make up the terrestrial and aquatic environments for each ecoregion. They are used as targets based on the hypothesis that by ensuring their full representation in the portfolio, the majority of species in each ecoregion—including the vast number of poorly studied or unknown species—will also be included. In this way the coarse filter system targets serve as a substitute or surrogate for common species and species with inadequate data.

For each of these targets, all available records of location and status in the ecoregion are gathered and reviewed. Goals are then set for each target to serve as instructions or benchmarks for the identification of the portfolio of priority conservation areas. These goals describe how many populations (for species targets) or how much area (for system targets) the portfolio should include to represent each target, and how those target occurrences should be distributed across the ecoregion to ensure good representation of genetic diversity and hedge against local extirpations. More details of the development of ecoregional assessments are included in Appendix 12.

The Washington Natural Heritage Program provided a crosswalk comparison of habitat classification systems developed by WHROW, NatureServe, and WDFW's Priority Habitats and Species. This crosswalk is included as Appendix 14.

Statewide and Ecoregional Habitats of Conservation Concern: The master SGCN ranking matrix (Appendices 1 and 2) shows associated WHROW habitats for each species ranked for the statewide SGCN list. A list and description of priority WHROW habitats selected by the CWCS is also attached as Appendix 8. For purposes of reference only, Appendix 14 cross-references WHROW habitat classifications with WDFW PHS Habitats and NatureServe's Ecological System-based Land Cover Types for clarification. Habitat descriptions and evaluations included in the list of statewide Habitats of Conservation Concern were reviewed for accuracy by respected scientists within and outside the WDFW, including members of the Washington Natural Heritage Program. Chapter III, State Overview of the Washington CWCS also includes a table that groups all 29 of the WHROW wildlife habitats that occur in Washington into three priority groupings, Priority One, Priority Two, and Other. These statewide priority groupings were made by simply associating the wildlife species on the SGCN list with their associated habitats, as determined by WHROW. These habitat priorities were reviewed by WDFW managers and are compatible with other systems and lists of priority habitats employed by WDFW, including the existing PHS system.

Each of the ecoregional chapters in the Washington CWCS includes a list of those WHROW wildlife habitats found in that ecoregion titled Ecoregional Habitat Overview, as well as those habitats, which are considered to be a management priority for that ecoregion. As with the statewide list of priority habitats, ecoregional priority habitats were determined by deciding which habitats were most closely associated with species on the SGCN list found in that ecoregion.

In the future, the Washington CWCS's habitat classification and maps will be updated using "ecological systems." This will make the CWCS consistent with the USGS National Land Use/Land Cover mapping that is currently in progress. This coarse-filter classification is being adopted by all federal agencies and by NatureServe for regional conservation planning.

C. Identify Major Problems and Conservation Strategies for Species and Habitats

Guiding Principle 2: "Build a plan of plans." Construct the Washington CWCS from a large body of existing work, including nine ongoing ecoregional assessments.

The Washington Department of Fish and Wildlife experiences most of the same problems, threats and opportunities related to fish and wildlife conservation as other state wildlife agencies in the United States. Although the diversity of species and habitats may be greater than in many other states, the range of opportunities and possible actions available to WDFW and its conservation partners is similar to those available in other states. Fish and wildlife conservation in Washington—and other states, for that matter—is limited only by the laws in place to protect wildlife and habitat, the extent to which the public and decision makers will enforce these laws, and the funding available for conservation.

Statewide Problems and Conservation Strategies: In developing the CWCS for Washington, many other plans and assessments were reviewed and summarized. Some of these plans are described in Chapter III, State Overview. A narrative discussion of major statewide conservation problems and issues is also included in Chapter III, State Overview. WDFW did not attempt to prioritize the statewide problems and conservation strategies discussed in Chapters III. All of the major conservation problems discussed in Chapter III are serious problems, although their relative importance may vary from ecoregion to ecoregion. Subsequent to the release of the draft CWCS in June 2005, additional matrices were developed to provide more information on the life history, population status, distribution, problems, strategies and recommended conservation actions for each of the roughly 200 fish and wildlife species included on the SGCN list. These new matrices are discussed below.

Ecoregional Problems and Conservation Actions: Each ecoregional chapter of the Washington CWCS includes a list of Ecoregional Conservation Partnerships, as well as Major Plans and Assessments reviewed and used to develop each ecoregional discussion. Each chapter also includes a discussion of identified problems, as well as conservation actions that will be pursued in each ecoregion to address these problems. Many of these problems and conservation actions were extracted or synthesized from other plans. For the purposes of ensuring that the full range of conservation problems and threats were considered, WDFW staff consulted *Conventions for Defining, Naming, Measuring, Combining and Mapping Threats in Conservation, Draft 1* (Salafsky et al., December 2003).

Much of the staff work spent on developing these ecoregional chapters was completed after the draft CWCS was released in June 2005. The discussion of ecoregional conservation actions for wildlife species and associated habitats was expanded in scope and detail for the final CWCS.

Species Conservation Matrices: Conservation problems and corresponding strategies and actions are often interconnected at a range of levels. Whether a certain condition has an impact on an ecosystem, a habitat or a species, all three may be affected in some way. Adequately addressing problems at larger scales can have beneficial indirect effects at finer scales, and it is important to consider each individual species and the unique problems that affect the abundance and vitality of each.

Therefore, we created a set of matrices to detail each SGCN species' life history, status, distribution, general and specific problems, and conservation actions. Expanded text matrices for each taxon are included in Chapter IV, Species of Greatest Conservation Need, and a problems/actions checklist matrix that summarizes this information is attached as Appendix 10. In this way, each species may be targeted for specific actions, and cross references may group suites of species that are adversely affected by the same problems and which would benefit from the same conservation actions. Each of these matrices summarizes important conservation problems and actions for all Species of Greatest Conservation Need.

Species information, conservation problems and actions were refined from a variety of sources including ecoregional assessments, subbasin plans, management and recovery plans, status reports, current peer-reviewed literature, and expert opinion.

D. Provide for Periodic Monitoring of Species, Habitats and Conservation Actions

Monitoring is a key element in managing WDFW's fish, wildlife and habitat conservation programs, but WDFW's monitoring activities had never been pulled together and described in one place before. In 2005, WDFW Director Jeff Koenings appointed one of his senior policy staff as WDFW's new Monitoring Coordinator and asked her to develop a report that would summarize current and proposed monitoring activities for Washington's CWCS. She met with managers from the Fish, Wildlife and Habitat Programs on a number of occasions to ensure that key monitoring programs were included in the summary, and to design some future steps to monitor fish and wildlife species, associated habitats and biodiversity. The result of this internal coordination effort is described in Chapter VII, Monitoring and Adaptive Management.

E. Provide for the Periodic Review and Revision of the CWCS

Development of the CWCS is perhaps the largest and most complex conservation planning effort undertaken by WDFW since the agency's creation in 1994 (by merger of separate Departments of Wildlife and Fisheries). It was a huge effort for a relatively new agency without a history of comprehensive planning. Developing a new Species of Greatest Conservation Need list alone was a protracted and often painful process, but was worth the effort because it narrowed the field of species eligible for new funding from thousands to less than 200, including many invertebrates and other less well-known animals that were never before considered.

WDFW went into the CWCS process committed to developing the best comprehensive wildlife strategy it could produce in the less than two years allocated to the process. WDFW is equally committed to following through on the various strategic recommendations in the CWCS by reviewing these recommendations on a regular basis, revising the species and habitat priorities when necessary and appropriate, and adopting or developing fair and rational approaches to allocating responsibilities and funding for implementation, both within WDFW and among its various public and private conservation partners. The subject of CWCS review and revision is discussed in more detail in Chapter VII, Monitoring and Adaptive Management.

F. Coordinate Development of the CWCS with Federal, State, Local and Tribal Partners

The Washington Department of Fish and Wildlife has emphasized coordination with many public and private conservation partners in the development of its CWCS, with a strong emphasis on those partners who have a primary interest or statutory responsibility for fish and wildlife conservation. Both elements of coordination and public involvement have been addressed in an Outreach Plan discussed later in this chapter. CWCS coordination was accomplished at three different scales:

National: WDFW staff have worked closely with the U.S. Fish and Wildlife Service and the International Association of Fish and Wildlife Agencies (IAFWA) during all phases of the CWCS process. We have participated in national CWCS conferences in Burnet, Texas and Nebraska City, Nebraska in 2004; our Director gave a keynote talk at the Nebraska conference.

Regional: Throughout the CWCS development process, WDFW staff have met on a regular basis with Federal Aid staff at the U.S. Fish and Wildlife Service, Region One in Portland, Oregon. WDFW has participated in regular conference calls with the Development Assistance Team (DAT) representative from Region One, as well as other western state fish and wildlife agencies. Early in the process WDFW also took the lead in setting up coordination meetings with CWCS coordinators from Oregon and Idaho, as well as Northwest representatives from Defenders of Wildlife and The Nature Conservancy. These meetings were held at the WDFW regional office in Vancouver, Washington, until everyone got too busy with CWCS production to meet on a regular basis.

Statewide: WDFW staff coordinated the development of the Washington CWCS with a wide range of internal and external organizations, including our own management program staff in Olympia headquarters, our field staff in six administrative regions around the state, and other state, federal and tribal wildlife agencies. Teams of technical experts were convened as necessary to develop our Species of Greatest Conservation Need list and associated habitats; these teams were comprised mostly of headquarters staff from Olympia. Meetings were held in all WDFW regional offices to involve regional staff in development of the nine ecoregional chapters of the CWCS. WDFW also closely coordinated the development of its CWCS with the Washington Natural Heritage Program of the Department of Natural Resources, as well as staff from The Nature Conservancy of Washington, Defenders of Wildlife and Audubon Washington. Much of this coordination took place around certain issues on an ad hoc basis.

G. Incorporate Opportunities for Public Involvement into Development of the CWCS

One of the first tasks undertaken by WDFW in the CWCS process was the development of an Outreach Plan in late 2003. This plan built upon the outreach efforts of other plans such as the subbasin plans and ecoregional assessments, which all have their own public involvement and agency coordination elements. The CWCS Outreach Plan addresses the interagency coordination requirements of both Essential Element 6 and the Public Involvement requirement of Essential Element 7. Although review opportunities were provided for the general public in the draft CWCS review process, primary outreach attention was given to those agencies, organizations and stakeholder groups most affected by the strategies outlined in Washington's CWCS. The Outreach Plan also addresses WDFW's various internal publics, ranging from the Fish and Wildlife Commission and Department staff to various standing advisory committees to the Director.

The CWCS Outreach Plan, included as Appendix 4, outlines the following three phases or points of contact with agencies, NGOs and the public:

Initial Outreach: From November 2003 through June 2005 we met with existing WDFW advisory councils, an appointed CWCS Advisory Committee, federal and state agencies, Washington Indian tribes, the Governor's Office, key legislators and the Washington State Association of Counties on many occasions. At these briefings we provided an overview of the CWCS process and indicated that once we developed a draft CWCS document, we would provide opportunities to these same agencies and publics to comment on the draft and shape the future State Wildlife Grants (SWG) program for Washington.

We met with a wide range of agencies and organizations in our initial outreach phase; however, as indicated above, our main outreach focus was on agencies and organizations with special responsibilities for fish and wildlife conservation—our public and private conservation partners. See Appendix 15, Outreach Record. Treaty Indian tribes, for instance, have "co-management" status under federal treaties for managing and harvesting salmon, shellfish and some game animals. The Washington Department of Natural Resources and USDA Forest Service manage vast areas of public lands that provide habitat for Washington's fish and wildlife. The Washington Association of Counties and the Planning Association of Washington represent local elected officials and county planners responsible for implementing Washington's Growth Management Act, which is the most comprehensive state law addressing the protection of habitat and other identified "critical areas." Many of our conservation partners are listed in Appendix 5.

Special outreach efforts were directed toward conservation partners such as The Nature Conservancy, Audubon Washington and Defenders of Wildlife, as well as private timber and agriculture groups, which are heavily regulated and have a direct influence on Washington's rural landscape. Our initial outreach message was intended to secure interest and involvement in the CWCS process, but we also wanted to assure industry groups such as the Washington Farm Bureau and the Washington Forest Protection Association (timber industry lobby) that WDFW does not see the State Wildlife Grants program and CWCS requirements as a venue for justifying or recommending new regulatory programs.

A CWCS Advisory Committee was appointed by the Director of Fish and Wildlife in early 2004 and met periodically as a committee throughout the development of the CWCS. At each meeting we updated the committee on the process of Washington's CWCS and asked for their feedback on our approach. The committee included professionals experienced in their respective industries and fields. They provided honest, constructive feedback and served as a valuable sounding board for development of the CWCS. Members of the CWCS Advisory Committee are listed in Appendix 11.

Draft Strategy Review: Our original outreach plan called for two rounds of review for the draft CWCS; the first in March or April 2005 for our internal publics, the second in May and June 2005 for our external publics, including other conservation agencies. Because the production schedule for the draft CWCS took longer than expected and, in order to meet our August deadline for submittal to the NAAT, we combined both external and internal publics into one review period.

On June 1, 2005 WDFW sent out a statewide press release announcing that the draft CWCS would be posted on WDFW's website and that we would sponsor a series of six public meetings around the state in June. This press release is included as Appendix 16. On June 7, 2005 a first draft of the Washington CWCS was posted on WDFW's website at: www.wdfw.wa.gov/wlm/cwcs, and we immediately began conducting public meetings at our regional offices in Yakima, Spokane, Ephrata, Vancouver and Montesano. We also had a meeting with the CWCS Advisory Committee on June 9 in Olympia to brief them on the draft.

The public meetings were successful in giving interested publics an opportunity to review and ask questions about the draft CWCS, including draft ecoregional chapters, by having headquarters and regional staff walk through a copy of the draft projected on a large screen. The best-attended meetings were in Ephrata and Vancouver; the lowest attendance was in Montesano and Spokane, with one and two attendees each, respectively. When the public meetings were concluded, we scheduled follow-up meetings with major conservation partners, including the Washington Department of Natural Resources, U.S. Fish and Wildlife Service, and the USDA Forest Service.

The public was asked to provide comments on the draft CWCS to WDFW by June 30, 2005; this deadline was later extended to July 8 for the CWCS Advisory Committee and state and federal conservation agencies. Some conservation partners, such as The Nature Conservancy and Defenders of Wildlife, met our short review deadline; other review comments, mostly from state and federal agencies, trickled into WDFW through the week of July 25, 2005. Written comments on the draft CWCS were received from a number of interested individuals, advisory committee members, and the following conservation partners:

Defenders of Wildlife
The Nature Conservancy
U.S. Army, Yakima Training Center

U.S. Fish and Wildlife Service
USDA Forest Service
Washington Biodiversity Council
Washington Department of Natural Resources
Washington Farm Bureau
Washington Forest Protection Association

Post-submittal Outreach and Publicity: Once the final CWCS has been submitted to the NAAT and approved, WDFW will initiate a third round of outreach to the outdoor media and the public. The focus of this effort will be on the final CWCS and how it guides the future course of wildlife conservation in Washington. We will refer people to the web-based version of the CWCS, which will include many “hot links” to other websites and material referenced in the CWCS. We will also develop an Executive Summary of the Washington CWCS in the fall of 2005 and use it in this last phase of our outreach. The executive summary will be a full-color brochure, approximately 8 to 12 pages in length, and should be helpful in briefing elected officials, the media, and other publics that did not have the time or interest to read the entire CWCS. We hope to put copies of the executive summary in the hands of elected officials and others who can help us address the various problems and issues identified in the CWCS.

Outreach Record: Our outreach contacts from late 2003 through August 2005 are documented in an Outreach Record, included as Appendix 16.

Outreach Materials: A number of outreach tools were developed by WDFW prior to publicizing the CWCS process. These include the CWCS website at www.wdfw.wa.gov/wlm/cwcs, a number of CWCS PowerPoint slideshows tailored to fit different audiences, and two color brochures: one describes the Washington CWCS, and the other illustrates the interactive relationships between the CWCS and other planning efforts at different scales (Appendices 17 and 18).

LIST OF ACRONYMS

ALEA	Aquatic Lands Enhancement Account
BMP	Best Management Practices
BPA	Bonneville Power Administration
CAO	Critical Area Ordinance
CAPS	Contracts and Projects System (WDFW)
CARA	Conservation and Reinvestment Act of 1999
CBFWA	Columbia Basin Fish and Wildlife Authority
CCA	Candidate Conservation Agreement
CCMP	Comprehensive Conservation and Management Plan
CCP	Comprehensive Conservation Plan
CRMP	Comprehensive Resource Management Plan
CRP	Conservation Reserve Program
CWCS	Comprehensive Wildlife Conservation Strategy
DPS	Distinct Population Segment
EA	Ecoregional Assessment
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
FPA	Forest Protection Act
GAP	Gap Analysis Program
GDU	Genetically Distinct Unit
GIS	Geographic Information Systems
GMA	Growth Management Act
HCP	Habitat Conservation Plan
IAFWA	International Association of Fish and Wildlife Agencies
ICBEMP	Interior Columbia Basin Ecosystem Management Project
IPM	Integrated Pest Management
IWJV	Intermountain West Joint Venture
NAFTA	North American Free Trade Agreement
NEP	National Estuary Program
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service

PBDEs	Polybrominated Diphenyl Ethers (fire retardants)
PBTs	Persistent Bioaccumulative Toxins
PCBs	Polychlorinated Biphenyls
PEI	Pacific Education Institute
PHS	Priority Habitats and Species
PSNERP	Puget Sound Nearshore Ecosystem Restoration Project
RHA	Riparian Habitat Area
RMZ	Riparian Management Zone
SGCN	Species of Greatest Conservation Need
SMA	Shoreline Management Act
SSHIAP	Salmon & Steelhead Habitat Inventory & Assessment Project
SWG	State Wildlife Grants
TDR	Transfer of Development Rights
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
WAC	Washington Administrative Code
WADNR	Washington Department of Natural Resources
WDFW	Washington Department of Fish and Wildlife
WHROW	*Wildlife Habitat Relationships in Oregon and Washington* (Johnson & O'Neil 2000)
WNHP	Washington Natural Heritage Program
WWRP	Washington Wildlife and Recreation Program

GLOSSARY

Abiotic: Non-living components of an ecosystem; basic elements and compounds of the environment.

Adaptive management: An adaptive approach to management where we use the best scientific knowledge and technologies, clearly recognize knowledge gaps, build shared expectations among those who have a stake in ecosystem outcomes, monitor actions, and adjust management actions accordingly.

Algae: The common name for the relatively simple type of unicellular or multicellular plant which is never differentiated into root, stem and leaves, contains chlorophyll *a* as its photosynthetic pigment, has no true vascular system, and has no sterile layer of cells surrounding its reproductive organs.

Alluvial: Pertaining to river and stream deposits.

Alluvial soil: Soil formed in material deposited by the action of running water, such as a floodplain or delta.

Alpine tundra: A treeless region above the treeline of high mountains, characterized by cold winters and short, cool summers and having permafrost below a surface layer that may melt in summer.

Amphipod: Any of a large order of small, usually aquatic crustaceans with a laterally compressed body, for example, beach fleas.

Anadromous: Referring to the life cycle of fishes, such as salmon, in which adults travel upriver from the sea to breed, usually returning to the area where they were born.

Anaerobic: Referring to an environment in which oxygen is absent, or to a process which occurs only in the absence of oxygen, or to an organism that lives, is active, or occurs on the absence of oxygen, such as some yeasts or bacteria.

Annelids: Any of a phylum (Annelida) of usually elongated, segmented coelomate invertebrates, such as earthworms, various marine worms, and leeches.

Anoxic: Greatly deficient in oxygen; oxygenless.

Anthropogenic: Of, relating to, or resulting from the influence of humans on nature.

Aquaculture: The cultivation or farming of aquatic organisms such as fish and shellfish under captive conditions for purposes of human consumption.

Aquatic ecosystem: Any body of water such as a stream, lake or estuary, and all organisms and nonliving components within it, and functioning as a natural system.

Aquatic integrity: A mosaic of well connected, high-quality water and habitats that support a diverse assemblage of native and desired non-native species, the full expression of potential life histories and taxonomic lineages, and the taxonomic and genetic diversity necessary for long-term persistence and adaptation in a variable environment.

Arboreal: Living in the canopies of trees.

Archaebacteria: A taxonomic kingdom of bacteria, including sulphur-dependent bacteria, methane-producing bacteria, and halophilic bacteria.

Areas of environmental concern: Areas within the public lands where special management attention is required (when such areas are developed or used or where no development is required) to protect and prevent irreparable damage to important natural systems or processes, or to protect life and safety from natural hazards.

Arthropod: Invertebrate animals with a segmented body and jointed appendages, for example, spiders, bees and crabs.

Aspect: The direction a slope faces with respect to the cardinal compass points.

Association: A stable grouping of two or more plant species that characterize or dominate a type of biotic community.

Autecology: A subdivision of ecology that deals with the relationship of individuals of a species to their environment.

Avalanche chute: An area where periodic snow or rockslides prevent the establishment of forest conditions; typically shrub and herb dominated.

Avian: Relating to or derived from birds.

Avifauna: The birds of a specific region or period.

Barrens: A level area with poor, usually sandy or serpentine soils that is sparsely forested or unable to support normal vegetative cover and that generally has a low level of productivity. Barrens are frequently dominated by specialized groups of endemic plants.

Benthic: Occurring at the bottom of a body of water, for example, a seabed, riverbed, or lake bottom.

Benthos: In freshwater and marine ecosystems, the collection of organisms both attached to or resting on the bottom sediments and burrowed into the sediments.

Bioaccumulation: The process by which chemical contaminants become more concentrated in the tissues of organisms as they pass higher up the food chain. Heavy metals and pesticides such as DDT are stored in the fatty tissues of animals and are passed along to predators of those animals. The resulting concentrations eventually reach harmful levels in predators at the top of the food chain.

Biodiversity: The variety of organisms considered at all levels, from genetic variants belonging to the same species through arrays of genera, families and still higher taxonomic levels, includes the variety of ecosystems, that comprise both the communities of organisms within particular habitats and the physical conditions under which they live.

Biogeographic: The spatial distribution patterns of organisms in relation to change through time (paleoecological, historical, current, and future).

Biogeographical region: Any geographical region characterized by distinctive flora or fauna (such as a biome or an ecoregion).

Biogeography: The science that deals with the geographical distribution of animals and plants.

Biological diversity: The full variety of living organisms and their assemblages; the genetic variation within and between populations of species, and the many processes that link organisms and their physical environments into ecological systems.

Biomass: The total mass of all living organisms or of a particular set of organisms in an ecosystem or a trophic level in a food chain; usually expressed as a dry weight or as the carbon, nitrogen, or caloric content per unit area.

Biome: A major regional ecological community characterized by distinctive life forms and principal plant or animal species, such as tropical rain forest, tundra, grassland, or a desert.

Bioregion: A territory defined by a combination of biological, social, and geographic criteria, rather than geopolitical considerations; generally, a system or related, interconnected ecosystems.

Biota: The plants and animals of a specific region or period, or the total aggregation of organisms, in the biosphere.

Bivalve: A mollusk whose body is enclosed by two hinged valves or shells.

Blowdown: An extensive toppling of trees by wind within a relatively small area that significantly alters the small-scale climate within the ecosystem.

Boreal forest: The circumpolar, subarctic forest of high northern latitudes that is dominated by conifers. It is found south of the tundra in the Northern Hemisphere and often contains peaty or swampy areas.

Brackish: Water that is saline but not as salty as seawater.

Braided channel: A stream consisting of a network of interlacing small channels separated by bars, which may be vegetated and stable or barren and unstable.

Breeding Bird Survey: The North American Breeding Bird Survey (BBS) begun in 1966 to collect standardized data on bird populations along more than 3,400 survey routes across the continental United states and southern Canada for more than 250 species.

Broad scale: Encompassing a wide area.

Brood parasitism: The laying of eggs by one bird species in the nest of another bird species and the subsequent brooding of the egg and raising of the young by the parasitized host, usually to the detriment of the host's young.

Bunchgrass: Any of several grasses, especially of the western United States, that grow in tufts rather than forming turf, for example, the genus *Andropogon*.

Calcareous: Consisting of or containing calcium carbonate; a soil rich in calcium salts, derived from limestone or chalk. Also, an organism which has an affinity for such an alkaline or basic soil.

Candidate species: A species being considered for listing as a federally or state listed endangered or threatened species.

Canopy: A layer of foliage in a forest stand; most often refers to the uppermost layer of foliage.

Canopy closure: The degree to which the canopy blocks sunlight or obscures the sky. It can only be accurately determined from measurements taken under the canopy, as openings in the branches and crowns must be accounted for.

Carrying capacity: The maximum population of a given organism that a particular environment or habitat can sustain; implies continuing yield without environmental damage, often denoted as *K*.

Catchment: The area drained by a river or body of water.

Cetacean: Any of an order of aquatic, mostly marine mammals that include the whales, dolphins, porpoises, and related forms.

Channelization: The straightening of rivers or streams by means of an artificial channel.

Chlorofluorocarbons (CFCs): A group of gaseous compounds that contain carbon, chlorine, fluorine, and sometimes hydrogen, and are aerosol propellants and in the manufacture of plastic foams. Also referred to as greenhouse gases.

Cirque: A steep hollow, often containing a small body of water, found at the upper end of a mountain valley.

Clearcut: An area where the entire stand of trees has been removed in one cutting.

Climate: Generalized statement of the prevailing weather conditions at a given place, based on statistics of a long period of record. Includes seasonality of temperature and moisture.

Climax: The final stage of succession in an ecosystem. Also a community that reached a steady state under a particular set of environmental conditions.

Coarse filter: Refers to the communities or ecological systems which, if protected in sufficient quantity, should conserve the vast majority of species in the ecoregion.

Coarse woody debris (CWD): Portion of a tree that has fallen or been cut and left in the woods. Usually refers to pieces at least 20 inches in diameter.

Cohort: Individuals all resulting from the same birth-pulse, and thus all of the same age.

Commensal: Referring to the relationship between two kinds of organisms in which one obtains food or other benefits from the other without damaging or benefiting it.

Community: Any grouping of populations of different organisms that live together in a particular environment.

Connectivity: Condition in which the spatial arrangement of land cover types allows organisms and ecological processes (such as disturbance) to move across the landscape. Connectivity is the opposite of fragmentation.

Conservation biology: The body of knowledge that deal with the careful protection, utilization and planned management of living organisms and their vital processes to prevent their depletion, exploitation, destruction, or waste.

Conservation strategy: A management plan for a species, group of species, or ecosystem that prescribes standards and guidelines that if implemented provide a high likelihood that the species, groups of species or ecosystem, with its full complement of species and processes, will continue to exist well-distributed throughout a planning area, i.e. a viable population.

Continental shelf: The shallow, gradually sloping seabed around a continental margin not usually deeper than 650 feet and formed by submergence of part of a continent.

Copepods: any of a large subclass (Copepoda) of usually minute freshwater and marine crustaceans that form an important element of the plankton in the marine environment and in some fresh waters.

Corridor: A more or less contiguous connection between landmasses or habitats; a migration route that allows more or less uninhibited migration of most of the animals of one faunal region to another. In terms of conservation biology, a connection between habitat fragments in a fragmented landscape.

Cover: Vegetation used by wildlife for protection from predators, to mitigate weather conditions, or to reproduce. May also refer to the protection of soil and the shading provided to herbs and forbs by vegetation.

Critical habitat: Under the Endangered Species Act, critical habitat is defined as the specific areas within the geographic area occupied by a federally listed species on which are found physical and biological features essential to the conservation of the species and that may require special management considerations or protection, and specific areas outside the geographic area occupied by a listed species when it is determined that such areas are essential for the conservation of the species.

Crosswalk: A comparison of two different vegetation or habitat classification systems and resolving the differences between them to form a common standard.

Crown fires: Fires that spread from tree crown to tree crown, usually indicative of particularly hot (high intensity) fires in dry conditions.

Crustacean: Any of a large class (Crustacea) of mostly aquatic mandibulate arthropods that have a chitinous or calcareous and chitinous exoskeleton, a pair of often modified appendages on each segment, and two pairs of antennae; includes lobsters, shrimps, crabs, wood lice, water fleas, and barnacles.

Cyanobacteria: A large and varied group of bacteria that possess chlorophyll *a* and which carry out photosynthesis in the presence of light and air, producing oxygen. They were formerly regarded as algae and were called “blue-green” algae. The group is very old, and cyanobacteria are believed to have been the first oxygen-producing organisms on Earth.

Deciduous: Plants having structures that are shed at regular intervals or at a given stage in development, such as trees that shed their leaves seasonally.

Declining: Species that have exhibited significant, long-term reduction in habitat/and or numbers, and are subject to continuing threats in the ecoregion or state.

Defoliators: Insects that feed on foliage and act to remove some or all of the foliage from a tree, shrub or herb.

Degradation: The breaking down of a substance into smaller or simpler parts, usually by erosion.

Delta: An alluvial deposit at the mouth of a river or tidal inlet. Deltas occur when a sediment-laden current enters an open body of water, at which point there is a reduction in the velocity of the current, resulting in rapid deposition of the sediment, as at the mouth of a river where the river discharges into the sea or a lake.

Demersal: Living at or near the sea floor but having the capacity for active swimming.

Demography: The quantitative analysis of population structure and trends; population dynamics.

Desertification: The process by which an area or region becomes more arid through loss of soil and vegetative cover. The process is often accelerated by excessive, continuous overstocking and drought.

Detritus: Debris or waste material, usually organic, such as dead or partially decayed plants and animals, often important as a source of nutrients; or small particles of minerals from weathered rock, such as sand and silt.

Dewatering: The removal of water from a stream/river network, typically for irrigation, industrial or human use; commonly changes a network that developed by concentrating flows from stream/river branches to mainstems, to mainstems branching to canals, which reduces the flow in the mainstems.

Disjunct: Distinctly separate; a discontinuous range in which one or more populations are separated from other potentially interbreeding populations by a sufficient distance to preclude gene flow between them.

Dispersal: The movement, usually one-way and on any time scale, of plants or animals from their point of origin to another location where they subsequently produce offspring.

Distributary: A river branch flowing away from the main stream.

Disturbance: An effect of a planned human management activity or unplanned native or exotic agent or event that changes the state of a landscape element, landscape pattern, or regional composition.

Disturbance regime: The pattern of intervals between disturbance and severity of disturbance. For landscapes, this can be for a given disturbance, such as fire, or for a complex of disturbances.

Diurnal: Occurring or active only in daylight.

Diversity: The distribution and abundance of different plant and animal communities and species within the area covered by a land and resource management plan.

Drawdown: A lowering of the water level in a reservoir or other body of water.

Ecological approach: Natural resource planning and management activities that assure consideration of the relationship between all organisms (including humans) and their environment.

Ecological disequilibrium: A system that has unequal relationships of inputs and outputs that result in erratic (and unpredictable) successional patterns and associated responses to disturbance.

Ecological drainage unit (EDU): aggregates of watersheds that share ecological characteristics. These watersheds have similar climate, hydrologic regime, physiography, and zoogeographic history.

Ecological element: The individual constituent of the whole. For example, vegetation patch, stream reach, road, city site, or large snag.

Ecological function: The activity or role performed by an organism or element in relation to other organisms, elements or the environment.

Ecological integrity: The maintenance of native and desired non-native species and associated processes.

Ecological process: A series of actions, changes or functions that produce a resulting condition for biota, elements or the environment. For example, succession, decay, photosynthesis, food chain, fire, drought or flood.

Ecological succession: The chronological sequence of vegetation and associated animals in an area; or, continuous colonization, extinction, and replacement of species' populations at a particular site, due either to environmental changes or to the intrinsic properties of the plants and animals.

Ecological type: A category of land having a unique combination of potential natural community, soil, landscape features, climate and differing from other ecological types in its ability to produce vegetation and respond to management.

Ecology: The relationship of species, including humans, and their environment.

Ecoregion: A continuous geographic area in which the environmental complex produced by climate, topography and soil is sufficiently uniform to develop characteristics of potential major vegetation communities.

Ecoregional assessment target species: A wildlife species selected by ecoregional assessments as a focus for conservation assessment. For a detailed description of how target species were selected for each ecoregion, please refer to the ecoregional assessment documents.

Ecosystem: A community of organisms and their physical environment that interact as an ecological unit.

Ecosystem function: The major processes of ecosystems that regulate or influence the structure, composition and pattern. These include nutrient cycles, energy flows, trophic levels (food chains), diversity patterns in time/space development and evolution, cybernetics (control), hydrologic cycles and weathering processes.

Ecosystem-based management: The careful and skillful integration of ecological, economic, social and managerial principles to conserve, enhance, and restore ecosystems (including their functions, processes, constituent species, and productive capacities) to maintain their long-term viability and integrity while seeking desired conditions for uses, products, values and services.

Ecosystem viability: The ability to maintain diversity, productivity, resilience to stress health, renewability and/or yields of desired values, resource used, products, or services from an ecosystem while maintaining the integrity of the ecosystem over time.

Ecosystems approach: The ecosystem approach embodies three fundamental concepts: designating the physical boundary of the system and its parts; understanding the interactions of the parts as a functioning whole; and understanding the relation between the system and its context (external factors that influence the system and also internal information that must be synthesized to be understood at the scale of the defined system).

Ecotone: The boundary or transitional zone between adjacent communities containing the characteristic species of each, such as the edge of a woodland next to a field or lawn.

Ecotype: A locally adapted population of a species that has a distinctive limit of tolerance to environmental factors; a genetically uniform population of a species resulting from natural selection by the special conditions of a particular habitat factor.

Edaphic: Pertaining to soil or to the physical, chemical, and biological properties of the soil or substratum, which influence associated biota, such as pH and organic matter content.

Edge effect: The tendency for a transitional zone between communities (an *ecotone*) to contain a greater variety of species and more dense populations of species than either community surrounding it.

Element occurrence (EO): A term originating from the methodology of the Natural Heritage Network that refers to a unit of land or water on which a population of a species or example of an ecological community occurs. For communities, these EOs represent a defined area that contains a characteristic species composition and structure.

Emergent: An aquatic plant having most of its vegetative parts above water. Also, a tree that reaches or exceeds the level of the surrounding canopy.

Encroachment: Conditions where the succession/disturbance regimes have been changed to allow transition to dominance by species or structures that are not adapted to the biophysical succession/disturbance regime.

Endangered species: Any species which is in danger of extinction throughout all of its range; a species that is federally listed as Endangered by the U.S. Fish and Wildlife Service under the Endangered Species Act.

Endemic: Belonging or native to a particular people or geographic region; a genetically unique life form.

Environment: The complex of climatic, soil and biotic factors that act upon an organism or ecological community and ultimately determine its form and survival.

Ephemeral streams: Streams that contain running water only sporadically, such as during and following storm events.

Epipelagic: The oceanic zone extending from the surface to about 650 feet, where enough light penetrates to allow photosynthesis.

Epizootic: An outbreak of disease (an epidemic) in nonhuman animals, or pertaining to such an outbreak.

Equilibria/Equilibrium: A system that has cyclic successional patterns or multiple stable states, and associated response in disturbances.

Estuary: A semi-enclosed coastal body of water that has a free connection with the open sea and where fresh water derived from land drainage (usually mouths of rivers) is mixed with seawater; often subject to tidal action and cyclic fluctuations in salinity.

Eutrophication: The process by which a body of water acquires a high concentration of nutrients, especially phosphates and nitrates, which typically promote excessive growths of algae, decomposition of which depletes oxygen, causing the death of other organisms.

Exotic species: Species that occur in a given place, area or region as the result of direct or indirect, deliberate or accidental introduction by humans, permitting the species to cross a natural barrier to dispersal.

Extinction: The dying out of a species, or the condition of having no remaining living members; also, the process of bringing about such a condition.

Extirpation: The loss or removal of a species from one or more specific areas but not from all areas.

Fauna: The animal life of a region or geological period.

Fen: A marshy, low-lying wetland covered by shallow, usually stagnant, and often alkaline water that originates from groundwater sources.

Feral: Relating to plants or animals which have escaped from domestication, and to their descendants.

Fine filter: Species of concern or rare communities that complement the coarse filter, helping to ensure that the coarse filter strategy adequately captures the range of viable native species and ecological communities. Endangered or threatened, declining, vulnerable, wide-ranging, very rare, endemic and keystone species are some potential fine filter targets.

Fire regime: The characteristic frequency, extent, intensity, severity and seasonality of fires in an ecosystem.

Fluvial: Pertaining to rivers or streams and their action.

Forb: An herbaceous plant that is not a grass.

Fragmentation: Breaking up of contiguous areas into progressively smaller patches of increasing degrees of isolation.

Gallery forest: A narrow strip of forest along the margins of a river in an otherwise unwooded landscape.

Gap analysis: The process of identifying and classifying components of biological diversity to determine which components already occur in protected areas and which are not present or are under-represented in protected areas.

GAP (National Gap Analysis Program): Gap analysis is a scientific method for identifying the degree to which native animal species and natural communities are represented in the present-day mix of conservation lands. Those species and communities not adequately represented in the existing network of conservation lands constitute conservation "gaps". The purpose of the Gap Analysis Program (GAP) is to provide broad geographic information on the status of ordinary species (those not threatened with extinction or naturally rare) and their habitats in order to provide land managers, planners, scientists and policy makers with the information they need to make better-informed decisions.

Gastropod: Any of a large class (Gastropoda) of mollusks, usually with a univalve shell or no shell and a distinct head bearing sensory organs, such as snails and slugs.

Geographic Information System (GIS): A spatial type of information management system that provides for the entry, storage, manipulation, retrieval, and display of spatially oriented data.

Geomorphology: The study of landforms on a planet's surface and of the processes that have fashioned them.

Global rank: An assessment of a biological element's relative imperilment and conservation status across its geographic distribution, ranging from G1 (critically imperiled) to G5 (secure). Assigned by the Natural Heritage Network, global ranks for species and communities are determined by the number of occurrences or total area of coverage (communities only), modified by other factors such as condition, historic trend in distribution or condition, vulnerability, and impacts.

Graminoids: Grasses and grass-like plants such as sedges.

Groundfish: A bottom-dwelling fish, especially one of commercial importance such as cod, haddock, pollock or flounder.

Guild: A group of species having similar ecological resource requirements and foraging strategies and therefore having similar roles in the community.

Habitat: The place, including physical and biotic conditions, where a plant or animal usually occurs.

Habitat connections: A network of habitat patches linked by areas of like habitat. The linkages connect habitat areas within the watershed to each other and to areas outside the watershed. These connections include riparian areas, mid-slopes, and ridges. In the case of old growth forest habitat connections, each connection is planned to be sufficiently wide (at least 1,000 feet) to retain interior old growth-associated species.

Habitat fragmentation: The breaking up of a habitat into unconnected patches interspersed with other habitat, which may not be inhabitable by species occupying the habitat that was broken up. The breaking up is usually by human action, as, for example, the clearing of forest or grassland for agriculture, residential development, or overland electrical lines.

Habitat type: Place where an animal or plant normally lives, often characterized by a dominant plant for or physical characteristic.

Heterogeneity: Variation in the environment over space and time.

Heterogeneous: consisting of diverse or dissimilar parts; having non-uniform structure or composition.

Hibernacula: Plural of hibernaculum, a protective covering or structure, such as a cave or tree cavity, in which an animal remains dormant for the winter.

Historic: The approximate 1,000-year time period prior to Euro-American settlement (substantial effects in Washington assumed to have begun by the mid-1800s).

Holocene: The present, post-Pleistocene geologic epoch of the Quaternary period, including the last 10,000 years; the most recent postglacial period.

Home range: The geographic area within which an animal restricts its normal, daily activities.

Human dimension: An integral component of ecosystem management that recognizes people are part of ecosystems, that people's pursuits of past, present and future desires, needs and values have and will continue to influence ecosystems and must be included in ecosystem management.

Hybridization: Any crossing of individuals of different genetic composition, often belonging to separate species, resulting in hybrid offspring.

Hydrological cycle: The movement of water from the sea through the air to the land and back to the sea.

Hydrology: The study of the movement of water from the sea through the air to the land and back to the sea; the properties, distribution and circulation of water on or below the Earth's surface and in the atmosphere.

Hypoxic: Deficient in oxygen.

Impact: The combined concept of ecological stresses to a target and the sources of that stress to the target. Impacts are described in terms of severity and urgency.

Impoundment: A natural or artificial body of water held back by a dam.

Indicator species: An organism whose presence or state of health is used to identify a specific type of biotic community or as a measure of ecological conditions or changes occurring in the environment.

Indigenous: A species that occurs naturally in an area; native.

Integrated pest management (IPM): A pest management philosophy based on an understanding of natural habitat growth and development, habitat pest dynamics, and the interaction of the two.

Integrated resources management (IRM): The simultaneous consideration of ecological, physical, economic and social aspects of lands, waters and resources in developing and carrying multiple-use, sustained-yield management.

Intermittent stream: Any non-permanent flowing drainage feature having a definable channel and evidence of scour or deposition. This includes what are sometimes referred to as ephemeral streams if they meet these two criteria.

Intertidal: Relating to the littoral zone above the low-tide mark.

Invertebrate: An animal without a backbone, such as snails, worms and insects.

Karst: A limestone landscape characterized by skins, underground streams and caverns.

Keystone species: Organisms that play dominant roles in an ecosystem and affect many other organisms. The removal of a keystone predator from an ecosystem causes a reduction of the species diversity among its former prey.

Krummholz: A discontinuous belt of stunted forest or scrub typical of windswept alpine regions close to treeline; a wind-deformed tree at high elevations.

Lacustrine: Pertaining to or living in lakes or ponds.

Landscape: A spatially heterogeneous area with repeating patterns of elements and associated disturbance regimes, with similar climate and geomorphology.

Landscape connectivity: The spatial contiguity within the landscape; a measure of how easy or difficult it is for organisms to move through the landscape without crossing habitat barriers.

Landscape ecology: The relationships of structure, function and change in a heterogeneous land area composed of interacting ecosystems. Structure, function and change refer to the patterns and processes of terrestrial, aquatic, hydrologic, social and economic systems across space and through time.

Lek: A mating system among birds during which males display communally at a traditional site (one used year after year), for example, sage-grouse.

Lentic: Related to still waters such as ponds, lakes or swamps.

Levee: A raised embankment along the edge of a river channel, often constructed as protection against flooding. Natural levees result from periodic overbank flooding, when coarser sediment is immediately deposited because of a reduction in river velocity.

Lichen: A composite organism consisting of a fungus and algae or cyanobacteria living in symbiotic association.

Life history: The significant features of the life cycle through which an organism passes, with particular reference to strategies influencing survival and reproduction.

Linkages: Route that permits movement of individual animals from one habitat type to another similar habitat type.

List of endangered or threatened species: A listing of animals and plants administratively determined to meet legal criteria for protection under provisions of the U.S. Endangered Species Act.

Littoral zone: The biogeographic zone in a body of fresh water where light penetration is sufficient for the growth of plants; the intertidal zone of the seashore.

Loess: Unconsolidated sediment deposited by wind. Loess is usually composed or unstratified fine sand or silt.

Lotic: Relating to or living in moving water, such as a river or stream.

Macroclimate: Climate that lies just beyond the modifying irregularities of landform and vegetation.

Macrofauna: Animals large enough to be seen with the naked eye.

Management disturbances: Intentional, planned human disturbance that changes the structure and composition of a landscape element, landscape pattern, or regional composition, such as timber harvest, thinning, range improvement, livestock grazing, prescribed fire planned ignition, fire suppression, etc.

Marine protected areas (MPAs): Any area of intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment (IUCN 1988).

Marsh: An ecosystem of more or less continuously waterlogged soil dominated by emersed herbaceous plants but without a surface accumulation of peat. A marsh differs from a swamp in that it is dominated by rushes, reeds, cattails and sedges, with few if any woody plants, and differs from a bog in having soil rather than peat at its base.

Matrix: The most extensive and most connected landscape element type present, which plays the dominant role in landscape functioning. Also a landscape element surrounding a patch.

Mature forest: Generally used in an economic sense to indicate that a forest has attained harvest age.

Maximum sustainable yield: The maximum yield or crop which may be harvested year after year without damage to the system, or the theoretical point at which the size of a population is such as to produce a maximum rate of increase.

Megafauna: The largest size category of animals in a community.

Meiofauna: That part of the microfauna that inhabits algae, rock fissures, and superficial layers of the muddy sea bottom. They are smaller than 1 millimeter but larger than 0.1 millimeter.

Mesic: Neither wet (hydric) nor dry (xeric); intermediate in moisture, without extremes.

Metapopulation: A group of populations, usually of the same species, which exist at the same time but in different places.

Microclimate: The climate that prevails in a small area, usually in the layer near the ground.

Mollusk: An organism in the phylum Mollusca (for example snails, clams, or squids), characterized by soft, unsegmented body parts enclosed in a shell.

Monitor species: Washington State monitor species are those that require management, survey, or data emphasis for one or more of the following reasons: 1) they were classified as endangered, threatened, or sensitive within the previous five years; 2) they require habitat that is of limited availability during some portion of their life cycle; 3) they are indicators of environmental quality; and 4) there are unresolved taxonomic questions that may affect their candidacy for listing as endangered, threatened or sensitive species.

Monitoring: A process of collecting information to evaluate whether objectives of a management plan are being realized.

Montane: Of, relating to, growing in, or being the biogeographical zone of relatively moist, cool upland slopes below the timberline, often dominated by large coniferous trees.

Moraine: An accumulation of boulders, stones or other debris carried and deposited by a glacier.

Mosaic: Heterogeneous ecological conditions on a landscape usually produced by the variable, patchy effects of disturbances: a patchwork of vegetation communities within a landscape as determined by environmental conditions.

Native: Plants or animals that are indigenous to a given place; the pre-Euro-American settlement system.

Natural conditions: Plant and animal communities where humans have not directly impacted either the plant community or the soil by such activities as logging, grazing or cultivation.

Natural variability: Range of the spatial, structural, compositional and temporal characteristics of ecosystem elements during a period specified to represent "natural" conditions.

Nearshore marine zone: The area of the marine environment extending from the supratidal area above the ordinary or mean high water line to the subtidal area. In the Puget Trough ecoregion, the nearshore marine area extends below to –130 feet, because beyond that depth data were less available. This also approximates the photic zone, or depth of macrophytes.

Neotropical migrant: A bird that nests in temperate regions and migrates to the Neotropical faunal region, which includes the West Indies, Mexico, Central America, and that part of South American within the tropics.

Nonnative (also exotic, introduced, and alien): A plant or animal that is not native to the area in which it occurs; it was either purposely or accidentally introduced.

Nonpoint: Not from a single, well-defined site. Nonpoint sources are pollution-producing entities not tied to a specific origin, such as an individual smokestack; including runoff, which washes pollutants from roads into storm sewers and bodies of water or agricultural chemicals from lawns, fields and golf courses.

Obligate: Essential, necessary; unable to exist in any other state, mode or relationship; restricted to one particularly characteristic mode of life.

Obligate species: A plant or animal that occurs only in a narrowly defined habitat such as a tree cavity, rock cave, or wet meadow.

Old growth: Referring to an ecosystem or community, particularly a forest, which has not experienced intense or widespread disturbance for a long time relative to the life spans of the dominant species and that has entered a late successional stage; usually associated with high diversity of species, specialization, and structural complexity.

Oligotrophic: Waters or soils that are poor in nutrients and have low primary productivity.

Overgrazing: Continued heavy grazing that exceeds the recovery capacity of the plant community and creates a deteriorated range.

Palustrine: Pertaining to wet or marshy habitats.

Parasite: An organism that is intimately associated with and metabolically dependent on another living organism (the host) for completion of its life cycle, and which is typically detrimental to the host.

Patch: Ecosystem elements (e.g. areas of vegetation) that are relatively homogeneous internally and that differ from what surrounds them.

Patch dynamics: The idea that communities are a mosaic of different areas (patches) within which nonbiological disturbances (such as climate) and biological interactions proceed.

Pathogen: A specific causative agent of a disease, such as a bacterium or a virus.

Pelagic: Referring to or occurring in the open sea.

Perennial stream: A stream that typically has running water on a year-round basis.

Peripheral: A species or community that only occurs near the edges of an ecoregion or state and is primarily located in other ecoregions or states.

Physiographic province: A region of the landscape with distinctive geographical features.

Physiography: Landform; physical geography.

Pioneer: The first species or community to colonize or recolonize a barren or disturbed area, thereby commencing a new biological succession.

Plant association: Stands of vegetation with similar combinations of species united into abstract types; a basic unit in plant community classification.

Playa: A nearly level area at the bottom of an undrained desert basin, sometimes temporarily covered with water during wet periods. Playas are barren and usually saline.

Pleistocene: The earlier epoch of the Quaternary period or the corresponding system of rocks; 1.6 million to 10,000 years ago; the “Ice Age”.

Pluvial: Characterized by abundant rain.

Polychlorinated biphenyls (PCBs): A group of toxic, carcinogenic organic compounds containing more than one chlorine atom; very stable compounds, fat-soluble; they therefore accumulate in ever-higher concentrations as they move up the food chain.

Population: A group of individuals of a species living in a certain area that maintains some degree of reproductive isolation.

Population dynamics: The aggregate of changes that occur during the life of a population. Included are all phases of recruitment and growth, senility, mortality, seasonal fluctuation in biomass, and persistence of each year class and its relative dominance, as well as the effects that any or all of these factors exert on the population.

Population viability: Probability that a population will persist for a specified period across its range despite normal fluctuations in population and environmental conditions.

Prescribed fire: A fire burning under specified conditions that will accomplish certain planned objectives. The fire may result from planned or unplanned ignitions.

Province: An area of land, less extensive than a region, having a characteristic plant and animal population.

Range: The area or region over which an organism occurs.

Rangeland: Land on which the native vegetation is predominantly grasses, grass-like plants, forbs or shrubs. Includes lands revegetated naturally or artificially when routine management of that vegetation is accomplished mainly through manipulation of grazing.

Recovery plan: A plan that lists the actions that must be taken and the objectives that must be reached before an organism is no longer endangered or threatened and may be removed from the list of endangered and threatened species.

Regime: A regular pattern of occurrence or action.

Region: The broadest scale of landscape ecology composed of a coarse-grained pattern of connected landscapes with contrasting boundaries that have a similar macroclimate and sphere of human activity and interest.

Relict: Persistent remnants of a formerly widespread species surviving in an environment that has undergone considerable change.

Resilience: The ability of an ecosystem to maintain diversity, integrity and ecological processes following disturbance.

Restoration, ecological: The reestablishment of pre-disturbance functions and related chemical, biological and hydrological characteristics.

Restoration, passive: The discontinuation of those activities that are causing degradation or preventing the ecosystem’s recovery.

Riparian: Relating to, living, or located on the bank of a natural watercourse (such as a river) or sometimes of a lake or tidewater.

Riparian ecosystem: Ecosystems transitional between terrestrial and aquatic ecosystems. Also, streams, lakes, wet areas and adjacent vegetation communities and their associated soils that have free water at or near the surface.

Riparian zone: An area of vegetation adjacent to an aquatic ecosystem. It has a high water table, certain soil characteristics, and some vegetation that requires free (unbound chemically) water or conditions that are more moist than normal. This zone is transitional between aquatic and upland zones.

Riprap: A general term for large, blocky stones that are artificially placed to stabilize and prevent erosion along a riverbank or shoreline.

Risk analysis: A qualitative assessment of the probability of persistence of wildlife species and ecological systems under various alternatives and management options; generally also accounts for scientific uncertainties.

Rookery: Breeding or nesting place for some gregarious mammals and birds.

Runoff: Precipitation on land that runs off to a body of water.

Salmonid: Any of a family of elongate bony fishes (such as salmon or trout) that have the last three vertebrae upturned.

Sanitation: The removal of dead or damaged trees, or trees susceptible to insect and disease attack, such as intermediate and suppressed trees, essentially to prevent the spread of pest or pathogens and to promote forest health.

Savanna: A grassland-woodland mosaic vegetation type with long dry periods and receiving more rainfall than desert areas but not enough to support complete forest cover.

Sediment: Materials that sink to the bottom of a body of water or materials that are deposited by wind, water or glaciers.

Sensitive species: A species not formally listed as endangered or threatened, but considered to be at risk as evidenced by: a significant current or predicted downward trend in population numbers or density, or a significant current or predicted downward trend in habitat capability that would reduce a species' existing distribution.

Seral: Relating to a phase in the sequential development of ecological communities formed in ecological succession in a particular habitat and leading to a particular climax association; intermediate communities in an ecological succession.

Sere: The series of stages that follow one another in an ecologic succession; a series of biotic communities that follow one another in time on any given area of the Earth's surface.

Serotinous cones: Pinecones that remain on the tree for many years and are tightly closed until stimulated by the heat of a forest fire to oen and release seeds.

Sessile: Permanently attached to a substrate or established; not free to move about. Also, attached without a stalk.

Silviculture: The art and science of managing forest stands to provide or maintain structures, species composition and growth rates that contribute to forest management goals.

Site: The classification of land area based on its climate, physiographic (physical geography), edaphic (soil), and biotic factors that determine its suitability and productivity for particular species and silvicultural alternatives.

Slough: A swamp, marsh or muddy backwater.

Smolt: The stage in the life of salmon and similar fishes in which the subadult individuals acquire a silvery color and migrate down the river to begin their adult lives in the open sea.

Snag: A standing dead tree or stump that provides habitat for a broad range of wildlife, from beetle larvae (and the birds that feed upon them) to dens for raccoons.

Spawn: The eggs of certain aquatic organisms; also, the act of producing such eggs or egg masses.

Species: A group of organisms formally recognized as distinct from other groups; the taxon rank in the hierarchy of biological classification below genus; the basic unit of biological classification, defined by the reproductive isolation of the group from all other groups of organisms.

Species diversity: See *Biological diversity*.

Species richness: The absolute number of species in an assemblage or community.

Staging area: A traditional area, usually a lake, where birds that migrate in flocks rest and feed either immediately before or during migration. Many flocks may be gathered in such an area.

Stand composition: The representation of tree species in a forest stand, expressed by some measure of dominance (e.g., percent of volume, number, basal area, cover).

Stand structure: The physical and temporal distribution of plants in a stand.

Steppe: Specifically, the temperate, semiarid areas of treeless grassland in the mid-latitudes of Europe and Asia; more generally, any such grassland.

Stewardship: A land ethic for current and future generations that 1) encourages wise use and conservation of resources; 2) sustains and enhances productivity of resources; and 3) protects resources.

Stressors: Physical or biotic factors that stress individual organisms/communities.

Subalpine: The zone just below treeline on temperate mountains, usually dominated by a coniferous forest ecologically similar to boreal forest. The elevation of this zone increases with a decrease in latitude.

Subbasin: The fourth delineation within the hydrologic unit code system. provides a delineation generally of a river, or group of rivers, that flow into a basin.

Sublittoral zone: The deeper zone of a lake below the limit of rooted vegetation; the marine zone extending from the lower margin of the intertidal (littoral) to the outer edge of the continental shelf at a depth of about 650 feet.

Subsidence: The process of sinking or settling of a land surface or a crustal elevation because of natural or artificial causes.

Subspecies: A race of a species that is granted a taxonomic name; rules for designating subspecies are subjective, but subspecies are generally geographically distinct and form populations (not merely morphs) that differ to some degree from other geographic populations of the species.

Substrate: The surface of medium that serves as a base for something.

Subtidal: Applied to that portion of a tidal flat environment that lies below the level of mean low water for spring tides. Normally it is covered by water at all states of the tide. Often used as a general descriptive term for a shallow marine depositional environment.

Succession: The development of biotic communities following disturbances that produce an earlier successional community.

Successional stage: One in a series of usually transitory communities or developmental stages that occur on a particular site or area over a period of time.

Suitability: The appropriateness of applying certain resource management practices to a particular area of land, as determined by an analysis of the economic and environmental consequences and the alternative uses foregone.

Supratidal: Area above the mean high water line, such as the top of a bluff or the extent of a salt marsh in the upper intertidal; the upper limit of the nearshore marine zone.

Sustainability: The ability to sustain diversity, productivity, resilience to stress, health, renewability and/or yields of desired values, resource uses, products, or services from an ecosystem while maintaining the integrity of the ecosystem over time.

Sustainable development: The use of land and water to sustain production indefinitely without environmental deterioration, ideally without loss of native biodiversity.

Synergistic: Pertaining to the cooperative action of two or more agencies such that the total is greater than the sum of the component actions; combined action or operation.

Talus: Broken rock forming a more or less continuous layer that may or may not be covered by duff and litter.

Taxon (Taxa): Any organism or group or organisms of the same taxonomic rank; for example, members of an order, family, genus or species.

Threatened species: Any species that is likely to become an endangered species throughout all or a significant portion of its range; a species federally listed as Threatened by the U.S. Fish and Wildlife Service under the Endangered Species Act.

Threshold: The boundary between ecological states that, once crossed, is not easily reversible and results in the loss of capacity to produce commodities and satisfy values.

Topography: The natural and constructed relief of an area.

Treeline: The upper limits of tree growth in mountains or at high latitudes.

Trophic: Pertaining to nutrition or to a position in a food web, food chain, or food pyramid.

Tundra: A level or rolling treeless plain in the arctic or subarctic regions; the soil is black and mucky, the subsoil is permanently frozen, and the vegetation is dominated by mosses, lichens, herbs and dwarf shrubs. A similar environment occurs in mountainous areas above the timberline.

Turbid: Having sediment or foreign particles stirred up or suspended; muddy.

Umbrella species: Species that, by being protected, may also protect the habitat and populations of other species.

Understory: The vegetation layer between the overstory or canopy and the groundcover of a forest community, usually formed by shade-tolerant species or young individuals of emergent species. May also refer to the groundcover if no tree or shrub layer is present.

Vertebrate: An animal with a backbone; includes mammals, birds, reptiles, amphibians, and fishes.

Viability: The ability of a species to persist for many generations or an ecological community or system to persist over some time period.

Viable population: A population that has adequate numbers and dispersion of reproductive individuals to ensure the continued existence of the species population in the area.

Vulnerable: Vulnerable species are usually abundant, may or may not be declining, but some aspect of their life history puts them at risk of decline (e.g., migratory concentration or rare/endemic habitat).

Watershed: An area or a region that is bordered by a divide and from which water drains to a particular watercourse or body of water.

Watershed analysis: A systematic procedure for characterizing watershed and ecological processes to meet specific management and social objectives. Watershed analysis is a stratum of ecosystem management planning applied to watersheds of approximately 20 to 200 square miles.

Wetland: A general term applied to land areas that are seasonally or permanently waterlogged, including lakes, rivers, estuaries and freshwater marshes; an area of low-lying land submerged or inundated periodically by fresh or saline water.

Widespread: A species or community typically found in the ecoregion or state, but common in several other ecoregions or states.

Wilderness: An area designated by congressional action under the 1964 Protection Act. Wilderness is defined as undeveloped federal land retaining its primeval character and influence without permanent improvements or human habitation. Wilderness areas are protected and managed to preserve their natural conditions, which generally appear to have been affected primarily by the forces of nature, with the imprint of human activity substantially unnoticeable; have outstanding opportunities for solitude or for a primitive and confined type of recreation; include at least 5,000 acres or are of sufficient size to make practical their preservation, enjoyment and use in an unimpaired condition; and may contain features of scientific, educational, scenic, or historical value as well as ecological and geologic interest.

Woodland: A vegetation community that includes widely spaced large trees. The tree crowns are typically more spreading in form than those of forest trees and do not form a closed canopy. Grass, heath or scrub may develop between the trees.

Xeric: Dry; tolerating or adapted to dry conditions.

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APPENDIX 1:
CWCS SPECIES OF GREATEST CONSERVATION NEED

09/12/2005

				CRITERIA																														
				179	9.5	Concerns				7.5	Actions									PHS				Ecoregions										
Evo	ELCODE	COMMON NAME	SCIENTIFIC NAME	SGCN	Y-Axis	Threats	Current status	Socio-econ value	Vulnerability	X-Axis	Knowledge	Expenditures	Conservation measures in place	Status for Calculation	RANKING BIOLOGIST COMMENTS	WDFW Species Of Concern	ESA	NHP G-Rank	NHP S-Rank	Criteria	Area	Region	WDFW Game Plan	NW Coast	Puget Trough	N Cascades	W Cascades	E Cascades	Okanogan	Can. Rockies	Blue Mountains	Columbia Plat.	WHROW HABITAT COMMENTS	MANAGEMENT/ RECOVERY/ STATUS REPORTS AND DATES
6	AMABA01030	Preble's shrew	Sorex preblei	1	**13**	5	4	1	3	**4**	1	1	2	S1	Peripheral, unknown if still extant	M	Co	G4	S1												x		5, 8, 15-17, 19, 22, 25	
6	AMABA01230	Merriam's shrew	Sorex merriami	1	**10**	3	3	1	3	**6**	1	2	3	C		C		G5	S3	1	a	1,2,3									x	T	15, 16, 17, 18	
6	AMACC01060	Keen's myotis	Myotis keeni	1	**15**	5	4	1	5	**4**	1	1	2	S1	Peripheral	C	Co	G2	S1	1,2	a	6		T	x								1	
6	AMACC08010	Pallid Townsend's big-eared bat	Corynorhinus townsendii pallascens	1	**11**	3	3	2	3	**7**	2	2	3	C		C	Co	G4	S3	1,2	a	1,2,3,4,5,6						T	T	T	T	T	1-7, 9, 11-16, 19, 21, 23-25	MR 1991
6	AMACC08014	Pacific Townsend's big-eared bat	Corynorhinus townsendii townsend	1	**11**	3	3	2	3	**7**	2	2	3	C		C	Co	G4	S3	1,2	a	1,2,3,4,5,6		T	T	T	T						1-7, 9, 11-16, 19, 21, 23-25	MR 1991
6	AMAEB03040	White-tailed jackrabbit	Lepus townsendi	1	**13**	4	3	2	4	**3**	1	1	1	C		C		G5	S2	1,3	a,c	1,2,3							T			x	15, 16	
6	AMAEB03050	Black-tailed jackrabbit	Lepus californicus	1	**11**	3	3	2	3	**5**	2	1	2	C		C		G5	S2	1,3	a,c	1,2,3										x	16, 18	
6	AMAEB04010	Pygmy rabbit	Brachylagus idahoensis	1	**18**	5	5	3	5	**4**	2	1	1	E		E	E	G4	S1	1	a	1,2,3										T	16	SR 1993, RP 2003;1995
6	AMAFB03050	Olympic marmot	Marmota olympus	1	**10**	3	2	2	3	**6**	1	2	3	S3				G3	S3					T									9, 10	
6	AMAFB05010	Townsend's ground squirrel ssp.	Spermophilus townsendii townsendi	1	**13**	4	3	1	5	**4**	2	1	1	C		C		G4	S3	1	a	3										x	16, 17, 19	
6	AMAFB05020	Washington ground squirrel	Spermophilus washington	1	**12**	4	3	1	4	**3**	1	1	1	C		C	C	G3	S2	1	c	1,2										x	15, 16, 17	SR 2004d
6	AMAFB05200	Townsend's ground squirrel ssp.	Spermophilus townsendii nancyae	1	**12**	4	3	1	4	**3**	1	1	1	S2		C		G5	S2													x	16, 17, 18	
6	AMAFB07020	Western gray squirrel	Sciurus griseus	1	**16**	5	4	2	5	**4**	2	1	1	T		T	Co	G5	S2	1	a	2,3,5,6			T		T	T	T			x	2, 3, 7, 20	SR 1993, RP 2005, MR 1991
6	AMAFC01041	Brush Prairie pocket gopher	Thomomys talpoides douglasi	1	**13**	4	3	1	5	**3**	1	1	1	C		C		G5	S2	1	a	5			T								1, 4-9, 13-16, 19, 24, 25	SR 2005, MR 1991
6	AMAFC01060	Mazama (western) pocket gopher	Thomomys mazama	1	**14**	5	3	1	5	**4**	1	1	2	C		C	C	G4	S2	1	a	5,6		T	x								1-4, 7, 9,--11, 19, 20, 27	SR 2005d, MR 1991
6	AMAFF11012	Kincaid meadow vole	Microtus pennsylvanicus kincaid	1	**10**	4	1	1	4	**3**	1	1	1	M		M	Co	G5	S2													x	5, 19, 22, 25	
6	AMAFF11041	Shaw Island Townsend's vole	Microtus townsendii puget	1	**11**	2	4	1	4	**6**	1	3	2	S1				G5	S1						T								1-3, 11, 19, 22, 23, 26	
6	AMAFF11170	Gray-tailed vole	Microtus canicaudus	1	**10**	3	3	1	3	**4**	1	1	2	C		C		G4	S2	1,2	a	5			T								11, 19	
6	AMAGE07010	Killer whale	Orcinus orca	1	**17**	4	5	3	5	**7**	2	2	3	E		E		G4	S1	1,2	c	4,6		x	T								29, 30, 31, 32	SR 2004, RP 2004 fed
6	AMAGF01010	Pacific harbor porpoise	Phocoena phocoena	1	**13**	3	3	2	5	**5**	3	1	1	C		C		G4	SU	1,2	c	4,6		x	T								29, 30, 31	
6	AMAJA01030	Gray wolf	Canis lupus	1	**13**	3	5	3	2	**6**	2	1	3	E	Historical	E	T	G4	S1	1	a	1,2,3,4,5		T		T		T	T	T	T		4, 5, 7, 9, 10	RP 1991 fed, MR 1991
6	AMAJB01020	Grizzly bear	Ursus arctos	1	**18**	5	5	3	5	**7**	3	1	3	E	Historical	E	T	G4	S1	1	a	1,2,3,4				T		T	T	T			5, 8, 9, 10	RP 1993 fed, MR 1991
6	AMAJC03010	Steller sea lion	Eumetopias jubatus	1	**15**	5	4	2	4	**7**	2	2	3	T		T	T	G3	S2	1,2	c	4,6		x	x								27, 29, 30, 31	SR 1993, RP F
6	AMAJF01010	Marten (Coastal population)	Martes americana	1	**11**	4	0	2	5	**6**	2	1	3	S4				G5	S4	3	c	1,2,3,4,5,6	x	T									1, 4, 5, 6, 9, 24	MR 1991
6	AMAJF01021	Fisher	Martes pennanti pacifica	1	**15**	3	5	2	5	**6**	3	1	2	E	Historical	E	Co	G5	SH	1	a	1,2,3,4,5,6		x	x	T	T	T	T	T			1, 4, 5, 23	SR 1998, RP 2005, MR 1991
6	AMAJF03010	Wolverine	Gulo gulo	1	**14**	3	4	3	4	**7**	3	1	3	S1		C	Co	G4	S1	1	a	1,2,3,4,5,6				T	T	T	T	T			4, 9, 10, 24	
6	AMAJF04010	American badger	Taxidea taxus	1	**11**	4	0	3	4	**4**	1	1	2	S4				G5	S4				x						T	x	x	x	5, 7, 8, 13-17, 19 (pastures, CRP areas)	
6	AMAJF09010	Sea otter	Enhydra lutris	1	**18**	5	5	3	5	**7**	3	1	3	E		E	Co	G4	S2	1,2	c	6		x	x								30, 31	SR 2000, RP 2004;2000
6	AMAJH03010	Lynx	Lynx canadensis	1	**16**	4	4	3	5	**6**	3	1	2	T		T	T	G5	S1	1	a	1,2,3,4				x		T	T	T			4, 5, 6	SR 1999, RP 2001, MR 1991
6	AMALC01010	Elk (Nooksack herd, mixed)	C.e. nelsoni, roosevelti	1	**11**	4	0	3	4	**7**	2	2	3	S5	Close to extirpation due to variety of threats.			G5	S5				x			x							1, 2, 4, 9, 11, 19, 22-24	MP 2002, Game Plan 2003
6	AMALC02022	Columbian white-tailed deer	Odocoileus virginianus leucurus	1	**13**	3	5	2	3	**7**	3	2	2	E		E	E	G5	S1	1	c	5		T	T								1, 2, 3, 11, 19, 20, 22, 23	RP 1983 fed, MR 1991
6	AMALC04011	Woodland caribou	Rangifer tarandus	1	**17**	5	5	2	5	**6**	3	1	2	E		E	E	G5	S1	1	a	1								T			4, 5, 9, 22, 24, 25	RP 1994 fed, MR 1991, Coop 1996
6	AMALD01010	Pronghorn antelope	Antilocapra americana	1	**13**	3	5	2	3	**7**	1	2	4	X	Planned reintroduction																	x	15, 16, 17, 18, 19	
5	ABNBA01030	Common loon	Gavia immer	1	**14**	4	3	3	4	**7**	3	1	3	S	East Cascades peripheral	S		G5	S2	1,2	b,c	1,2,3,4,5,6		T	x	T	T	T	T	T		x	21, 22, 28, 29, 30, 31	SR 2000, MR 2003
5	ABNCA04010	Western grebe	Aechmophorus occidentalis	1	**14**	4	3	2	5	**5**	2	2	1	C		C		G5	S3	1,2	b	1,2,3		x	T		x		x			x	21, 22, 28, 29, 30, 31	
5	ABNFC01010	American white pelican	Pelecanus erythrorhynchos	1	**17**	4	5	3	5	**4**	2	1	1	E		E		G3	S1	1,2	b,c	1,2,3,5							x		x	T	21, 22. Nests on islands, feeds in open water	MR 2003
5	ABNGA04010	Great blue heron	Ardea herodias	1	**10**	3	1	3	3	**6**	3	1	2	M		M		G5	S4	2	b	1,2,3,4,5,6		T	T	T	T		T	x	x		1, 2, 11, 19, 20-26, 28	MR 2003
5	ABNJB02030	Trumpeter swan	Cygnus buccinator	1	**12**	4	2	3	3	**7**	2	2	3	S3				G4	S3	2,3	3	1,2,3,4,5,6	x	x	T				T			T	19, 21, 22, 28	
5	ABNJB03043	Tule greater white-fronted goose	Anser albifrons gambelli	1	**13**	3	2	3	5	**5**	1	1	3	S3	No surveys during migration, management concern			G5	S3				x	x	x								19, 21, 22, 28	
5	ABNJB05010	Brant goose	Branta bernicla	1	**11**	3	2	3	3	**6**	2	2	2	S3				G5	S3	2,3	c	4,6	x	T	T								28, 29, 30	
5	ABNJB10110	Northern pintail	Anas acuta	1	**11**	3	2	3	3	**7**	2	2	3	S3				G5	S3				x	x	x		x		x	x			15, 19, 21, 22, 28, 30	
5	ABNJB11030	Redhead	Aythya americana	1	**11**	3	2	3	3	**7**	2	2	3	S3	Management concern			G5	S3				x						x	x		x	21, 22, 28, 29, 30	
5	ABNJB11060	Greater scaup	Aythya marila	1	**10**	4	0	3	3	**7**	2	2	3	S5	Management concern			G5	S5				x	x	x							x	21, 28, 30	
5	ABNJB11070	Lesser scaup	Aythya affinis	1	**10**	4	0	3	3	**7**	2	2	3	S4	Management concern			G5	S4				x	x	x		x			x		x	21, 22, 28	
5	ABNJB16010	Long-tailed duck	Clangula hyemalis	1	**11**	3	2	3	3	**7**	2	2	3	S3	Management concern			G5	S3				x	x	x								29, 30	
5	ABNJB17010	Black scoter	Melanitta nigra	1	**10**	3	0	3	4	**5**	1	2	2	S4	Management concern.			G5	S4					x	x								28, 29, 30, 31	
5	ABNJB17020	Surf scoter	Melanitta perspicillata	1	**13**	4	2	3	4	**5**	1	2	2	S3				G5	S3					T	x								28, 29, 30	
5	ABNJB17030	White-winged scoter	Melanitta fusca	1	**10**	4	0	3	3	**5**	1	2	2	S5	Management concern.			G5	S5						x								28, 29, 30	
5	ABNKC10010	Bald eagle	Haliaeetus leucocephalus	1	**13**	3	4	3	3	**7**	2	2	3	T		T	T	G4	S4	1	b,c	1,2,3,4,5,6		T	T	T	T	T	T	T	T	T	1-7, 19-23, 25, 27-30	SR 2001, RP 1990, MR 2003
5	ABNKC12060	Northern goshawk	Accipiter gentilis	1	**10**	3	3	2	2	**6**	2	2	2	C		C	Co	G5	S3	1	b	1,2,3,4,5,6		T	T	T	T	T	T	x	T	T	1, 3, 4, 5, 6, 7, 8, 13, 22-25	MR 2003
5	ABNKC19120	Ferruginous hawk	Buteo regalis	1	**15**	4	4	3	4	**5**	3	1	1	T		T	Co	G4	S2	1	b	1,2,3										T	14, 15, 16, 17, 18, 19	RP 1996, MR 2003
5	ABNKC22010	Golden eagle	Aquila chrysaetos	1	**12**	3	3	3	3	**6**	3	1	2	C		C		G5	S3	1	b	1,2,3,4,5,6		x	x	T	T	T	T	x	x	x	7, 13, 14, 15, 16, 17, 19, 25	MR 2003
5	ABNKD06070	Peregrine falcon	Falco peregrinus	1	**11**	2	3	3	3	**7**	2	2	3	S		S	Co	G4	S2	1	b	1,2,3,4,5,6		T	T	T	T	T	T	x	T	T	1-16, 20-30	SR 2002, MR 2003
5	ABNKD06090	Prairie falcon	Falco mexicanus	1	**10**	3	1	3	3	**5**	2	1	2	M		M		G5	S3	3	b	1,2,3,5							T		x	x	13, 15, 16, 18, 19	MR 2003

CWCS SPECIES OF GREATEST CONSERVATION NEED

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Evo	ELCODE	COMMON NAME	SCIENTIFIC NAME	SGCN (179)	Y-Axis (9.5)	Threats (Concerns)	Current status	Socio-econ value	Vulnerability	X-Axis (7.5)	Knowledge (Actions)	Expenditures	Conservation measures in place	Status for Calculation	RANKING BIOLOGIST COMMENTS	WDFW Species Of Concern	ESA	NHP G-Rank	NHP S-Rank	PHS Criteria	PHS Area	PHS Region	WDFW Game Plan	NW Coast	Puget Trough	N Cascades	W Cascades	E Cascades	Okanogan	Can. Rockies	Blue Mountains	Columbia Plat.	WHROW HABITAT COMMENTS	MANAGEMENT/ RECOVERY/ STATUS REPORTS AND DATES
5	ABNLC12010	Greater sage-grouse	Centrocercus urophasianus	1	**17**	5	4	3	5	**6**	3	1	2	T		T	C	G4	S1	1,3	b,c	1,2,3										T	15, 16, 17, 18, 19	SR 2003;1998, RP 2004, MR 2003
5	ABNLC13030	Sharp-tailed grouse	Tympanuchus phasianellus	1	**17**	5	4	3	5	**5**	2	1	2	T		T	Co	G4	S2	1,3	b,c	1,2							T			T	7, 8, 15, 16, 17, 19, 25	SR 1998, RP 1995, MR 2003
5	ABNLC24010	Mountain quai	Oreortyx pictus	1	**14**	3	4	3	4	**4**	1	1	2	S1				G5	S1	3	a	1,3,4,5,6	x					x			T		1, 2, 3, 4, 5, 7, 12, 14, 23, 25	SR 1993, RP 1993, MR 2003
5	ABNMK01010	Sandhill crane (greater)	Grus canadensis	1	**17**	4	5	3	5	**7**	3	2	2	E	Disjunct?	E			S1	1	b,c	1,2,3,4,5,6						x	T			x	15, 19, 22, 25	RP 2002, MR 2003
5	ABNNB03031	Snowy plover	Charadrius alexandrinus nivosus	1	**16**	5	4	2	5	**6**	2	2	2	T		E	T	G4	S1	1	b	6		T									18, 21, 26, 28	RP 1995;2001fed, MR 2003
5	ABNNC01020	Black oystercatcher	Haematopus bachmani	1	**10**	3	1	3	3	**6**	2	1	3	M		M		G5	S4					T	x								26, 27	MR 2003
5	ABNNF02010	Willet	Catoptrophorus semipalmatus	1	**11**	3	2	2	4	**6**	2	1	3	S3	Extremely limited range.			G5	S3	2	b	1,2,3,4,5,6		x									16, 17, 18, 19, 21, 22, 28	
5	ABNNF06010	Upland sandpiper	Bartramia longicauda	1	**15**	5	5	2	3	**4**	2	1	1	E	Peripheral species.	E		G5	SH	1	a	1										x	15, 22	RP 1995;1998 fed, MR 2003
5	ABNNF08040	Marbled godwit	Limosa fedoa	1	**12**	2	2	3	5	**5**	2	1	2	S3	Extremely limited range. WA subspecies breeds in AK.			G5	S3	2	b	1,2,3,4,5,6		x	x							x	18, 21, 26, 28	
5	ABNNF11020	Red knot	Calidris canutus	1	**13**	4	2	3	4	**4**	1	1	2	S3				G5	S3					x	x								19, 26, 28	
5	ABNNF11160	Rock sandpiper	Calidris ptilocnemis	1	**12**	3	2	3	4	**4**	1	1	2	S3				G5	S3					T	x								26, 27	
5	ABNNM08080	Arctic tern	Sterna paradisaea	1	**11**	4	1	2	4	**7**	3	1	3	M		M		G5	S2					x	x								26, 27, 30, 31, 32	
5	ABNNN02010	Common murre	Uria aalge	1	**10**	3	3	1	3	**7**	2	2	3	C		C		G5	S4	1,2	b,c	4,6		T	x								27, 28, 29, 30, 31	MR 2003
5	ABNNN06010	Marbled murrelet	Brachyramphus marmoratus	1	**16**	5	4	2	5	**6**	3	1	2	T	East Cascades peripheral	T	T	G3	S3	1,2	a,b,c	4,5,6		T	T	T	T						1, 3, 28, 29, 30, 31	SR 1993, RP 1997;1997 fed, MR
5	ABNNN07030	Ancient murrelet	Synthliboramphus antiquus	1	**10**	3	2	2	3	**6**	1	2	3	S3	Breeder?			G4	S3					T	x								29, 30, 31	
5	ABNNN08010	Cassin's auklet	Ptychoramphus aleuticus	1	**12**	3	3	2	4	**6**	1	2	3	C		C	Co	G4	S3	1,2	b	6		T	x								27, 30, 31, 32	
5	ABNNN12010	Tufted puffin	Fratercula cirrhata	1	**13**	3	3	3	4	**7**	2	2	3	C		C	Co	G5	S3	1,2,3	b,c	4,6		T	x								27, 29, 30, 31, 32	
5	ABNRB02020	Yellow-billed cuckoo	Coccyzus americanus	1	**15**	5	3	2	5	**3**	1	1	1	C	Extirpated?	C	C	G5	SH	1	a	1,2,4			T		T						23, 25	MR 1991
5	ABNSB01020	Flammulated owl	Otus flammeolus	1	**13**	4	3	2	4	**4**	1	1	2	C		C		G4	S3	1	b,c	1,2,3						T	T	T	T	x	3, 5, 6, 7, 25	MR 2003
5	ABNSB10010	Burrowing owl	Athene cunicularia	1	**14**	4	3	3	4	**4**	2	1	1	C		C	Co	G4	S2	1	b,c	1,2,3,5							T		x	T	11, 15, 16, 17, 18, 19, 22	SR 2004d, MR 2003
5	ABNSB12011	Northern spotted owl	Strix occidentalis caurina	1	**18**	5	5	3	5	**6**	3	2	1	E		E	T	G3	S1	1	a	2,3,4,5,6		T	T	T	T	T					1, 3, 4, 5, 7	RP 1992 fed, MR 1991, SR 2004
5	ABNSB12040	Great gray owl	Strix nebulosa	1	**10**	3	1	2	4	**5**	2	1	2	M		M		G5	S2										T		x		3, 5, 6, 7, 22, 24	
5	ABNUA03020	Vaux's swift	Chaetura vauxi	1	**11**	3	3	2	3	**5**	2	1	2	C		C		G5	S3	1	b	1,2,3,4,5,6		T	T	T	T	T	T	x	T	x	1, 4, 5, 20, 21, 23, 24	MR 2003
5	ABNYF04010	Lewis' woodpecker	Melanerpes lewis	1	**11**	3	3	2	3	**5**	2	1	2	C		C		G4	S3	1	b	1,2,3,5						T	T	T	T	T	2, 3, 5, 7, 11, 19, 25	MR 2003
5	ABNYF04050	Acorn woodpecker	Melanerpes formicivorus	1	**13**	3	4	2	4	**5**	2	1	2	S1	Peripheral species.	M		G5	S1									x					2, 7, 11, 20	
5	ABNYF07070	White-headed woodpecker	Picoides albolarvatus	1	**13**	4	3	2	4	**3**	1	1	1	C		C		G4	S2	1	b,c	1,2,3,5						T	T		T	x	5, 7	MR 2003
5	ABNYF07090	Black-backed woodpecker	Picoides arcticus	1	**12**	3	3	2	4	**4**	2	1	1	C		C		G5	S3	1	b,c	1,2,3,5						T	T	x	T		3, 4, 5, 6, 7, 9, 24	MR 2003
5	ABNYF12020	Pileated woodpecker	Dryocopus pileatus	1	**12**	3	3	2	4	**6**	2	2	2	C		C		G5	S4	1	b	1,2,3,4,5,6		x	x	x	T	T	x	x	x	x	1, 3, 4, 5, 7, 20, 23, 24, 25	MR 2003
5	ABPAT0201L	Streaked horned lark	Eremophila alpestris strigata	1	**16**	5	4	2	5	**4**	1	1	2	S1		C	C	G5	S1	1	a	4,5,6		T	T								9, 10, 11, 15, 16, 17, 18, 19, 20, 26	SR 2005
5	ABPAU01010	Purple martin	Progne subis	1	**13**	4	3	2	4	**5**	2	1	2	C		C		G5	S3	1	b	4,5,6		T	T								1, 2, 3, 26, 27, 28	MR 2003
5	ABPAZ01021	Slender-billed white-breasted nuthatch	Sitta carolinensis aculeata	1	**16**	5	4	2	5	**3**	1	1	1	S1		C	Co	G5	S1	1	a	5,6			T		x						2, 3, 7, 11, 20, 23, 25	
5	ABPAZ01030	Pygmy nuthatch	Sitta pygmaea	1	**10**	4	2	1	3	**4**	1	1	2	S3				G5	S3									x	T	x	T		7, 25	
5	ABPBJ15020	Western bluebird (W WA)	Sialia mexicana	1	**11**	3	1	3	4	**6**	2	1	3	M		M		G5	S3					T	T		x						1-7, 11, 13, 15, 19, 20, 25	MR 1991
5	ABPBK04010	Sage thrasher	Oreoscoptes montanus	1	**13**	4	3	2	4	**4**	1	1	2	C		C		G5	S3	1	b,c	1,2,3,5							T			x	16, 17, 18	MR 2003
5	ABPBR01030	Loggerhead shrike	Lanius ludovicianus	1	**11**	3	3	2	3	**5**	2	1	2	C		C	Co	G4	S3	1	b,c	1,2,3,5							x			T	11, 13, 15, 16, 17, 18, 19	MR 2003
5	ABPBX95011	Oregon vesper sparrow	Pooecetes gramineus affinis	1	**15**	4	4	2	5	**4**	2	1	1	S1	Grasslands, prairie	C	Co	G5	S1	1	a	4,5,6			T								3, 9, 11, 13, 15, 16, 17, 19	
5	ABPBX97020	Sage sparrow	Amphispiza belli	1	**12**	4	3	1	4	**4**	2	1	1	C		C		G5	S3	1	b,c	1,2,3							x			T	13, 16, 17	MR 2003
4	ARAAD02031	Western pond turtle	Actinemys (Clemmys) marmorata	1	**17**	5	5	2	5	**6**	2	1	3	E	West Cascades, East Cascades (disjunct?)	E	Co	G3	S1	1	a	4,5,6			T		T	x					2, 3, 7, 11, 12, 21, 22, 23	SR 1993, RP 1999, MR 1997
4	ARACF12030	Pygmy horned lizard	Phrynosoma douglasi	1	**11**	4	2	1	4	**5**	1	2	2	S3				G5	S3										x		x	T	6, 7, 13, 15, 16, 17, 20	
4	ARACF14030	Sagebrush lizard	Sceloporus graciosus	1	**11**	4	3	1	3	**5**	2	1	2	C		C	Co	G5	S2	1	a	1,2,3							T		x	x	3, 6, 7, 12-18, 20	
4	ARADB07010	Racer (W WA)	Coluber constrictor	1	**10**	5	0	1	4	**3**	1	1	1	S5				G5	S5						T		x						2, 5, 6, 7, 11, 13-20, 25	
4	ARADB09010	Sharptail snake	Contia tenuis	1	**12**	5	3	1	3	**3**	1	1	1	C	Disjunct?	C		G5	S2	1	a	2,3,5,6			T			x				x	1, 2, 3, 7, 11, 19, 20, 23, 25	
4	ARADB19060	California mountain kingsnake	Lampropeltis zonata	1	**12**	4	4	1	3	**4**	1	1	2	S1	Disjunct?	C		G4	S1	1	a	5					T	x					7, 11, 12	MR 1997
4	ARADB21040	Striped whipsnake	Masticophis taeniatus	1	**14**	4	4	1	5	**3**	1	1	1	S1	Peripheral, historical?	C		G5	S1	1	a	1,2,3										T	3, 7, 12, 13, 16, 17, 18	MR 1997
4	ARADB26021	Pacific gopher snake (W WA)	Pituophis catenifer catenifer	1	**11**	5	1	1	4	**3**	1	1	1	M		M		G5	S5						T								2, 5, 6, 7, 11, 14-20, 25	
3	AAAAA01140	Tiger salamander	Ambystoma tigrinum	1	**13**	5	1	2	5	**6**	3	1	2	M		M		G5	S3										T			x	7, 15, 16, 17, 19-22, 25	
3	AAAAD12040	Dunn's salamander	Plethodon dunni	1	**10**	3	3	1	3	**6**	2	2	2	C		C		G4	S2	1	a	5,6		T									1, 4, 23	MR 1997
3	AAAAD12100	Larch Mountain salamander	Plethodon larselli	1	**10**	3	3	1	3	**5**	1	2	2	S		S	Co	G3	S3	1	a	3,4,5			T	x	T	T					1, 4	SR 1993, MR 1997
3	AAAAD12190	Van Dyke's salamander	Plethodon vandyke	1	**16**	5	3	3	5	**6**	1	2	3	C		C	Co	G3	S3	1	a	5,6		T	T		T						1, 4, 23	MR 1997
3	AAAAJ01030	Cascade torrent salamander	Rhyacotriton cascadae	1	**10**	3	3	1	3	**5**	1	2	2	C		C		G3	S3	1	a	5,6			T		T						1, 4, 23	MR 1997
3	AAAAJ01040	Columbia torrent salamander	Rhyacotriton kezeri	1	**10**	3	3	1	3	**5**	1	2	2	C		C	Co	G3	S3	1	a	5,6		T	T								1, 4, 23	MR 1997
3	AAABA01020	Rocky Mountain tailed frog	Ascaphus montanus	1	**12**	4	3	2	3	**4**	1	1	2	C		C		G4	SU	1	a	1									T		1, 4, 5, 23, 25	
3	AAABB01030	Western toad	Bufo boreas	1	**13**	4	3	2	4	**6**	3	1	2	C		C	Co	G4	S3	1	a	1,2,3,4,5,6		T	T	x	T	T	T	T	T	T	1-18, 21, 22, 23, 24, 25	
3	AAABH01170	Northern leopard frog	Rana pipiens	1	**18**	5	5	3	5	**5**	2	1	2	E		E	Co	G5	S1	1	a	1,2,3,5							T	x		T	7, 15, 16, 17, 21, 22, 25	SR 1999, MR 1997
3	AAABH01180	Oregon spotted frog	Rana pretiosa	1	**18**	5	5	3	5	**6**	2	1	3	E		E	C	G2	S1	1	a	5,6			T	x		x					2, 5, 7, 11, 21, 22, 23	SR 1997, RP 1998, MR 1997

CWCS SPECIES OF GREATEST CONSERVATION NEED

09/12/2005

Evo	ELCODE	COMMON NAME	SCIENTIFIC NAME	179 SGCN	9.5 Y-Axis	Concerns: Threats	Concerns: Current status	Concerns: Socio-econ value	Concerns: Vulnerability	7.5 X-Axis	Actions: Knowledge	Actions: Expenditures	Actions: Conservation measures in place	Status for Calculation	RANKING BIOLOGIST COMMENTS
3	AAABH01290	Columbia spotted frog	Rana luteiventris	1	**14**	4	3	2	5	**5**	2	1	2	C	
2	AFBAA02030	River lamprey	Lampetra ayresi	1	**13**	4	3	2	4	**5**	3	1	1	C	Possibly declining.
2	AFBAA02100	Pacific lamprey	Lampetra tridentata	1	**13**	4	2	3	4	**7**	2	2	3	S3	
2	AFC4A06100	Copper rockfish	Sebastes caurinus	1	**14**	4	3	3	4	**6**	2	2	2	C	Live to at least 50 years
2	AFC4A06180	Greenstriped rockfish	Sebastes elongatus	1	**10**	3	3	1	3	**6**	1	1	4	C	Live to be 54 years old.
2	AFC4A06330	Quillback rockfish	Sebastes maliger	1	**14**	4	3	3	4	**7**	2	1	4	C	Old geezers (95 y)
2	AFC4A06350	Black rockfish (Puget Sound)	Sebastes melanops	1	**12**	3	3	3	3	**7**	2	2	3	C	
2	AFC4A06410	China rockfish	Sebastes nebulosus	1	**12**	3	3	3	3	**4**	1	1	2	C	Live to be 79 years old
2	AFC4A06420	Tiger rockfish	Sebastes nigrocinctus	1	**12**	2	3	3	4	**6**	1	1	4	C	Live to be 115 years old.
2	AFC4A06440	Bocaccio rockfish	Sebastes paucispinis	1	**13**	4	3	3	3	**5**	1	1	3	C	Live to be 50 years
2	AFC4A06460	Canary rockfish	Sebastes pinniger	1	**14**	4	3	3	4	**6**	2	1	3	C	Live to be 84 years old
2	AFC4A06480	Redstripe rockfish	Sebastes proriger	1	**10**	3	3	1	3	**6**	1	1	4	C	Live to be 55 years old
2	AFC4A06530	Yelloweye rockfish	Sebastes ruberrimus	1	**16**	5	3	3	5	**6**	2	1	3	C	Live to be 118 years old, fer chrissakes!!!
2	AFC4E02170	Margined sculpin	Cottus marginatus	1	**11**	3	3	2	3	**5**	1	1	3	S	
2	AFCAA01030	Green sturgeon	Acipenser medirostris	1	**14**	4	3	3	4	**7**	2	1	4	S2	
2	AFCFA07030	Pacific herring (Cherry Pt, Discovery Bay)	Clupea pallasi	1	**13**	4	3	3	3	**7**	2	1	4	C	
2	AFCHA02088	Westslope cutthroat	Oncorhynchus clarki lewis	1	**10**	3	0	3	4	**7**	2	1	4	G4	
2	AFCHA02092	Inland redband trout	Oncorhynchus mykiss gairdner	1	**10**	3	0	3	4	**5**	1	1	3	G5	
2	AFCHA03020	Pygmy whitefish	Prosopium coulteri	1	**13**	3	3	3	4	**4**	1	1	2	S	Found in only 9 lakes in WA.
2	AFCHA05023	Bull trout (Columbia Basin)	Salvelinus confluentus	1	**13**	3	4	2	4	**7**	2	2	3	T	
2	AFCHA05024	Bull trout (Coastal/Puget Sound)	Salvelinus confluentus	1	**11**	2	4	3	2	**7**	2	2	3	T	
2	AFCHB04010	Eulachon	Thaleichthys pacificus	1	**11**	3	3	3	2	**5**	2	1	2	C	
2	AFCHD03010	Olympic mudminnow	Novumbra hubbsi	1	**12**	3	3	2	4	**5**	1	1	3	S	
2	AFCJB13030	Surfsmelt	Hypomesus pretiosus	1	**11**	4	0	3	4	**7**	2	1	4	G5	
2	AFCJB37040	Leopard dace	Rhinichthys falcatus	1	**11**	3	3	2	3	**4**	1	2	1	C	
2	AFCJC02160	Mountain sucker	Catostomus platyrhynchus	1	**11**	3	3	2	3	**4**	1	1	2	C	
2	AFCJC02260	Salish sucker	Catostomus sp. 4	1	**13**	4	4	2	3	**3**	1	1	1	S1	
2	AFCS601030	Pacific sand lance	Ammodytes hexapterus	1	**10**	4	0	3	3	**6**	2	1	3		
1	IICOL02090	Columbia River tiger beetle	Cicindela columbica	1	**15**	5	4	1	5	**3**	1	1	1	S1	May be extirpated in WA.
1	IICOL0210B	Siuslaw sand tiger beetle	Cicindela hirticollis siuslawensis	1	**11**	4	2	1	4	**3**	1	1	1	S3	Endemic to PNW coast.
1	IICOL4H010	Beller's ground beetle	Agonum belleri	1	**11**	4	3	1	3	**3**	1	1	1	C	Endemic to PNW. Inhabits sphagnum bogs.
1	IICOL4J010	Long-horned leaf beetle	Donacia idola	1	**10**	3	3	1	3	**3**	1	1	1	C	Endemic to PNW. Known only from sphagnum bogs.
1	IICOL4K010	Hatch's click beetle	Eanus hatchii	1	**11**	3	4	1	3	**3**	1	1	1	S1	Endemic to PNW. Known only from sphagnum bogs.
1	IICOL4L110	Mann's mollusk-eating ground beetle	Scaphinotus mannii	1	**13**	4	3	1	5	**3**	1	1	1	C	A very vulnerable and possibly endangered species.
1	IILEP37050	Propertius' duskywing butterfly	Erynnis propertius	1	**11**	4	1	2	4	**5**	2	1	2	M	Western Washington only.
1	IILEP65209	Oregon branded skipper butterfly	Hesperia colorado oregonia	1	**10**	4	1	2	3	**4**	1	1	2	M	
1	IILEP66030	Mardon skipper butterfly	Polites mardon	1	**15**	4	5	2	4	**5**	2	1	2	E	
1	IILEP66092	Dog star skipper butterfly	Polites sonora siris	1	**10**	3	3	1	3	**3**	1	1	1	S2	
1	IILEP72040	Yuma skipper butterfly	Ochlodes yuma	1	**12**	3	4	1	4	**4**	1	1	2	S1	
1	IILEP90021	Shepard's parnassian butterfly	Parnassius clodius shepard	1	**14**	4	4	2	4	**4**	2	1	1	S1	
1	IILEPA5011	Island marble butterfly	Euchloe ausonides insulanus	1	**15**	4	4	2	5	**5**	2	1	2	S1	
1	IILEPC1152	Makah (Queen Charlotte) copper	Lycaena mariposa charlottensis	1	**12**	3	3	2	4	**4**	1	1	2	C	
1	IILEPC8012	Chinquapin hairstreak butterfly	Habrodais grunus herri	1	**11**	3	4	1	3	**3**	1	1	1	S1	
1	IILEPE2100	Johnson's hairstreak butterfly	Mitoura johnsoni	1	**12**	3	3	2	4	**3**	1	1	1	C	
1	IILEPE2137	Juniper hairstreak butterfly	Mitoura grynea barry	1	**10**	3	3	1	3	**3**	1	1	1	C	
1	IILEPE2213	Hoary elfin butterfly (W WA)	Incisalia polia obscura	1	**10**	3	2	1	4	**4**	1	1	2	S3	
1	IILEPG801G	Puget (Blackmore's) blue butterfly	Icaricia icarioides blackmorei	1	**11**	3	3	2	3	**5**	2	1	2	S2	
1	IILEPJ6028	Puget Sound fritillary butterfly	Speyeria cybele pugetensis	1	**10**	3	2	2	3	**4**	2	1	1	S3	Heath scrub

ELCODE	WDFW Species Of Concern	ESA	NHP G-Rank	NHP S-Rank	PHS: Criteria	PHS: Area	PHS: Region	WDFW Game Plan	NW Coast	Puget Trough	N Cascades	W Cascades	E Cascades	Okanogan	Can. Rockies	Blue Mountains	Columbia Plat.	WHROW HABITAT COMMENTS	MANAGEMENT/ RECOVERY/ STATUS REPORTS AND DATES
AAABH01290	C	Co	G4	S4	1	a	1,2,3,4				x		T	T	x	x	T	4-9, 13, 14, 15, 16, 21, 22, 24, 25	MR 1997
AFBAA02030	C	Co	G4	S2	1	a	4,5,6		T	x	x	T	T			T	x	21, 29, 31	
AFBAA02100		Co	G5	S3					T	T	x	T	T			x	T	21, 29, 31, 32?	
AFC4A06100	C	Co			1,2,3	c	4,6		x	T									SR 1997, MR 1998 (PS);2003 (coastal)
AFC4A06180	C				1,2,3	c	4,6		x	x									SR 1997, MR 1998 (PS);2003 (coastal)
AFC4A06330	C	Co			1,2,3	c	4,6		x	T									SR 1997, MR 1998(PS);2003 (coastal)
AFC4A06350	C				1,2,3	c	4,6			T									SR 1997, MR 1998 (PS);2003, SR 1999
AFC4A06410	C				1,2,3	a	4,6		x	x									SR 1997, MR 1998 (PS);2003 (coastal)
AFC4A06420	C				1,2,3	a	4,6		x	T									SR 1997 (PS), MR 2003 (coastal)
AFC4A06440	C				1,2,3	c	4,6		x	x									SR 1997, MR 1998 (PS);2003 (coastal)
AFC4A06460	C				1,2,3	c	4,6		x	x									SR 1997, MR 1998 (PS);2003, SR 2001
AFC4A06480	C				1,2,3	c	4,6		x	x									SR 1997, MR 1998 (PS);2003 (coastal)
AFC4A06530	C				1,2,3	a	4,6		x	T									MR 1997, MR 1998 (PS);2003, SR 2002
AFC4E02170	S	Co	G3	S1	1	a	1									T	T	21	SR 1998
AFCAA01030			G3	S2	2,3	a	4,5,6		T	x		x						21	
AFCFA07030	C	C	GU	SU	1,2,3	b,c	4,6			T									MP 1998, SR 2004 (PS, coastal)
AFCHA02088		Co	G4		3	a	4,6						x	T	T	T	T	21, 28, 29, 30, 31, 32	
AFCHA02092			G5											x	T	x	T	21	
AFCHA03020	S		G5	S1	1,2	a	1,2,3,4,5,6		T			x	x	T	x			21	SR 1998, MR 1991
AFCHA05023	C	T	G3	SU	1,2,3	a,c	1,2,3,4,5,6						T	T	x	T	T	21, 28, 29, 30, 31, 32	RP 2002 fed, MP 2000
AFCHA05024	C	T	G3	SU	1,2,3	a,c	1,2,3,4,5,6		T	T	x	T						21, 28, 29, 30, 31, 32	RP 2004 fed, MP 2000
AFCHB04010	C	C	G5	S4	1,2,3	c	4,5,6		x	x		x							MP 1998
AFCHD03010	S		G3	S2	1	a	4,5,6		T	T								21, 23	SR 1999, MR 1991
AFCJB13030			G5	SU	2,3	b,c	4,6		x	T									MP 1998
AFCJB37040	C		G4	S2	1	a	1,2,3,5					x	T	T		x	x	21	
AFCJC02160	C		G5	S2	1	a	1,2,3,5					T	T			x	T	21	MR 1991
AFCJC02260	M		G1	S1						T	x	x						21	
AFCS601030					2,3	b,c	4,6		x	T									MR 1998
IICOL02090	C		G2	SH	1	a	1,2,3,5									x	x	25. Sandbars and sand dunes in riparian zones of large lowland rivers	
IICOL0210B			G5	S3					T									26, 28	
IICOL4H010	C	Co	G3	S3	1	a	4			T	x							23. Margins of bogs with open water and mats of sphagnum	MR 1995
IICOL4J010	C		GU	SU	1	a	4			x	x							23. Sphagnum bogs.	MR 1995
IICOL4K010	C	Co	G2	S1	1	a	4			T									MR 1995
IICOL4L110	C				1	a	1									x	x	25. Confined to riparian strips of lowland tributaries of the Snake R.	
IILEP37050	M		G5	S3						x	T	x	x					2, 11	
IILEP65209	M		G5	S2						T								11 and 2/11 (ecotone)	
IILEP66030	E	C	G2	S1	1	a	3,5,6			T		T	T					11, 2/11, 6, 7, 9, 15, 19, 22, 4/15, 5/15,	SR 1999, MR 1995
IILEP66092			G4	S2					x	T								11, 19, 22, 1/11, 2/11	
IILEP72040	C		G5	S1	1	a	2										x	16, 21, 22	MR 1995
IILEP90021	C		G5	S1	1	a	1									x	x	14, 25	MR 1995
IILEPA5011	C	Co	G5	S1	1	a	4			T								11, 19, 26, 27, 28	
IILEPC1152	C	Co	G5	S2	1	a	6		T									22, 23	MR 1995
IILEPC8012	C		G4	S1	1	a	5					x	x					1, 2, 23	MR 1995
IILEPE2100	C		G2	S2	1	a	4,5,6		T	T	T	x						1, 2, 4	MR 1995
IILEPE2137	C		G4	S2	1	a	1,2,5						x			T	x	7, 13	MR 1995
IILEPE2213	M		G5	S3						x								2, 6, 7, 9, 11, 22, heath scrub	
IILEPG801G	C		G5	S2					T	T								9, 11, 1/11, 2/11, 4/11, 22/11 (ecotones)	MR 1995
IILEPJ6028			G4	S3					x	T		x						2, 6, 9, 11, 19, 22, 23, 1/11, 4/11, heath	

CWCS SPECIES OF GREATEST CONSERVATION NEED

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Evo	ELCODE	COMMON NAME	SCIENTIFIC NAME	SGCN (179)	Y-Axis (9.5)	Threats	Current status	Socio-econ value	Vulnerability	X-Axis (7.5)	Knowledge	Expenditures	Conservation measures in place	Status for Calculation	RANKING BIOLOGIST COMMENTS	WDFW Species Of Concern	ESA	NHP G-Rank	NHP S-Rank	PHS Criteria	PHS Area	PHS Region	WDFW Game Plan	NW Coast	Puget Trough	N Cascades	W Cascades	E Cascades	Okanogan	Can. Rockies	Blue Mountains	Columbia Plat.	WHROW HABITAT COMMENTS	MANAGEMENT/ RECOVERY/ STATUS REPORTS AND DATES
						Concerns					Actions													Ecoregions										
1	IILEPJ6087	Oregon silverspot butterfly	Speyeria zerene hippolyta	1	**17**	5	5	2	5	**6**	2	2	2	E		E	T	G5	SX	1	a	6		T									19, 22, 26, 27, 26/6, 26/1, 26/2	SR 1993, RP1982;2001 fed, MR 1995
1	IILEPJ608A	Valley silverspot butterfly	Speyeria zerene bremneri	1	**13**	4	3	2	4	**4**	2	1	1	C		C	Co	G5	S2	1	a	4,5,6		T	T		x						2, 9, 11, 19, 22, 23, 1/11, 4/11	MR 1995
1	IILEPJ7030	Silver-bordered fritillary butterfly	Boloria selene atrocostalis	1	**13**	4	3	2	4	**3**	1	1	1	C		C		G5	S3	1	a	1,2,3							T	x		T	19, 22, 24, 25	MR 1995
1	IILEPK405K	Taylor's checkerspot butterfly	Euphydryas editha taylori	1	**14**	4	4	2	4	**5**	2	1	2	S1		C	C	G5	S1	1	a	4,5,6			T		x						2, 11, 19, 23, 27, 28 and 2/11 (ecotone)	SR 2005, MR 1995
1	IILEPP1021	Great arctic butterfly	Oeneis nevadensis gigas	1	**12**	3	3	2	4	**3**	1	1	1	C		C		G5	SH	1	a	4			x								2, 11	
1	IILEYKP140	Sand-verbena moth	Copablepharon fuscum	1	**13**	4	4	1	4	**4**	2	1	1	S1					S1					T	x								26	
1	IIODO06020	White-belted ringtail dragonfly	Erpetogomphus compositus	1	**13**	4	4	2	3	**3**	1	1	1	S1				G5	S1													x	21	
1	IIODO08150	Columbia (Lynn's) clubtail dragonfly	Gomphus lynnae	1	**12**	3	4	2	3	**3**	1	1	1	S1			Co	G2	S1													x	21	
1	IIODO08330	Pacific clubtail dragonfly	Gomphus kurilis	1	**12**	3	4	2	3	**3**	1	1	1	S1				G4	S1						T		x						21	
1	IIODO14170	Subarctic darner dragonfly	Aeshna subarctica	1	**12**	3	3	2	4	**6**	1	1	4	S2				G5	S2										T				21, 22	
1	IIODO44010	Boreal whiteface dragonfly	Leucorrhinia borealis	1	**12**	3	4	2	3	**3**	1	1	1	S1	Peripheral species (CS).			G5	S1										T				21, 22, 24	
1	IIODO70020	Subarctic bluet dragonfly	Coenagrion interrogatum	1	**11**	3	3	2	3	**3**	1	1	1	S2				G5	S2										T				9, 10, 21, 22, 24	
1	IMBIV04020	California floater (bivalve)	Anodonta californiensis	1	**14**	4	4	2	4	**4**	1	1	2	S1		C	Co	G3	S1	1,2	a	1,2,3,5							T			T	21	MR 1995
1	IMBIV04090	Western floater (bivalve)	Anodonta kennerly	1	**10**	4	0	2	4	**4**	1	1	2	S4				G4	S4					T	x							x	21	
1	IMBIV04100	Winged floater (bivalve)	Anodonta nuttalliana	1	**11**	4	0	2	5	**4**	1	1	2	G3				G3	SU					x			x		x		x	x	21	
1	IMBIV04110	Oregon floater (bivalve)	Anodonta oregonensis	1	**10**	3	2	2	3	**4**	1	1	2	S3				G5	S3					T			x		T		x	x	21	
1	IMBIV19010	Western ridged mussel	Gonidea angulata	1	**14**	4	3	3	4	**4**	1	1	2	S2				G3	S2					T	T		x		T		x	x	21	
1	IMBIV27020	Western pearlshell (bivalve)	Margaritifera falcata	1	**10**	4	0	2	4	**4**	1	1	2	S4				G4	S4					T	x		x				x	x	21	
1	IMGAS62030	Bluegray taildropper (slug)	Prophysaon coeruleum	1	**10**	4	0	2	4	**3**	1	1	1	S4				G4	S4						x		x						1	
1	IMGAS80100	Crowned tightcoil (snail)	Pristiloma pilsbryi	1	**14**	4	4	1	5	**3**	1	1	1	S1				G1	S1					T									1	
1	IMGAS93030	Columbia oregonian	Cryptomastix hendersoni	1	**10**	4	0	1	5	**3**	1	1	1	G2	Found in talus, springs and seeps in the Columbia Gorge; extirpated from Skamania Co.			G2														x	14, 25	
1	IMGASB2020	Oregon megomphix (snail)	Megomphix hemphilli	1	**10**	4	0	2	4	**3**	1	1	1	G2				G2						T	T		x						1	
6	AMABA01170	Pacific water shrew	Sorex bendirii	0	**6**	2	1	1	2	**9**	1	3	5	M		M		G4	S4						T	T							1, 2, 4, 5, 22, 23, 24, 25	
6	AMABA01221	Destruction Island shrew	Sorex trowbridgii destruction	0	**10**	2	4	1	3	**9**	1	3	5	S1			Co	G5	S1					T		T							1, 19, 27	
6	AMABA01250	Pygmy shrew	Sorex hoyi	0	**6**	2	1	1	2	**9**	2	3	4	M		M		G5	S2														5	MR 1991
6	AMABB02010	Townsend's mole	Scapanus townsendi	0	**3**	1	0	1	1	**9**	1	3	5	S5				G5	S5						T	T							1, 9, 11, 19, 20, 22, 23, 27	
6	AMABB02011	Olympic snow mole	Scapanus townsendii olympicus	0	**3**	1	0	1	1	**9**	1	3	5	G5				G5						T									4, 9, 10, 24	
6	AMACC01020	Yuma myotis	Myotis yumanensis	0	**4**	1	0	1	2	**6**	2	2	2	S5			Co	G5	S5					T									1, 2, 4,-7, 9, 11, 13-16, 19-25, 28	
6	AMACC01070	Long-eared myotis	Myotis evotis	0	**6**	2	1	1	2	**6**	2	2	2	M		M	Co	G5	S4					T									1-7, 9, 13-18, 21-25	
6	AMACC01090	Fringed myotis	Myotis thysanodes	0	**8**	3	1	1	3	**6**	2	2	2	M		M	Co	G4	S3					T				T					1, 2, 3, 21	
6	AMACC01110	Long-legged myotis	Myotis volans	0	**6**	2	1	1	2	**5**	2	1	2	M		M	Co	G5	S3					T		T	T	T	T				1-9, 11, 14, 21, 22, 23, 25, 28	
6	AMACC01120	California myotis	Myotis californicus	0	**5**	2	0	1	2	**6**	2	2	2	S5				G5	S5														1, 2, 5, 6, 7, 8, 11, 14-17, 21-25, 28	
6	AMACC01140	Small-footed myotis	Myotis ciliolabrum	0	**6**	2	1	1	2	**6**	2	2	2	M	Peripheral	M	Co	G5	S4														13, 14, 15, 16, 17, 21, 25	
6	AMACC03010	Western pipistrelle	Pipistrellus hesperus	0	**6**	2	1	1	2	**5**	1	2	2	M		M		G5	S3														14, 15, 16, 17, 18, 21, 25	
6	AMACC04010	Big brown bat	Eptesicus fuscus	0	**3**	1	0	1	1	**11**	3	3	5	S5				G5	S5	2	b,c	1,2,3,4,5,6											1, 2, 4, 5, 6, 7, 11, 13, 14, 19-25, 27, 28	
6	AMACC05030	Hoary bat	Lasiurus cinereus	0	**4**	1	1	1	1	**6**	2	2	2	M		M		G5	S5														1, 2, 4, 5, 6, 7, 20, 21	
6	AMACC07010	Spotted bat	Euderma maculatum	0	**9**	3	1	2	3	**7**	2	2	3	M	Peripheral	M		G4	S3								T		T			T	7, 14, 15, 16, 18, 19, 21, 22, 25	
6	AMACC10010	Pallid bat	Antrozous pallidus	0	**6**	2	1	1	2	**5**	2	2	1	M		M		G5	S3	2	b,c	1,2,3,4,5,6							T			T	3, 7, 13-19, 21, 22, 25	
6	AMAEA01020	Pika	Ochotona princips	0	**9**	3	0	2	4	**4**	1	1	2	S5				G5	S5														9,10	
6	AMAEB03010	Snowshoe hare	Lepus americanus	0	**6**	2	0	2	2	**10**	3	3	4	S5				G5	S5				x										1, 2, 4, 5, 6, 8, 9, 23, 24, 25	
6	AMAFB02020	Least chipmunk	Tamias minimus	0	**6**	3	0	1	2	**6**	1	2	3	S4	Shrub-steppe obligate.			G5	S4														8, 16, 17, 18	
6	AMAFB02031	Olympic yellow-pine chipmunk	Tamias amoenus caurinus	0	**7**	2	0	2	3	**8**	1	2	5	G5				G5						T									4, 9, 10	
6	AMAFB02130	Red-tailed chipmunk	Tamias ruficaudus	0	**6**	1	1	2	2	**7**	1	3	3	M		M		G5	S2														5	
6	AMAFB03020	Yellow-bellied marmot	Marmota flaviventris	0	**6**	2	0	2	2	**9**	3	2	4	S4				G5	S4				x										7, 9, 10, 13, 14-20, 25	
6	AMAFB09020	Northern flying squirrel	Glaucomys sabrinus	0	**5**	2	0	1	2	**10**	3	3	4	S4				G5	S4														1, 2, 4, 5, 6, 7, 23, 24, 25	
6	AMAFC01042	White Salmon pocket gopher	Thomomys talpoides limoses	0	**6**	2	1	1	2	**6**	1	2	3	M		M		G5	S3														5, 7, 15, 16, 19	
6	AMAFD01070	Great Basin pocket mouse	Perognathus parvus	0	**3**	1	0	1	1	**10**	2	3	5	S5				G5	S5										T				13, 15, 16, 17, 18	
6	AMAFD03010	Ord's kangaroo rat	Dipodomys ordii	0	**7**	2	1	1	3	**8**	2	3	3	M		M		G5	S4														16, 17	
6	AMAFE01010	American beaver	Castor canadensis	0	**5**	2	0	2	1	**10**	3	3	4	S5				G5	S5				x										1, 2, 4, 5, 6, 7, 21, 22, 23, 24, 25	
6	AMAFF02030	Western harvest mouse	Reithrodontomys megalotis	0	**3**	1	0	1	1	**11**	3	3	5	S4				G5	S4										T				15, 16, 19, 22, 25	
6	AMAFF06010	Northern grasshopper mouse	Onychomys leucogaster	0	**4**	1	1	1	1	**10**	2	3	5	M		M		G5	S4													T	16, 17, 18	
6	AMAFF13010	Sagebrush vole	Lemmiscus curtatus	0	**8**	3	1	1	3	**4**	1	1	2	M		M		G5	S3													T	15, 16, 17	
6	AMAFF15010	Muskrat	Ondatra zibethicus	0	**4**	1	0	2	1	**11**	3	3	5	S5				G5	S5				x										19, 21, 22, 23, 25	
6	AMAFF17020	Northern bog lemming	Synaptomys borealis	0	**8**	3	1	1	3	**6**	1	2	3	M		M		G4	S3							T							5, 6, 9, 22, 24	
6	AMAFJ01010	Porcupine	Erethizon dorsatum	0	**3**	1	0	1	1	**11**	3	3	5	S5				G5	S5				x										1, 2, 4, 5, 6, 7, 8, 9, 13, 14, 23, 24, 25	

CWCS SPECIES OF GREATEST CONSERVATION NEED

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				179	CRITERIA 9.5	Concerns				7.5	Actions									PHS				Ecoregions										
Evo	ELCODE	COMMON NAME	SCIENTIFIC NAME	SGCN	Y-Axis	Threats	Current status	Socio-econ value	Vulnerability	X-Axis	Knowledge	Expenditures	Conservation measures in place	Status for Calculation	RANKING BIOLOGIST COMMENTS	WDFW Species Of Concern	ESA	NHP G-Rank	NHP S-Rank	Criteria	Area	Region	WDFW Game Plan	NW Coast	Puget Trough	N Cascades	W Cascades	E Cascades	Okanogan	Can. Rockies	Blue Mountains	Columbia Plat.	WHROW HABITAT COMMENTS	MANAGEMENT/ RECOVERY/ STATUS REPORTS AND DATES
6	AMAGC01010	Sperm whale	Physeter macrocephalus	0	**12**	3	5	1	3	**10**	3	3	4	E	Pelagic, peripheral.	E	E	G3	SZ														32	
6	AMAGF02010	Dall's porpoise	Phocoenoides dall	0	**5**	1	1	2	1	**8**	3	2	3	M		M		G4	SU	2	c	4,6											29, 31, 32	
6	AMAGG01010	Gray whale	Eschrichtius robustus	0	**11**	2	3	3	3	**10**	3	3	4	S		S		G3	SZ	1,2	a	4,6			T								28, 30, 31	SR 1997
6	AMAGH01010	Fin whale	Balaenoptera physalus	0	**14**	3	5	1	5	**9**	3	3	3	E		E	E	G3	SZ														30, 31, 32	
6	AMAGH01020	Sei whale	Balaenoptera borealis	0	**12**	2	5	2	3	**10**	2	3	5	E		E	E	G3	SZ														28, 30, 31	RP F
6	AMAGH01030	Minke whale	Balaena acutorostrata	0	**9**	3	0	3	3	**7**	2	3	2	G5				G5	SZ						T								30, 31, 32	
6	AMAGH01040	Blue whale	Balaenoptera musculus	0	**14**	3	5	1	5	**9**	3	3	3	E		E	E	G3	SZ														30, 31, 32	
6	AMAGH02010	Humpback whale	Megaptera novaeangliae	0	**14**	3	5	3	3	**8**	3	2	3	E		E	E	G3	SZ						T								31, 32	
6	AMAGJ02010	Black right whale	Balaena glacialis	0	**16**	5	5	1	5	**9**	1	3	5	E		E	E		SU														30, 31, 32	
6	AMAJA01010	Coyote	Canis latrans	0	**4**	1	0	2	1	**9**	3	3	3	S5				G5	S5				x										1, 2, 4-20, 22, 23, 24, 25	
6	AMAJA03010	Red fox	Vulpes vulpes	0	**6**	2	0	2	2	**8**	2	2	4	S5				G5	S5				x										9, 10. 11, 19, 20, 27	
6	AMAJB01010	Black bear	Ursus americanus	0	**4**	1	0	2	1	**5**	3	1	1	S5				G5	S5				x										1, 2, 4,-10, 14, 19, 20, 22, 23, 24, 25	
6	AMAJC04010	California sea lion	Zalophus californianus	0	**4**	1	0	2	1	**11**	3	3	5	G5				G5	SU	2	c	4,6											28, 29, 30, 31	
6	AMAJE02010	Raccoon	Procyon lotor	0	**4**	1	0	2	1	**11**	3	3	5	S5				G5	S5				x										1, 2, 11, 19, 20-28	
6	AMAJF01010	Marten (Cascade population)	Martes americana	0	**6**	2	0	2	2	**9**	3	2	4	S4				G5	S4	3	c	1,2,3,4,5,6	x				T	T					1, 4, 5, 6, 9, 24	MR 1991
6	AMAJF02010	Ermine	Mustela erminea anguinae	0	**3**	1	0	1	1	**11**	3	3	5	S5				G5	S5				x	T									1, 4, 5, 15, 19	
6	AMAJF02030	Long-tailed weasel	Mustela frenata	0	**3**	1	0	1	1	**10**	2	3	5	S5				G5	S5				x										1, 2, 4,-20, 22, 23, 24, 25, 26, 27	
6	AMAJF02050	Mink	Mustela vison	0	**3**	1	0	1	1	**11**	3	3	5	S5				G5	S5	3	c	1,2,3,4,5,6	x										1, 21, 22, 23, 24, 25, 26, 27, 28	
6	AMAJF05020	Western spotted skunk	Spilogale gracilis	0	**7**	3	0	1	3	**7**	2	2	3	S4				G5	S4				x										1, 4, 5	
6	AMAJF06010	Striped skunk	Mephitis mephitis	0	**3**	1	0	1	1	**11**	3	3	5	S5				G5	S5				x										1, 2, 11, 12, 19, 22, 23, 25, 26, 27	
6	AMAJF10010	River otter	Lontra canadensis	0	**7**	2	0	3	2	**10**	3	3	4	S4				G5	S4				x			T							21, 22, 23, 25, 26, 28, 30	
6	AMAJG01010	Harbor seal	Phoca vitulina	0	**7**	1	1	2	3	**10**	3	2	5	M		M		G5	S4	2	c	4,5,6			T								26, 27, 28, 29, 30, 31	
6	AMAJH03020	Bobcat	Lynx rufus	0	**4**	1	0	2	1	**11**	3	3	5	S5				G5	S5				x										1, 2, 4-8, 11-18, 20, 22-25, 27	
6	AMAJH04010	Cougar	Puma concolor	0	**6**	2	0	3	1	**9**	2	2	5	S4				G5	S4				x										1, 2, 4,-9, 12, 13, 14, 22-25	
6	AMALC02010	Columbian black-tailed deer	Odocoileus hemionus columbianus	0	**5**	1	0	3	1	**11**	3	3	5	S5				G5	S5	3	c	3,4,5,6	x										1, 2, 4-7, 9-12, 19, 20, 22-27	
6	AMALC02010	Rocky Mountain mule deer	Odocoileus hemionus hemionus	0	**9**	3	0	3	3	**9**	3	3	3	S5				G5	S5	3	b,c	1,2,3,5	x										4-10, 13-20, 22, 24, 25	
6	AMALC02020	Northwest white-tailed deer	Odocoileus virginianus ochrourus	0	**5**	1	0	3	1	**11**	3	3	5	S5				G5	S5	3	b,c	1,2	x										4, 5, 7, 8, 14, 15, 19, 22, 2 5	
6	AMALC03010	Moose	Alces alces	0	**5**	1	0	3	1	**8**	2	3	3	S5				G5	S5	3	c	1,2	x										4, 5, 8, 21, 22, 24, 25	
6	AMALCO1012	Rocky Mountain elk	Cervus elaphus nelson	0	**6**	2	0	3	1	**9**	3	3	3	S5				G5	S5	3	b,c	1,3,5,6	x				T	T			T		1, 4-9, 13-17, 19, 22, 23, 24, 25	
6	AMALCO1013	Roosevelt elk	Cervus elaphus roosevelti	0	**6**	2	0	3	1	**9**	3	3	3	S5				G5	S5	3	b,c	4,5,6	x			T	T	T					1, 2, 4, 9, 11, 12, 19, 22, 23, 24, 27	
6	AMALE02010	Mountain goat	Oreamnos americanus	0	**12**	3	3	3	3	**8**	2	2	4	S2				G5	S2	3	b,c	1,2,3,4,5,6	x			T	T	T	T				4, 9, 10	RP 1997, MR 1991
6	AMALE04010	Bighorn sheep	Ovis canadensis	0	**13**	4	2	3	4	**8**	3	2	3	S3			Co	G4	S3	3	b,c	1,2,3	x					T	T		T	T	13, 14, 15, 16, 17	
5	ABNCA03010	Horned grebe	Podiceps auritus	0	**7**	2	1	2	2	**5**	1	1	3	M		M		G	S3														21, 22, 28, 30	
5	ABNCA03020	Red-necked grebe	Podiceps grisegena	0	**9**	3	1	2	3	**6**	2	1	3	M	Peripheral species -- JA	M		G5	S3						T								21, 22, 28, 29, 30, 31	
5	ABNCA03030	Eared grebe	Podiceps nigricollis	0	**9**	2	3	2	2	**6**	2	1	3	S2				G5	S2														21, 22	
5	ABNCA04020	Clark's grebe	Aechmophorus clarkii	0	**9**	3	1	1	4	**4**	1	1	2	M		M		G5	S2						T								21, 22, 28, 29, 30, 31	
5	ABNDA01020	Short-tailed albatross	Phoebastria albatrus	0	**7**	2	0	2	3	**6**	2	1	3	G1	Pelagic/peripheral.	C	E	G1	SA	1	a	6											31, 32	
5	ABNDC04010	Fork-tailed storm petrel	Oceanodroma furcata	0	**9**	2	2	2	3	**3**	1	1	1	S3				G5	S3					T									27, 31, 32	
5	ABNDC04020	Leach's storm petrel	Oceanodroma leucorhoa	0	**8**	3	0	2	3	**3**	1	1	1	S4				G5	S4					T									27, 31, 32	
5	ABNFC01020	Brown pelican	Pelecanus occidentalis	0	**12**	2	5	3	2	**9**	3	1	5	E	Peripheral species - JA.	E	E	G4	S3	1,2	c	6		T									20, 26, 27, 28, 30	RP 1983f
5	ABNFD01020	Double-crested cormorant	Phalacrocorax auritus	0	**4**	1	0	2	1	**6**	3	2	1	S4				G5	S4					T		T							20, 21, 22, 25, 26, 27, 28, 29, 30	
5	ABNFD01040	Brandt's cormorant	Phalacrocorax penicillatus	0	**9**	2	3	2	2	**4**	2	1	1	C		C		G5	S3	1,2	b,c	4,5,6		T							T		27, 28, 29, 30, 31	
5	ABNFD01050	Pelagic cormorant	Phalacrocorax pelagicus	0	**6**	2	0	2	2	**4**	2	1	1	S4				G5	S4					T									27, 28, 29, 30, 31	
5	ABNGA01020	American bittern	Botaurus lentiginosis	0	**7**	2	2	1	2	**6**	2	1	3	S3				G4	S3										T				19, 22, 28. Uses wet meadows.	
5	ABNGA04040	Great egret	Ardea alba	0	**8**	2	1	3	2	**7**	3	1	3	M	Peripheral species.	M		G5	S3														11, 18, 19, 21, 22, 23, 25, 28	
5	ABNGA08010	Green heron	Butorides virescens	0	**7**	2	1	2	2	**5**	1	1	3	M		M		G5	S3														21, 22, 23, 28	
5	ABNGA11010	Black-crowned night heron	Nycticorax nycticorax	0	**7**	2	1	2	2	**7**	3	1	3	M		M		G5	S3	2	b	1,2,3,4,5,6											21, 22, 23, 25	
5	ABNJB02010	Tundra swan	Cygnus columbianus	0	**9**	3	0	3	3	**7**	2	2	3	S4				G5	S4	2,3	c	1,2,3,4,5,6	x										19, 21, 22, 28	
5	ABNJB03040	Pacific greater white-fronted goose	Anser albifrons	0	**7**	1	2	3	1	**9**	3	3	3	S3				G5	S3				x										19, 21, 22, 28	
5	ABNJB04010	Snow goose (lesser, Wrangel Island)	Chen caerulescens	0	**14**	4	2	3	5	**10**	3	3	4	S3	Look at this population only -- very vulnerable.			G5	S3	2,3	c	4	x		T								19, 21, 22, 28	
5	ABNJB05030	Western Canada goose	Branta canadensis	0	**5**	1	0	3	1	**7**	3	2	2	S5				G5					x											
5	ABNJB05032	Vancouver Canada goose	Branta canadensis fulva	0	**9**	3	0	3	3	**6**	1	2	3										x											
5	ABNJB05033	Lesser Canada goose	Branta canadensis parvipes	0	**8**	3	0	3	2	**9**	2	3	4										x										15, 16, 17, 19, 21, 22, 28	
5	ABNJB05034	Taverner Canada goose	Branta canadensis taverneri	0	**8**	3	0	3	2	**9**	2	3	4										x										15, 16, 17, 19, 21, 22, 28	
5	ABNJB05035	Aleutian Canada goose	Branta canadensis leucopareia	0	**11**	2	4	3	2	**10**	3	3	4	T		T	Co	G5	SZ	1	c	5,6	x		T								15, 16, 17, 19, 21, 22, 28	SR 1997, RP 1997f
5	ABNJB05037	Cackling Canada goose	Branta canadensis minima	0	**9**	4	0	3	2	**9**	2	3	4	G5				G5					x										15, 16, 17, 19, 21, 22, 28	

CWCS SPECIES OF GREATEST CONSERVATION NEED

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Evo	ELCODE	COMMON NAME	SCIENTIFIC NAME	SGCN (179)	Y-Axis (9.5)	Threats	Current status	Socio-econ value	Vulnerability	X-Axis (7.5)	Knowledge	Expenditures	Conservation measures in place	Status for Calculation	RANKING BIOLOGIST COMMENTS	WDFW Species Of Concern	ESA	NHP G-Rank	NHP S-Rank	PHS Criteria	PHS Area	PHS Region	WDFW Game Plan	NW Coast	Puget Trough	N Cascades	W Cascades	E Cascades	Okanogan	Can. Rockies	Blue Mountains	Columbia Plat.	WHROW HABITAT COMMENTS	MANAGEMENT/ RECOVERY/ STATUS REPORTS AND DATES
5	ABNJB05039	Dusky Canada goose	Branta canadensis occidentalis	0	**9**	4	0	3	2	**8**	1	3	4	G5				G5					x		T								15, 16, 17, 19, 21, 22, 28	
5	ABNJB09010	Wood duck	Aix sponsa	0	**10**	2	2	3	3	**8**	2	3	3	S3				G5	S3	3	b	1,2,3,4,5,6											19, 21, 23, 25	
5	ABNJB10010	Green-winged teal	Anas crecca	0	**6**	2	0	3	1	**8**	2	3	3	S4				G5	S4														15, 19, 21, 22, 23, 25, 28	
5	ABNJB10060	Mallard	Anas platyrhynchos	0	**7**	3	0	3	1	**9**	3	3	3	S5				G5	S5				x										15, 16, 19, 20, 21, 22, 23, 25, 28, 30	
5	ABNJB10140	Cinnamon teal	Anas cyanoptera	0	**6**	2	0	3	1	**7**	2	2	3	S5	Poor information on breeding origins, banding			G5	S5				x										19, 21, 22	
5	ABNJB10150	Northern shoveler	Anas clypeata	0	**6**	2	0	3	1	**7**	2	2	3	S5	Poor information on breeding origins, banding			G5	S5				x										11, 15, 19, 21, 22	
5	ABNJB10160	Gadwall	Anas strepera	0	**6**	2	0	3	1	**7**	2	2	3	S5	Poor information on breeding origins, banding			G5	S5				x										15, 19, 21, 22, 28	
5	ABNJB10180	American wigeon	Anas americana	0	**6**	2	0	3	1	**7**	2	2	3	S4				G5	S4														15, 19, 21, 22, 23, 28, 30	
5	ABNJB11020	Canvasback	Aythya valisinaria	0	**9**	3	0	3	3	**7**	2	2	3	S4	Management concern			G5	S4				x										21, 22, 28, 29, 30	
5	ABNJB15010	Harlequin duck	Histrionicus histrionicus	0	**12**	3	3	3	3	**8**	3	2	3	S2			Co	G4	S2	2,3	b,c	1,2,3,4,5,6	x	T		T	T	T					21, 23, 25, 28, 30	MR 2003
5	ABNJB18010	Common goldeneye	Bucephala clangula	0	**5**	1	0	3	1	**10**	3	2	5	S5				G5	S5	2,3	b,c	1,2,3,4,5,6		T									21, 28, 30	
5	ABNJB18020	Barrow's goldeneye	Bucephala islandica	0	**8**	2	2	3	1	**6**	2	2	2	S3				G5	S3	2,3	b,c	1,2,3,4,5,6		T		T							4, 9, 10, 21, 22, 24, 28, 30	MR 2003
5	ABNJB18030	Bufflehead	Bucephala albeola	0	**5**	1	0	3	1	**10**	3	2	5	G5				G5	SZ	2,3	b,c	1,2,3,4,5,6											4, 21, 22, 23, 24, 25, 28, 30	
5	ABNJB20010	Hooded merganser	Lophodytes cucullatus	0	**9**	3	2	3	1	**6**	2	1	3	S3				G5	S3	3	b	1,2,3,4,5,6											1, 21, 22, 23, 25, 28	
5	ABNJB21010	Common merganser	Mergus merganser	0	**9**	3	2	3	1	**7**	2	2	3	S3				G5	S3														1, 21, 23, 25, 28	
5	ABNJB21020	Red-breasted merganser	Mergus serrator	0	**6**	2	0	3	1	**6**	2	2	2	S5				G5	S5				x										28, 30	
5	ABNJB22010	Ruddy duck	Oxyura jamaicensis	0	**7**	3	0	3	1	**7**	2	2	3	S4				G5	S4														21, 22, 28	
5	ABNKA02010	Turkey vulture	Cathartes aura	0	**8**	2	1	2	3	**7**	3	1	3	M		M		G5	S4														1, 2, 4-7, 13, 15-19, 22, 23, 25, 27, 28	
5	ABNKC01010	Osprey	Pandion haliaetus	0	**7**	2	1	2	2	**8**	3	1	4	M		M		G5	S4														1, 2, 4-7, 16, 20, 21, 23, 25, 27, 28, 30	
5	ABNKC06010	White-tailed kite	Elanus leucurus	0	**7**	1	3	2	1	**7**	2	1	4	S2				G5	S2														11, 19, 26	
5	ABNKC19070	Swainson's hawk	Buteo swainsoni	0	**9**	3	1	2	3	**6**	2	1	3	M		M		G5	S3														13, 15, 16, 17, 18, 19, 22, 25	
5	ABNKD06020	American kestrel	Falco sparverius	0	**6**	1	0	2	3	**6**	2	1	3	S4				G5	S4														1, 2, 4-7, 11, 14,-23, 25	
5	ABNKD06030	Merlin	Falco columbarius	0	**7**	2	3	1	1	**8**	3	1	4	C		C		G5	S3	1	b	1,2,3,4,5,6											1, 13, 20, 21, 23, 26, 28, 30	
5	ABNKD06080	Gyrfalcon	Falco rusticolus	0	**7**	2	1	3	1	**8**	2	2	4	M		M		G5	S2														19, 21, 22, 26, 28	
5	ABNLC09010	Spruce grouse	Falcipennis canadensis	0	**8**	3	0	2	3	**7**	2	2	3	S4				G5	S4				x										5, 6, 9, 24	
5	ABNLC09020	Blue grouse	Dendragapus obscurus	0	**6**	2	0	3	1	**8**	2	2	4	S4				G5	S4	3	b,c	1,2,3,4,5,6	x	T	T	T			T				1, 2, 4, 5, 6, 7, 8, 9, 10, 16, 24, 25	
5	ABNLC10030	White-tailed ptarmigan	Lagopus leucurus saxitilis	0	**7**	2	2	2	1	**6**	2	1	3	S3				G5	S3					T		T							9, 10	
5	ABNLC11010	Ruffed grouse	Bonasa umbellus	0	**7**	2	0	3	2	**11**	3	3	5	S5				G5	S5				x										1, 2, 5, 7, 8, 9, 19, 23, 24, 25	
5	ABNME14020	American coot	Fulica americana	0	**4**	1	0	2	1	**7**	2	1	4	S4				G5	S4				x										19, 20, 21, 22, 28	
5	ABNNB02010	Black-bellied plover	Pluvialis squatarola	0	**7**	2	0	2	3	**6**	3	1	2	S4	Limited distribution. Spartina a problem in areas.			G5	S4	2	b	1,2,3,4,5,6											18, 19, 21, 26, 28	
5	ABNNB02040	Pacific golden-plover	Pluvialis fulva	0	**9**	2	3	2	2	**5**	2	1	2	S2				G5	S2														19, 21, 26, 28	
5	ABNNB03090	Killdeer	Charadrius vociferus	0	**6**	3	0	1	2	**6**	3	1	2	S4				G5	S4								T	T					11, 15-23, 25, 26, 27, 28	
5	ABNND01010	Black-necked stilt	Himantopus mexicanus	0	**7**	2	1	2	2	**6**	2	1	3	M		M		G5	S3														15, 16, 18, 19, 21, 22	
5	ABNND02010	American avocet	Recurvirostra americana	0	**6**	2	0	2	2	**6**	2	1	3	S4				G5	S4										T				15, 16, 18, 19, 21, 22	
5	ABNNF01020	Greater yellowlegs	Tringa melanoleuca	0	**4**	1	0	2	1	**7**	3	1	3	S4				G5	S4	2	b	1,2,3,4,5,6											18, 19, 21, 22, 28, 30	
5	ABNNF03010	Wandering tattler	Heteroscelus incanus	0	**8**	2	2	2	2	**6**	2	1	3	S3				G5	S3	2	b	1,2,3,4,5,6											26, 27	
5	ABNNF04020	Spotted sandpiper	Actitis macularia	0	**5**	1	2	1	1	**5**	2	1	2	S3				G5	S3														15-19, 21, 22, 23, 25, 26, 28	
5	ABNNF07020	Whimbrel	Numenius phaeopus	0	**6**	1	2	1	2	**6**	2	1	3	S3	Irregularly distributed.			G5	S3	2	b	1,2,3,4,5,6											1, 9, 26, 27, 28	
5	ABNNF07070	Long-billed curlew	Numenius americanus	0	**8**	2	1	2	3	**6**	2	1	3	M		M		G5	S2										T			T	15, 16, 17, 18, 19, 22, 28	
5	ABNNF09010	Ruddy turnstone	Arenaria interpres	0	**5**	1	0	2	2	**7**	3	1	3	S4				G5	S4	2	b	1,2,3,4,5,6											26, 27, 28	
5	ABNNF09020	Black turnstone	Arenaria melanocephala	0	**6**	2	0	2	2	**6**	2	1	3	S4				G5	S4					T									21, 26, 27, 28	
5	ABNNF10010	Surfbird	Aphriza virgata	0	**6**	2	0	1	3	**5**	1	1	3	S4				G5	S4					T									26, 27	
5	ABNNF11030	Sanderling	Calidris alba	0	**7**	2	0	2	3	**5**	3	1	1	S4	Vulnerable to oil spills. WA population increasing			G5	S4	2	b	1,2,3,4,5,6											18, 26, 28	
5	ABNNF11050	Western sandpiper	Calidris mauri	0	**9**	4	0	2	3	**6**	3	1	2	S4	Declining population almost certain. Spartina a problem in areas.			G5	S4	2	b	1,2,3,4,5,6											18, 19, 21, 22, 26, 28	
5	ABNNF11100	Least sandpiper	Calidris minutilla	0	**5**	2	0	1	2	**7**	3	1	3	S4				G5	S4	2	b	1,2,3,4,5,6											18, 19, 21, 22, 28	
5	ABNNF11170	Dunlin	Calidris alpina	0	**5**	2	0	2	1	**7**	3	1	3	S4				G5	S4					T									18, 19, 21, 22, 26, 28	
5	ABNNF16010	Short-billed dowitcher	Limnodromus griseus	0	**7**	3	0	2	2	**6**	3	1	2	S4	Population may be declining. Spartina a problem in areas.			G5	S4	2	b	1,2,3,4,5,6											19, 21, 26, 28	
5	ABNNF18030	Wilson's snipe	Gallinago delicata	0	**8**	3	0	3	2	**6**	2	1	3	S4				G5	S4				x										11, 19, 22, 28	
5	ABNNF20010	Wilson's phalarope	Phalaropus tricolor	0	**8**	2	2	2	2	**6**	2	1	3	S3				G5	S3										T				18, 21, 22	
5	ABNNF20020	Red-necked phalarope	Phalaropus lobatus	0	**5**	1	0	2	2	**6**	2	1	3	S4				G4	S4	2	b	1,2,3,4,5,6											21, 28, 29, 30, 31, 32	
5	ABNNF20030	Red phalarope	Phalaropus fulicarius	0	**5**	1	0	2	2	**6**	2	1	3	S4	Use of offshore areas not clearly understood. Oil spills.			G5	S4	2	b	1,2,3,4,5,6											31, 32	
5	ABNNM03020	Franklin's gull	Larus pipixcan	0	**5**	2	0	1	2	**6**	2	1	3	G4				G4	SZ													T	19, 21, 22, 26, 28, 30	

CWCS SPECIES OF GREATEST CONSERVATION NEED

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Evo	ELCODE	COMMON NAME	SCIENTIFIC NAME	SGCN (179)	CRITERIA: Y-Axis (9.5)	Concerns: Threats	Concerns: Current status	Concerns: Socio-econ value	Concerns: Vulnerability	X-Axis (7.5)	Actions: Knowledge	Actions: Expenditures	Actions: Conservation measures in place	Status for Calculation	RANKING BIOLOGIST COMMENTS	WDFW Species Of Concern	ESA	NHP G-Rank	NHP S-Rank	PHS: Criteria	PHS: Area	PHS: Region	WDFW Game Plan	Ecoregions: NW Coast	Puget Trough	N Cascades	W Cascades	E Cascades	Okanogan	Can. Rockies	Blue Mountains	Columbia Plat.	WHROW HABITAT COMMENTS	MANAGEMENT/ RECOVERY/ STATUS REPORTS AND DATES
5	ABNNM03100	Ring-billed gull	Larus delawarensis	0	**6**	2	0	2	2	**8**	3	1	4	S5				G5	S5														19, 20, 21, 22, 26-31	
5	ABNNM03180	Western gull	Larus occidentalis	0	**4**	2	0	1	1	**6**	2	1	3	S4				G5	S4					T									20, 26, 27, 28, 30, 31	
5	ABNNM08020	Caspian tern	Sterna caspia	0	**11**	4	1	2	4	**8**	3	2	3	M		M		G5	S3					T									21, 22, 26, 27, 28, 30	
5	ABNNM08040	Elegant tern	Sterna elegans	0	**4**	1	0	2	1	**8**	2	1	5	G2	Winter migrant only.			G2															26, 27, 28, 30	
5	ABNNM08090	Forster's tern	Sterna forsteri	0	**7**	2	1	2	2	**7**	2	1	4	M		M		G5	S3													T	22, 26, 28, 30	
5	ABNNM10020	Black tern	Chlidonias niger	0	**7**	2	1	2	2	**7**	3	1	3	M		M	Co	G4	S4						T							T	19, 21, 22	
5	ABNNN05020	Pigeon guillemot	Cepphus columba	0	**8**	3	0	2	3	**6**	2	2	2	S4				G5	S4					T									27, 28, 29, 30	
5	ABNNN11010	Rhinoceros auklet	Cerorhinca monocerata	0	**9**	3	0	2	4	**7**	2	2	3	S4				G5	S4					T									27, 28, 29, 30, 31, 32	
5	ABNPB01080	Band-tailed pigeon	Columba fasciata	0	**11**	3	2	3	3	**9**	3	2	4	S3				G4	S3	3	b,c	4,5,6	x	T	T	T	T	T					1, 2, 3, 4, 19, 20, 23, 26, 27, 28	
5	ABNPB04040	Mourning dove	Zenaida macroura	0	**7**	3	0	3	1	**6**	2	1	3	S5				G5	S5				x										1, 2, 7, 11-20, 23, 25	
5	ABNSB01040	Western screech owl	Otus kennicotii macfarlane	0	**4**	1	0	2	1	**7**	2	1	4	S4				G5	S4										T				1, 2, 5, 6, 7, 8, 13, 20, 23, 25	
5	ABNSB06010	Snowy owl	Nyctea scandiaca	0	**6**	1	1	3	1	**8**	2	1	5	M		M		G5	S3														19, 26	
5	ABNSB08010	Northern pygmy owl	Glaucidium gnoma	0	**4**	1	0	1	2	**6**	2	1	3	S4				G5	S4					T									1, 2, 5, 6, 7, 9, 13, 23, 25	
5	ABNSB12020	Barred owl	Strix varia	0	**4**	1	0	2	1	**8**	2	1	5	S5				G5	S5														1, 5, 23	
5	ABNSB13040	Short-eared owl	Asio flammeus	0	**9**	3	2	2	2	**5**	2	1	2	S3				G5	S3						T					T			11, 15, 16, 19, 22	
5	ABNSB15010	Boreal owl	Aegolius funereus	0	**6**	1	1	2	2	**5**	1	1	3	M		M		G5	S3										T				4, 5, 8	
5	ABNTA02020	Common nighthawk	Chordeiles minor	0	**6**	2	0	2	2	**6**	2	1	3	S4				G5	S4						T								1, 2, 4, 5, 6, 7, 11-25	
5	ABNTA04010	Common poorwill	Phalaenoptilus nuttall	0	**8**	2	2	2	2	**6**	1	1	4	S3				G5	S3														2, 5, 6, 7, 15, 16, 17, 18, 19	
5	ABNUA01010	Black swift	Cypseloides niger	0	**7**	2	1	2	2	**5**	1	1	3	M		M		G4	S3							T	T	T	T	T			1, 2, 4, 5, 6, 7, 9, 10, 20-30	
5	ABNUA06010	White-throated swift	Aeronautes saxatalis	0	**8**	2	2	2	2	**5**	1	1	3	S3				G5	S3														5, 7, 14, 15, 16, 17, 18, 19, 21, 22, 25	
5	ABNUC48010	Calliope hummingbird	Stellula calliope	0	**6**	2	0	2	2	**5**	1	1	3	S4				G5	S4								T	T	T		T		24, 25	
5	ABNUC51020	Rufous hummingbird	Selasphorus rufus	0	**7**	3	0	2	2	**5**	2	1	2	S4				G5	S4					T	T	T	T	T	T		T		1, 2, 4-11, 14, 19, 20, 23- 27	
5	ABNYF05020	Red-breasted sapsucker	Sphyrapicus ruber	0	**0**		0			**0**				S4				G5	S4					T										
5	ABNYF05030	Williamson's sapsucker	Sphyrapicus thyroideus	0	**8**	2	2	2	2	**5**	1	1	3	S3				G5	S3									T	T		T		4, 5, 6, 7, 8, 9	
5	ABNYF05040	Red-naped sapsucker	Sphyrapicus nuchalis	0	**6**	2	0	2	2	**6**	2	1	3	S4				G5	S4						T				T		T		1, 2, 4, 23, 24	
5	ABNYF07030	Downy woodpecker	Picoides pubescens	0	**4**	1	0	2	1	**8**	3	1	4	S4				G5	S4														1, 2, 9, 19, 20, 23, 25	
5	ABNYF07110	Three-toed woodpecker	Picoides tridactylus	0	**6**	2	1	1	2	**6**	2	1	3	M		M		G5	S3												T		4, 5, 6, 7, 9, 24	
5	ABPAE32010	Olive-sided flycatcher	Contopus cooperi	0	**6**	2	0	2	2	**6**	2	1	3	S4			Co	G5	S4					T	T	T	T	T	T		T		1, 3, 4, 5, 6, 7, 9, 23, 24, 25	
5	ABPAE32050	Western wood pewee	Contopus sordidulus	0	**3**	1	0	1	1	**6**	2	1	3	S5				G5	S5					T	T								11, 19, 20, 23, 25	
5	ABPAE33040	Willow flycatcher	Empidonax traillii	0	**4**	2	0	1	1	**7**	3	1	3	S4			Co	G5	S4						T	T	T	T	T		T		1, 2,4, 23, 24, 25	
5	ABPAE33080	Hammond's flycatcher	Empidonax hammondii	0	**3**	1	0	1	1	**6**	1	1	4	S5				G5	S5							T			T		T		1, 2, 4, 5, 7	
5	ABPAE33090	Dusky flycatcher	Empidonax oberholseri	0	**3**	1	0	1	1	**7**	2	1	4	S4				G5	S4												T		4, 5, 6, 7, 8, 13, 24, 25	
5	ABPAE33100	Gray flycatcher	Empidonax wrightii	0	**4**	1	1	1	1	**5**	1	1	3	M		M		G5	S2									T				T	6, 7, 13, 16	
5	ABPAE33120	Pacific-slope flycatcher	Empidonax difficilis	0	**3**	1	0	1	1	**7**	2	1	4	S4				G5	S4					T	T	T							1, 2, 4, 23, 24	
5	ABPAE33160	Cordilleran flycatcher	Empidonax occidentalis	0	**6**	2	2	1	1	**6**	1	1	4	S3				G5	S3												T		5, 25	
5	ABPAE43050	Ash-throated flycatcher	Myiarchus cinerascens	0	**9**	3	1	2	3	**4**	1	1	2	M		M		G5	S2														2, 11, 13, 20	
5	ABPAU07010	Northern rough-winged swallow	Stelgidopteryx serripennis	0	**7**	2	0	2	3	**5**	1	1	3	S4				G5	S4														1, 2, 4-7, 11, 13-18, 21-23, 25-28, 30	
5	ABPAW01010	Blackcapped chickadee	Poecile atricapilla	0	**4**	1	0	2	1	**7**	3	1	3	S5				G5	S5														1, 2, 20, 23, 25	
5	ABPAW01060	Boreal chickadee	Poecile hudsonicus	0	**5**	1	1	2	1	**6**	1	1	4	M	Peripheral species -- JA	M		G5	S3														4, 9, 24	
5	ABPAW01070	Chestnut-backed chickadee	Poecile rufescens	0	**4**	1	0	2	1	**7**	2	1	4	S5				G5	S5					T	T								1, 4, 5, 20, 23, 24	
5	ABPBA01010	Brown creeper	Certhia americana	0	**5**	2	0	1	2	**6**	2	1	3	S4				G5	S4								T	T					1, 2, 4, 5, 6, 7, 20, 23, 24, 25	
5	ABPBG03010	Rock wren	Salpinctes obsoletus	0	**4**	1	0	2	1	**4**	1	1	2	S4				G5	S4														13, 15, 16	
5	ABPBG04010	Canyon wren	Catherpes mexicanus	0	**3**	1	0	1	1	**4**	1	1	2	S4				G5	S4										T				4, 5, 6, 7, 13, 14, 15, 16, 17, 25	
5	ABPBG09050	Winter wren	Troglodytes troglodytes	0	**3**	1	0	1	1	**7**	2	1	4	S5				G5	S5														1, 4, 5, 9, 23, 24, 25, 26	
5	ABPBG10020	Marsh wren	Cistothorus palustris	0	**4**	2	0	1	1	**6**	2	1	3	S4				G5	S4														22, 28	
5	ABPBH01010	American dipper	Cinclus mexicanus	0	**6**	2	0	2	2	**6**	2	1	3	S5				G5	S5							T			T				21, 23	
5	ABPBJ05010	Golden-crowned kinglet	Regulus satrapa	0	**4**	2	0	1	1	**6**	2	1	3	S4				G5	S4					T	T								1, 2, 4, 5, 7, 9, 20, 23, 24, 25	
5	ABPBJ18080	Veery	Catharus fuscescens	0	**8**	2	2	2	2	**6**	2	1	3	S3				G5	S3										T		T	T	25	
5	ABPBJ18100	Swainson's thrush	Catharus ustulatus	0	**4**	2	0	1	1	**6**	2	1	3	S5				G5	S5												T		1, 4, 5, 8, 23, 24, 25	
5	ABPBX03010	Yellow warbler	Dendroica petechia	0	**5**	2	0	1	2	**7**	3	1	3	S4				G5	S4										T		T		23, 25	
5	ABPBX03070	Black-throated gray warbler	Dendroica nigrescens	0	**3**	1	0	1	1	**6**	1	1	4	S5				G5	S5					T	T	T	T	T					1, 2, 5, 7, 23	
5	ABPBX03080	Townsend's warbler	Dendroica townsend	0	**4**	1	0	2	1	**6**	2	1	3	S4				G5	S4						T		T	T			T		1, 2, 4, 5, 9, 20, 23, 24	
5	ABPBX03090	Hermit warbler	Dendroica occidentalis	0	**3**	1	0	1	1	**4**	2	1	1	S4				G4	S4					T	T		T	T					1, 2, 4, 23, 24	
5	ABPBX10020	Northern waterthrush	Seiurus noveboracensis	0	**7**	2	1	2	2	**7**	2	1	4	M	Peripheral species -- JA.	M		G5	S3														23, 25	
5	ABPBX11040	Macgillivray's warbler	Oporornis tolmiei	0	**5**	2	0	1	2	**6**	2	1	3	S4				G5	S4												T	T	1, 2, 4, 5, 7, 9, 23, 24, 25	
5	ABPBX16020	Wilson's warbler	Wilsonia pusilla	0	**3**	1	0	1	1	**6**	2	1	3	S5				G5	S5												T	T	1, 2, 4, 5, 23, 24, 25	

CWCS SPECIES OF GREATEST CONSERVATION NEED

09/12/2005

Evo	ELCODE	COMMON NAME	SCIENTIFIC NAME	179 SGCN	CRITERIA 9.5 Y-Axis	Concerns Threats	Current status	Socio-econ value	Vulnerability	7.5 X-Axis	Actions Knowledge	Expenditures	Conservation measures in place	Status for Calculation	RANKING BIOLOGIST COMMENTS	WDFW Species Of Concern	ESA	NHP G-Rank	NHP S-Rank	PHS Criteria	Area	Region	WDFW Game Plan	Ecoregions NW Coast	Puget Trough	N Cascades	W Cascades	E Cascades	Okanogan	Can. Rockies	Blue Mountains	Columbia Plat.	WHROW HABITAT COMMENTS	MANAGEMENT/ RECOVERY/ STATUS REPORTS AND DATES
5	ABPBX24010	Western yellow-breasted chat	Icteria virens auricollis	0	**8**	2	2	2	2	**5**	1	1	3	S3				G5	S3										T				1, 2, 19, 23, 25	
5	ABPBX45050	Western tanager	Piranga ludoviciana	0	**4**	1	0	2	1	**6**	2	1	3	S5				G5	S5														1, 2, 4, 5, 6, 7, 8, 9, 23, 24, 25	
5	ABPBX74010	Green-tailed towhee	Pipilo chlorurus	0	**9**	1	3	2	3	**5**	1	1	3	S2	Peripheral species.	M		G5	S2													T	4, 5, 6, 7, 8, 13, 15, 16	
5	ABPBX94040	Brewer's sparrow	Spizella breweri	0	**9**	3	2	1	3	**5**	2	1	2	S3				G5	S3										T			T	15, 16, 17, 18	
5	ABPBX97010	Black-throated sparrow	Amphispiza bilineata	0	**8**	2	4	1	1	**3**	1	1	1	S1	Peripheral species.			G5	S1														16, 17, 18	
5	ABPBXA0020	Grasshopper sparrow	Ammodramus savannarum	0	**7**	3	1	1	2	**7**	3	2	2	M		M		G5	S3						T				T			T	11, 15, 16, 17, 19	
5	ABPBXA9010	Bobolink	Dolichonyx oryzivorus	0	**8**	3	1	2	2	**5**	2	1	2	M	Peripheral, associated with agriculture.	M		G5	S2										T			T	19, 22, 25	
5	ABPBXB0020	Tricolored blackbird	Agelaius tricolor	0	**8**	1	3	1	3	**5**	1	1	3	S2				G3	S2						T								22	
5	ABPBY04030	Cassin's finch	Carpodacus cassinii	0	**5**	2	0	2	1	**5**	1	1	3	S4				G5	S4										T				4, 5, 6, 7, 8, 9, 13, 24, 25	
5	ABPBY06010	Common redpoll	Carduelis flammea	0	**7**	1	3	2	1	**7**	2	1	4	S2	Not a breeder.			G5	S2														4, 5, 9, 10, 24, 25	
5	ABPBY06090	Lesser goldfinch	Carduelis psaltria	0	**5**	2	1	1	1	**5**	1	1	3	M	Peripheral, recent range expansion	M		G5	S2														2, 11, 19, 23	
4	ARAAD01010	Painted turtle	Chrysemys picta	0	**8**	3	0	2	3	**7**	3	1	3	S5				G5	S5						T								2, 7, 14, 15, 16, 21, 22, 23, 25	
4	ARACB01040	Southern alligator lizard	Elgaria multicarinata	0	**6**	2	1	1	2	**4**	1	1	2	M		M		G5	S4														2, 11	
4	ARACF14080	Western fence lizard	Sceloporus occidentalis	0	**6**	2	0	1	3	**6**	1	2	3	G5																			1, 2, 5, 6, 7, 11-17, 19, 20, 26	
4	ARADA01010	Rubber boa	Charina bottae	0	**4**	1	0	1	2	**6**	2	1	3	S4				G5	S4										T				1, 2, 4,-8, 11, 13, 14, 16, 17, 19--24, 25	
4	ARADB10010	Ringneck snake	Diadophis punctatus	0	**7**	2	1	1	3	**5**	2	1	2	M		M		G5	S3						T								1, 2, 3, 7, 11, 12, 16	
4	ARADB18010	Night snake	Hypsiglena torquata	0	**8**	3	1	1	3	**5**	2	1	2	M		M		G5	S2										T				5, 6, 7, 13, 14, 15, 16, 17, 18	
4	ARADE02120	Western rattlesnake	Crotalus viridis	0	**9**	3	0	2	4	**6**	3	1	2	S5				G5	S5						T			T	T				1, 3, 5, 6, 7, 8, 11-19, 23, 25	
3	AAAAA01080	Long-toed salamander	Ambystoma macrodactylum	0	**3**	1	0	1	1	**7**	3	2	2	S5				G5	S5														7, 13, 15, 16, 17, 19, 20, 21, 22, 25	
3	AAAAH01010	Cope's giant salamander	Dicamptodon copei	0	**8**	3	1	1	3	**5**	1	2	2	M		M		G3	S3					T	T		T						1, 21, 23	
3	AAAAH01040	Coastal giant salamander	Dicamptodon tenebrosus	0	**5**	2	0	1	2	**6**	2	2	2	S5				G5	S5						T								1, 2, 3, 4, 5, 23	
3	AAAAJ01010	Olympic torrent salamander	Rhyacotriton olympicus	0	**8**	3	1	1	3	**5**	1	2	2	M	Much of population protected in ONP	M	Co	G3	S3					T	T								1, 4, 23	
3	AAABA01010	Tailed frog	Ascaphus truei	0	**8**	3	1	2	2	**8**	3	2	3	M		M	Co	G4	S4					T	T		T	T	T				1, 4, 5, 23, 25	
3	AAABB01180	Woodhouse's toad	Bufo woodhousi	0	**6**	2	1	1	2	**5**	2	1	2	M		M		G5	S3													T	15, 16, 17, 18, 19, 20, 21, 22, 25	
3	AAABH01020	Northern red-legged frog	Rana aurora aurora	0	**9**	4	0	2	3	**6**	3	1	2	S4			Co	G4	S4					T	T		T	T					1, 2, 4, 11, 21, 22, 23, 25	
3	AAABH01060	Cascades frog	Rana cascadae	0	**8**	3	1	2	2	**7**	2	1	4	M		M	Co	G4	S4					T			T	T					4, 9, 21, 22, 23, 24, 25	
2	AFC4A06040	Brown rockfish	Sebastes auriculatus	0	**12**	2	3	3	4	**8**	2	2	4	C	Young whippersnappers at 35 years life span	C	Co			1,2,3	c	4,6												SR 1997, MR 1998 (PS);2003 (coastal)
2	AFC4A06190	Puget Sound rockfish	Sebastes emphaeus	0	**7**	1	3	1	2	**6**	1	1	4	C		C									T									
2	AFC4A06210	Widow rockfish	Sebastes entomelas	0	**10**	2	3	2	3	**8**	2	1	5	C		C				1,2,3	c	4,6												SR 1997, MR 1998 (PS);2003, SR 2
2	AFC4A06240	Yellowtail rockfish	Sebastes flavidus	0	**12**	3	3	3	3	**8**	2	1	5	C		C				1,2,3	c	4,6												SR 1997, MR 1998 (PS);2003, SR 2
2	AFC4D02010	Lingcod	Ophiodon elongatus	0	**7**	2	0	3	2	**8**	2	2	4							2,3	a	4,6			T									
2	AFC4E02050	Mottled sculpin	Cottus bairdi	0	**4**	1	0	2	1	**5**	3	1	1	S4				G5	S4										T			T	21	
2	AFC4E02060	Piute sculpin	Cottus beldingi	0	**5**	1	1	2	1	**3**	1	1	1	M		M		G5	S3									T				T	21	
2	AFC4E02080	Slimy sculpin	Cottus cognatus	0	**7**	2	1	2	2	**5**	3	1	1	M		M		G5	S3													T	21	
2	AFC4E02090	Shorthead sculpin	Cottus confusus	0	**0**		0			**0**																	T	T					21	
2	AFCAA01050	White sturgeon (Columbia River)	Acipenser transmontanus pop.2	0	**13**	4	2	3	4	**10**	3	3	4	S3				G4	S3					T	T		T	T		T			21	
2	AFCHA0208A	Coastal resident/searun cutthroat	Oncorhynchus clarki clarki	0	**6**	2	0	2	2	**7**	2	1	4	G4			Co	G4	SU	3	a	4,5,6					T						21, 28, 29, 30, 31, 32	MR 1991
2	AFCHA05040	Dolly varden	Salvelinus confluentus/malma	0	**9**	3		3	3	**8**	3	1	4	C		C	T	G3	S3	1,2,3	a	1,2,3,4,5,6									T		21, 28, 29, 30, 31, 32	
2	AFCHB03010	Longfin smelt	Spirinchus thaleichthys	0	**7**	2	2	1	2	**8**	2	2	4	S3				G5	S3	2,3	b,c	4,6												
2	AFCJB06010	Lake chub	Couesius plumbeus	0	**8**	2	3	1	2	**4**	2	1	1	C		C		G5	S2	1	a	1,2,3,5							T				21	
2	AFCJB13030	Tui chub	Gila bicolor	0	**9**	2	3	1	3	**4**	2	1	1	S2				G4	S2													T	21	
2	AFCJB37050	Speckled dace	Rhinichthys osculus	0	**4**	1	0	2	1	**4**	2	1	1	S5				G5	S5										T	T		T	21	
2	AFCJB37110	Nooksack dace	Rhinichthys sp. 4	0	**4**	1	0	2	1	**3**	1	1	1	G3		M		G3	S4						T								21	
2	AFCJB37120	Umatilla dace	Rhinichthys umatilla	0	**9**	2	3	2	2	**3**	1	1	1	C		C		G4	S2	1	a	1,2,3						T	T				21	
2	AFCJC02030	Longnose sucker	Catostomus catostomus	0	**4**	1	0	2	1	**4**	2	1	1	S4				G5	S4													T	21	
2	AFCLC01020	Sand roller	Percopsis transmontana	0	**5**	1	1	2	1	**3**	1	1	1	M		M		G4	S3									T				T	21	
2	AFCMA01010	Burbot	Lota lota	0	**9**	3	2	2	2	**11**	3	3	5	S3				G5	S3											T			21	
2	AFCMA08010	Pacific cod (S&C Puget Sound)	Gadus macrocephalus	0	**12**	2	3	3	4	**10**	3	2	5	C		C	Co			1,2,3	b,c	4,6												SR 1997, MR 1998 (PS);2003 (coastal)
2	AFCMA10020	Pacific hake (C Puget Sound)	Merluccius productus	0	**12**	2	3	3	4	**8**	3	1	4	C		C	Co			1,2,3	b,c	4,6												SR 1997, MR 1998 (PS);2003, SR 2001
2	AFCMA14010	Walleye pollock (S. Puget Sound)	Theragra chalcogramma	0	**13**	3	3	3	4	**8**	3	1	4	C		C	Co			1,2,3	b,c	4,6												SR 1997, MR 1998 (PS);2003 (coastal)
2	AFCTB16080	Rock sole	Lepidopsetta bilineata	0	**8**	3	0	3	2	**6**	3	1	2							3	b,c	4,6												
2	AFCTB16100	English sole	Pleuronectes vetulus	0	**7**	3	0	3	1	**10**	3	3	4							3	b,c	4,6												
2	AFDEA07010	Dogfish shark	Squalus acanthias	0	**8**	2	0	2	4	**7**	3	1	3																					

CWCS SPECIES OF GREATEST CONSERVATION NEED

09/12/2005

Evo	ELCODE	COMMON NAME	SCIENTIFIC NAME	SGCN (179)	Y-Axis (9.5)	Threats	Current status	Socio-econ value	Vulnerability	X-Axis (7.5)	Knowledge	Expenditures	Conservation measures in place	Status for Calculation	RANKING BIOLOGIST COMMENTS	WDFW Species Of Concern	ESA	NHP G-Rank	NHP S-Rank	PHS Criteria	PHS Area	PHS Region	WDFW Game Plan	NW Coast	Puget Trough	N Cascades	W Cascades	E Cascades	Okanogan	Can. Rockies	Blue Mountains	Columbia Plat.	WHROW HABITAT COMMENTS	MANAGEMENT/ RECOVERY/ STATUS REPORTS AND DATES
					CRITERIA:	Concerns					Actions									PHS				Ecoregions										
1	ICMAL05910	A cave obligate amphipod	Stygobromus elliotti	0	**7**	3	0	1	3	**3**	1	1	1	G1	Only occurs in WA. Mentioned in Grande Ronde subbasin plan.			G1	SU															
1	ICMALC2010	Dungeness crab	Cancer magister	0	**7**	2	0	3	2	**11**	3	3	5							2,3	b,c	4,6											28, 29, 30, 31	
1	ICMALC3010	Pandalid shrimp	Pandalus spp.	0	**9**	2	0	3	4	**10**	2	3	5							2,3	c	4,6											28, 29, 30, 31	
1	IDHYD06010	Polyorchis jellyfish	Polyorchis penicillatus	0	**7**	3	0	1	3	**4**	2	1	1												T								1	
1	IEECH11010	Red urchin	Strongylocentrotus franciscanus	0	**9**	3	0	3	3	**8**	1	2	5							3	c	4,6											28, 29, 30, 31	
1	IICLL04030	A springtail	Arrhopalites clarus	0	**0**		0			**1**	1			G2				G2																
1	IICOL6E090	Roth's blind ground beetle	Pterostichus rothi	0	**0**		0			**1**	1			G1	Not enough known to rank			G1						T										
1	IICOL6E170	Johnson's Waterfall carabid beetle	Pterostichus johnsoni	0	**0**					**0**																	T							
1	IICOL6E210	A ground beetle	Pterostichus inanis	0	**0**					**0**																	T							
1	IICOL6E220	A ground beetle	Pterostichus smetani	0	**0**					**0**																	T							
1	IICOL6L161	A ground beetle	Nebria vandykei vandykei	0	**0**					**0**					Endemic												T							
1	IICOL6L190	Mann's gazelle beetle	Nebria danmanni	0	**8**	3	0	1	4	**5**	1	1	3											T									9, 10	
1	IICOLB7070	A rove beetle	Quedius bakeri	0	**0**					**0**																	T							
1	IICOLB7080	A rove beetle	Quedius narada	0	**0**					**0**																	T							
1	IICOLB7090	A rove beetle	Quedius paradisi	0	**0**					**0**																	T							
1	IICOLB7100	A rove beetle	Quedius tahomae	0	**0**					**0**																	T							
1	IICOLW8010	Wood-borer beetle	Buprestis gibbsi	0	**0**		0			**1**	1				Not enough known to rank										T			T						
1	IICOLW9010	A rove beetle	Coryphium vandykei	0	**0**					**0**																	T							
1	IICOLX1010	A rove beetle	Gnathoryphium mandibulare	0	**0**					**0**																	T							
1	IICOLX2010	Wood-borer beetle	Oistus edmonstoni	0	**0**		0			**1**	1				Not enough known to rank										T									
1	IICOLX3010	A rove beetle	Subhaida rainieri	0	**0**					**0**																	T							
1	IICOLX4010	A rove beetle	Tachinus ovalis	0	**0**					**0**																	T							
1	IIEPH33360	A mayfly	Paraleptophlebia vaciva	0	**0**		0			**1**	1			G2				G2															21	
1	IIEPH43130	A mayfly	Epeorus hesperus	0	**0**		0			**1**	1			G2				G2															21	
1	IIEPH50120	A mayfly	Drunella pelosa	0	**0**		0			**1**	1			G2				G2															21	
1	IIEPH57030	A mayfly	Ametropus ammophilus	0	**0**		0			**1**	1			G2				G2															21	
1	IIHEM07020	Hairy shore bug	Saldula villosa	0	**0**		0			**1**	1			G3				G3						T										
1	IIHEM40090	Mirid bug	Ceratocapsus downesi	0	**0**		0			**1**	1														T									
1	IIHEM69010	Mirid bug	Clivenema fusca	0	**0**		0			**1**	1														T									
1	IIHEMF0010	Coreid bug	Coriomeris insularis	0	**0**		0			**1**	1														T									
1	IILEP04020	Silver-spotted skipper	Epargyreus clarus californicus	0	**8**	3	1	1	3	**4**	1	1	2	M		M		G5	S4														2, 11, 19, 23	
1	IILEP16020	Northern cloudy wing (western WA)	Thorybes pylades	0	**7**	3	1	1	2	**3**	1	1	1	M	M for western WA only.	M		G5	S3														2, 7, 14, 19, 23, 2 5	
1	IILEP37010	Dreamy duskywing (western WA)	Erynnis icelus	0	**8**	3	1	1	3	**3**	1	1	1	M		M		G5	S4														4, 5, 8, 14, 19, 23, 24, 25	
1	IILEP37110	Pacuvius (Dyar's) duskywing	Erynnis pacuvius lilius	0	**6**	2	1	1	2	**4**	1	1	2	M	Species is ceonothus-dependent	M		G5	S2														5, 7, 12	
1	IILEP37170	Persius duskywing (PT, Willapa)	Erynnis persius	0	**8**	3	1	1	3	**4**	1	1	2	M	M for Puget Trough and Willapa Hills populations only	M		G5	S5														9, 10, 11, 14	
1	IILEP38010	Grizzled skipper	Pyrgus centaureae	0	**7**	2	1	1	3	**3**	1	1	1	M		M		G5	S2							T			T				9, 10	
1	IILEP42011	Arctic skipper (western WA)	Carterocephalus palaemon mandan	0	**8**	3	1	1	3	**3**	1	1	1	M	Habitats listed for W WA only	M		G5	S3														11, 19, 22, 23, 28	
1	IILEP57020	Garita skipperling	Oarisma garita	0	**7**	2	1	1	3	**3**	1	1	1	M		M		G5	S2										T				4, 19, 22	
1	IILEP65020	Juba skipper (western WA)	Hesperia juba	0	**8**	3	1	1	3	**4**	1	1	2	M	M for western WA only.	M		G5	S5														11, 14, 15, 16, 17, 19	
1	IILEP65030	Common branded skipper	Hesperia comma	0	**0**		0			**2**	2			S5	one is this? (NW Coast - ask Jeff Lewis)			G5	S5					T		T								
1	IILEP65180	Nevada skipper	Hesperia nevada	0	**8**	3	1	1	3	**3**	1	1	1	M		M		G5	S2														9, 10, 15, 16	
1	IILEP66010	Peck's skipper	Polites peckius	0	**8**	3	1	1	3	**3**	1	1	1	M		M																	22, 24, 25	
1	IILEP66060	Tawny-edged skipper	Polites themistocles	0	**7**	2	1	1	3	**3**	1	1	1	M		M		G5	S2														22, 24, 25	
1	IILEP66080	Long dash skipper	Polites mystic	0	**8**	3	1	1	3	**3**	1	1	1	M		M		G5	S4														22, 24, 25	
1	IILEP66090	Sonora skipper	Polites sonora sonora	0	**7**	3	1	1	2	**4**	1	1	2	M		M		G4	S4														9, 15, 22, 24, 25	
1	IILEP72010	Bonneville skipper	Ochlodes sylvanoides bonnevilla	0	**7**	3	1	1	2	**3**	1	1	1	M		M		G5	S5														15, 16, 17, 19, 22, 25	
1	IILEP72011	Woodland skipper, coastal spp.	Ochlodes sylvanoides orecoastus	0	**8**	3	1	1	3	**3**	1	1	1	M		M		G5	S5					T									26, 27	
1	IILEP77100	Kiowa skipper	Euphyes vestris kiowah	0	**4**		4			**1**	1			S1	Not enough known to rank	M		G5	S1														22, 25	
1	IILEP77101	Dun skipper	Euphyes vestris vestris	0	**7**	3	1	1	2	**3**	1	1	1	M		M		G5	S3						T								11, 22	
1	IILEP80180	Roadside skipper	Amblycirtes vialis	0	**7**	3	1	1	2	**4**	1	1	2	M		M		G5	S4													T	5, 6, 7	
1	IILEP90020	Clodius parnassian	Parnassius clodius altaurus (gallatinu	0	**8**	3	1	1	3	**3**	1	1	1	M	Recommended inclusion M taxon	M		G5	SU														4, 8, 9, 14	
1	IILEP90054	Smintheus parnassian	Parnassius smintheus olympiannus	0	**7**	2	0	2	3	**5**	1	1	3	S4				G5	S4					T									9, 10	
1	IILEPA1020	Spring white	Pieris sysymbrii flavitincta	0	**6**	2	0	1	3	**4**	1	1	2	S4				G5	S4					T									8, 10 (WWA) 14, 15, 16, 25 (E WA)	
1	IILEPA8040	Western sulphur (Strait of Juan de Fuca)	Colias occidentalis occidentalis	0	**7**	3	0	1	3	**4**	1	1	2	G3	M for Straits of Juan de Fuca only.	M		G3	S5						T	T							11, 19, 27	
1	IILEPA8042	Intermountain sulphur	Colias occidentalis pseudochristina	0	**4**		4			**1**	1			S1				G3	S1														4, 9, 10	

CWCS SPECIES OF GREATEST CONSERVATION NEED

09/12/2005

Evo	ELCODE	COMMON NAME	SCIENTIFIC NAME	SGCN (179)	CRITERIA: Y-Axis (9.5)	Concerns: Threats	Concerns: Current status	Concerns: Socio-econ value	Concerns: Vulnerability	X-Axis (7.5)	Actions: Knowledge	Actions: Expenditures	Actions: Conservation measures in place	Status for Calculation	RANKING BIOLOGIST COMMENTS	WDFW Species Of Concern	ESA	NHP G-Rank	NHP S-Rank	PHS: Criteria	PHS: Area	PHS: Region	WDFW Game Plan	Ecoregions: NW Coast	Puget Trough	N Cascades	W Cascades	E Cascades	Okanogan	Can. Rockies	Blue Mountains	Columbia Plat.	WHROW HABITAT COMMENTS	MANAGEMENT/ RECOVERY/ STATUS REPORTS AND DATES
1	IILEPA8100	Arctic sulphur	Colias nastes streckeri	0	**8**	3	0	1	4	**4**	1	1	2	S4				G5	S4														9, 10	
1	IILEPC1020	Lustrous copper	Lycaena cuprea henryae	0	**9**	3	1	2	3	**3**	1	1	1	M	Scree slopes.	M		G5	S2							T							9, 10, scree slopes	
1	IILEPC1050	Edith's copper	Lycaena editha editha	0	**7**	3	1	1	2	**3**	1	1	1	M		M		G5	S4														5, 9, 24	
1	IILEPC1080	Ruddy copper	Lycaena rubida perkinsorum	0	**9**	3	1	2	3	**4**	1	1	2	M		M		G5	S4														7, 13, 15, 16, 19	
1	IILEPC1130	Purplish copper	Lycaena helloides	0	**4**	1	1	1	1	**6**	2	1	3	M		M		G5	S5														1, 2, 4-9, 11, 14, 19, 20, 22, 23, 25-28	
1	IILEPC1140	Nivalis copper	Lycaena nivalis brown	0	**7**	2	1	2	2	**5**	1	1	3	M		M		G5	S3					T									4, 5, 9, 14, 16	
1	IILEPD4010	Behr's hairstreak	Satyrium behrii columba	0	**7**	3	0	1	3	**3**	1	1	1	S4	Recommended addition. Okanogan EA . Purschia tridentata	M		G5	S4														16	
1	IILEPD4050	Sylvan hairstreak	Satyrium sylvinum sylvinum	0	**8**	3	1	1	3	**3**	1	1	1	M		M		G4	S4												T	T	14, 22, 25	
1	IILEPD4140	Coral hairstreak	Harkenclenus titus immaculosus	0	**6**	2	1	1	2	**4**	1	1	2	M		M		G5	S4														14, 19, 25	
1	IILEPE2050	Washington green hairstreak	Callophrys affinis washingtonia	0	**7**	3	1	1	2	**4**	1	1	2	M	lithosols	M		G5	S4														15, 16, 17	
1	IILEPE2070	Canyon green hairstreak	Callophrys sheridanii neoperplexa	0	**8**	3	1	1	3	**3**	1	1	1	M		M		G5	S3														9, 10, 14, 15, 16, 17	
1	IILEPE2080	Bramble green hairstreak	Callophrys dumetorum	0	**9**	3	1	1	4	**3**	1	1	1	M	Heath scrub	M			S2														1, 2, 5, 6, 7, 15, 19, heath scrub	
1	IILEPE2090	Thicket hairstreak	Mitoura spinetorum spinetorum	0	**9**	3	1	2	3	**3**	1	1	1	M		M		G5	S3														4, 5, 6, 7	
1	IILEPE2112	Arborvitae hairstreak	Mitoura grynea rosneri	0	**7**	3	1	1	2	**3**	1	1	1	M		M																	4, 5	
1	IILEPE2200	Moss elfin (western WA)	Incisalia mossii mossii	0	**9**	3	1	1	4	**3**	1	1	1	M	M for western WA only. Rock outcrops and cliffs.	M		G4	S3					T									1, 2, 4, 5, 7, 9, 11, 14, 15, 27, rock outcrops and cliffs	
1	IILEPE2250	Shelton pine elfin	Incisalia eryphon sheltonensis	0	**6**	2	1	1	2	**3**	1	1	1	M		M		G5	S3														2, 6, 11	
1	IILEPF9010	Eastern tailed blue	Everes comyntas comyntas	0	**3**		3			**1**	1			S2	Not enough known to rank	M		G5	S2										T			T	19, 25	
1	IILEPG501F	Anna's blue	Lycaeides anna ricei	0	**0**					**0**														T			T							
1	IILEPG6010	Greenish blue (Olympic Peninsula	Plebejus saepiolus (all ssp. In area)	0	**6**	2	0	1	3	**4**	1	1	2	S5				G5	S5					T									9, 10, 19, 22, 24, 25	
1	IILEPG8060	Acmon blue	Plebejus acmon spangelatus	0	**6**	2	0	1	3	**5**	1	1	3	S5				G5	S5					T									9, 10	
1	IILEPH0050	Mountain blue	Agriades glandon megalo	0																				T										
1	IILEPJ6101	Egleis fritillary	Speyeria egleis mcdunnough	0	**8**	3	1	1	3	**3**	1	1	1	M		M		G5	S2														9, 10	
1	IILEPJ6102	Egleis fritillary	Speyeria egleis owen	0	**8**	3	1	1	3	**3**	1	1	1	M		M		G5	S2								T	T					9, 10	
1	IILEPJ6120	Hydaspe fritillary	Speyeria hydaspe rhodope	0	**1**		1			**1**	1			M	M for San Juans population only. Found throughout W WA.	M		G4	S4														1, 2, 9, 11, 22, 23, 24	
1	IILEPJ6130	Mormon fritillary	Speyeria mormonia washingtonia	0	**0**					**0**																	T	T						
1	IILEPJ7040	Meadow fritillary	Boloria bellona todd	0	**9**	3	1	1	4	**3**	1	1	1	M		M		G5	S2										T				8, 9, 10, 15, 19, 22, 24, 25	
1	IILEPJ7100	Freija fritillary	Boloria freija freija	0	**7**	2	1	1	3	**3**	1	1	1	M		M		G5	S2										T				9, 10	
1	IILEPJ7120	Astarte fritillary	Boloria astarte astarte	0	**8**	3	1	1	3	**4**	1	1	2	M		M		G5	S3							T			T				9, 10	
1	IILEPJ7140	Arctic fritillary	Boloria chariclea rainier	0	**5**	2	0	1	2	**5**	1	1	3	S5				G5	S5					T									4, 9, 10, 22, 24	
1	IILEPJ9160	Northern checkerspot	Chlosyne palla sterope	0	**0**					**0**																		T						
1	IILEPK3080	Pale crescent	Phyciodes pallidus barnes	0	**8**	2	2	1	3	**3**	1	1	1	S3				G5	S3														14, 15	
1	IILEPK3100	Pasco pearl crescent	Phyciodes cocyta pascoensis	0	**8**	3	1	1	3	**4**	1	1	2	M		M		G5	S4														14, 15, 16, 19, 22, 25	
1	IILEPK4032	Chalcedon checkerspot	Euphydryas chalcedona perdiccas	0	**7**	2	1	1	3	**5**	1	1	3	M	M for Puget Trough populations only, which are no longer recognized as this subspecies.	M		G5	S2					T									9, 10	
1	IILEPK4050	Edith's checkerspot	Euphydryas editha colonia	0	**5**	2	0	1	2	**5**	1	1	3	S5				G5	S5					T									9,10	
1	IILEPK4071	Hopfinger's checkerspot	Euphydryas anicia hopfingeri	0	**8**	3	1	1	3	**3**	1	1	1	M		M		G5	S5														7, 9, 14, 16, 25	
1	IILEPK5091	Oreas anglewing	Polygonia oreas threatful	0	**8**	3	1	1	3	**4**	1	1	2	M		M		G5	S3							T			T				1, 4, 9, 22, 23, 24, 25	
1	IILEPK6010	Compton tortoiseshell	Nymphalis vau-album watson	0	**8**	3	1	2	2	**3**	1	1	1	M		M		G5	S3							T					T		4, 5, 8, 14, 23, 25	
1	IILEPK7010	American painted lady	Vanessa virginiensis	0	**7**	2	1	2	2	**5**	2	1	2	M	Vagrant, emigrant	M		G5	SZ								T	T					14, 15, 16, 19, 26	
1	IILEPL3020	Viceroy	Limenitis archippus lahontan	0	**9**	3	1	2	3	**4**	2	1	1	M		M		G5	S4										T				14, 19, 22, 25	
1	IILEPN6038	Vancouver ringlet	Coenonympha tullia insulana	0	**7**	3	1	1	2	**5**	2	1	2	M		M		G3	S3					T									11, 19	
1	IILEPN8010	Vidler's alpine	Erebia vidleri	0	**7**	2	2	1	2	**4**	1	1	2	S3				G4	S3					T		T							4, 9, 10	
1	IILEPP1045	Chryxus arctic	Oeneis chryxus valerata	0	**7**	2	1	1	3	**3**	1	1	1	M		M		G5	S2					T									9, 10	
1	IILEPP1100	Melissa arctic	Oeneis melissa beani	0	**7**	2	1	1	3	**3**	1	1	1	M		M		G5	S2							T			T				9, 10	
1	IILEPP2010	Monarch	Danaus plexippus	0	**8**	3	0	3	2	**4**	2	1	1	S4				G4	S4														14, 15, 19, 25	
1	IILEX13030	Clark's sphinx moth	Proserpinus clarkiae	0	**0**		0			**1**	1				Not enough known to rank										T									
1	IILEY89400	An underwing moth	Catocala allusa	0	**0**		0			**1**	1			G4	Not enough known to rank			G4	SU						T									
1	IIODO26060	Western river cruiser	Macromia magnifica	0	**9**	2	2	2	3	**3**	1	1	1	S3	Recommended deletion.			G4	S3										T				21	
1	IIODO65010	River jewelwing	Calopteryx aequabilis	0	**6**	2	0	2	2	**3**	1	1	1	S4				G5	S4						T								21, 22	
1	IIODO71290	Alkali bluet	Enallagma clausum	0	**8**	3	0	2	3	**3**	1	1	1	S4	Recommended inclusion.			G5	S4															
1	IIORT08020	An ice cricket	Grylloblatta chirugica	0	**0**					**0**																		T						
1	IIORTF1010	Olympic grasshopper	Nisquallia olympica	0	**8**	3	0	1	4	**5**	1	1	3	G1				G1						T									9, 10	
1	IIPLE0G030	A stonefly	Megaleuctra kincaidi	0	**0**		0			**1**	1			G2				G2															21	
1	IIPLE0G050	A stonefly	Megaleuctra stigmata	0	**0**		0			**1**	1			G2				G2															21	
1	IIPLE0J110	A stonefly	Malenka wenatchee	0	**0**		0			**1**	1			G2				G2															21	

CWCS SPECIES OF GREATEST CONSERVATION NEED

09/12/2005

Evo	ELCODE	COMMON NAME	SCIENTIFIC NAME	SGCN	Y-Axis	Threats	Current status	Socio-econ value	Vulnerability	X-Axis	Knowledge	Expenditures	Conservation measures in place	Status for Calculation	RANKING BIOLOGIST COMMENTS	WDFW Species Of Concern	ESA	NHP G-Rank	NHP S-Rank	PHS Criteria	PHS Area	PHS Region	WDFW Game Plan	NW Coast	Puget Trough	N Cascades	W Cascades	E Cascades	Okanogan	Can. Rockies	Blue Mountains	Columbia Plat.	WHROW HABITAT COMMENTS	MANAGEMENT/ RECOVERY/ STATUS REPORTS AND DATES
				179	9.5	CRITERIA: Concerns				7.5	Actions									PHS				Ecoregions										
1	IIPLE0K010	Meltwater lednian stonefly	Lednia tumana	0	**4**		4			**1**	1			S1				G1	S1														21	
1	IIPLE1B020	A stonefly	Kathroperla takhoma	0	**0**		0			**1**	1			G2				G2															21	
1	IIPLE1G020	Fender's soliperlan stonefly	Soliperla fenderi	0	**4**		4			**3**	1	1	1	S1			Co	G2	S1														21	
1	IIPLE24480	A stonefly	Isoperla raineri	0	**0**		0			**1**	1			G2				G2															21	
1	IIPLE27050	A stonefly	Megarcys yosemite	0	**0**		0			**1**	1			G2				G2															21	
1	IITRI19040	Fender's rhyacophilan caddisfly	Rhyacophila fender	0	**0**		0			**1**	1														T								21	
1	IITRI2A020	Vertrees' ceraclean caddisfly	Ceraclea vertreesi	0	**0**		0			**1**	1														T								21	
1	IITRI9050	Haddock's rhyacophilan caddisfly	Rhyacophila haddocki	0	**0**		0			**1**	1			G1				G1						T									21	
1	ILACA11010	A cave obligate mite	Elliotta howarth	0	**7**	3	0	1	3	**3**	1	1	1	G1	WA, ID. Mentioned in Grande Ronde subbasin plan.			G1	SU															
1	IMBIV60010	Native mussel	Mytilus trossulus	0	**10**	4	0	3	3	**8**	3	2	3																				28, 30	
1	IMBIV61010	Littleneck clam	Protothaca staminea	0	**7**	2	0	3	2	**9**	2	3	4							2,3	c	4,8											28, 30	
1	IMBIV62010	Butter clam	Saxidomus giganteus	0	**7**	2	0	3	2	**9**	2	3	4							2,3	c	4,7											28, 30	
1	IMBIV63010	Razor clam	Siliqua patula	0	**9**	3	0	3	3	**10**	3	3	4							2,3	c	6											26	
1	IMBIV64010	Rock scallop	Crassedoma giganteum	0	**5**	1	0	3	1	**7**	2	2	3												T								28, 29, 30	
1	IMBIVA1020	Geoduck clam	Panopea abrupta	0	**9**	3	0	3	3	**9**	2	3	4							2,3	c	4,6											28, 29, 30	
1	IMBIVB9030	Olympia oyster	Ostrea conchaphila	0	**13**	4	3	3	3	**8**	1	3	4	C		C				1,2,3	a,c	6			T								28, 30	
1	IMGAS20040	Pacific vertigo	Vertigo andrusiana	0	**8**	3	0	1	4	**3**	1	1	1	G1	Records also from BC to OR, not much known			G1															1	
1	IMGAS21020	Western flat-whorl	Planogyra clappi	0	**6**	3	0	1	2	**4**	2	1	1	G3	Shown to decline in logged habitats (Ovaska and Sopuck, 2001)			G3															1	
1	IMGAS59010	Keeled jumping-slug	Hemphillia burringtoni	0	**7**	2	0	2	3	**3**	1	1	1	G1				G1						T									1	
1	IMGAS59050	Warty jumping-slug	Hemphillia glandulosa	0	**7**	2	0	2	3	**4**	2	1	1	G2				G2						T	T								1	
1	IMGAS59060	Malone jumping-slug	Hemphillipa malonei	0	**0**		0			**0**				G2				G2						T										
1	IMGAS59070	Panther jumping-slug	Hemphillia pantherina	0	**0**					**0**																	T							
1	IMGAS80010	Northern tightcoil	Pristiloma arcticum	0	**9**	3	0	1	5	**4**	2	1	1	G2	(crenophilic). Only 3 localities known from WA (Burke et al., 1999)			G2															1	
1	IMGAS80050	Broadwhorl tightcoil	Pristiloma johnsoni	0	**7**	3	0	1	3	**3**	1	1	1	G2				G2															1	
1	IMGAS80140	Shiny tightcoil	Pristiloma wascoense	0	**8**	3	0	1	4	**3**	1	1	1	G2	Blue Mountains. Records also from ID and OR, not much known			G2															5	
1	IMGAS87020	Evening fieldslug	Deroceras hesperium	0	**7**	3	0	1	3	**3**	1	1	1	G1	Swamps or seeps, usually containing skunk cabbage			G1						T	T								23	
1	IMGAS93010	Puget oregonian (snail)	Cryptomastix devia	0	**9**	4	0	2	3	**4**	2	1	1	G2	talus, and Chelan Co. and Wenatchee Ranger District.			G2						T	T								1, 14	
1	IMGASB5840	Chelan mountainsnail	Oreohelix sp. 1	0	**0**					**0**																		T						
1	IMGASE5020	Glossy valvata	Valvata humeralis	0	**3**		3			**1**	1			S2				G5	S2														21	
1	IMGASE5040	Ramshorn valvata	Valvata mergella	0	**0**		0			**1**	1			G2				G2						T									21	
1	IMGASE5080	Threeridge valvata	Valvata tricarinata	0	**4**		4			**1**	1			S1				G5	S1														21	
1	IMGASF4270	Columbia duskysnail	Lyogyrus sp. 4	0	**0**		0			**1**	1														T								21	
1	IMGASG3040	Giant Columbia spire snail	Fluminicola columbiana	0	**3**		3			**1**	1			S2		C	Co	G2	S2	1,2	a	1,2,3			T							T	21	
1	IMGASG3130	Olympia pebblesnail	Fluminicola virens	0	**0**		0			**1**	1			G2				G2						T									21	
1	IMGASK4020	Bulb juga (snail)	Juga bulbosa	0	**0**		0			**1**	1																					T	21	
1	IMGASK4032	Dalles juga	Juga hemphilli dallesensis	0	**0**					**0**																	T	T						
1	IMGASK4033	Barren juga	Juga hemphilli hemphilli	0	**4**		4			**1**	1			S1				G2	S1						T								21	
1	IMGASK4100	Basalt juga	Juga (Oreobasis) sp. 1	0	**0**					**0**																	T	T						
1	IMGASL5210	Widelip pondsnail	Stagnicola traski	0	**4**		4			**1**	1			S1				G2	S1														21	
1	IMGASL6010	Giant Columbia River limpet	Fisherola nuttall	0	**3**		3			**1**	1			S2		C		G2	S2	1,2	a	1,2,3			T							T	21	RP 1995f (Snake River)
1	IMGASM0060	Rotund physa	Physella columbiana	0	**0**		0			**1**	1			G2				G2							T								21	
1	IMGASM0080	Olive physa	Physella cooperi	0	**4**		4			**1**	1			S1				G3	S1														21	
1	IMGASM0150	Grain physa	Physella hordacea	0	**4**		4			**1**	1			S1				G1	S1														21	
1	IMGASM0190	Twisted physa	Physella lordi	0	**4**		4			**1**	1			S1				G5	S1														21	
1	IMGASM0310	Sunset physa	Physella virginea	0	**0**		0			**1**	1			G2				G2															21	
1	IMGASM5020	Star gyro	Gyraulus crista	0	**4**		4			**1**	1			S1				G5	S1														21	
1	IMGASN0030	Coarse rams-horn	Planorbella binney	0	**4**		4			**1**	1			S1				G4	S1														21	
1	IMGASN1010	Sharp sprite	Promenetus exacuous	0	**4**		4			**1**	1			S1				G5	S1														21	
1	IMGASN1020	Umbilicate sprite	Promenetus umbilicatellus	0	**3**		3			**1**	1			S2				G4	S2														21	
1	IMGASR3010	Newcomb's littorine snail	Algamorda newcombiana	0	**4**		4			**1**	1			S1		C	Co	G1	S1	1,2	a	6		T									21	MR 1995, RP 2004f
1	IMGASV2040	Northern abalone	Haliotis kamtschatkana	0	**16**	5	3	3	5	**9**	2	3	4	C		C				1,2,3	a	4,6			T								28, 29, 30, 31	
1	IMGASX0010	Pristine springsnail	Pristinicola hemphill	0	**0**		0			**1**	1																					T	21	

APPENDIX 2:

CWCS SALMONIDS OF GREATEST CONSERVATION NEED

BY GDU (Genetic Diversity Unit)

09/12/2005

			CRITERIA									STATUS			
		14	11.5	Conservation Concerns				7.5	Conservation Actions						
COMMON NAME (Genetic Diversity Unit)	**SCIENTIFIC NAME**	**SGCN**	**Y-Axis**	Threats	Current risk	Socio-economic value	Vulnerability	**X-Axis**	Knowledge	Expenditures	Conservation measures in	WDFW Species Of Concern	WNHP	ESA	**WHROW HABITAT COMMENTS**
Ozette Sockeye	Oncorhynchus nerka	1	**16**	3	5	3	5	**4**	2	1	1	C	G5/T2	T	21
Lower Dungeness Pink Salmon	Oncorhynchus gorbuscha	1	**16**	5	3	3	5	**5**	3	1	1		S2		21, 28, 29, 30, 31, 32
Upper Dungeness Pink Salmon	Oncorhynchus gorbuscha	1	**16**	5	3	3	5	**5**	3	1	1		S2		21, 28, 29, 30, 31, 32
Mid-Columbia Steelhead	Oncorhynchus mykiss	1	**16**	5	5	3	3	**6**	2	1	3	C	G5/T2	T	21, 28, 29, 30, 31, 32
Snake River Steelhead	Oncorhynchus mykiss	1	**16**	5	5	3	3	**6**	2	1	3	C	G5/T2	T	21, 28, 29, 30, 31, 32
Upper Columbia Steelhead	Oncorhynchus mykiss	1	**16**	5	5	3	3	**6**	2	1	3	C	G5/T2	E	21, 28, 29, 30, 31, 32
Mid-Columbia Coho	Oncorhynchus kisutch	1	**16**	5	5	3	3	**7**	3	2	2		G4		21, 28, 29, 30, 31, 32
Yakima Steelhead	Oncorhynchus mykiss	1	**16**	5	5	3	3	**7**	3	1	3		G5/T2		21, 28, 29, 30, 31, 32
Lower Columbia Steelhead	Oncorhynchus mykiss	1	**15**	4	5	3	3	**6**	2	1	3	C	G5/T2	T	21, 28, 29, 30, 31, 32
Lake Pleasant Sockeye	Oncorhynchus nerka	1	**14**	3	3	3	5	**3**	1	1	1		G5/T3		21
Lower Columbia Coho	Oncorhynchus kisutch	1	**14**	3	5	3	3	**6**	3	1	2		G4/T2	C	21, 28, 29, 30, 31, 32
South Puget Sound Steelhead	Oncorhynchus mykiss	1	**14**	4	4	3	3	**6**	2	1	3		S5		21, 28, 29, 30, 31, 32
North Puget Sound Steelhead	Oncorhynchus mykiss	1	**13**	3	4	3	3	**6**	2	1	3		S5		21, 28, 29, 30, 31, 32
Upper Columbia Fall Chinook	Oncorhynchus tshawytscha	1	**13**	4	3	3	3	**7**	2	2	3		G5/T1		21, 28, 29, 30, 31, 32
Below Bonneville Fall Chum	Oncorhynchus keta	0	**18**	5	5	3	5	**8**	3	2	3	C		T	21, 28, 29, 30, 31, 32
Grays River Fall Chum	Oncorhynchus keta	0	**18**	5	5	3	5	**8**	3	2	3			T	21, 28, 29, 30, 31, 32
Eastern Strait of Juan de Fuca Fall Chinook	Oncorhynchus tschawytscha	0	**16**	5	5	3	3	**8**	3	2	3			T	21, 28, 29, 30, 31, 32
Lower Columbia Tule Fall Chinook	Oncorhynchus tschawytscha	0	**16**	5	5	3	3	**8**	3	2	3	C		T	21, 28, 29, 30, 31, 32
Mid- and Lower Columbia Spring Chinook	Oncorhynchus tschawytscha	0	**16**	5	5	3	3	**8**	3	2	3	C		T	21, 28, 29, 30, 31, 32
Mid-Columbia Tule Fall Chinook	Oncorhynchus tschawytscha	0	**16**	5	5	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
North Fork Nooksack Spring Chinook	Oncorhynchus tschawytscha	0	**16**	5	5	3	3	**8**	3	2	3			T	21, 28, 29, 30, 31, 32
S Puget Snd, Hood Canal & Snohomish Chinook	Oncorhynchus tschawytscha	0	**16**	5	5	3	3	**8**	3	2	3			T	21, 28, 29, 30, 31, 32
Snake River Spring Chinook	Oncorhynchus tschawytscha	0	**16**	5	5	3	3	**8**	3	2	3	C		T	21, 28, 29, 30, 31, 32
South Fork Nooksack Spring Chinook	Oncorhynchus tschawytscha	0	**16**	5	5	3	3	**8**	3	2	3			T	21, 28, 29, 30, 31, 32
South Puget Sound Spring Chinook	Oncorhynchus tschawytscha	0	**16**	5	5	3	3	**8**	3	2	3	C		T	21, 28, 29, 30, 31, 32

CWCS SALMONIDS OF GREATEST CONSERVATION NEED

BY GDU (Genetic Diversity Unit)

09/12/2005

			CRITERIA									STATUS			
		14	11.5	Conservation Concerns				7.5	Conservation Actions						
COMMON NAME (Genetic Diversity Unit)	**SCIENTIFIC NAME**	**SGCN**	**Y-Axis**	Threats	Current risk	Socio-economic value	Vulnerability	**X-Axis**	Knowledge	Expenditures	Conservation measures in	WDFW Species Of Concern	WNHP	ESA	**WHROW HABITAT COMMENTS**
Stillaguamish & Skagit Chinook	Oncorhynchus tschawytscha	0	**16**	5	5	3	3	**8**	3	2	3			T	21, 28, 29, 30, 31, 32
Upper Columbia Spring Chinook	Oncorhynchus tschawytscha	0	**16**	5	5	3	3	**8**	3	2	3	C		E	21, 28, 29, 30, 31, 32
Mid-Columbia and Snake Fall Chinook	Oncorhynchus tschawytscha	0	**15**	4	5	3	3	**8**	3	2	3	C		T	21, 28, 29, 30, 31, 32
Discovery Bay/Sequim Bay Summer Chum	Oncorhynchus keta	0	**14**	3	5	3	3	**8**	3	2	3			T	21, 28, 29, 30, 31, 32
Hood Canal Summer Chum	Oncorhynchus keta	0	**14**	3	5	3	3	**8**	3	2	3	C		T	21, 28, 29, 30, 31, 32
Okanogan Sockeye	Oncorhynchus nerka	0	**14**	5	1	3	5	**8**	3	2	3				21, 28, 29, 30, 31, 32
Strait of Juan de Fuca Summer Chum	Oncorhynchus keta	0	**14**	3	5	3	3	**8**	3	2	3			T	21, 28, 29, 30, 31, 32
Wenatchee Sockeye	Oncorhynchus nerka	0	**14**	5	1	3	5	**8**	3	2	3				21, 28, 29, 30, 31, 32
Chehalis Spring Chinook	Oncorhynchus tschawytscha	0	**12**	3	3	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
Lk Washington Beach Spawners Sockeye	Oncorhynchus nerka	0	**12**	3	3	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
North Coast Spring Chinook	Oncorhynchus tschawytscha	0	**12**	3	3	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
Strait of Juan de Fuca Fall Chum	Oncorhynchus keta	0	**12**	3	3	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
Western Strait of Juan de Fuca Fall Chinook	Oncorhynchus tschawytscha	0	**12**	3	3	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
Lower Columbia Bright Fall Chinook	Oncorhynchus tschawytscha	0	**11**	4	1	3	3	**8**	3	2	3	C		T	21, 28, 29, 30, 31, 32
South Coast Fall Chinook	Oncorhynchus tschawytscha	0	**11**	3	2	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
Upper Columbia Summer Chinook	Oncorhynchus tschawytscha	0	**11**	4	1	3	3	**10**	3	2	5				21, 28, 29, 30, 31, 32
Southwest Washington Steelhead	Oncorhynchus mykiss	0	**10**	2	2	3	3	**6**	2	1	3				21, 28, 29, 30, 31, 32
North Coast Steelhead	Oncorhynchus mykiss	0	**10**	1	3	3	3	**7**	3	1	3				21, 28, 29, 30, 31, 32
Baker Sockeye	Oncorhynchus nerka	0	**10**	3	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
Central Puget Sound Fall Chum	Oncorhynchus keta	0	**10**	3	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
Central/South Puget Sound Fall Chum	Oncorhynchus keta	0	**10**	3	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
Fraser Fall Chum	Oncorhynchus keta	0	**10**	3	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
Hood Canal Fall Chum	Oncorhynchus keta	0	**10**	3	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
Hood Canal Pink Salmon	Oncorhynchus gorbuscha	0	**10**	3	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
Lk Washington River Spawners Sockeye	Oncorhynchus nerka	0	**10**	3	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
Nisqually Pink Salmon	Oncorhynchus gorbuscha	0	**10**	3	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32

CWCS SALMONIDS OF GREATEST CONSERVATION NEED

BY GDU (Genetic Diversity Unit)

09/12/2005

			CRITERIA									STATUS			
		14	11.5	Conservation Concerns				7.5	Conservation Actions						
COMMON NAME (Genetic Diversity Unit)	**SCIENTIFIC NAME**	**SGCN**	**Y-Axis**	Threats	Current risk	Socio-economic value	Vulnerability	**X-Axis**	Knowledge	Expenditures	Conservation measures in	WDFW Species Of Concern	WNHP	ESA	**WHROW HABITAT COMMENTS**
Nooksack Pink Salmon	Oncorhynchus gorbuscha	0	**10**	3	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
North Puget Sound Fall Chum	Oncorhynchus keta	0	**10**	3	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
North Puget Sound Pink Salmon	Oncorhynchus gorbuscha	0	**10**	3	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
Puyallup Pink Salmon	Oncorhynchus gorbuscha	0	**10**	3	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
Quinault Sockeye	Oncorhynchus nerka	0	**10**	3	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
Snohomish Even-Year Pink Salmon	Oncorhynchus gorbuscha	0	**10**	3	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
South Coast Fall Chum	Oncorhynchus keta	0	**10**	3	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
South Puget Sound Summer Chum	Oncorhynchus keta	0	**10**	3	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
South Puget Sound Winter Chum	Oncorhynchus keta	0	**10**	3	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
North Coast Fall Chum	Oncorhynchus keta	0	**9**	3	0	3	3	**3**	1	1	1				21, 28, 29, 30, 31, 32
Fraser Coho	Oncorhynchus kisutch	0	**9**	2	1	3	3	**7**	2	2	3				21, 28, 29, 30, 31, 32
North Coast Fall Chinook	Oncorhynchus tschawytscha	0	**9**	2	1	3	3	**7**	2	2	3				21, 28, 29, 30, 31, 32
Hood Canal Coho	Oncorhynchus kisutch	0	**9**	2	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
North Coast Coho	Oncorhynchus kisutch	0	**9**	2	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
North Puget Sound Coho	Oncorhynchus kisutch	0	**9**	2	1	3	3	**8**	3	2	3			C	21, 28, 29, 30, 31, 32
South Coast Coho	Oncorhynchus kisutch	0	**9**	2	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32
South Puget Sound Coho	Oncorhynchus kisutch	0	**9**	2	1	3	3	**8**	3	2	3			C	21, 28, 29, 30, 31, 32
Strait of Juan de Fuca Coho	Oncorhynchus kisutch	0	**9**	2	1	3	3	**8**	3	2	3				21, 28, 29, 30, 31, 32

APPENDIX 3: CRITERIA FOR RANKING SPECIES OF GREATEST CONSERVATION NEED

WASHINGTON CWCS SPECIES RANKING CRITERIA

<table>
<tr><th>FACTOR</th><th>CRITERIA</th><th>NOTES</th></tr>
<tr><td colspan="3">CONSERVATION CONCERNS – The HIGHER the score, the HIGHER the priority</td></tr>
<tr><td>THREATS</td><td>Number of threats
Irreversibility, immediacy of threats
Rank 1 through 5

1 = Low threat
3 = Medium threat
5 = High threat

Threats are to be considered for WA only unless species is migratory and has a known limiting factor outside the state.</td><td>Threats are defined as human-caused impacts.

WA state actions may not be restricted to addressing threats within the state. For example, funds might be used to attend international conferences for the conservation of a particular species.

A species with different threats in different regions can be treated as different species in the matrix, i.e. western meadowlark (westside) and western meadowlark (eastside)</td></tr>
<tr><td>CURRENT STATUS</td><td>Degree of concern (WDFW listings, NHP global and state rankings).
Automatically calculated in spreadsheet using assigned values for each rank.

<table><tr><th colspan="2">WDFW</th><th colspan="2">NHP</th></tr><tr><td>E</td><td>3</td><td>G1</td><td>3</td></tr><tr><td>T</td><td>3</td><td>G2</td><td>3</td></tr><tr><td>S</td><td>2</td><td>G3</td><td>2</td></tr><tr><td>C</td><td>2</td><td>G4</td><td>1</td></tr><tr><td>M</td><td>1</td><td>G5</td><td>0</td></tr><tr><td></td><td></td><td>S1</td><td>3</td></tr><tr><td></td><td></td><td>S2</td><td>3</td></tr><tr><td></td><td></td><td>S3</td><td>2</td></tr><tr><td></td><td></td><td>S4</td><td>1</td></tr><tr><td></td><td></td><td>S5</td><td>0</td></tr></table></td><td>Where a species has dual rankings, the ranking of highest concern was chosen for consideration.

Number values for each rank were assigned by expert judgment.

Species with too little information for ranking (i.e. GU or SU) were not assigned a value. Expert judgment will be needed on a species-by-species basis.

Rank 1 through 3

1 = Low status
2 = Medium status
3 = High status</td></tr>
<tr><td>SOCIO/ ECONOMIC VALUE</td><td>Rank 1 through 3

1 = Low value
2 = Medium value
3 = High value</td><td>Cultural icon (i.e. tribal)
Commercial/game species
Non-consumptive recreational
Flagship species
Keystone species
Indicator species</td></tr>
<tr><td>VULNERABLE</td><td>Rank 1 through 5

1 = Low vulnerability
3 = Medium vulnerability
5 = High vulnerability</td><td>Vulnerability is defined through elements of life history.

Reproductive mechanisms
Scale of endemism
Specialist
Restricted distribution
Peripheral range (breeding vs. non)</td></tr>
</table>

FACTOR	CRITERIA	NOTES
CONSERVATION ACTIONS – The LOWER the score, the HIGHER the priority		
KNOWLEDGE	**Adequate knowledge to manage species in the state of Washington.** 1 = Low knowledge in WA 2 = Medium knowledge in WA 3 = High knowledge in WA	Knowledge of species applicable to Washington populations. Example: Consider ecological relationships, limiting factors, population dynamics.
EXPENDITURES	**Non-SWG sources of funding available or being used** 1 = Inadequate 2 = Partly adequate 3 = Mostly adequate	Based on what you know, give us your opinion. Example: 1 = <$50K 2 = $50K - $500K 3 = >$500K
ADEQUACY OF CONSERVATION MEASURES IN PLACE	**Amount of current protection related to species need:** 1 = Inadequate 3 = Partly adequate 5 = Mostly adequate	Consider the following: Regulation Planning efforts Acquisition Easement Population manipulation Enforcement/compliance Education Community involvement/concern Mitigation

EXAMPLE of Conservation Measures for the spotted owl: **Resulting score would be a 3.**

CONSERVATION MEASURES	INADEQUATE	PARTLY ADEQUATE	MOSTLY ADEQUATE
Regulation		x	
Planning efforts		x	
Acquisition		x	
Easement		--	
Population manipulation	x		
Enforcement/compliance	x		
Education		x	
Community involvement/concern		x	
Mitigation	x		

APPENDIX 9: SGCN STATUS AND TREND CHECKLIST

09/12/2005

			Population Size/Status						Population Trend				State Status									
TYPE	COMMON NAME	SCIENTIFIC NAME	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown	Endangered	Threatened	Sensitive	Candidate	Monitor	Game	Commercial	None	WNHP	NOTES
Mammal	Preble's shrew	Sorex preblei	?		?			x				x								x	S1	Extirpated?
Mammal	Merriam's shrew	Sorex merriami			x							x				x					S3	
Mammal	Keen's myotis	Myotis keeni						x				x				x					S1	
Mammal	Pallid Townsend's big-eared bat	Corynorhinus townsendii pallascens			x							x				x					S3	
Mammal	Pacific Townsend's big-eared bat	Corynorhinus townsendii townsendii			x							x				x					S3	
Mammal	White-tailed jackrabbit	Lepus townsendii			x				x							x					S2	
Mammal	Black-tailed jackrabbit	Lepus californicus			x				x							x					S2	
Mammal	Pygmy rabbit	Brachylagus idahoensis	?	x					x				x								S1	None in wild; captive population only.
Mammal	Olympic marmot	Marmota olympus			x							x								x	S3	
Mammal	Townsend's ground squirrel ssp.	Spermophilus townsendii townsendii			x				x							x					S3	
Mammal	Washington ground squirrel	Spermophilus washingtoni			x				x							x					S2	
Mammal	Townsend's ground squirrel ssp.	Spermophilus townsendii nancyae			x							x								x	S2	
Mammal	Western gray squirrel	Sciurus griseus			x				x					x							S2	
Mammal	Brush Prairie pocket gopher	Thomomys talpoides douglasi			x							x				x					S2	
Mammal	Mazama (western) pocket gopher	Thomomys mazama			x				x							x					S2	
Mammal	Kincaid meadow vole	Microtus pennsylvanicus kincaidi			x							x					x				S2	
Mammal	Shaw Island Townsend's vole	Microtus townsendii pugeti			x							x								x	S1	
Mammal	Gray-tailed vole	Microtus canicaudus			x							x				x					S2	
Mammal	Killer whale	Orcinus orca			x				x				x								S1	
Mammal	Pacific harbor porpoise	Phocoena phocoena			x							x				x					G4	
Mammal	Gray wolf	Canis lupus	?									x	x								S1	Extirpated?
Mammal	Grizzly bear	Ursus arctos		x							x		x								S1	
Mammal	Steller sea lion	Eumetopias jubatus			x				x					x							S2	
Mammal	Marten (Coastal population)	Martes americana			x				x									x			S4	
Mammal	Fisher	Martes pennanti pacifica	x							x			x								SH	
Mammal	Wolverine	Gulo gulo		x						x						x					S1	
Mammal	American badger	Taxidea taxus			x				x									x			S4	

			Population Size/Status						Population Trend				State Status									
TYPE	**COMMON NAME**	**SCIENTIFIC NAME**	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown	Endangered	Threatened	Sensitive	Candidate	Monitor	Game	Commercial	None	WNHP	**NOTES**
Mammal	Sea otter	Enhydra lutris			x						x		x								S2	
Mammal	Lynx	Lynx canadensis			x							x		x							S1	
Mammal	Elk (Nooksack herd, mixed)	C.e. nelsoni, roosevelti			x				x									x			S5	
Mammal	Columbian white-tailed deer	Odocoileus virginianus leucurus			x						x		x								S1	
Mammal	Woodland caribou	Rangifer tarandus		x					x				x								S1	
Mammal	Pronghorn antelope	Antilocapra americana	x							x								x			SH	Possible future reintroduction.
Bird	Common loon	Gavia immer			x					x					x						S2	
Bird	Western grebe	Aechmophorus occidentalis			x				x							x					S3	
Bird	American white pelican	Pelecanus erythrorhynchos			x						x		x								S1	
Bird	Great blue heron	Ardea herodias			x							x					x				S4	
Bird	Trumpeter swan	Cygnus buccinator			x						x							x			S3	
Bird	Tule greater white-fronted goose	Anser albifrons gambelli			x							x						x			S3	No surveys during migration.
Bird	Pacific black brant	Branta bernicla			x				x									x			S3	Migration areas not known in detail.
Bird	Northern pintail	Anas acuta					x		x									x			S3	
Bird	Redhead	Aythya americana			x					x								x			S3	Management concern.
Bird	Greater scaup	Aythya marila				x												x			S5	Management concern.
Bird	Lesser scaup	Aythya affinis				x			x									x			S4	Management concern.
Bird	Long-tailed duck	Clangula hyemalis			x				x											x	S3	Management concern.
Bird	Black scoter	Melanitta nigra			x				x									x			S4	Management concern.
Bird	Surf scoter	Melanitta perspicillata				x			x									x			S3	
Bird	White-winged scoter	Melanitta fusca			x				x									x			S5	Management concern.
Bird	Bald eagle	Haliaeetus leucocephalus				x					x			x							S4	
Bird	Northern goshawk	Accipiter gentilis			x							x				x					S3	
Bird	Ferruginous hawk	Buteo regalis			x				x					x							S2	
Bird	Golden eagle	Aquila chrysaetos			x							x				x					S3	
Bird	Peregrine falcon	Falco peregrinus			x						x				x						S2	
Bird	Prairie falcon	Falco mexicanus			x							x					x				S3	
Bird	Greater sage-grouse	Centrocercus urophasianus			x					x				x							S1	

			Population Size/Status						Population Trend				State Status									
TYPE	COMMON NAME	SCIENTIFIC NAME	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown	Endangered	Threatened	Sensitive	Candidate	Monitor	Game	Commercial	None	WNHP	NOTES
Bird	Sharp-tailed grouse	Tympanuchus phasianellus			x				x					x							S2	
Bird	Mountain quail	Oreortyx pictus			x							x						x			S1	
Bird	Sandhill crane (greater)	Grus canadensis		x							x		x								S1	
Bird	Snowy plover	Charadrius alexandrinus nivosus			x						x			x							S1	
Bird	Black oystercatcher	Haematopus bachmani			x					x							x				S4	
Bird	Willet	Catoptrophorus semipalmatus			x							x								x	S3	Extremely limited range.
Bird	Upland sandpiper	Bartramia longicauda	?	x								x	x								SH	Peripheral species.
Bird	Marbled godwit	Limosa fedoa			x							x								x	S3	Extremely limited range.
Bird	Red knot	Calidris canutus			x				x											x	S3	
Bird	Rock sandpiper	Calidris ptilocnemis			x				x											x	S3	
Bird	Arctic tern	Sterna paradisaea						x				x					x				S2	
Bird	Common murre	Uria aalge				x			x							x					S4	
Bird	Marbled murrelet	Brachyramphus marmoratus			x				x					x							S3	
Bird	Ancient murrelet	Synthliboramphus antiquus			x							x								x	S3	Breeder?
Bird	Cassin's auklet	Ptychoramphus aleuticus				x			x							x					S3	
Bird	Tufted puffin	Fratercula cirrhata			x				x							x					S3	
Bird	Yellow-billed cuckoo	Coccyzus americanus	?									x				x					SH	Extirpated?
Bird	Flammulated owl	Otus flammeolus			x							x				x					S3	
Bird	Burrowing owl	Athene cunicularia			x				x							x					S2	
Bird	Northern spotted owl	Strix occidentalis caurina			x				x				x								S1	
Bird	Great gray owl	Strix nebulosa			x							x					x				S2	
Bird	Vaux's swift	Chaetura vauxi			x				x							x					S3	
Bird	Lewis' woodpecker	Melanerpes lewis			x				x							x					S3	
Bird	Acorn woodpecker	Melanerpes formicivorus		x						x							x				S1	Peripheral.
Bird	White-headed woodpecker	Picoides albolarvatus			x				x							x					S2	
Bird	Black-backed woodpecker	Picoides arcticus			x							x				x					S3	
Bird	Pileated woodpecker	Dryocopus pileatus				x						x				x					S4	
Bird	Streaked horned lark	Eremophila alpestris strigata		x								x								x	S1	

			Population Size/Status						Population Trend				State Status									
TYPE	**COMMON NAME**	**SCIENTIFIC NAME**	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown	Endangered	Threatened	Sensitive	Candidate	Monitor	Game	Commercial	None	WNHP	**NOTES**
Bird	Purple martin	Progne subis			x					x						x					S3	
Bird	Slender-billed white-breasted nuthatch	Sitta carolinensis aculeata		x					x											x	S1	
Bird	Pygmy nuthatch	Sitta pygmaea			x							x								x	S3	
Bird	Western bluebird (W WA)	Sialia mexicana			x				x								x				S3	
Bird	Sage thrasher	Oreoscoptes montanus			x				x							x					S3	
Bird	Loggerhead shrike	Lanius ludovicianus			x				x							x					S3	
Bird	Oregon vesper sparrow	Pooecetes gramineus affinis			x				x											x	S1	Grasslands, prairie
Bird	Sage sparrow	Amphispiza belli			x				x							x					S3	
Reptile	Western pond turtle	Actinemys (Clemmys) marmorata			x						x		x								S1	
Reptile	Pygmy horned lizard	Phrynosoma douglasii				x						x								x	S3	
Reptile	Sagebrush lizard	Sceloporus graciosus			x				x							x					S2	
Reptile	Racer (W WA)	Coluber constrictor	?									x								x	S5	May be extirpated in western WA.
Reptile	Sharptail snake	Contia tenuis			x							x				x					S2	
Reptile	California mountain kingsnake	Lampropeltis zonata			x							x				x					S1	
Reptile	Striped whipsnake	Masticophis taeniatus			x							x				x					S1	Peripheral, historical?
Reptile	Pacific gopher snake (W WA)	Pituophis catenifer catenifer	?	x								x					x				S5	May be extirpated in western WA.
Amphibian	Tiger salamander	Ambystoma tigrinum				x						x					x				S3	
Amphibian	Dunn's salamander	Plethodon dunni			x					x						x					S2	Possibly declining.
Amphibian	Larch Mountain salamander	Plethodon larselli			x							x			x						S3	
Amphibian	Van Dyke's salamander	Plethodon vandykei			x							x				x					S3	
Amphibian	Cascade torrent salamander	Rhyacotriton cascadae				x						x				x					S3	
Amphibian	Columbia torrent salamander	Rhyacotriton kezeri				x						x				x					S3	
Amphibian	Rocky Mountain tailed frog	Ascaphus montanus				x			x							x					G4	
Amphibian	Western toad	Bufo boreas				x			x							x					S3	
Amphibian	Northern leopard frog	Rana pipiens			x				x				x								S1	
Amphibian	Oregon spotted frog	Rana pretiosa			x				x				x								S1	
Amphibian	Columbia spotted frog	Rana luteiventris			x							x				x					S4	
Fish	River lamprey	Lampetra ayresi						x				x				x					S2	

			Population Size/Status						Population Trend				State Status									
TYPE	**COMMON NAME**	**SCIENTIFIC NAME**	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown	Endangered	Threatened	Sensitive	Candidate	Monitor	Game	Commercial	None	WNHP	**NOTES**
Fish	Pacific lamprey	Lampetra tridentata						x				x								x	S3	Possibly declining.
Fish	Copper rockfish	Sebastes caurinus		x						x						x						
Fish	Greenstriped rockfish	Sebastes elongatus						x				x				x						
Fish	Quillback rockfish	Sebastes maliger		x						x						x						
Fish	Black rockfish (Puget Sound)	Sebastes melanops			x							x				x						
Fish	China rockfish	Sebastes nebulosus						x				x				x						
Fish	Tiger rockfish	Sebastes nigrocinctus						x				x				x						
Fish	Bocaccio rockfish	Sebastes paucispinis		x								x				x						
Fish	Canary rockfish	Sebastes pinniger			x							x				x						
Fish	Redstripe rockfish	Sebastes proriger						x				x				x						
Fish	Yelloweye rockfish	Sebastes ruberrimus		x								x										
Fish	Margined sculpin	Cottus marginatus				x						x			x						S1	Locally abundant but very small range.
Fish	Green sturgeon	Acipenser medirostris				x			x										x		S2	
Fish	Pacific herring (Cherry Pt, Discovery Bay)	Clupea pallasi		x						x						x						
Fish	Westslope cutthroat	Oncorhynchus clarki lewisi				x				x								x			G4	
Fish	Inland redband trout	Oncorhynchus mykiss gairdneri						x				x						x			G5	
Fish	Bull trout	Salvelinus confluentus						x				x				x					G3	
Fish	Pygmy whitefish	Prosopium coulteri						x				x			x						S1	Only in 9 lakes in WA.
Fish	Eulachon	Thaleichthys pacificus		?								x				x					S4	
Fish	Olympic mudminnow	Novumbra hubbsi						x				x			x						S2	
Fish	Surfsmelt	Hypomesus pretiosus				x						x							x		G5	
Fish	Leopard dace	Rhinichthys falcatus						x				x				x					S2	
Fish	Mountain sucker	Catostomus platyrhynchus						x				x				x					S2	
Fish	Salish sucker	Catostomus sp. 4						x				x									S1	
Fish	Pacific sand lance	Ammodytes hexapterus					x					x								x		PHS species.
Coleoptera	Columbia River tiger beetle	Cicindela columbica	?									x				x					SH	May be extirpated in WA.
Coleoptera	Siuslaw sand tiger beetle	Cicindela hirticollis siuslawensis			x							x								x	S3	Endemic to PNW coast.
Coleoptera	Beller's ground beetle	Agonum belleri			x							x				x					S3	Endemic to PNW. Sphagnum bogs.
Coleoptera	Long-horned leaf beetle	Donacia idola			x							x				x						Endemic to PNW. Sphagnum bogs.

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TYPE	COMMON NAME	SCIENTIFIC NAME	Population Size/Status						Population Trend				State Status								WNHP	NOTES
			Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown	Endangered	Threatened	Sensitive	Candidate	Monitor	Game	Commercial	None		
Coleoptera	Hatch's click beetle	Eanus hatchii			x							x								x	S1	Endemic to PNW. Sphagnum bogs.
Coleoptera	Mann's mollusk-eating ground beetle	Scaphinotus mannii			x				x							x						Vulnerable and possibly endangered.
Lepidoptera	Propertius' duskywing	Erynnis propertius			x				x								x				S3	Western Washington only.
Lepidoptera	Oregon branded skipper	Hesperia colorado oregonia						x				x					x				S2	
Lepidoptera	Mardon skipper	Polites mardon		x								x	x								S1	
Lepidoptera	Dog star skipper	Polites sonora siris						x				x								x	S2	
Lepidoptera	Yuma skipper	Ochlodes yuma		x								x				x					S1	
Lepidoptera	Shepard's parnassian	Parnassius clodius shepardi			x							x				x					S1	
Lepidoptera	Island marble	Euchloe ausonides insulanus		x								x								x	S1	
Lepidoptera	Makah (Queen Charlotte) copper	Lycaena mariposa charlottensis			x							x				x					S2	
Lepidoptera	Chinquapin hairstreak	Habrodais grunus herri			x							x				x					S1	
Lepidoptera	Johnson's hairstreak	Mitoura johnsoni						x				x				x					S2	
Lepidoptera	Juniper hairstreak	Mitoura grynea barryi						x				x				x					S2	
Lepidoptera	Hoary elfin (W WA)	Incisalia polia obscura						x				x								x	S3	
Lepidoptera	Puget (Blackmore's) blue	Icaricia icarioides blackmorei			x				x											x	S2	
Lepidoptera	Puget Sound fritillary	Speyeria cybele pugetensis						x	x											x	S3	Heath scrub.
Lepidoptera	Oregon silverspot	Speyeria zerene hippolyta	x									x	x								SX	
Lepidoptera	Valley silverspot	Speyeria zerene bremnerii			x				x							x					S2	
Lepidoptera	Silver-bordered fritillary	Boloria selene atrocostalis			x							x				x					S3	
Lepidoptera	Taylor's checkerspot	Euphydryas editha taylori		x					x											x	S1	
Lepidoptera	Great arctic	Oeneis nevadensis gigas	?					x				x				x					SH	May be extirpated in WA.
Lepidoptera	Sand-verbena moth	Copablepharon fuscum			x				x											x	S1	
I - Odonata	White-belted ringtail	Erpetogomphus compositus		x								x								x	S1	
I - Odonata	Columbia (Lynn's) clubtail	Gomphus lynnae			x							x								x	S1	
I - Odonata	Pacific clubtail	Gomphus kurilis			x							x								x	S1	
I - Odonata	Subarctic darner	Aeshna subarctica			x							x								x	S2	
I - Odonata	Boreal whiteface	Leucorrhinia borealis		x								x								x	S1	Peripheral species.
I - Odonata	Subarctic bluet	Coenagrion interrogatum			x							x								x	S2	

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TYPE	COMMON NAME	SCIENTIFIC NAME	Population Size/Status						Population Trend				State Status								WNHP	NOTES
			Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown	Endangered	Threatened	Sensitive	Candidate	Monitor	Game	Commercial	None		
Bivalvia	California floater	Anodonta californiensis			x				x							x					S1	
Bivalvia	Western floater	Anodonta kennerlyi			x				x											x	S4	
Bivalvia	Winged floater	Anodonta nuttalliana			x				x											x	G3	
Bivalvia	Oregon floater	Anodonta oregonensis			x				x											x	S3	
Bivalvia	Western ridged mussel	Gonidea angulata			x				x											x	S2	
Bivalvia	Western pearlshell	Margaritifera falcata				x			x											x	S4	
Gastropoda (T)	Bluegray taildropper	Prophysaon coeruleum		x					x											x	S4	
Gastropoda (T)	Crowned tightcoil	Pristiloma pilsbryi	?									x								x	S1	May be extirpated in WA.
Gastropoda (T)	Columbia oregonian	Cryptomastix hendersoni			x				x											x	G2	Found in talus, springs and seeps in the Columbia Gorge; extirpated from Skamania Co.
Gastropoda (T)	Oregon megomphix	Megomphix hemphilli			x				x											x	G2	

APPENDIX 10: SGCN CONSERVATION PROBLEMS AND ACTIONS CHECKLIST

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		CONSERVATION PROBLEMS																				CONSERVATION ACTIONS																		
									Habitat													Research and data collection				Planning		Population management					Habitat management							
Type	Species Common Name	Agriculture	Disease and/or predation	Environmental Contaminants	Fire regime alteration	Forest practices	Grazing practices	Harvest and/or persecution	Conversion	Degradation	Fragmentation	Loss	Human development	Human disturbance	Hydrologic impacts	Invasive species	Lack of information	Limited distribution	Loss of prey/ food source	Mining	Transportation systems	Distribution and abundance	Limiting factors	Suitable habitat	Monitor population trends	Determine and recommend status	Develop recovery, strategy, management plan	Protect known populations	Augment/reintroduce population	Control and monitor mortality	Control and monitor disturbance	Protect or manage prey base/food source	Monitor habitat status	Restore/ enhance habitat	Permanet habitat conservation	Control invasive species	Control and monitor contaminants	Other habitat protection	Education and cooperation	Enforcement
Mammal	Preble's shrew																x	x				x	x	x	x	x		x		x										
Mammal	Merriam's shrew	x		x	x		x			x	x	x					x					x	x	x											x			x		
Mammal	Keen's myotis					x					x	x		x			x	x				x	x	x											x			x		
Mammal	Pallid Townsend's big-eared bat	x							x			x	x	x						x				x							x				x			x		x
Mammal	Pacific Townsend's big-eared bat											x		x										x											x			x		
Mammal	White-tailed jackrabbit	x	x						x			x					x	x				x			x	x		x	x	x				x	x					
Mammal	Black-tailed jackrabbit	x	x						x			x					x	x				x			x	x	x	x	x	x				x	x					
Mammal	Pygmy rabbit										x	x						x					x		x			x	x	x				x	x			x		
Mammal	Olympic marmot		x											x				x						x	x	x					x		x					x		
Mammal	Townsend's ground squirrel *townsendii*		x					x	x	x		x	x				x					x		x	x	x	x			x			x					x	x	
Mammal	Washington ground squirrel	x			x			x	x		x	x	x			x	x							x	x	x		x		x	x		x	x	x	x			x	x
Mammal	Townsend's ground squirrel *nancyae*		x					x	x	x		x	x				x					x		x	x	x	x			x			x					x	x	
Mammal	Western gray squirrel		x		x	x						x	x			x		x				x		x	x				x		x		x		x	x		x	x	x
Mammal	Brush Prairie pocket gopher							x		x	x	x	x			x		x				x			x	x							x	x	x	x			x	x
Mammal	Mazama (western) pocket gopher							x		x	x	x	x			x		x				x			x			x						x	x				x	x
Mammal	Kincaid meadow vole																x					x		x		x														
Mammal	Shaw Island Townsend's vole																x	x				x		x		x														
Mammal	Gray-tailed vole											x	x				x	x				x		x	x								x							
Mammal	Killer whale			x						x				x					x				x									x		x			x	x	x	x
Mammal	Pacific harbor porpoise			x				x					x	x							x	x			x	x					x			x			x			
Mammal	Gray wolf							x			x	x		x				x	x		x		x								x	x	x	x	x			x	x	x
Mammal	Grizzly bear										x	x		x				x			x				x					x	x			x				x		x
Mammal	Steller sea lion			x				x										x	x			x	x		x					x	x	x					x			
Mammal	Marten (Coastal population)																x	x				x				x		x	x											
Mammal	Fisher							x			x	x					x	x				x		x	x				x				x					x		
Mammal	Wolverine									x	x	x		x				x			x	x			x	x					x			x	x			x		x

		CONSERVATION PROBLEMS																				CONSERVATION ACTIONS																		
									Habitat													Research and data collection				Planning		Population management					Habitat management							
Type	Species Common Name	Agriculture	Disease and/or predation	Environmental Contaminants	Fire regime alteration	Forest practices	Grazing practices	Harvest and/or persecution	Conversion	Degradation	Fragmentation	Loss	Human development	Human disturbance	Hydrologic impacts	Invasive species	Lack of information	Limited distribution	Loss of prey/ food source	Mining	Transportation systems	Distribution and abundance	Limiting factors	Suitable habitat	Monitor population trends	Determine and recommend status	Develop recovery, strategy, management plan	Protect known populations	Augment/reintroduce population	Control and monitor mortality	Control and monitor disturbance	Protect or manage prey base/food source	Monitor habitat status	Restore/ enhance habitat	Permanet habitat conservation	Control invasive species	Control and monitor contaminants	Other habitat protection	Education and cooperation	Enforcement
Mammal	American badger	x									x	x	x				x					x		x	x	x							x							
Mammal	Sea otter		x	x				x										x				x			x												x		x	
Mammal	Lynx					x	x			x		x						x			x	x		x	x								x		x			x	x	
Mammal	Elk (Nooksack herd, mixed)							x										x				x		x	x						x				x			x		x
Mammal	Columbian white-tailed deer							x				x						x				x			x				x	x			x		x			x		x
Mammal	Woodland caribou		x			x												x											x	x					x			x	x	
Mammal	Pronghorn antelope											x						x						x			x		x				x							
Bird	Common loon			x						x		x	x	x	x									x				x		x					x		x	x	x	
Bird	Western grebe			x				x						x								x								x	x		x		x		x	x		x
Bird	American white pelican			x				x				x		x	x										x						x		x		x		x	x	x	
Bird	Great blue heron											x	x	x			x					x			x								x		x			x	x	
Bird	Trumpeter swan	x		x					x			x												x											x		x	x		
Bird	Tule greater white-fronted goose			x						x		x	x				x									x								x	x		x			
Bird	Brant			x						x		x	x	x					x												x			x	x		x	x		
Bird	Northern pintail							x	x	x		x	x																					x	x			x		x
Bird	Redhead							x		x		x	x	x	x				x															x	x			x	x	x
Bird	Greater scaup			x				x		x		x	x	x																	x			x			x		x	x
Bird	Lesser scaup	x						x	x			x		x																					x			x	x	x
Bird	Long-tailed duck			x				x				x	x						x				x	x									x	x	x		x	x		x
Bird	Black scoter			x				x				x	x						x					x									x	x	x		x	x		x
Bird	Surf scoter			x				x				x	x						x					x									x	x	x		x	x		x
Bird	White-winged scoter			x				x				x	x						x					x									x	x	x			x		x
Bird	Bald eagle			x		x		x		x		x	x	x					x						x			x		x	x	x	x	x	x		x	x	x	x
Bird	Northern goshawk				x	x						x	x				x					x			x								x		x			x	x	
Bird	Ferruginous hawk	x			x				x	x		x	x	x					x													x		x	x			x	x	
Bird	Golden eagle			x						x	x	x	x	x					x											x	x	x		x	x	x		x		
Bird	Peregrine falcon			x										x											x			x			x						x	x	x	x
Bird	Prairie falcon	x			x				x	x		x	x	x					x												x				x			x		
Bird	Greater sage-grouse	x	x	x	x		x		x	x		x	x			x		x							x				x	x	x			x	x	x		x	x	

		CONSERVATION PROBLEMS																				CONSERVATION ACTIONS																		
									Habitat													Research and data collection				Planning		Population management					Habitat management							
Type	Species Common Name	Agriculture	Disease and/or predation	Environmental Contaminants	Fire regime alteration	Forest practices	Grazing practices	Harvest and/or persecution	Conversion	Degradation	Fragmentation	Loss	Human development	Human disturbance	Hydrologic impacts	Invasive species	Lack of information	Limited distribution	Loss of prey/ food source	Mining	Transportation systems	Distribution and abundance	Limiting factors	Suitable habitat	Monitor population trends	Determine and recommend status	Develop recovery, strategy, management plan	Protect known populations	Augment/reintroduce population	Control and monitor mortality	Control and monitor disturbance	Protect or manage prey base/food source	Monitor habitat status	Restore/ enhance habitat	Permanent habitat conservation	Control invasive species	Control and monitor contaminants	Other habitat protection	Education and cooperation	Enforcement
Bird	Sharp-tailed grouse	x	x				x		x			x	x					x							x				x	x	x			x	x			x	x	
Bird	Mountain quail			x			x					x	x																					x	x			x	x	
Bird	Sandhill crane (greater)	x					x			x		x	x	x	x						x							x			x			x	x			x	x	
Bird	Snowy plover			x								x		x		x															x				x	x	x	x		x
Bird	Black oystercatcher			x						x				x																	x						x		x	
Bird	Willet			x								x	x																						x		x	x		
Bird	Upland sandpiper						x			x		x	x		x	x																			x	x		x	x	
Bird	Marbled godwit			x						x		x	x																						x		x	x	x	
Bird	Red knot			x						x						x																				x	x			
Bird	Rock sandpiper			x						x		x																									x			
Bird	Arctic tern			x				x		x		x		x																	x						x		x	x
Bird	Common murre		x	x				x						x					x											x	x	x					x		x	
Bird	Marbled murrelet			x		x		x			x	x	x				x					x	x	x			x						x		x		x	x		
Bird	Ancient murrelet			x				x																													x		x	x
Bird	Cassin's auklet		x	x				x						x																x	x						x		x	x
Bird	Tufted puffin			x				x									x					x	x	x	x								x				x			
Bird	Yellow-billed cuckoo											x					x					x												x						
Bird	Flammulated owl			x		x				x		x					x					x		x	x									x	x		x	x		
Bird	Burrowing owl	x		x						x		x																						x	x		x	x	x	
Bird	Northern spotted owl					x						x				x								x	x		x							x	x			x	x	
Bird	Great gray owl					x				x							x					x		x	x		x							x	x			x	x	
Bird	Vaux's swift					x						x					x					x	x	x	x										x			x		
Bird	Lewis' woodpecker				x	x	x			x		x	x			x	x					x	x		x										x	x		x		
Bird	Acorn woodpecker																x					x		x																
Bird	White-headed woodpecker					x				x		x					x					x		x	x									x	x			x		
Bird	Black-backed woodpecker				x	x						x					x					x	x	x	x									x	x			x		
Bird	Pileated woodpecker					x						x					x					x	x		x									x	x			x		
Bird	Streaked horned lark				x							x				x		x					x						x					x	x			x		
Bird	Purple martin															x																				x				

		CONSERVATION PROBLEMS																				CONSERVATION ACTIONS																		
									Habitat													Research and data collection				Planning		Population management					Habitat management							
Type	Species Common Name	Agriculture	Disease and/or predation	Environmental Contaminants	Fire regime alteration	Forest practices	Grazing practices	Harvest and/or persecution	Conversion	Degradation	Fragmentation	Loss	Human development	Human disturbance	Hydrologic impacts	Invasive species	Lack of information	Limited distribution	Loss of prey/ food source	Mining	Transportation systems	Distribution and abundance	Limiting factors	Suitable habitat	Monitor population trends	Determine and recommend status	Develop recovery, strategy, management plan	Protect known populations	Augment/reintroduce population	Control and monitor mortality	Control and monitor disturbance	Protect or manage prey base/food source	Monitor habitat status	Restore/ enhance habitat	Permanet habitat conservation	Control invasive species	Control and monitor contaminants	Other habitat protection	Education and cooperation	Enforcement
Bird	Slender-billed white-breasted nuthatch								x			x					x	x				x	x	x	x				x						x			x	x	
Bird	Pygmy nuthatch				x	x	x			x		x	x				x					x												x	x			x		
Bird	Western bluebird (W WA)				x	x				x		x	x			x	x					x			x	x								x	x			x		
Bird	Sage thrasher	x		x			x				x	x	x				x					x			x									x	x	x		x	x	
Bird	Loggerhead shrike	x							x			x					x					x		x	x									x	x			x		
Bird	Oregon vesper sparrow	x		x	x							x	x			x	x					x		x										x	x		x	x		
Bird	Sage sparrow	x			x					x	x	x	x			x	x				x	x		x	x									x	x	x		x		
Reptile	Western pond turtle		x									x	x			x		x											x					x	x	x		x		
Reptile	Pygmy horned lizard	x						x				x	x				x					x													x			x	x	
Reptile	Sagebrush lizard	x								x		x				x	x	x				x		x										x	x	x		x		
Reptile	Racer (W WA)																x					x																		
Reptile	Sharptail snake											x		x			x	x				x	x												x			x		
Reptile	California mountain kingsnake							x				x	x				x	x				x		x	x										x			x	x	x
Reptile	Striped whipsnake											x	x				x					x	x				x			x				x	x			x		
Reptile	Pacific gopher snake (W WA)																x					x																		
Amphibian	Tiger salamander							x								x						x	x	x											x	x		x	x	
Amphibian	Dunn's salamander					x				x	x	x		x			x	x				x	x	x	x			x			x		x		x			x		
Amphibian	Larch Mountain salamander					x						x					x					x	x												x			x		
Amphibian	Van Dyke's salamander			x		x						x					x	x				x		x	x										x			x		
Amphibian	Cascade torrent salamander					x				x		x						x				x	x	x									x		x			x		
Amphibian	Columbia torrent salamander					x				x		x					x					x	x	x									x							
Amphibian	Rocky Mountain tailed frog					x				x		x					x					x	x	x									x					x		
Amphibian	Western toad												x				x					x	x	x										x	x			x		
Amphibian	Northern leopard frog	x	x	x												x	x					x	x	x												x	x			
Amphibian	Oregon spotted frog											x			x	x	x					x	x	x											x	x		x		
Amphibian	Columbia spotted frog														x	x	x					x	x	x											x	x		x		
Fish	River lamprey														x		x						x	x	x								x	x						
Fish	Pacific lamprey														x		x						x	x	x								x	x						
Fish	Copper rockfish		x	x				x									x					x	x		x					x							x	x		x

Type	Species Common Name	CONSERVATION PROBLEMS							Habitat													CONSERVATION ACTIONS: Research and data collection				Planning		Population management					Habitat management							
		Agriculture	Disease and/or predation	Environmental Contaminants	Fire regime alteration	Forest practices	Grazing practices	Harvest and/or persecution	Conversion	Degradation	Fragmentation	Loss	Human development	Human disturbance	Hydrologic impacts	Invasive species	Lack of information	Limited distribution	Loss of prey/ food source	Mining	Transportation systems	Distribution and abundance	Limiting factors	Suitable habitat	Monitor population trends	Determine and recommend status	Develop recovery, strategy, management plan	Protect known populations	Augment/reintroduce population	Control and monitor mortality	Control and monitor disturbance	Protect or manage prey base/food source	Monitor habitat status	Restore/ enhance habitat	Permanet habitat conservation	Control invasive species	Control and monitor contaminants	Other habitat protection	Education and cooperation	Enforcement
Fish	Greenstriped rockfish		x	x				x									x					x	x		x					x								x		x
Fish	Quillback rockfish		x					x									x					x	x		x					x								x		x
Fish	Black rockfish (Puget Sound)		x					x									x					x	x		x					x								x		x
Fish	China rockfish							x									x					x	x		x													x		x
Fish	Tiger rockfish		x					x									x					x	x		x					x								x		x
Fish	Bocaccio rockfish		x					x									x					x	x		x					x								x		x
Fish	Canary rockfish		x					x									x					x	x		x					x								x		x
Fish	Redstripe rockfish		x					x									x					x	x		x					x								x		x
Fish	Yelloweye rockfish		x					x									x					x	x		x					x								x		x
Fish	Margined sculpin	x				x				x		x						x				x		x											x			x		
Fish	Green sturgeon			x		x	x	x		x					x		x					x			x									x			x	x	x	x
Fish	Pacific herring (Cherry Pt, Discovery Bay)									x		x	x				x					x	x		x					x								x		x
Fish	Westslope cutthroat															x																				x				
Fish	Inland redband trout	x				x						x			x																				x			x	x	
Fish	Bull trout	x		x		x	x	x		x		x	x		x	x	x					x	x	x	x			x			x		x	x	x	x	x	x	x	x
Fish	Pygmy whitefish			x		x				x		x			x	x						x													x	x	x	x		
Fish	Eulachon							x							x		x					x	x	x	x		x											x		
Fish	Olympic mudminnow											x	x		x	x		x				x													x	x		x		
Fish	Surfsmelt							x		x		x	x									x	x	x	x								x		x			x		
Fish	Leopard dace																x					x																		
Fish	Mountain sucker																x					x																		
Fish	Salish sucker											x	x				x	x				x		x	x													x		
Fish	Pacific sand lance									x		x	x				x					x	x	x	x								x					x		x
Invertebrate	Columbia River tiger beetle											x			x		x					x	x	x											x			x		
Invertebrate	Siuslaw sand tiger beetle													x		x	x	x				x	x	x											x	x		x		
Invertebrate	Beller's ground beetle									x			x		x		x	x				x	x	x											x			x		
Invertebrate	Long-horned leaf beetle									x			x		x		x	x				x	x	x											x			x		
Invertebrate	Hatch's click beetle									x			x		x		x	x				x	x	x											x			x		
Invertebrate	Mann's mollusk-eating ground beetle						x					x	x				x	x				x	x	x										x	x			x		

		CONSERVATION PROBLEMS																				CONSERVATION ACTIONS																		
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Invertebrate	Propertius' duskywing									x								x																	x			x		
Invertebrate	Oregon branded skipper											x	x			x								x		x	x								x	x		x		
Invertebrate	Mardon skipper				x		x		x			x		x		x		x											x						x	x		x	x	
Invertebrate	Dog star skipper			x								x				x							x	x		x	x								x	x		x		
Invertebrate	Yuma skipper												x	x				x									x								x			x	x	
Invertebrate	Shepard's parnassian												x			x						x					x								x	x		x		
Invertebrate	Island marble																	x				x	x	x											x			x		
Invertebrate	Makah (Queen Charlotte) copper								x			x	x									x													x			x		
Invertebrate	Chinquapin hairstreak		x	x		x												x				x		x											x			x	x	
Invertebrate	Johnson's hairstreak					x						x										x		x									x		x			x		
Invertebrate	Juniper hairstreak											x	x									x					x								x			x		
Invertebrate	Hoary elfin (W WA)									x	x	x	x					x																x	x			x		
Invertebrate	Blackmore's (Puget) blue									x		x				x																x		x	x	x		x		
Invertebrate	Puget Sound fritillary									x		x	x			x						x		x			x								x	x		x		
Invertebrate	Oregon silverspot butterfly									x		x	x			x													x					x		x		x		
Invertebrate	Valley silverspot									x		x				x								x					x					x	x	x		x		
Invertebrate	Silver-bordered fritillary											x			x							x			x		x						x		x			x		
Invertebrate	Taylor's checkerspot				x							x	x	x		x													x					x	x			x		
Invertebrate	Great arctic																x					x																		
Invertebrate	Sand-verbena moth													x		x	x	x				x		x											x	x		x		
Invertebrate	White-belted ringtail																x	x				x	x		x													x		
Invertebrate	Columbia (Lynn's) clubtail			x												x	x	x				x	x	x	x											x	x			
Invertebrate	Pacific clubtail																x	x				x	x	x	x													x		
Invertebrate	Subarctic darner																x	x				x	x	x	x													x		
Invertebrate	Boreal whiteface																x	x				x	x	x	x													x		
Invertebrate	Subarctic bluet																x	x				x	x	x	x													x		
Invertebrate	California floater			x											x	x	x	x				x	x		x				x							x	x			
Invertebrate	Western floater			x											x	x	x	x				x	x		x				x							x	x			
Invertebrate	Winged floater			x											x	x	x	x				x	x		x				x							x	x			

		CONSERVATION PROBLEMS																				CONSERVATION ACTIONS																		
									Habitat													Research and data collection				Planning		Population management					Habitat management							
Type	Species Common Name	Agriculture	Disease and/or predation	Environmental Contaminants	Fire regime alteration	Forest practices	Grazing practices	Harvest and/or persecution	Conversion	Degradation	Fragmentation	Loss	Human development	Human disturbance	Hydrologic impacts	Invasive species	Lack of information	Limited distribution	Loss of prey/ food source	Mining	Transportation systems	Distribution and abundance	Limiting factors	Suitable habitat	Monitor population trends	Determine and recommend status	Develop recovery, strategy, management plan	Protect known populations	Augment/reintroduce population	Control and monitor mortality	Control and monitor disturbance	Protect or manage prey base/food source	Monitor habitat status	Restore/ enhance habitat	Permanet habitat conservation	Control invasive species	Control and monitor contaminants	Other habitat protection	Education and cooperation	Enforcement
Invertebrate	Oregon floater			x											x	x	x	x				x	x		x				x							x	x			
Invertebrate	Western ridged mussel			x													x	x				x	x		x				x					x			x	x		
Invertebrate	Western pearlshell			x				x									x	x				x	x		x				x								x		x	x
Invertebrate	Bluegray taildropper					x						x	x				x	x				x		x	x				x						x			x		
Invertebrate	Crowned tightcoil																x	x				x		x	x				x						x			x		
Invertebrate	Columbia oregonian					x				x	x	x	x				x	x				x	x	x				x	x				x	x				x		
Invertebrate	Oregon megomphix				x	x						x	x				x	x				x		x	x				x						x			x		

APPENDIX 6: SGCN WILDLIFE SPECIES PLANS

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APPENDIX 7: SGCN SALMON PLANS AND STRATEGIES

An Outline For Salmon Recovery Planshttp://wdfw.wa.gov/recovery/recovery_model.htm

Bull Trout and Dolly Varden Management Plan http://wdfw.wa.gov/fish/bulltrt/bulldoly.htm

Draft Recovery Plan for the Coastal-Puget Sound Distinct Population Segment of Bull Trout *(Salvelinus confluentus)* http://pacific.fws.gov/bulltrout/jcs/documents/PugetSdpt1.pdf

Hood Canal and Eastern Strait of Juan de Fuca Summer Chum Salmon Recovery Plan (draft) http://www.hccc.cog.wa.us/about.htm

Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan (draft) http://www.nwr.noaa.gov/1srd/Recovery/domains/willow/WMU_Plan/WMU_Plan_files.html#vol1

Lower Columbia Salmon Recovery and Watershed Plans http://www.lcfrb.gen.wa.us/December%20Final%20%20Plans/lower_columbia_salmon_recovery_a.htm

Pacific Coastal Salmon Recovery Fund (NOAA) http://www.nwr.noaa.gov/pcsrf/index.htm

Pacific Coastal Salmon Recovery Program (NWIFC) http://www.nwifc.wa.gov/recovery/documents/coastalrecovery.pdf

Pacific Fishery Management Council, Salmon Fishery Management Plan http://www.pcouncil.org/salmon/salfmp.html

Pacific Salmon Commission http://www.psc.org/Index.htm

Puget Sound Action Plan 2005-2007 Puget Sound Conservation and Recovery Plan http://www.psat.wa.gov/Publications/priorities_05/Priorities_05_review.htm

Puget Sound Comprehensive Chinook Management Plan http://wdfw.wa.gov/fish/papers/ps_chinook_management/harvest/index.htm

Puget Sound Salmon Recovery Plan (draft) http://www.sharedsalmonstrategy.org/plan/index.htm

Puget Sound Shared Salmon Strategy http://www.sharedsalmonstrategy.org

Reference Guide to Salmon Habitat Conservation at the Watershed Level. http://www.governor.wa.gov/gsro/publications/watershed/reference.pdf

Regional Fisheries Enhancement Group http://wdfw.wa.gov/volunter/rfeg/rfeg_outcomes.htm

Roadmap for Salmon Habitat Conservation at the Watershed Level http://www.governor.wa.gov/gsro/publications/watershed/roadmap.pdf

Salmon & Steelhead Habitat Inventory & Assessment Project (SSHIAP) http://wdfw.wa.gov/hab/sshiap/

Salmon and Steelhead Stock Inventory (SaSSI) http://wdfw.wa.gov/fish/sassi/sassi.htm

Salmon Recovery Funding Board http://www.iac.wa.gov/srfb/default.asp

Salmon Recovery Plans (2003)
http://wdfw.wa.gov/recovery/salmon_recovery_plan_model_jun03.pdf

Snake River Salmon Recovery Plan for SE Washington (draft)
http://www.snakeriverboard.org/pdf_files/DraftPubSummary06005.pdf

South Puget Sound Salmon Recovery Plan
http://home.comcast.net/%7Esouthsoundsalmon/home.htm

Statewide Strategy to Recover Salmon: Extinction is Not an Option
http://www.governor.wa.gov/gsro/strategy/strategy.htm
The Columbia River Anadromous Fish Restoration Plan of the Nez Perce, Umatilla, Warm Springs and Yakama Tribes (Columbia River Inter-Tribal Fish Commission)
http://www.critfc.org/text/trp.html

Upper Columbia Salmon Recovery Board, A Biological Strategy to Protect and Restore Salmonid Habitat in the Upper Columbia Region (2003)
http://www.co.chelan.wa.us/nr/data/biological_strategy_2003.pdf

Upper Columbia Salmon Recovery Plan (draft)
http://okanogancounty.org/water/salmon%20recovery;%20draft%20review%20corner.htm

USFWS Pacific Region: Fisheries Program Strategic Plan 2004-2006
http://pacific.fws.gov/Fisheries/Docs/Pacific%20Region%20Step%20Down%20Plan.pdf

Washington Department of Ecology Watershed Planning
http://www.ecy.wa.gov/watershed/index.html

Watershed (WRIA) Planning for Salmon Habitat http://dnr.metrokc.gov/Wrias/

WDFW Salmon Recovery http://wdfw.wa.gov/recovery.htm

WDFW Watershed Stewardship Team http://wdfw.wa.gov/hab/wst.htm

Yakima Subbasin Salmon Recovery Plan (draft)
http://www.co.yakima.wa.us/yaksubbasin/Library/ExecutiveSummary.pdf

APPENDIX 8: ASSOCIATED HABITATS OF CONSERVATION CONCERN

- Westside Lowlands Conifer-Hardwood Forest
- Westside Oak and Dry Douglas-fir Forest and Woodlands
- Montane Mixed-Conifer Forest
- Eastside (Interior) Mixed Conifer Forest
- Lodgepole Pine Forest and Woodlands
- Ponderosa Pine and Eastside White Oak Forest and Woodlands
- Upland Aspen Forest
- Subalpine Parkland
- Westside Grasslands
- Eastside (Interior) Grasslands
- Shrub-steppe
- Open Water
- Herbaceous Wetlands
- Westside Riparian-Wetlands
- Montane Coniferous Wetlands
- Eastside (Interior) Riparian-Wetlands
- Coastal Dunes and Beaches
- Bays and Estuaries
- Inland Marine Deeper Waters
- Marine Nearshore and Shelf

The following priority habitat descriptions and photos are excerpted from *Wildlife Habitat Relationships in Oregon and Washington*.

Westside Lowlands Conifer-Hardwood Forest

Christopher B. Chappell and Jimmy Kagan

Geographic Distribution. This forest habitat occurs throughout low-elevation western Washington, except on extremely dry or wet sites. The global distribution extends from southeastern Alaska south to southwestern Oregon.

Physical Setting. Climate is relatively mild and moist to wet. Mean annual precipitation is mostly 35-100 inches, but can vary locally. Snowfall ranges from rare to regular, but is transitory. Summers are relatively dry. Summer fog is a major factor on the outer coast in the Sitka spruce zone. Elevation ranges from sea level to a maximum of about 2,000 ft in much of northern Washington. Soils and geology are very diverse. Topography ranges from relatively flat glacial till plains to steep mountainous terrain.

Landscape Setting. This is the most extensive habitat in the lowlands on the west side of the Cascades, and forms the matrix within which other habitats occur as patches, especially Westside Riparian-Wetlands and less commonly Herbaceous Wetlands or Open Water. It also occurs adjacent to or in a mosaic with Urban and Mixed Environs (hereafter Urban) or Agriculture, Pasture and Mixed Environs (hereafter Agriculture) habitats. In the driest areas, it occurs adjacent to or in a mosaic with Westside Oak and Dry Douglas-fir Forest and Woodlands. Bordering this habitat at upper elevations is Montane Mixed Conifer Forest. Along the coastline, it often occurs adjacent to Coastal Dunes and Beaches. The primary land use for this habitat is forestry.

Structure. This habitat is forest, or rarely woodland, dominated by evergreen conifers, deciduous broadleaf trees, or both. Late seral stands typically have an abundance of large (>164 ft tall) coniferous trees, a multi-layered canopy structure, large snags, and many large logs on the ground. Early seral stands typically have smaller trees, single-storied canopies, and may be dominated by conifers, broadleaf trees, or both. Coarse woody debris is abundant in early seral stands after natural disturbances but much less so after clearcutting. Forest understories are structurally diverse: evergreen shrubs tend to dominate on nutrient-poor or drier sites; deciduous shrubs, ferns, and/or forbs tend to dominate on relatively nutrient-rich or moist sites. Shrubs may be low (1.6 ft tall), medium-tall (3.3- 6.6 ft), or tall (6.6-13.1 ft). Almost all structural stages are represented in the successional sequence within this habitat. Mosses are often a major ground cover. Lichens are abundant in the canopy of old stands.

Composition. Western hemlock (*Tsuga heterophylla*) and Douglas-fir (*Pseudotsuga menziesii*) are the most characteristic species and 1 or both are typically present. Most stands are dominated by 1 or more of the following: Douglas-fir, western hemlock, western redcedar (*Thuja plicata*), Sitka spruce (Picea sitchensis), red alder (Alnus rubra), or bigleaf maple (Acer macrophyllum). Trees of local importance that may be dominant include shore pine (*Pinus contorta* var. *contorta*) on stabilized dunes, and grand fir (*Abies grandis*) in drier climates. Western white pine (*Pinus monticola*) is frequent but subordinate in importance through much of this habitat. Pacific silver fir (*Abies amabilis*) is largely absent except on the wettest low-elevation portion of the western Olympic Peninsula, where it is common and sometimes co-dominant. Common small subcanopy trees are cascara buckthorn (*Rhamnus purshiana*) in more moist climates and Pacific yew (*Taxus brevifolia*) in somewhat drier climates or sites. Sitka spruce is found as a major species only in the outer coastal area at low elevations where summer fog is a significant factor. Bigleaf maple is most abundant in the Puget Lowland, but occurs elsewhere also. Douglas-fir is absent to uncommon as a native species in the very wet maritime outer coastal area of Washington, including the coastal plain on the west side of the Olympic Peninsula. However, it has been extensively planted in that area. Paper birch (*Betula papyrifera*) occurs as a codominant only in Whatcom County, Washington. Grand fir occurs as an occasional co-dominant only in the Puget Lowland. Dominant or co-dominant understory shrub species of more than local importance include salal (*Gaultheria shallon*), dwarf Oregon grape (*Mahonia nervosa*), vine maple (*Acer circinatum*), Pacific rhododendron (*Rhododendron macrophyllum*), salmonberry (*Rubus spectabilis*), trailing blackberry (R. ursinus), red elderberry (Sambucus racemosa), fools huckleberry (*Menziesia ferruginea*), beargrass (*Xerophyllum tenax*), oval-leaf huckleberry (*Vaccinium ovalifolium*), evergreen huckleberry (*V. ovatum*), and red huckleberry (*V. parvifolium*). Salal and rhododendron are particularly associated with low nutrient or relatively dry sites. Swordfern (*Polystichum munitum*) is the most common herbaceous species and is often dominant on nitrogen-rich or moist sites. Other forbs and ferns that frequently dominate the understory are Oregon oxalis (*Oxalis oregana*), deer fern (*Blechnum spican*t), bracken fern (*Pteridium aquilinum)*, vanilla leaf (*Achlys triphylla*), twinflower (*Linnaea borealis*), false lily-of-the-valley (*Maianthemum dilatatum*), western spring beauty (*Claytonia siberica*), foamflower (*Tiarella trifoliata*), inside-out flower (*Vancouveria hexandra*), and common whipplea (*Whipplea modesta*).

Other Classifications and Key References. This habitat includes most of the forests and their successional seres within the *Tsuga heterophylla* and *Picea sitchensis* zones. This habitat is also referred to as Douglas-fir-western hemlock and Sitka spruce-western hemlock forests, spruce-cedar-hemlock forest and cedar-hemlock-Douglas-fir forest. The Washington GAP Vegetation map includes this vegetation as conifer forest, mixed hardwood/conifer forest, and hardwood forest in the Sitka spruce, western hemlock, Olympic Douglas-fir, Puget Sound Douglas-fir and Cowlitz River zones. A number of other references describe elements of this habitat.

Natural Disturbance Regime. Fire is the major natural disturbance in all but the wettest climatic area (Sitka spruce zone), where wind becomes the major source of natural disturbance. Natural fire-return intervals generally range from about 100 years or less in the driest areas to several hundred years. Mean fire-return interval for the western hemlock zone as a whole is 250 years, but may vary greatly. Major natural fires are associated with occasional extreme weather condition. Fires are typically high-severity, with few trees surviving. However, low- and moderate-severity fires that leave partial to complete live canopies are not uncommon, especially in drier climatic areas. Occasional major windstorms hit outer coastal forests most intensely, where fires are rare. Severity of wind disturbance varies greatly, with minor events being extremely frequent and major events occurring once every few decades. Bark beetles and fungi are significant causes of mortality that typically operate on a small scale. Landslides are another natural disturbance that occur in some areas.

Succession and Stand Dynamics. After a severe fire or blowdown, a typical stand will be briefly occupied by annual and perennial forbs and grasses as well as pre-disturbance understory shrubs and herbs that resprout. Herbaceous species generally give way to dominance by shrubs or a mixture of shrubs and young trees within a few years. If shrubs are dense and trees did not establish early, the site may remain as a shrubland for an indeterminate period. Early seral tree species can be any of the potential dominants for the habitat, depending on environment, type of disturbance, and seed source. All of these species except the short-lived red alder are capable of persisting for at least a few hundred years. Douglas-fir is the most common dominant after fire, but is uncommon in the wettest zones. It is also the most fire resistant of the trees in this habitat and survives moderate-severity fires well. After the tree canopy closes, the understory may become sparse, corresponding with the stem-exclusion stage. Eventually tree density will decrease and the understory will begin to flourish again, typically at stand age 60-100 years. As trees grow larger and a new generation of shade-tolerant understory trees (usually western hemlock, less commonly western redcedar) grows up, a multi-layered canopy will gradually develop and be well expressed by stand age 200-400 years. Another fire is likely to return before the loss of shade-intolerant Douglas-fir from the canopy at stand age 800-1,000 years, unless the stand is located in the wet maritime zone. Throughout this habitat, western hemlock tends to increase in importance as stand development proceeds. Coarse woody debris peaks in abundance in the first 50 years after a fire and is least abundant at about stand age 100-200 years.

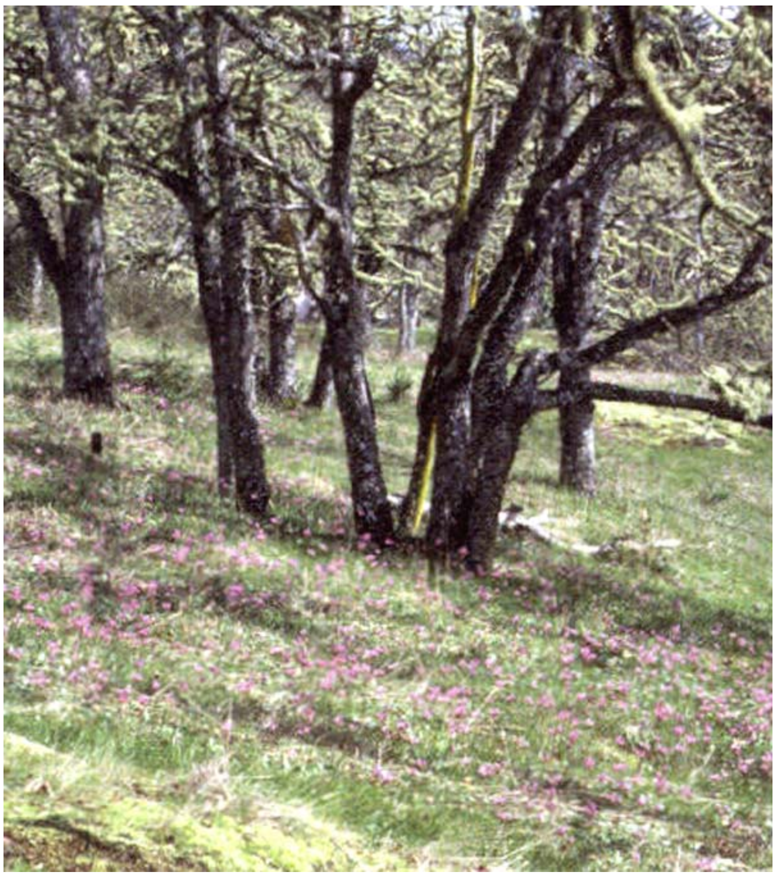
Effects of Management and Anthropogenic Impacts. Red alder is more successful after typical logging disturbance than after fire alone on moist, nutrient-rich sites, perhaps because of the species' ability to establish abundantly on scarified soils. Alder is much more common now because of large-scale logging activities. Alder grows more quickly in height early in succession than the conifers, thereby prompting many forest managers to apply herbicides for alder control. If alder is allowed to grow and dominate early successional stands, it will decline in importance after about 70 years and die out completely by age 100. Often there are suppressed conifers in the subcanopy that potentially can respond to the death of the alder canopy. However, salmonberry sometimes forms a dense shrub layer under the alder, which can exclude conifer regeneration. Salmonberry responds positively to soil disturbance, such as that associated with logging. Bigleaf maple sprouts readily after logging and is therefore well adapted to increase after disturbance as well. Clearcut logging and plantation forestry have resulted in less diverse tree canopies, and have focused mainly on Douglas-fir, with reductions in coarse woody debris over natural levels, a shortened stand initiation phase, and succession truncated well before late-seral characteristics are expressed. Douglas-fir has been almost universally planted, even in wet coastal areas of Washington, where it is rare in natural stands.

Status and Trends. Extremely large areas of this habitat remain. Some loss has occurred, primarily to development in the Puget Lowland. Condition of what remains has been degraded by industrial forest practices at both the stand and landscape scale. Most of the habitat is probably now in Douglas-fir plantations. Only a fraction of the original old-growth forest remains, mostly in national forests in the Cascade and Olympic mountains. Areal extent continues to be reduced gradually, especially in the Puget Lowland. An increase in alternative silviculture practices may be improving structural and species diversity in some areas. However, intensive logging of natural-origin mature and young stands and even small areas of old growth continues. Of the 62 plant associations representing this habitat listed in the National Vegetation Classification, 27 percent are globally imperiled or critically imperiled.

Westside Oak and Dry Douglas-fir Forest and Woodlands

Christopher B. Chappell and Jimmy Kagan

Geographic Distribution. This habitat is primarily found in the Puget Lowlands ecoregion. It is common in and around the San Juan Islands and in parts of Thurston, Pierce and Mason counties. Minor occurrences can also be found in the northeastern Olympic Mountains and western Cascades. This habitat is composed of several geographic variants: California black oak and ponderosa pine are found in a small area of Pierce County. Shore pine is only important in San Juan and Mason counties. Dry Douglas-fir forests (without oak or madrone) are mainly in the Puget Lowland and rarely in the Olympic Mountains or west Cascades. Pacific madrone and Douglas-fir/Pacific madrone stands without oak are limited to the Puget Lowland foothills.



Physical Setting. This habitat typically occupies dry sites west of the Cascades. Annual mean precipitation ranges from 17 to 60 inches, occasionally higher. Elevation ranges from sea level to about 3,500 in the Olympic Mountains, but is mainly below 1,500 ft. Topography ranges from nearly level to very steep slopes, where aspect tends to be southern or western. Soils on dry sites are typically shallow over bedrock, very stony, or very deep and excessively drained. Parent materials include various types of bedrock, shallow or very coarse glacial till, alluvium, and glacial outwash.

Landscape Setting. This habitat is found in a mosaic with, or adjacent to, Westside Grasslands, Westside Lowlands Conifer-Hardwood Forest, Westside Riparian-Wetlands, Urban, and Agriculture. Inclusions of Open Water or Herbaceous Wetlands sometimes occur. In the Puget Lowland, this habitat is sometimes found adjacent to Puget Sound (Nearshore Marine). Land use of this habitat includes forestry (generally small scale), livestock grazing, and low-density rural residential.

Structure. This is a forest or woodland dominated by evergreen conifers, deciduous broadleaf trees, evergreen broadleaf trees, or some mixture of conifers and broadleaf trees. Canopy structure varies from single- to multi-storied. Large conifers, when present, typically emerge above broadleaf trees in mixed canopy stands. Large snags and logs are less abundant than in other westside forest habitats, but can be prominent, especially in unlogged old stands. Understories vary in structure: grasses, shrubs, ferns, or some combination will typically dominate. Deciduous broadleaf shrubs are perhaps most typical as understory dominants in the existing landscape. Early successional stand structure varies depending on understory species present and if initiated following logging or fire.

Composition. The canopy is typically dominated by one or more of the following species: Douglas-fir (*Pseudotsuga menziesii*), Oregon white oak (*Quercus garryana*), Pacific madrone (*Arbutus menziesii*), shore pine (*Pinus contorta* var. *contorta*), or California black oak (*Q. kelloggii*). Grand fir (*Abies grandis*) is occasionally co-dominant with Douglas-fir in the northern Puget Lowlands. Oregon ash (*Fraxinus latifolia*) is occasionally co-dominant with white oak in riparian oak stands. Several other tree species may be present, but western hemlock (*Tsuga heterophylla*) and western redcedar (*Thuja plicata*) generally cannot regenerate successfully because of dry conditions. This lack of shade-tolerant tree regeneration, along with understory indicators like tall Oregon grape (*Mahonia aquifolium*), and blue wildrye (*Elymus glaucus*), help distinguish dry Douglas-fir forests from mid-seral Douglas-fir stands on more mesic sites, which are part of the Westside Lowlands Conifer-Hardwood Forest. Tree regeneration, when present, is typically Douglas-fir, less commonly grand fir. Deciduous shrubs that commonly dominate or co-dominate the understory are oceanspray (*Holodiscus discolor*), baldhip rose (*Rosa gymnocarpa*), poison-oak (*Toxicodendron diversiloba*), serviceberry (*Amelanchier alnifolia*), beaked hazel (*Corylus cornuta*), trailing blackberry (*Rubus ursinus*), Indian plum (*Oemleria cerasiformis*), snowberries (*Symphoricarpos albus* and *S. mollis*), and oval-leaf viburnum (*Viburnum ellipticum*). Evergreen shrubs or vines that sometimes are dominant where conifers are important in the canopy include salal (*Gaultheria shallon*), dwarf Oregon grape (*Mahonia nervosa*), Pacific rhododendron (*Rhododendron macrophyllum*), hairy honeysuckle (*Lonicera hispidula*), evergreen huckleberry (*Vaccinium ovatum*), and Piper's barberry (*Mahonia piperiana*). Native graminoids that commonly dominate or co-dominate the understory was western fescue (*Festuca occidentalis*), Alaska oniongrass (*Melica subulata*), blue wildrye, and long-stolon sedge (*Carex inops*). Kentucky bluegrass (*Poa pratensis*) is a major non-native dominant in oak woodland understories. Swordfern (*Polystichum munitum*) or, less commonly, bracken fern (*Pteridium aquilinum*) sometimes co-dominates the understory, especially on sites that formerly supported grasslands and savannas. Forbs, many of which are characteristic of these dry sites, are often abundant and diverse, but typically do not dominate. Common camas (*Camassia quamash*), cleavers (*Galium aparine*), or other forbs are occasionally co-dominant with graminoids.

Other Classifications and Key References. This habitat has been described as oak groves and dry site Douglas-fir forest in the *Tsuga heterophylla* zone of western Washington. The Washington Gap Project represents this habitat as part of hardwood forest, mixed hardwood/conifer forest, and conifer forest in the Woodland/Prairie Mosaic, Puget Sound Douglas-fir, and to a minor degree, the Cowlitz River. Other references describe elements of this habitat.

Natural Disturbance Regime. Fire is the major natural disturbance in this habitat. In presettlement times, fire frequency probably ranged from frequent (every few years) to moderately frequent (once every 50-100 years) and reflected low-severity and moderate-severity fire regimes. Fire frequency has been much lower in the last 100 years. Windstorms are an occasional disturbance, most important in the San Juan Islands and vicinity. Understories are sometimes browsed heavily by deer in the San Juan Islands, thus preventing dominance by deciduous shrubs and favoring grasses and forbs.

Succession and Stand Dynamics. Many of these forests and woodlands were formerly either grasslands or savannas that probably burned frequently, thus preventing dominance by trees. Some portions of this habitat in the central Puget Lowlands may have formerly been dominated by shrubs (salal, beaked hazel, and evergreen huckleberry for lengthy periods, probably also because of the particular combination of fire frequency and intensity.

Other areas were woodlands to semi-open forests that burned moderately frequently, as evidenced by the relict stands of old-growth Douglas-fir. The dominant trees in this habitat establish most abundantly after fire. Moderate-severity fires kill many trees but also leave many alive, creating opportunities for establishment of new cohorts of tree sand increasing structural complexity. Oaks and madrone resprout after fire if they are top-killed. Without periodic fire, most oak-dominated stands will eventually convert to Douglas-fir forests. Animal dissemination of acorns may be important in dispersal of oaks. Shore pine, where present, is an early-seral upper canopy series that grows quickly and dies out after about 100-150 years, yielding to a mature Douglas-fir stand unless another fire intervenes before the death of the pine.

Effects of Management and Anthropogenic Impacts. Clearcut or similar logging reduces canopy structural complexity and abundance of large woody debris. Dry Douglas-fir stands are well suited to alternative silvicultural practices such as uneven-aged management or maintaining two-storied stands. Oaks and madrone will typically resprout after logging and thus can increase in importance relative to conifers in mixed canopy stands. Selective logging of Douglas-fir in oak stands can prevent long-term loss of oak dominance. with fire exclusion, stands have probably increased in tree density and grassy understories have been replaced by deciduous shrubs. Moderate to heavy grazing or other significant ground disturbance, especially in grassy understories, leads to increases in non-native invader species, many of which are now abundant in stands with grassy or formerly grassy understories. Scot's broom (*Cytisus scoparius*) is an exotic shrub particularly invasive and persistent in oak woodlands. Exotic herbaceous invaders include colonial bentgrass (*Agrostis capillaris*), common velvetgrass (*Holcus lanatus*), Kentucky bluegrass, tall oatgrass (Arrhenatherum elatius) rigid brome (*Bromus rigidus*), orchardgrass (*Dactylis glomerata*), hedgehog dogtail (*Cynosurus echinatus*), tall fescue (*Festuca arundinacea*), and common St. Johnswort (*Hypericum perforatum*).

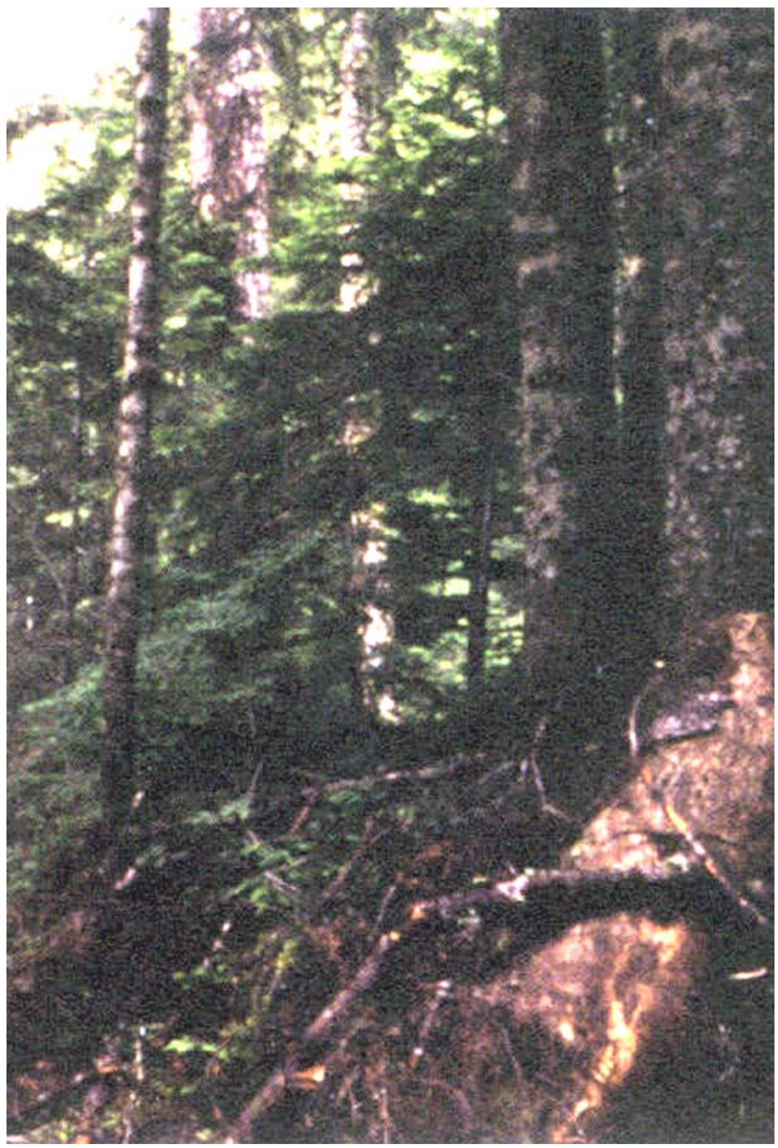
Status and Trends. This habitat is relatively limited in area and is currently declining in extent and condition. With the cessation of regular burning 100-130 years ago, many grasslands and savannas were invaded by a greater density of trees and thus converted to a different habitat. Conversely, large areas of this habitat have been converted to Urban or Agriculture habitats. Most of what remains has been considerably degraded by invasion of exotic species or by logging and consequent loss of structural diversity. Ongoing threats include residential development, increase and spread of exotic species, and fire suppression effects (the latter especially in oak-dominated stands). Thirteen of 27 plant associations listed in the National Vegetation Classification are considered globally imperiled or critically imperiled.

Montane Mixed Conifer Forest

Christopher B. Chappell

Geographic Distribution. These forests occur in mountains throughout Washington, including the Cascade Range, Olympic Mountains, Okanogan Highlands, Coast Range (rarely), and Blue Mountains.

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 to >200 inches. Elevation is mid to upper montane, as low as 2,000 ft in northern Washington. On the west side, it occupies an elevational zone of about 2,500 to 3,000 vertical feet, and on the eastside it occupies a narrower zone of about 1,500 vertical feet. Topography is generally mountainous. Soils are typically not well developed, but varied in their parent material: glacial till, volcanic ash, residuum, or colluvium. Spodosols are common.

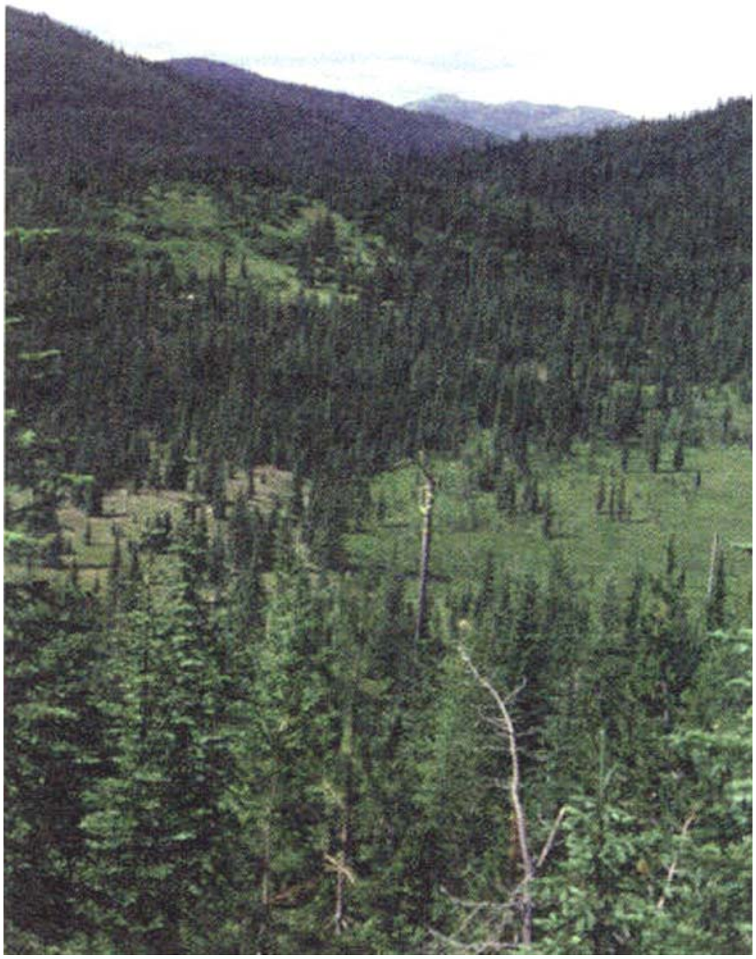


Landscape Setting. This habitat is found adjacent to Westside Lowlands Conifer-Hardwood Forest or Eastside Mixed Conifer Forests to Subalpine Parkland at its upper elevation limits. Inclusions of Montane Forested Wetlands, Westside Riparian Wetlands, and less commonly Open Water or Herbaceous Wetlands occur within the matrix of montane forest habitat. The typical land use is forestry or recreation. Most of this type is found on public lands managed for timber values, and much of it has been harvested in a dispersed patch pattern.

Structure. This is a forest, or rarely woodland, dominated by evergreen conifers. Canopy structure varies from single- to multi-storied. Tree size also varies from small to very large. Large snags and logs vary from abundant to uncommon. Understories vary in structure: shrubs, forbs, ferns, graminoids or some combination of these usually dominate, but they can be depauperate as well. Deciduous broadleaf shrubs are most typical as understory dominants. Early successional structure after logging or fire varies depending on understory species present. Mosses are a major ground cover and epiphytic lichens are typically abundant in the canopy.

Composition. This forest habitat is recognized by the dominance or prominence of one of the following species: Pacific silver fir (*Abies amabilis*), mountain hemlock (*Tsuga mertensiana*), subalpine fir (*A. lasiocarpa*), 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*) and western redcedar (*Thuja plicata*). Tree regeneration is typically dominated by Pacific silver fir in moist westside middle-elevation zones; by mountain hemlock, sometimes with silver fir, in cool, very snowy zones on the west side and along the Cascade Crest and 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. Douglas-fir is important east of the Cascade Crest and at lower elevations on the west side. Pacific silver fir is a major species on the west side. Noble fir, as a native species, is found primarily in the western Cascades in central Washington. Mountain hemlock is a common dominant at higher elevations along the Cascade Crest and to the west. Western hemlock, and to a lesser degree western redcedar, occur as dominants primarily with silver fir at lower elevations on the west side. Alaska yellow-cedar occurs as a co-dominant west of the Cascade Crest in Washington. Deciduous shrubs that commonly dominate or co-dominate the understory are oval-leaf huckleberry (*Vaccinium ovalifolium*), big huckleberry (*V. membranaceum*), grouseberry (*V. scoparium*), dwarf huckleberry (*V. cespitosum*), fools huckleberry (Menziesia ferruginea), Cascade azalea (*Rhododendron albiflorum*), devil's-club (*Oplopanax horridus*), and, in the far south only, baldhip rose (*Rosa gymnocarpa*), currants (*Ribes* spp.), and creeping snowberry (*Symphoricarpos mollis*). Important evergreen shrubs include salal (*Gaultheria shallon*), dwarf Oregon grape (*Mahonia nervosa*), Pacific rhododendron (*Rhododendron macrophyllum*), and beargrass *(Xerophyllum tenax*). Deer fern (*Blechnum spicant*) and western oak fern (*Gymnocarpium dryopteris)* are commonly co-dominant. The most abundant forbs include Oregon oxalis (*Oxalis oregana*), single-leaf foamflower (*Tiarella trifoliata* var. *unifoliata*), rosy twisted-stalk (*Streptopus roseus)*, queen's cup (*Clintonia uniflora*), western bunchberry (*Cornus unalaschkensis*), twinflower (*Linnaea borealis*), prince's pine (*Chimaphila umbellata*), five-leaved bramble (*Rubus pedatus*), and dwarf bramble (*R. lasiococcus*), avalanche lily (*Erythronium montanum*), Sitka valerian (*Valeriana sitchensis*), and false lily-of-the-valley (*Maianthemum dilatatum*).

Other Classifications and Key References. This habitat includes most of the upland forests and their successional stages, except lodgepole pine dominated forests, in the *Tsuga mertensiana*, *Abies amabilis, A. magnifica* var. *shastensis, A. lasiocarpa* zones of Franklin and Dyrness. Portions of this habitat have also been referred to as *A. amabilis-Tsuga heterophylla* forests, *A. magnifica* var. *shastensis* forests, and T*suga mertensiana* forests. It is equivalent to most of the conifer forest in the Silver Fir, Mountain Hemlock, and Subalpine Fir Zones of Washington GAP. Other references describe elements of this habitat.



Natural Disturbance Regime. Fire is the major natural disturbance in this habitat. Fire regimes are primarily of the high-severity type, but also include the moderate-severity regime (moderately frequent and highly variable) for Shasta red fir forests. Mean fire-return intervals vary greatly, from 800 years for some mountain hemlock-silver fir forests to about 40 years for red fir forests. Windstorms are a common small-scale disturbance and occasionally result in stand replacement. Insects and fungi are often important small-scale disturbances. However, they may affect larger areas also, for example, laminated root rot (*Phellinus weirii*) is a major natural disturbance, affecting large areas of mountain hemlock forests in the Oregon Cascades.

Succession and Stand Dynamics. After fire, a typical stand will briefly be occupied by annual and perennial ruderal forbs and grasses, as well as pre-disturbance understory shrubs and herbs that resprout. Stand initiation can take a long time, especially at higher elevations, resulting in shrub/herb dominance (with or without a scattered tree layer) for extended periods. Early seral tree species can be any of the potential dominants for the habitat, or lodgepole pine, depending on the environment, type of disturbance, and seed source. Fires tend to favor early seral dominance of lodgepole pine, Douglas-fir, noble fir, or Shasta red fir, if their seeds are present 1. In some areas, large stand-replacement fires will result in conversion of this habitat to the Lodgepole Pine Forest and Woodland habitat, distinguished by dominance of lodgepole. After the tree canopy closes, the understory typically becomes sparse for a time. Eventually tree density will decrease and the understory will begin to flourish again, but this process takes longer than in lower elevation forests, generally at least 100 years after the disturbance, sometimes much longer. As stand development proceeds, relatively shade-intolerant trees (lodgepole pine, Douglas-fir, western hemlock, noble fir, Engelmann spruce) typically decrease in importance and more shade-tolerant species (Pacific silver fir, subalpine fir, mountain hemlock) increase. Complex multi-layered canopies with large trees will typically take at least 300 years to develop, often much longer, and on some sites may never develop. Tree growth rates, and therefore the potential to develop these structural features, tend to decrease with increasing elevation.

Effects of Management and Anthropogenic Impacts. Forest management practices, such as clearcutting and plantations, have in many cases resulted in less diverse tree canopies with an emphasis on Douglas-fir. They also reduce coarse woody debris compared to natural levels, and truncate succession well before late-seral characteristics are expressed. Post-harvest regeneration of trees has been a perpetual problem for forest managers in much of this habitat. Planting of Douglas-fir has often failed at higher elevations, even where old Douglas-fir were present in the unmanaged stand. Slash burning often has negative impacts on productivity and regeneration. Management has since shifted away from burning and toward planting noble fir or native species, natural regeneration, and advance regeneration. Noble fir plantations are now fairly common in managed landscapes, even outside the natural range of the species. Advance regeneration management tends to simulate wind disturbance but without the abundant downed wood component. Shelterwood cuts are a common management strategy in Engelmann spruce or subalpine fir stands.

Status and Trends. This habitat occupies large areas of the region. There has probably been little or no decline in the extent of this type over time. Large areas of this habitat are relatively undisturbed by human impacts and include significant old-growth stands. Other areas have been extensively affected by logging, especially dispersed patch clearcuts. The habitat is stable in area, but is probably still declining in condition because of continued logging. This habitat is one of the best protected, with large areas represented in national parks and wilderness areas. The only threat is continued road building and clearcutting in unprotected areas. None of the 81 plant associations representing this habitat listed in the National Vegetation Classification is considered imperiled.

Eastside (Interior) Mixed Conifer Forest

Rex C. Crawford

Geographic Distribution. The Eastside Mixed Conifer Forest habitat appears primarily in the Blue Mountains, East Cascades, and Okanogan Highland ecoregions of Washington. Douglas-fir-ponderosa pine forests occur along the eastern slope of the Cascades, the Blue Mountains, and the Okanogan Highlands. Grand fir-Douglas-fir forests and western larch forests are widely distributed throughout the Blue Mountains and, lesser so, along the east slope of the Cascades south of Lake Chelan and in the eastern Okanogan Highlands. Western hemlock-western redcedar-Douglas-fir forests are found in the Selkirk Mountains of eastern Washington, and on the east slope of the Cascades south of Lake Chelan to the Columbia River Gorge.

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

Landscape Setting. This habitat makes up most of the continuous montane forests of the inland Pacific Northwest. It is located between the subalpine portions of the Montane Mixed Conifer Forest habitat in eastern Washington and lower tree line Ponderosa Pine and Forest and Woodlands.

Structure. Eastside Mixed Conifer habitats are montane forests and woodlands. Stand canopy structure is generally diverse, although single-layer forest canopies are currently more common than multi-layered forests with snags and large woody debris. The tree layer varies from closed forests to more open-canopy forests or woodlands. This habitat may include very open stands. The undergrowth is complex and diverse. Tall shrubs, low shrubs, forbs or any combination may dominate stands. Deciduous shrubs typify shrub layers. Prolonged canopy closure may lead to development of a sparsely vegetated undergrowth.

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 vine maple (*Acer circinatum*) in the Cascades, 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*), Cascade azalea (*Rhododendron albiflorum*), 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 chinquapin (*Castanopsis chrysophylla*), a tall shrub in southeastern Cascades, low to mid-height dwarf Oregon grape (*Mahonia nervosa* in the east Cascades and *M. repens* elsewhere), beargrass (*Xerophyllum tenax*), and kinnikinnick (*A. uva-ursi*).Herbaceous broadleaf plants are important indicators of site productivity and disturbance. Species generally indicating productive sites include western oak fern (*Gymnocarpium dryopteris*), vanilla leaf (*Achlys triphylla*), wild ginger (*Asarum caudatum*), queen's cup (*Clintonia uniflora*), goldthread (*Coptis occidentalis*), false bugbane (*Trautvetteria caroliniensis*), windflower (*Anemone oregana, A. piperi, A. lyallii*), Hooker's fairybells (*Disporum hookeri*), Sitka valerian (*Valeriana sitchensis*), and pioneer violet (*Viola glabella*). Other indicator forbs are dogbane (*Apocynum androsaemifolium*), false solomonseal (*Maianthemum stellata*), heartleaf arnica (*Arnica cordifolia*), several lupines (*Lupinus caudatus, L. latifolius, L. argenteus* ssp. argenteus var. *laxiflorus*), western meadowrue (*Thalictrum occidentale*), rattlesnake plantain (*Goodyera oblongifolia*), skunkleaf polemonium (*Polemonium pulcherrimum*), trailplant (*Adenocaulon bicolor*), twinflower (*Linnaea borealis*), western starflower (*Trientalis latifolia*), and several wintergreens (*Pyrola asarifolia, P. picta, Orthilia secunda*). Graminoids are common in this forest habitat. Columbia brome (*Bromus vulgaris*), oniongrass (*Melica bulbosa*), northwestern sedge (*Carex concinnoides*) and western fescue (*Festuca occidentalis*) are found mostly in mesic forests with shrubs or mixed with forb species. Bluebunch wheatgrass (*Pseudoroegneria spicata*), Idaho fescue (*Festuca idahoensis*), and junegrass (*Koeleria macrantha*) are found in drier more open forests or woodlands.

Other Classifications and Key References. This habitat includes the moist portions of the *Pseudotsuga menziesii*, *Abies grandis*, and *Tsuga heterophylla* zones of eastern Washington. Other references describe elements of this habitat.
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Natural Disturbance Regime. Fires were probably of moderate frequency (30-100 years) in presettlement times. Inland Pacific Northwest Douglas-fir and western larch forests have a mean fire interval of 52 years. Typically, stand replacement fire-return intervals are 150-500 years with moderate severity-fire intervals of 50-100 years. Specific fire influences vary with site characteristics. Generally, wetter sites burn less frequently and stands are older with more western hemlock and western redcedar than drier sites. Many sites dominated by

Douglas-fir and ponderosa pine, which were formerly maintained by wildfire, may now be dominated by grand fir (a fire sensitive, shade-tolerant species).

Succession and Stand Dynamics. Successional relationships of this type reflect complex interrelationships between site potential, plant species characteristics, and disturbance regime. Generally, early seral forests of shade-intolerant trees (western larch, western white pine, ponderosa pine, Douglas-fir) or tolerant trees (grand fir, western redcedar, western hemlock) develop some 50 years following disturbance. This stage is preceded by forb- or shrub- dominated communities. These early stage mosaics are maintained on ridges and drier topographic positions by frequent fires. Early seral forest develops into mid-seral habitat of large trees during the next 50-100 years. Stand replacing fires recycle this stage back to early seral stages over most of the landscape. Without high-severity fires, a late-seral condition develops either single-layer or multi-layer structure during the next 100-200 years. These structures are typical of cool bottomlands that usually only experience low-intensity fires.

Effects of Management and Anthropogenic Impacts. This habitat has been most affected by 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. Mid-seral forest structure is currently 70 percent more abundant than in historical, native systems. Late-seral forests of shade-intolerant species are now essentially absent. Early-seral forest abundance is similar to that found historically but lacks snags and other legacy features.

Status and Trends. Interior Douglas-fir, Grand fir, and Western redcedar/Western hemlock cover types are more abundant now than before 1900, whereas the Western larch and Western white pine types are significantly less abundant. Twenty percent of Pacific Northwest Douglas-fir, grand fir, western redcedar, western hemlock, and western white pine associations listed in the National Vegetation Classification are considered imperiled or critically imperiled. 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.

Lodgepole Pine Forest and Woodlands

Rex C. Crawford

Geographic Distribution. This habitat is found along the eastside of the Cascade Range, in the Blue Mountains and the Okanogan Highlands. With grassy undergrowth, this habitat appears primarily along the eastern slope of the Cascade Range and occasionally in the Blue Mountains and Okanogan Highlands. Subalpine lodgepole pine habitat occurs on the broad plateau areas along the crest of the Cascade Range and the Blue Mountains, and in the higher elevations in the Okanogan Highlands. On pumice soils this habitat is confined to the eastern slope of the Cascade Range from near Mt. Jefferson south to the vicinity of Crater Lake.

Physical Setting. This habitat is located mostly at mid- to higher elevations (3,000-9,000 ft. 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.

Landscape Setting. This habitat appears within Montane Mixed Conifer Forest east of the Cascade crest and the cooler Eastside Mixed Conifer Forest habitats. Most pumice soil lodgepole pine habitat is intermixed with Ponderosa Pine Forest and Woodland habitats and is located between Eastside Mixed Conifer Forest habitat and either Western Juniper Woodland or Shrub-steppe habitat.

Structure. The lodgepole pine habitat is composed of open to closed evergreen conifer tree canopies. Vertical structure is typically a single tree layer. Reproduction of other more shade-tolerant conifers can be abundant in the undergrowth. Several distinct undergrowth types develop under the tree layer: evergreen or deciduous medium-tall shrubs, evergreen low shrub, or graminoids with few shrubs. On pumice soils, a sparsely developed shrub and graminoid undergrowth appears with open to closed tree canopies.

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 Oregon grape (*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. Some undergrowth is dominated by graminoids with few shrubs. Pinegrass (*Calamagrostis rubescens*) and/or Geyer's sedge (*Carex geyeri*) can appear with grouseberry in the subalpine zone. Pumice soils support grassy undergrowth of long-stolon sedge (*C. inops*), Idaho fescue (*Festuca idahoensis*) or western needlegrass (*Stipa occidentalis*). The latter 2 species may occur with bitterbrush or big sagebrush and other bunchgrass steppe species. Other non-dominant indicator graminoids frequently encountered in this habitat are California oatgrass (*Danthonia californica*), blue wildrye (*Elymus glaucus*), Columbia brome (*Bromus vulgaris*) and oniongrass (*Melica bulbosa*). Kentucky bluegrass (*Poa pratensis*), and bottlebrush squirreltail (*Elymus elymoides*) can be locally abundant where livestock grazing has persisted. The forb component of this habitat is diverse and varies with environmental conditions. A partial forb list includes goldthread (*Coptis occidentalis*), false solomonseal (*Maianthemum stellata*), heartleaf arnica *(Arnica cordifolia),* several lupines (*Lupinus caudatus, L. latifolius, L. argenteus* ssp. *argenteus* var*. laxiflorus),* meadowrue (*Thalictrum occidentale*), queen's cup (*Clintonia uniflora*), rattlesnake plantain (*Goodyera oblongifolia*), skunkleaf polemonium (*Polemonium pulcherrimum*), trailplant (*Adenocaulon bicolor*), twinflower (*Linnaea borealis*), Sitka valerian (*Valeriana sitchensis*), western starflower (*Trientalis latifolia*), and several wintergreens (*Pyrola asarifolia, P. picta, Orthilia secunda*).

Other Classifications and Key References. The Lodgepole Pine Forest and Woodland habitat includes the *Pinus contorta* zone of eastern Washington. Quigley and Arbelbide referred to this habitat as Lodgepole pine cover type and as a part of the Dry Forest potential vegetation group. Other references detail forest associations with this habitat.

Natural Disturbance Regime. This habitat typically reflects early successional forest vegetation that originated with fires. Inland Pacific Northwest lodgepole pine has a mean fire interval of 112 years. Summer drought areas generally have low to medium-intensity ground fires occurring at intervals of 25-50 years, whereas areas with more moisture have a sparse undergrowth and slow fuel build-up that results in less frequent, more intense fire. With time, lodgepole pine stands increase in fuel loads. Woody fuels accumulate on the forest floor from insect (mountain pine beetle) and disease outbreaks and residual wood from past fires. Mountain pine beetle outbreaks thin stands that add fuel and create a drier environment for fire or open canopies and create gaps for other conifer regeneration. High severity crown fires are likely in young stands, when the tree crowns are near deadwood on the ground. After the stand opens up, shade-tolerant trees increase in number.

Succession and Stand Dynamics. Most Lodgepole Pine Forest and Woodlands are early- to mid seral stages initiated by fire. Typically, lodgepole pine establishes within 10-20 years after fire. This can be a gap phase process where seed sources are scarce. Lodgepole stands break up after 100-200 years. Without fires and insects, stands become more closed-canopy forest with sparse undergrowth. Because lodgepole pine cannot reproduce under its own canopy, old unburned stands are replaced by shade-tolerant conifers. Lodgepole pine on pumice soils is not seral to other tree species; these extensive stands, if not burned, thin naturally, with lodgepole pine regenerating in patches. On poorly drained pumice soils, quaking aspen sometimes plays a mid-seral role and is displaced by lodgepole when aspen clones die. Serotinous cones (cones releasing seeds after fire) are uncommon in eastern Oregon lodgepole pine (*P. c.* var. *murrayana*). On the Colville National Forest in Washington, only 10% of lodgepole pine (*P. c.* var. *latifolia*) trees in low-elevation Douglas-fir habitats had serotinous cones, whereas 82% of cones in high-elevation subalpine fir habitats were serotinous.

Effects of Management and Anthropogenic Impacts. Fire suppression has left many single canopy lodgepole pine habitats unburned to develop into more multilayered stands. Thinning of serotinous lodgepole pine forests with fire intervals <20 years can reduce their importance over time. In pumice-soil lodgepole stands, lack of natural.

Status and Trends. Quigley and Arbelbide concluded that the extent of the lodgepole pine cover type in Oregon and Washington is 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. At a finer scale, these forests have been fragmented by roads, timber harvest, and influenced by periodic livestock grazing and altered fire regimes.

Ponderosa Pine Forest and Woodlands (includes Eastside Oak)
Rex C. Crawford and Jimmy Kagan

Geographic Distribution. This habitat occurs in much of eastern Washington, including the eastern slopes of the Cascades, the Blue Mountains and foothills, and the Okanogan Highlands. Ponderosa pine woodland and savanna habitats occur in the foothills of the Blue Mountains, along the eastern base of the Cascade Range, the Okanogan Highlands, and in the Columbia Basin in northeastern Washington.

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. Average annual precipitation ranges from about 14 to 30 inches on ponderosa pine sites and often occurs as snow. This habitat can be found at elevations of 100 ft in the Columbia River Gorge to dry, warm areas over 6,000 ft . Timber harvest, livestock grazing, and pockets of urban development are major land uses.

Landscape Setting. This woodland habitat typifies the lower treeline zone forming transitions with Eastside Mixed Conifer Forest and Western Juniper and Mountain Mahogany Woodland, Shrub-steppe, Eastside Grassland, or Agriculture habitats. Douglas-fir-ponderosa pine woodlands are found near or within the Eastside Mixed Conifer Forest habitat. Oregon oak woodlands appear in the driest most restricted landscapes in transition to Eastside Grassland or Shrub-steppe.

Structure. This habitat is typically a woodland or savanna with tree canopy coverage of 10-60 percent, although closed-canopy stands are possible. The tree layer is usually composed of widely spaced large conifer trees. Many stands tend towards a multi-layered condition with encroaching conifer regeneration. Isolated taller conifers above broadleaf deciduous trees characterize part of this habitat. Deciduous woodlands or forests are an important part of the structural variety of this habitat. Clonal deciduous trees can create dense patches across a grassy landscape rather than scattered individual trees. The undergrowth may include dense stands of shrubs or, more often, be dominated by grasses, sedges, or forbs. Shrub-steppe shrubs may be prominent in some stands and create a distinct tree-shrub-sparse-grassland habitat.

Composition. Ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*) are the most common evergreen trees in this habitat. Grand fir (Abies grandis) may be frequent in the undergrowth on more productive sites giving stands a multi-layer structure. In rare instances, grand fir can be co-dominant in the upper canopy. Tall ponderosa pine over Oregon white oak (*Quercus garryana*) trees form stands along part of the eastern Cascades. These stands usually have younger cohorts of pines. Oregon white oak dominates open woodlands or savannas in limited areas. 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. Short shrubs such as kinnikinnick (*A. uva-ursi*) are found across the range of this habitat. Antelope bitterbrush (*Purshia tridentata*), big sagebrush (*Artemisia tridentata*), black sagebrush (*A. nova*) and green rabbitbrush (Chrysothamnus viscidiflorus) often grow with Douglas-fir, ponderosa pine and/or Oregon white oak, which typically have a bunchgrass and shrub-steppe ground cover. Undergrowth is generally dominated by herbaceous species, especially graminoids. Within a forest matrix, these woodland habitats have an open to closed sodgrass undergrowth. Drier savanna and woodland undergrowth typically contains bunchgrass steppe species, such as Idaho fescue (*Festuca idahoensis*), rough fescue (*F. campestris*), bluebunch wheatgrass (*Pseudoroegneria spicata*), Indian ricegrass (*Oryzopsis hymenoides*), or needlegrasses (*Stipa comata, S. occidentalis*). Forbs are common associates in this habitat and are too numerous to be listed.

Other Classifications and Key References. This habitat is referred to as Pacific ponderosa pine-Douglas-fir and Pacific ponderosa pine, and Oregon white oak by the Society of American Foresters. Other references describe elements of this habitat.

Natural Disturbance Regime. Fire plays an important role in creating vegetation structure and composition in this habitat. Most of the habitat has experienced frequent low-severity fires that maintained woodland or savanna conditions. A mean fire interval of 20 years for ponderosa pine is the shortest of the vegetation types. Soil drought plays a role in maintaining an open tree canopy in part of this dry woodland habitat.

Succession and Stand Dynamics. This habitat is climax on sites near the dry limits of each of the dominant conifer species and is more seral as the environment becomes more favorable for tree growth. Open seral stands are gradually replaced by more closed shade-tolerant climax stands. Oregon white oak can reproduce under its own shade but is intolerant of overtopping by conifers. Oregon white oak woodlands are considered fire climax and are seral to conifers. In drier conditions, unfavorable to conifers, oak is climax. Oregon white oak sprouts from the trunk and root crown following cutting or burning and form clonal patches of trees.

Effects of Management and Anthropogenic Impacts. Pre-1900, this habitat was mostly open and park like with relatively few undergrowth trees. Currently, much of this habitat has a younger tree cohort of more shade-tolerant species that gives the habitat a more closed, multi-layered 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. Large late seral ponderosa pine, Douglas-fir, and Oregon white oak are harvested in much of this habitat. Under most management regimes, typical tree size decreases and tree density increases in this habitat. Ponderosa pine-Oregon white oak habitat is now denser than in the past and may contain more shrubs than in pre-settlement habitats. In some areas, new woodlands have been created by patchy tree establishment at the forest-steppe boundary.

Status and Trends. Interior Ponderosa Pine cover type is significantly less in extent than pre-1900 and that the 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.

Upland Aspen Forest

Rex C. Crawford and Jimmy Kagan

Geographic Distribution. Quaking aspen groves are the most widespread habitat in North America, but are a minor type throughout eastern Washington. Upland Aspen habitat is found in the northeastern Cascade of Washington. Aspen stands are much more common in the Rocky Mountain states.

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 elevation.

Landscape Setting. Aspen forms a "subalpine belt" above the Western Juniper and Mountain Mahogany Woodland habitat and below Montane Shrubsteppe Habitat on Steens Mountain in southern Oregon. It can occur in seral stands in the lower Eastside Mixed Conifer Forest and Ponderosa Pine Forest and Woodlands habitats. Primary land use is livestock grazing.

Structure. Deciduous trees usually less than 48 feet tall dominate this woodland or forest habitat. The tree layer grows over a forb-, grass-, or low shrub-dominated undergrowth. Relatively simple 2-tiered stands characterize the typical vertical structure of woody plants in this habitat. This habitat is composed of one to many clones of trees with larger trees toward the center of each clone. Conifers invade and create mixed evergreen-deciduous woodland or forest habitats.

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.), sweet cicely (*Osmorhiza* spp.), and valerian (*Valeriana* spp.).

Other Classifications and Key References. This habitat is called "Aspen" by the Society of American Foresters and "Aspen woodland" by the Society of Range Management.

Natural Disturbance Regime. Fire plays an important role in maintenance of this habitat. Quaking aspen will colonize sites after fire or other stand disturbances through root sprouting. Research on fire scars in aspen stands in central Utah indicated that most fires occurred before 1885, and concluded that the natural fire return interval was 7-10 years. Ungulate browsing plays a variable role in aspen habitat; ungulates may slow tree regeneration by consuming aspen sprouts on some sites, and may have little influence in other stands.

Succession and Stand Dynamics. There is no generalized successional pattern across the range of this habitat. Aspen sprouts after fire and spreads vegetatively into large clonal or multi-clonal stands. Because aspen is shade intolerant and cannot reproduce under its own canopy, conifers can invade most aspen habitat. In central Utah, quaking aspen was invaded by conifers in 75-140 years. Apparently, some aspen habitat is not invaded by conifers, but eventually clones deteriorate and succeed to shrubs, grasses, and/or forbs. This transition to grasses and forbs occurs more likely on dry sites.

Effects of Management and Anthropogenic Impacts. Domestic sheep reportedly consume four times more aspen sprouts than do cattle. 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.

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

Subalpine Parkland

Rex C. Crawford and Christopher B. Chappell

Geographic Distribution. The Subalpine Parkland habitat occurs throughout the high mountain ranges of Washington (e.g., Cascade crest, Olympic Mountains, and Okanogan Highlands).

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 in 6 months and several feet of snow typically accumulate. Whitebark pine sites receive 24-70 inches per year and some sites only rarely accumulate a significant snowpack. Summer soil drought is possible in eastside parklands but rare in west side areas. Elevation varies from 4,500 to 6,000 ft in the western Cascades and Olympic Mountains and from 5,000 to 8,000 ft in the eastern Cascades.

Landscape Setting. The Subalpine Parkland habitat lies above the Mixed Montane Conifer Forest or Lodgepole Pine Forest habitat and below the Alpine Grassland and Shrubland habitat. Associated wetlands in subalpine parklands extend up a short distance into the alpine zone. Primary land use is recreation, watershed protection, and grazing.

Structure. Subalpine Parkland habitat has a tree layer typically between 10 and 30 percent canopy cover. Openings among trees are highly variable. The habitat appears either as parkland, that is, a mosaic of treeless openings and small patches of trees often with closed canopies, or as woodlands or savanna-like stands of scattered trees. The ground layer can be composed of (1) low to matted dwarf shrubs (<1 ft tall) that are evergreen or deciduous and often small-leaved; (2) sod grasses, bunchgrasses, or sedges; (3) forbs; or (4) moss- or lichen-covered soils. Herb or shrub-dominated wetlands appear within the parkland areas and are considered part of this habitat; wetlands can occur as deciduous shrub thickets up to 6.6 ft tall, as scattered tall shrubs, as dwarf shrub thickets, or as short herbaceous plants <1.6 ft tall. In general, western Cascades and Olympic areas are mostly parklands composed of a mosaic of patches of trees interspersed with heather shrublands or wetlands, whereas eastern Cascades and Rocky Mountain areas are parklands and woodlands typically dominated by grasses or sedges, with fewer heathers.

Composition. Species composition in this habitat varies with geography or local site conditions. The tree layer can be composed of one or several tree species. Subalpine fir (*Abies lasiocarpa*), Engelmann spruce (Picea engelmannii) and lodgepole pine (Pinus contorta) are found throughout the Pacific Northwest. Alaska yellowcedar (*Chamaecyparis nootkatensis*), Pacific silver fir (*A. amabilis*), and mountain hemlock (*Tsuga mertensiana*) are most common in the Olympics and Cascades. Whitebark pine (*P. albicaulis*) is found primarily in the eastern Cascade Mountains, Okanogan Highlands, and Blue Mountains. Subalpine larch (*Larix lyallii*) occurs only in the northern Cascade Mountains, primarily east of the crest. West Cascades and Olympic areas generally are parklands. Tree islands often have big huckleberry (*Vaccinium membranaceum*) in the undergrowth interspersed with heather shrublands between. Openings are composed of pink mountain-heather (*Phyllodoce empetriformis*), white mountainheather (*Cassiope mertensiana*) and Cascade blueberry (*Vaccinium deliciosum*). Drier areas are more woodland or savanna-like, often with low shrubs, such as common juniper, 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*), and blueberries (*Vaccinium uliginosum or V. deliciosum*). Tufted hairgrass (*Deschampsia caespitosa*) is characteristic of subalpine wetlands. The remaining flora of this habitat is diverse and complex. The following herbaceous broadleaf plants are important indicators of differences in the habitat: American bistort (*Polygonum bistortoides*), American false hellebore (*Veratrum viride*), fringe leaf cinquefoil (*Potentilla flabellifolia*), marsh marigolds (*Caltha leptosepala*), avalanche lily (*Erythronium montanum*), partridgefoot (*Luetkea pectinata*), Sitka valerian (*Valeriana sitchensis*), subalpine lupine (*Lupinus arcticus* ssp. *subalpinus*), and alpine aster (*Aster alpigenus*). Showy sedge (*Carex spectabilis*) is also locally abundant.

Other Classifications and Key References. This habitat is called the Hudsonian Zone, Parkland subzone, meadow-forest mosaic 74, upper subalpine zone, Meadows and Park, and Subalpine Parkland in various references. Other references describe elements of this habitat.

Natural Disturbance Regime. Although fire is rare to infrequent in this habitat, it plays an important role, particularly in drier environments. Whitebark pine woodland fire intervals varied from 50 to 300 years before 1900. Mountain hemlock parkland fire reoccurrence is 400-800 years. Wind blasting by ice and snow crystals is a critical factor in these woodlands and establishes the higher limits of the habitat. Periodic shifts in climatic factors, such as drought, snowpack depth, or snow duration either allow tree invasions into meadows and shrublands or eliminate or retard tree growth. Volcanic activity plays a long-term role in establishing this habitat. Wetlands are usually seasonally or perennially flooded by snowmelt and springs, or by sub-irrigation.

Succession and Stand Dynamics. Succession in this habitat occurs through a complex set of relationships between vegetation response to climatic shifts and catastrophic disturbance, and plant species interactions and site modification that create microsites. A typical succession of subalpine trees into meadows or shrublands begins with the invasion of a single tree, subalpine fir and mountain hemlock in the wetter climates and whitebark pine and subalpine larch in drier climates. If the environment allows, tree density slowly increases (over decades to centuries) through seedlings or branch layering by subalpine fir. The tree patches or individual trees change the local environment and create microsites for shade-tolerant trees, Pacific silver fir in wetter areas, and subalpine fir and Engelmann spruce in drier areas. Whitebark pine, an early invading tree, is dispersed long distances by Clark's nutcrackers and shorter distances by mammals. Most other tree species are wind dispersed.

Effects of Management and Anthropogenic Impacts. Fire suppression has contributed to change in habitat structure and functions. For example, the current "average" whitebark pine stand will burn every 3,000 years or longer because of fire suppression. 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. This is particularly important on drier sites and in subalpine larch stands. During wet cycles, fire suppression can lead to tree islands coalescing and the conversion of parklands into a more closed forest habitat. Parkland conditions can displace alpine conditions through tree invasions. Livestock use and heavy horse or foot traffic can lead to trampling and soil compaction. Slow growth in this habitat prevents rapid recovery.

Status and Trends. This habitat is generally stable with local changes to particular tree variants. 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 percent of Pacific Northwest subalpine parkland community types listed in the National Vegetation Classification are considered imperiled.

Westside Grasslands

Christopher B. Chappell and Jimmy Kagan

Geographic Distribution. This habitat is restricted primarily to the Puget Lowland ecoregion, with most now occurring in Pierce, Thurston and San Juan counties, Washington. It also occurs in scattered small outliers in the eastern Olympic Mountains and the western Cascades.

Physical Setting. The climate is mild and moderately dry (17-55 inches mean annual precipitation), with moist winters and dry summers. Elevation is mostly low and ranges up to a maximum of about 3,500 feet. Topography varies from flat to mounded or rolling to steep slopes. Most sites are topoedaphically dry and experience extreme soil drought in the summer. Much of what currently remains of this habitat is found on the South Puget prairies, which are underlain by very deep gravelly/sandy glacial outwash that is excessively well drained. Many other small sites, often called "balds", have shallow soils overlying bedrock and typically are on south- or west-facing slopes.

Landscape Setting. This habitat occurs adjacent to or in a mosaic with Westside Riparian-Wetlands, Westside Oak and Dry Douglas-fir Forests and Woodlands, Agriculture or Urban habitats. Westside grassland habitat occurs less commonly in a matrix of Westside Lowland Conifer-Hardwood Forest. In the San Juan Islands, the habitat sometimes occurs on bluffs or slopes adjacent to marine habitats. Currently this habitat is used for grazing, recreation, and, in the southern Puget Sound area, for military training.

Structure. This habitat is grassland or, less commonly, savanna, with <30% tree or shrub cover. Bunchgrasses predominate in native-dominated sites, with space between the vascular plants typically covered by mosses, fruticose lichens, or native forbs. Montane balds are sometimes dominated in part by short forbs (<1.6 ft) or dwarf shrubs. Degraded sites are dominated by rhizomatous exotic grasses with some native herbaceous component still present. Scattered trees are either evergreen conifers or deciduous broadleaves. Shrubs may be absent, scattered, or very prominent, and include evergreen and deciduous broadleaf physiognomy.

Composition. The major native dominant bunchgrass is Roemer's fescue (*Festuca idahoensis* var. *roemeri*). Red fescue (*F. rubra*) and California oatgrass (*Danthonia* *californica*) are frequently dominant or co-dominant on a local basis. Long-stolon sedge (*Carex inops*) is occasionally co-dominant, especially in savannas and in the Columbia Gorge. Slender wheatgrass (*Elymus trachycaulus*), blue wildrye (*E. glaucus*), prairie junegrass (*Koeleria macrantha*), and Lemmon's needlegrass (*Stipa lemmonii*) can be important locally. Major exotic dominant species are colonial bentgrass (*Agrostis capillaris*), sweet vernalgrass (*Anthoxanthum odoratum*), Kentucky bluegrass (*Poa pratensis*), tall oatgrass (*Arrhenatherum elatius*), medusahead (*Taeniatherum caput-medusae*), tall fescue (*F. arundinacea*), and soft brome (*Bromus mollis*). Common camas (*Camassia quamash*) is probably the most important forb in terms of cover, but it rarely dominates. The bracken fern (*Pteridium aquilinum*) is sometimes co-dominant. A rich diversity of native forbs is typical of sites in good condition. Roemer's fescue is distributed throughout the Puget Lowland and in montane balds of the eastern and northeastern Olympics. Native red fescue is a major component near saltwater in the northern Puget Lowland and in montane balds of the Columbia Gorge. Non-native varieties of red fescue can occur throughout the area, especially in degraded habitats. California oatgrass communities are found in the San Juan Islands. Junegrass is a co-dependent in some montane balds; it occurs less abundantly throughout the area. Lemmon's needlegrass is primarily found on shallow-soiled balds of the San Juan Islands. The most common savanna tree is Douglas-fir (*Pseudotsuga menziesii*). Oregon white oak (*Quercus garryana*) formerly was part of extensive savannas, but is now rare in that structural condition. Ponderosa pine (*Pinus ponderosa*) is very local. The most common shrub is the exotic species Scot's broom (*Cytisus scoparius*), which frequently forms open stands over the grass. Common snowberry (Symphoricarpos albus), Nootka rose (*Rosa nutkana*), poison-oak (Toxicodendron diversilobum), and serviceberry (*Amelanchier alnifolia*) are other common shrubs. The dwarf shrubs kinnikinnick (*Arctostaphylos uva-ursi*) and common juniper (*Juniperus communis*) sometimes dominate small areas in montane balds, and the former sometimes on South Puget prairies. *Racomitrium canescens* is the most common ground moss.

Other Classifications and Key References. Portions of this habitat have been referred to as prairies by many authors. Franklin and Dyrness described this habitat as prairie in the Puget Sound area and grassland in the San Juan Islands. The Washington Gap project mapped this habitat as part of nonforested in the Woodland/Prairie Mosaic Zone. Other references describe elements of this habitat.

Natural Disturbance Regime. Historically, fire was a major component of this habitat. In addition to occasional lightning strikes, fires were intentionally set by indigenous inhabitants to maintain food staples such as camas and bracken fern. Although there is no definitive fire history information, evidence suggests that many, if not most, of these grasslands burned every few years. Annual soil drought naturally eliminated or thinned invading trees and promoted higher frequency fire regimes in the past.

Succession and Stand Dynamics. Historically, regular fires or extreme environmental conditions on the most xeric sites prevented the establishment and continued growth of most woody vegetation, thereby maintaining the grasslands and oak savannas. In some patches, scattered oaks or even Douglas-fir survived long enough to obtain some fire resistance and the frequent light fires then helped to maintain savannas. Oaks were also able to resprout if the above-ground stem was killed. High fire frequencies combined with digging of roots by Native Americans could have favored the abundance of forbs over that of grasses in many areas of the pre-European landscape.

Effects of Management and Anthropogenic Impacts. The exclusion of fire from most of this habitat over the last 100+ years has resulted in profound changes. Oak savanna has, for all practical purposes, disappeared from the landscape. Douglas-fir encroachment, in the absence of fire, is a “natural” process that occurs eventually on the vast majority of westside grasslands, except perhaps on the very driest sites. This encroachment leads to the conversion of grasslands to forests. Fire exclusion has also resulted in increases in shrub cover and the conversion of some grasslands to shrublands. Exotic species are prominent in this habitat and generally increase after ground-disturbing activities like grazing or off-road vehicle use. Scot’s broom, tall oatgrass, colonial bentgrass, sweet vernalgrass, tall fescue, common velvetgrass (*Holcus lanatus*), Kentucky bluegrass, soft brome, common St. Johnswort (*Hypericum perforatum*), and hairy cat’s ear (*Hypochaeris radicata*) are among the most troublesome species. The dominant native grass, Roemer’s fescue, can be eliminated with heavy grazing. Prescribed fire and other management tolls have been used recently to control Scot’s broom, Douglas-fir encroachment, and to attempt to mimic historical conditions in some areas.

Status and Trends. This habitat is very rare and limited in areal extent. In the southern Puget Sound area, only about 10% of the original area of the habitat is extant, and only 3% is dominated by native species. Overall decline is significantly greater than these figures suggest because the habitat is even more decimated and degraded elsewhere. Causes of the decline are fire suppression, conversion to agriculture and urban, and invasion of exotic species. Most of what remains is dominated or co-dominated by exotic species. Current trends are continued decline both in area and condition. Ongoing threats include urban conversion, increase of exotic species, ground disturbance via tracked vehicle use for military training, and effects of fire suppression. Eleven out of 12 native plant association representing this habitat listed for the National Vegetation Classification are considered imperiled or critically imperiled.

Eastside (Interior) Grasslands

Rex. C. Crawford and Jimmy Kagan

Geographic Distribution. This habitat is found primarily in Washington at mid- to low elevations and on plateaus in the Blue Mountains. Idaho fescue grassland habitats were formerly widespread in the Palouse region of southeastern Washington; most of this habitat has been converted to agriculture. Idaho fescue grasslands still occur in isolated, moist sites near lower treeline in the foothills of the Blue Mountains, the Northern Rockies, and east Cascades near the Columbia River Gorge. Bluebunch wheatgrass grassland habitats are common throughout the Columbia Basin, both as modified native grasslands in deep canyons and the dry Palouse and as fire-induced representatives in the shrub-steppe. Sand dropseed and three-awn needlegrass grassland habitats are restricted to river terraces in the Columbia Basin and Blue Mountains of Washington.

Physical Setting. This habitat develops in hot, dry climates in the Pacific Northwest. Annual precipitation totals 8-20 inches; only 10 percent falls in the hottest months, July through September. Snow accumulation is low (1-6 inches) and occurs only in January and February in eastern portions of its range and November through March in the west. More snow accumulates in grasslands within the forest matrix. Soils are variable: (1) highly productive loess soils up to 51 inches deep, (2) rocky flats, (3) steep slopes, and (4) sandy, gravel or cobble soils. An important variant of this habitat occurs on sandy, gravelly, or silty river terraces or seasonally exposed river gravel or Spokane flood deposits. The grassland habitat is typically upland vegetation but it may also include riparian bottomlands dominated by non-native grasses. This habitat is found from 500 to 6,000 ft in elevation.

Landscape Setting. Eastside grassland habitat appears well below and in a matrix with lower treeline Ponderosa Pine Forests and Woodlands. It can also be part of the lower elevation forest matrix. Most grassland habitat occurs in 2 distinct large landscapes: plateau and canyon grasslands. Several rivers flow through narrow basalt canyons below plateaus supporting prairies or shrub-steppe. The canyons can be some 2,132 ft deep below the plateau. The plateau above is composed of gentle slopes with deep silty loess soils in an expansive rolling dune-like landscape. Grasslands may occur in a patchwork with shallow soil scablands or within biscuit scablands or mounded topography. Naturally occurring grasslands are beyond the range of bitterbrush and sagebrush species. This habitat exists today in the shrub-steppe landscape where grasslands are created by brush removal, chaining or spraying, or by fire. Agricultural uses and introduced perennial plants on abandoned or planted fields are common throughout the

current distribution of eastside grassland habitats.

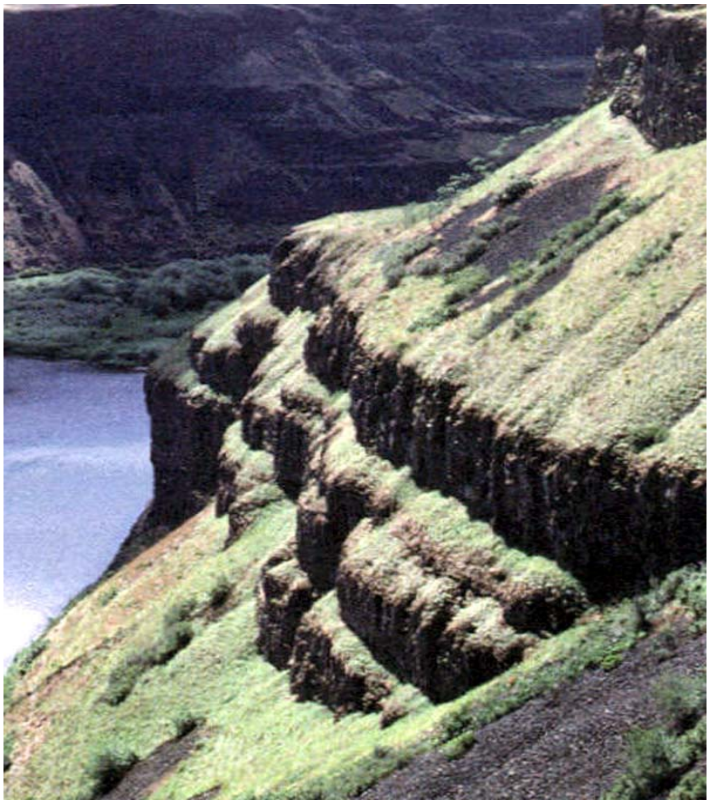
Structure. This habitat is dominated by short to medium-tall grasses (<3.3 ft). Total herbaceous cover can be closed to only sparsely vegetated. In general, this habitat is an open and irregular arrangement of grass clumps rather than a continuous sod cover. These medium-tall grasslands often have scattered and diverse patches of low shrubs, but few or no medium-tall shrubs (<10 percent cover of shrubs are taller than the grass layer). Native forbs may contribute significant cover or they may be absent. Grasslands in canyons are dominated by bunchgrasses growing in lower densities than on deep-soil prairie sites. The soil surface between perennial plants can be covered with a diverse cryptogamic or microbiotic layer of mosses, lichens, and various soil bacteria and algae. Moister environments can support a dense sod of rhizomatous perennial grasses. Annual plants are a common spring and early summer feature of this habitat.

Composition. Bluebunch wheatgrass (*Pseudoroegneria spicata*) and Idaho fescue (*Festuca idahoensis*) are the characteristic native bunchgrasses of this habitat and either or both can be dominant. Idaho fescue is common in more moist areas and bluebunch wheatgrass more abundant in drier areas. Rough fescue (*F. campestris*) is a characteristic dominant on moist sites in northeastern Washington. Sand dropseed (*Sporobolus cryptandrus*) or three-awn (*Aristida longiseta*) are native dominant grasses on hot, dry sites in deep canyons. Sandberg bluegrass (*Poa sandbergii*) is usually present, and occasionally codominant in drier areas. Bottlebrush squirreltail (*Elymus elymoides*) and Thurber needlegrass (*Stipa thurberiana*) can be locally dominant. Annual grasses are usually present; cheatgrass (Bromus tectorum) is the most widespread. In addition, medusahead (*Taeniatherum caput-medusae*), and other annual bromes (*Bromus commutatus, B. mollis, B. japonicus*) may be present to co-dominant. Moist environments, including riparian bottomlands, are often co-dominated by Kentucky bluegrass (*Poa pratensis*). A dense and diverse forb layer can be present or entirely absent; >40 species of native forbs can grow in this habitat including balsamroots (*Balsamorhiza* spp.), biscuitroots (*Lomatium* spp.), buckwheat (*Eriogonum* spp.), fleabane (*Erigeron* spp.), lupines (*Lupinus* spp.), and milkvetches (*Astragalus* spp.). Common exotic forbs that can grow in this habitat are knapweeds (*Centaurea solstitialis, C. diffusa, C. maculosa*), tall tumblemustard (*Sisymbrium altissimum*), and Russian thistle (Salsola kali). Smooth sumac (*Rhus glabra*) is a deciduous shrub locally found in combination with these grassland species. Rabbitbrushes (*Chrysothamnus nauseosus, C. viscidiflorus*) can occur in this habitat in small amounts, especially where grazed by livestock. In moist Palouse regions, common snowberry (*Symphoricarpos albus*) or Nootka rose (*Rosa nutkana*) may be present, but is shorter than the bunchgrasses. Dry sites contain low succulent prickly pear (*Opuntia polyacantha*). Big sagebrush (*Artemisia tridentata*) is occasional and may be increasing in grasslands on former shrub-steppe sites. Black hawthorn (*Crataegus douglasii*) and other tall shrubs can form dense thickets near Idaho fescue grasslands. Rarely, ponderosa pine (*Pinus ponderosa*) or western juniper (*Juniperus occidentalis*) can occur as isolated trees.

Other Classifications and Key References. This habitat is called Palouse Prairie, Pacific Northwest grassland, steppe vegetation, or bunchgrass prairie in general ecological literature. Washington GAP types 13, 21, 22, 24, 29-31, 82, and 99 map this habitat. Franklin and Dyrness include this habitat in steppe zones of Washington. Other references describe elements of this habitat.

Natural Disturbance Regime. The fire-return interval for sagebrush and bunchgrass is estimated at 25 years. The native bunchgrass habitat apparently lacked extensive herds of large grazing and browsing animals until the late 1800's. Burrowing animals and their predators likely played important roles in creating small-scale patch patterns.

Succession and Stand Dynamics. Currently fires burn less frequently in the Palouse grasslands than historically because of fire suppression, roads, and conversions to cropland. Without fire, black hawthorn shrubland patches expand on slopes along with common snowberry and rose. Fires covering large areas of shrub-steppe habitat can eliminate shrubs and their seed sources and create eastside grassland habitat. Fires that follow heavy grazing or repeated early season fires can result in annual grasslands of cheatgrass, medusahead, knapweed, or yellow star-thistle. Annual exotic grasslands are common in dry grasslands and are included in modified grasslands as part of the Agriculture habitat.



Effects of Management and Anthropogenic Impacts. Large expanses of grasslands are currently used for livestock ranching. Deep soil Palouse sites are mostly converted to agriculture. Drier grasslands and canyon grasslands, those with shallower soils, steeper topography, or hotter, drier environments, were more intensively grazed and for longer periods than were deep-soil grasslands. Evidently, these drier native bunchgrass grasslands changed irreversibly to persistent annual grass and forblands. Some annual grassland, native bunchgrass, and shrub-steppe habitats were converted to intermediate wheatgrass, or more commonly, crested wheatgrass (*Agropyron cristatum*)-dominated areas. These form persistent grasslands and are included as modified grasslands in the Agriculture habitat. With intense livestock use, some riparian bottomlands become dominated by non-native grasses. Many native dropseed grasslands have been submerged by dam reservoirs.

Status and Trends. Most of the Palouse prairie of southeastern Washington and adjacent Idaho and Oregon has been converted to agriculture. Remnants still occur in the foothills of the Blue Mountains and in isolated, moist Columbia Basin sites. The Palouse is one of the most endangered ecosystems in the United States, with only one percent of the original habitat remaining; it is highly fragmented with most sites <10 acres. All these areas are subject to weed invasions and drift of aerial biocides. Since 1900, 94 percent of the Palouse grasslands have been converted to crop, hay, or pasture lands. Fescue-Bunchgrass and Wheatgrass bunchgrass cover types have significantly decreased in area since pre-1900, while exotic forbs and annual grasses have significantly increased since pre-1900. Fifty percent of the plant associations recognized as components of eastside grassland habitat listed in the National Vegetation Classification are considered imperiled or critically imperiled.

Shrub-steppe

Rex. C. Crawford and Jimmy Kagan

Geographic Distribution. Shrub-steppe habitat is common across the Columbia Plateau of Washington. It extends up into the cold, dry environments of surrounding mountains. Basin big sagebrush Shrub-steppe occurs along stream channels, in valley bottoms and flats throughout eastern Washington. Wyoming sagebrush Shrub-steppe is the most widespread habitat in eastern Washington, occurring throughout the Columbia Plateau and the northern Great Basin. Mountain big sagebrush Shrub-steppe habitat occurs throughout the mountains of eastern Washington. Bitterbrush Shrub-steppe habitat appears primarily along the eastern slope of the Cascades, from north-central Washington to the Blue Mountains. Three-tip sagebrush Shrub-steppe occurs mostly along the northern and western Columbia Basin in Washington. Interior shrub dunes and sandy steppe and Shrub-steppe habitat is concentrated at low elevations near the Columbia River and in isolated pockets in the Northern Basin.

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 with most habitat occurring between 2,000 and 6,000 ft). 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.

Landscape Setting. Shrub-steppe habitat defines a biogeographic region and is the major vegetation on average sites in the Columbia Plateau, usually below Ponderosa Pine Forest and Woodlands, and Western Juniper and Mountain Mahogany Woodlands habitats. It forms mosaic landscapes with these woodland habitats and Eastside Grasslands, Dwarf Shrub-steppe, and Desert Playa and Salt Scrub habitats. Mountain sagebrush Shrub-steppe occurs at high elevations occasionally within the dry Eastside Mixed Conifer Forest and Montane Mixed Conifer Forest habitats. Shrub-steppe habitat can appear in large landscape patches. Livestock grazing is the primary land use in the Shrub-steppe, although much has been converted to irrigation or dry land agriculture. Large areas occur in military training areas and wildlife refuges.

Structure. This habitat is a shrub savanna or shrubland with shrub coverage of 10-60 percent. In an undisturbed condition, shrub cover varies between 10 and 30 percent. Shrubs are generally evergreen, although deciduous shrubs are prominent in many habitats. Shrub height typically is medium tall (1.6-3.3 ft) although some sites support shrubs approaching 9 ft tall. Vegetation structure in this habitat is characteristically an open shrub layer over a moderately open to closed bunchgrass layer. The more northern or productive sites generally have a denser grass layer and sparser shrub layer than southern or more xeric sites. In fact, the rare healthy site is better characterized as grassland with shrubs than a shrubland. The bunchgrass layer may contain a variety of forbs. Healthy habitat has very little exposed bare ground, and has mosses and lichens carpeting the area between taller plants. However, heavily grazed sites have dense shrubs making up >40 percent cover, with introduced annual grasses and little or no moss or lichen cover. Moist sites may support tall bunchgrasses (>3.3) or rhizomatous grasses. More southern Shrub-steppe may have native low shrubs dominating with bunchgrasses.

Composition. Characteristic and dominant mid-tall shrubs in the Shrub-steppe habitat include all three 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 two 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 co-dominate 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. When this habitat is in good or better ecological condition, a bunchgrass steppe layer is characteristic. Diagnostic native bunchgrasses that often dominate different Shrub-steppe habitats are (1) mid-grasses: bluebunch wheatgrass (*Pseudoroegneria spicata*), Idaho fescue (*Festuca idahoensis*), bottlebrush squirreltail (*Elymus elymoides*), and Thurber needlegrass (*Stipa thurberiana*); (2) short grasses: threadleaf sedge (*Carex filifolia*) and Sandberg bluegrass (Poa sandbergii); and (3) the tall grass, basin wildrye (*Leymus cinereus*). Idaho fescue is characteristic of the most productive Shrub-steppe vegetation. Bluebunch wheatgrass is co-dominant at xeric locations, whereas western needlegrass (*Stipa occidentalis*), long-stolon (*Carex inops*) or Geyer's sedge (*C. geyeri*) increase in abundance in higher elevation Shrub-steppe habitats. Needle-and-thread (*Stipa comata)* is the characteristic native bunchgrass on stabilized sandy soils. Indian ricegrass (*Oryzopsis hymenoides*) characterizes dunes. Grass layers on montane sites contain slender wheatgrass (*Elymus trachycaulus*), mountain fescue *(F. brachyphylla*), green fescue (*F. viridula*), Geyer's sedge, or tall bluegrasses (*Poa* spp.). Bottlebrush squirreltail can be locally important in the Columbia Basin, sand dropseed (*Sporobolus cryptandrus*) is important in the Basin and Range and basin wildrye is common in the more alkaline areas. Many sites support non-native plants, primarily cheatgrass (*Bromus tectorum*) or crested wheatgrass (*Agropyron cristatum*) with or without native grasses. Shrub-steppe habitat, depending on site potential and disturbance history, can be rich in forbs or have little forb cover. Trees may be present in some Shrub-steppe habitats, usually as isolated individuals from adjacent forest or woodland habitats.

Other Classifications and Key References. Franklin and Dyrness discussed this habitat in Shrub-steppe zones of Washington and Oregon. Other references describe elements of this habitat.

Natural Disturbance Regime. The fire-return interval for this habitat is 25 years. The native Shrub-steppe habitat apparently lacked extensive herds of large grazing and browsing animals until the late 1800's. Burrowing animals and their predators likely played important roles in creating small-scale patch patterns.

Succession and Stand Dynamics. With disturbance, mature stands of big sagebrush are reinvaded through soil-stored or windborne seeds. Invasion can be slow because sagebrush is not disseminated over long distances. Site dominance by big sagebrush usually takes a decade or more depending on fire severity and season, seed rain, post-fire moisture, and plant competition. Three-tip sagebrush is a climax species that reestablishes (from seeds or commonly from sprouts) within 5-10 years following a disturbance. Certain disturbance regimes promote three-tip sagebrush and it can out-compete herbaceous species. Bitterbrush is a climax species that plays a seral role colonizing by seed onto rocky and/or pumice soils. Bitterbrush may be declining and may be replaced by woodlands in the absence of fire. Silver sagebrush is a climax species that establishes during early seral stages and coexists with later arriving species. Big sagebrush, rabbitbrush, and short-spine horsebrush invade and can form dense stands after fire or livestock grazing. Frequent or high-intensity fire can create a patchy shrub cover or can eliminate shrub cover and create Eastside Grasslands habitat.

Effects of Management and Anthropogenic Impacts. 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. These disturbed sites can be converted to modified grasslands in the Agriculture habitat.

Status and Trends. Alteration of fire regimes, fragmentation, livestock grazing, and the addition of >800 exotic plant species have changed the character of Shrub-steppe habitat. Big Sagebrush and Mountain Sagebrush cover types are significantly smaller in area than before 1900, and that Bitterbrush/Bluebunch Wheatgrass cover type is similar to the pre-1900 extent. Basin Big Sagebrush and Big sagebrush-Warm potential vegetation type's successional pathways have been altered, some pathways of Antelope Bitterbrush have been altered and most pathways for Big Sagebrush-Cool are unaltered. Overall this habitat has seen an increase in exotic plant importance and a decrease in native bunchgrasses. More than half of the Pacific Northwest Shrub-steppe habitat community types listed in the National Vegetation Classification are considered imperiled or critically imperiled.

Open Water - Lakes, Rivers, and Streams

Eva L. Greda, David H. Johnson, and Tom O'Neil

Lakes, Ponds, and Reservoirs

Geographical Distribution. Lakes in Washington occur statewide and are found from near sea level to about 10,200 ft above sea level. There are 3,887 lakes and reservoirs in western Washington, and they total 176,920 acres. In contrast, there are 4,073 lakes and reservoirs in eastern Washington that total 436,843 acres.

Physical Setting. Continental glaciers melted and left depressions, where water accumulated and formed many lakes in the region. These kinds of lakes are predominantly found in Lower Puget Sound. Landslides that blocked natural valleys also allowed water to fill in behind them to form lakes, like Crescent Lake, Washington. The lakes in the Cascades and Olympic ranges were formed through glaciation and range in elevation from 2,500 to 5,000 ft. Beavers create many ponds and marshes in 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.

Structure. There are 4 distinct zones within this aquatic system: (1) the littoral zone at the edge of lakes is the most productive with diverse aquatic beds and emergent wetlands (part of Herbaceous Wetland's habitat); (2) the limnetic zone is deep open water, dominated by phytoplankton and freshwater fish, and extends down to the limits of light penetration; (3) the profundal zone below the limnetic zone, devoid of plant life and dominated with detritivores; (4) and the benthic zone reflecting bottom soil and sediments. Nutrients from the profundal zone are recycled back to upper layers by the spring and fall turnover of the water. Water in temperate climates stratifies because of the changes in water density. The uppermost layer, the epilimnion, is where water is warmer (less dense). Next, the metalimnion or thermocline, is a narrow layer that prevents the mixing of the upper and lowermost layers. The lowest layer is the hypolimnion, with colder and most dense waters. During the fall turnover, the cooled upper layers are mixed with other layers through wind action.

Natural Disturbance Regime. There are seasonal and decadal variations in the patterns of precipitation. In the Coast Range, there is usually one month of drought per year (usually July or August) and two months of drought once in a decade. The Cascades experience one month with no rain every year and a two-month dry period every third year. Dry years with <33 percent of normal precipitation occur once every 30 years along the coast, and every 30 years in the Cascades. Floods occur in Washington every year. Flooding season west of the Cascades occurs from October through April, with more than half of the floods occurring during December and January. Floods are the result of precipitation and snow melts. Floods west of the Cascades are influenced mostly by precipitation and thus are short-lived, while east of the Cascades floods are caused by melting snow, and the amount of flooding depends on how fast the snow melts. High water levels frequently last up to 60 days.

Effects of Management and Anthropogenic Impacts. Sewage effluents caused eutrophication of Lake Washington in Seattle, where plants increased in biomass and caused decreased light transmission. The situation was corrected, however, before it became serious as a result of a campaign of public education, and timely cleanup of the lake. Irrigation projects aimed at watering drier portions of the landscape may pose flooding dangers, as was the case with Soap Lake and Lake Leonore in eastern Washington. Finally, natural salinity of lakes can decrease as a result of irrigation withdrawal and can change the biota associated with them.

Rivers and Streams

Geographic Distribution. Streams and rivers are distributed statewide in Washington, forming a continuous network connecting high mountain areas to lowlands and the Pacific coast. Washington has more streams than any other state except Alaska. In Washington, the coastal region has 3,783 rivers and streams totaling 8,176 miles. The Puget Sound Region has 10,217 rivers and streams, which add up to 16,600 miles in length. The rivers and streams range from cold, fast-moving high-elevation streams to warmer lowland valley rivers. In all, there are 13,955 rivers and streams that add up to 24,774 miles. There are many more streams in Washington yet to be catalogued.

Physical Setting. Climate of the area's coastal region is very wet. The northern region in Washington is volcanic and bordered to the east by the Olympic Mountain Range, on the north by the Strait of Juan de Fuca, and on the west by the Pacific Ocean. In contrast, the southern portion in Washington is characterized by low-lying, rolling hills. The Puget Sound Region has a wet climate. Most of the streams entering Puget Sound have originated in glacier fields high in the mountains. Water from melting snowpacks and glaciers provide flow during the spring and winter. Annual rainfall in the lowlands ranges from 35 to 50 inches, from 75 to 100 inches in the foothills, and from 100 to >200 inches in the mountains (mostly in the form of snow). The western Cascades in Washington are composed of stable, volcanically derived rocks. They have low sediment-transport rates and stable beds composed largely of cobbles and boulders, which move only during extreme events. Velocities of river flow ranges from as little as 0.2

to 12 mph while large streams have an average annual flow of 10 cubic feet per second or greater. The Cascades and Blue mountains are similar in that they have more runs and glides and fewer pools, similar fish assemblages, and similar water quality.

Landscape setting. This habitat occurs throughout Washington. Ponds, lakes, and reservoirs are typically adjacent to Herbaceous Wetlands, while rivers and streams typically adjoin the Westside Riparian Wetlands, Eastside Riparian Wetlands, Herbaceous Wetlands, or Bays and Estuaries habitats.

Other Classifications and Key References. This habitat is called riverine and lacustrine in Anderson *et al.*, Cowardin *et al.*, Washington GAP Analysis Project, Mayer and Laudenslayer, and Wetzel. Other references describe elements of this habitat.

Effects of Management and Anthropogenic Impacts. Removal of gravel results in reduction of spawning areas for anadromous fish. Overgrazing, and loss of vegetation caused by logging produces increased water temperatures and excessive siltation, harming the invertebrate communities. Incorrectly installed culverts may act as barriers to migrating fish and may contribute to erosion and siltation downstream. Construction of dams is associated with changes in water quality, fish passage, competition between species, loss of spawning areas because of flooding, and declines in native fish populations. Historically, the region's rivers contained more braided multi-channels. Flood control measures such as channel straightening, diking, or removal of streambed material along with urban and agriculture development have all contributed to a loss of oxbows, river meanders, and flood plains. Unauthorized or over-appropriated withdrawals of water from the natural drainages also have caused a loss of open water habitat that has been detrimental to fish and wildlife production, particularly in the summer. Agricultural, industrial, and sewage runoff such as salts, sediments, fertilizers, pesticides, and bacteria harm aquatic species. Sludge and heavy waste buildup in estuaries is harmful to fish and shellfish. Unregulated aerial spraying of pesticides over agricultural areas also poses a threat to aquatic and terrestrial life. Direct loss of habitat and water quality occurs through irrigation. Very large floods may change the channels permanently through the settling of large amounts of sediments from hillslopes, through debris flow, and through movement of large boulders, particularly in the montane areas. Clearcutting creates excessive intermittent runoff conditions and increases erosion and siltation of streams as well as diminishes shade, and therefore causes higher water temperatures, fewer terrestrial and aquatic food organisms, and increased predation. Landslides, which contributed to the widening of the channel, were a direct result of clearcutting. Clearcut logging can alter snow accumulation and increase the size of peak flows during times of snowmelt. Clearcutting and vegetation removal affects the temperatures of streams, increasing them in the summer and decreasing in winter, especially in eastern parts of Washington. Building of roads, especially those of poor quality, can be a major contributor to sedimentation in the streams.

Status and Trends. The principal trend has been in relationship to dam building or channelization for hydroelectric power, flood control, or irrigation purposes. As an example, in 1994, there were >900 dams in Washington alone. The dams vary according to size, primary purpose, and ownership (state, federal, private, local). The first dam and reservoir in Washington was the Monroe Street Dam and Reservoir, built in 1890 at Spokane Falls. Since then the engineering and equipment necessary for dam building developed substantially, culminating in such projects as the Grand Coulee Dam on the Columbia River 214. In response to the damaging effects of dams on the indigenous biota and alteration and destruction of freshwater aquatic habitats, Washington state government questioned the benefits of dams, especially in light of the federal listing of several salmon species. There are now talks of possibly removing small dams to removing large federal dams like those on the lower Snake River,

Herbaceous Wetlands

Rex C. Crawford, Jimmy Kagan, and Christopher B. Chappell

Geographic Distribution. Herbaceous wetlands are found throughout the world and are represented in Washington wherever local hydrologic conditions promote their development. This habitat includes all wetlands except bogs and those within Subalpine Parkland and Alpine. Freshwater aquatic bed habitats are found throughout the Pacific Northwest, usually in isolated sites. They are more widespread in valley bottoms and high rainfall areas (e.g., Puget Trough, coastal terraces, coastal dunes), but are present in montane and arid climates as well. Hardstem bulrush-cattail-burred marshes occur in wet areas throughout Washington. Sedge meadows and montane meadows are common in 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 from sea level to 10,000 feet, although infrequently above 6,000 ft.

Landscape Setting. Herbaceous wetlands are found in all terrestrial habitats except Subalpine Parkland, Alpine Grasslands, and Shrublands habitats. Herbaceous wetlands commonly form a pattern with Westside and Eastside Riparian-Wetlands and Montane Coniferous Wetlands habitats along stream corridors. These marshes and wetlands also occur in closed basins in a mosaic with open water by lakeshores or ponds. Extensive deflation plain wetlands have developed between Coastal Dunes and Beaches habitat and the Pacific Ocean. Herbaceous wetlands are found in a mosaic with alkali grasslands in the Desert Playa and Salt Scrub habitat.

Structure. The herbaceous wetland habitat is generally a mix of emergent herbaceous plants with a grass-like life form (graminoids). These meadows often occur with deep or shallow water habitats with floating or rooting aquatic forbs. Various wetland communities are found in mosaics or in nearly pure stands of single species. Herbaceous cover is open to dense. The habitat can be comprised of tule marshes >6.6 ft tall or sedge meadows and wetlands <3.3 ft tall. It can be a dense, rhizomatous sward or a tufted graminoid wetland.

Graminoid wetland vegetation generally lacks many forbs, although the open extreme of this type contains a diverse forb component between widely spaced tall tufted grasses.

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 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*). Aquatic beds are part of this habitat and support a number of rooted aquatic plants, such as, yellow pond lily (*Nuphar lutea*) and unrooted, floating plants such as pondweeds (*Potamogeton* spp.), duckweed (*Lemna minor*), or water-meals (*Wolffia* spp.). Emergent herbaceous broadleaf plants, such as Pacific water parsley (*Oenanthe sarmentosa*), buckbean (*Menyanthes trifoliata*), water star-warts (*Callitriche* spp.), or bladderworts (*Utricularia* spp.) grow in permanent and semi-permanent standing water. Pacific silverweed (*Argentina egedii*) is common in coastal dune wetlands. Montane meadows occasionally are forb dominated with plants such as arrowleaf groundsel (*Senecio triangularis*) or lady fern (*Athyrium filix-femina*). Climbing nightshade (*Solanum dulcamara*), purple loosestrife (*Lythrum* salicaria), and poison hemlock (Conium maculatum) are common non-native forbs in wetland habitats. Shrubs or trees are not a common part of this herbaceous habitat although willow (*Salix* spp.) or other woody plants occasionally occur along margins, in patches or along streams running through these meadows.

Other Classifications and Key References. This habitat is called palustrine emergent wetlands in Cowardin *et al*. This habitat occurs in both lotic and lentic systems. National Wetland Inventory (NWI) calls this habitat palustrine shrubland. Other references describe elements of this habitat.

Natural Disturbance Regime. This habitat is maintained through a variety of hydrologic regimes that limit or exclude invasion by large woody plants. Habitats are permanently flooded, semi-permanently flooded, or flooded seasonally and may remain saturated through most of the growing season. Most wetlands are resistant to fire and those that are dry enough to burn usually burn in the fall. Most plants are sprouting species and recover quickly. Beavers play an important role in creating ponds and other impoundments in this habitat. Trampling and grazing by large native mammals is a natural process that creates habitat patches and influences tree invasion and success.

Succession and Stand Dynamics. Herbaceous wetlands are often in a mosaic with shrub- or tree-dominated wetland habitat. Woody species can successfully invade emergent wetlands when this herbaceous habitat dries. Emergent wetland plants invade open-water habitat as soil substrate is exposed; e.g., aquatic sedge and Northwest Territory sedge

(*Carex utriculata*) are pioneers following beaver dam breaks. As habitats flood, woody species decrease to patches on higher substrate (soil, organic matter, large woody debris) and emergent plants increase unless the flooding is permanent. Fire suppression can lead to woody species invasion in drier herbaceous wetland habitats.

Effects of Management and Anthropogenic Impacts. 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. If the alteration is long term, wetland systems may reestablish to reflect new hydrology, e.g., cattail is an aggressive invader in roadside ditches. Severe livestock grazing and trampling decreases aquatic sedge, Northwest Territory sedge (*Carex utriculata*), bluejoint reedgrass, and tufted hairgrass. Native species, however, such as Nebraska sedge, Baltic and jointed rush (*Juncus nodosus*), marsh cinquefoil (*Comarum palustris*), and introduced species dandelion (*Taraxacum officinale*), Kentucky bluegrass, spreading bentgrass (*Agrostis stolonifera*), and fowl bluegrass (*Poa palustris*) generally increase with grazing.

Status and Trends. Nationally, herbaceous wetlands have declined and the Pacific Northwest is no exception. These wetlands receive regulatory protection at the national, state, and county level; still, herbaceous wetlands have been filled, drained, grazed, and farmed extensively in the lowlands of Oregon and Washington. Montane wetland habitats are less altered than lowland habitats even though they have undergone modification as well. 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. Herbaceous wetlands are susceptible to exotic, noxious plant invasions.

Westside Riparian-Wetlands

Christopher B. Chappell and Jimmy Kagan

Geographic Distribution. This habitat is patchily distributed in the lowlands throughout the area west of the Cascade Crest. It also occurs less extensively at mid- to higher elevations in the Cascade and Olympic mountains, where it is limited to more specific environments.

Physical Setting. This habitat is characterized by wetland hydrology or soils, periodic riverine flooding, or perennial flowing freshwater. The climate varies from very wet to moderately dry and from mild to cold. Mean annual precipitation ranges from 20 to >150 inches per year. This habitat is found at elevations mostly below 3,000 ft, but it does extend up to 5,500 ft in the form of Sitka alder communities. Wetlands above these elevations are generally considered part of the Subalpine Parkland habitat and are not included here. Topography is typically flat to gently sloping or undulating, but can include moderate to steep slopes in the mountains. Geology is extremely variable. Gleyed or mottled mineral soils, organic soils, or alluvial soils are typical. Flooding regimes include permanently flooded (aquatic portions of small streams), seasonally flooded, saturated, and temporarily flooded. Nutrient-poor acidic bogs, except those high in the mountains, are considered part of this habitat.

Landscape Setting. This habitat typically occupies patches or linear strips within a matrix of forest or regrowing forest. The most frequent matrix habitat is Westside Lowlands Conifer-Hardwood Forest. If not forest, the matrix can be Agriculture, Urban, or Coastal Dunes and Beaches habitats, or rarely Westside Grasslands or Ceanothus-Manzanita Shrublands. This habitat also forms mosaics with or includes small patches of Herbaceous Wetlands. Open Water habitat is often adjacent to Westside Riparian-Wetlands. The major land use of the forested portions of this habitat is timber harvest. Livestock grazing occurs in some areas. Peat mining occurs in some bogs.

Structure. Most often this habitat is either a tall (6-30 ft) deciduous broadleaf shrubland, woodland or forest, or some mosaic of these. Short to medium-tall evergreen shrubs or graminoids and mosses dominate portions of bogs. Trees are evergreen conifers or deciduous broadleaf or a mixture of both. Conifer-dominated wetlands in the lowlands are included here, whereas mid-elevation conifer sites are part of Montane Coniferous Wetlands habitat. Height of the dominant vegetation can be >200 ft. Canopy height and structure vary greatly. Typical understories are composed of shrubs, forbs, and/or graminoids. Water is sometimes present on the surface for a portion of the year. Large woody debris is abundant in late seral forests and adjacent stream channels. Small stream channels and small backwater channels on larger streams are included in this habitat.

Composition. Red alder (*Alnus rubra*) is the most widespread tree species, but is absent from sphagnum bogs. Other deciduous broadleaf trees that commonly dominate or co-dominate include black cottonwood (*Populus balsamifera* ssp. *trichocarpa*), bigleaf maple (*Acer macrophyllum*), and Oregon ash (*Fraxinus latifolia*). Pacific willow (*Salix lucida* ssp. *lasiandra*) can form woodlands on major floodplains or co-dominate with other willows in tall shrublands. Conifers that frequently dominate or co-dominate include western redcedar (*Thuja plicata*), western hemlock (*Tsuga heterophylla*), and Sitka spruce (*Picea sitchensis*). Grand fir (*Abies grandis*) sometimes co-dominates, especially in drier climates and riverine flood plains. Douglas-fir (*Pseudotsuga menziesii*) is relatively uncommon. Shore pine (*Pinus contorta* var. *contorta*) is common in bogs and in deflation plain wetlands along the outer coast. Dominant species in tall shrublands include Sitka willow (*Salix sitchensis*), Hooker's willow (*Salix hookeriana*), Douglas' spirea (*Spiraea douglasii*), red-osier dogwood (*Cornus sericea*), western crabapple (*Malus fusca*), salmonberry (*Rubus spectabilis*), stink currant (*Ribes bracteosum*), devil's club (*Oplopanax horridus*), and sweet gale (*Myrica gale*). Labrador tea (*Ledum groenlandicum, L. glandulosum*), western swamp-laurel (*Kalmia microphylla*), sweet gale, and salal (*Gaultheria shallon*) often dominate sphagnum bogs. Vine maple (*Acer circinatum*) or Sitka alder (*Alnus viridis* ssp. *sinuata*) dominate tall shrublands in the mountains that are located on moist talus or in snow avalanche tracks.

Forests and willow, spirea, and dogwood shrublands within this habitat are limited to the area west of the Cascade Crest. Oregon ash communities occur primarily in the southern Puget Lowland (King County south) ecoregion. Sitka spruce communities are mainly found in the Coast Range area and western Olympic Peninsula in areas of coastal fog influence. Sitka alder and vine maple communities are located in the mountains, mainly in western Washington but to a lesser degree on the east slope of the Cascades. Sweet gale communities are found primarily at low elevations on the western Olympic Peninsula. Lodgepole pine-dominated communities are found as bogs in western Washington. Most sphagnum bogs are found in low elevation western Washington.

Shrubs that commonly dominate underneath a tree layer include salmonberry, salal, vine maple, red-osier dogwood, stink currant, Labrador tea, devil's club, thimbleberry (*Rubus parviflorus*), common snowberry (*Symphoricarpos albus*), beaked hazel (*Corylus cornuta*), and Pacific ninebark (*Physocarpus capitatus*). Understory dominant herbs include slough sedge (*Carex obnupta*), Dewey sedge (*C. deweyana*), Sitka sedge (*C. aquatilis* var. *dives*), skunk cabbage (*Lysichiton americanus*), coltsfoot (*Petasites frigidus*), great hedge-nettle (*Stachys ciliata*), youth-on-age (*Tolmiea menziesii*), lady fern (*Athyrium filix-femina*) oxalis (*Oxalis oregana, O. trillifolia*), stinging nettle (*Urtica dioica*), sword fern (*Polystichum munitum*), great burnet (*Sanguisorba officinalis*), scouring rush (*Equisetum hyemalis*), blue wildrye (*Elymus glaucus*), Pacific golden saxifrage (*Chrysoplenium glechomifolium*), and field horsetail (*Equisetum arvense*). Bogs often have areas dominated by more than one species of sedge (*Carex* spp.) or beakrush (*Rhynchospora alba*) and sphagnum moss (*Sphagnum* spp.) that are included within this habitat, despite their lack of woody vegetation. Sphagnum moss is a major ground cover in most bogs.

Other Classifications and Key References. This habitat includes all palustrine, forested wetlands and scrub-shrub wetlands at lower elevations on the westside as well as a small subset of persistent emergent wetlands, those within sphagnum bogs. However, drier portions of this habitat in riparian flood plains may not qualify as wetlands according to Cowardin's definition. They are associated with both lentic and lotic systems. Much of this habitat is probably not mapped as distinct types by the Gap projects because of its relatively small scale on the landscape and the difficulty of distinguishing forested wetlands. In the Washington Gap project, this habitat occupies portions of open water/wetlands (especially riparian), hardwood forest, and mixed hardwood/conifer forest, and to a minor degree, conifer forest in the following zones: Western hemlock, Sitka spruce, Olympic Douglas-fir, Puget Sound Douglas-fir, Cowlitz River, and Woodland/prairie mosaic. This habitat also occupies much of hardwood forest in the Silver fir, Mountain hemlock portions of Subalpine fir, Interior western hemlock/redcedar, and Grand fir zones. Other references describe this habitat.

Natural Disturbance Regime. The primary natural disturbance is flooding. Flooding frequency and intensity vary greatly with hydrogeomorphic setting. Floods can create new surfaces for primary succession, erode existing streambank communities, deposit sediment and nutrients on existing communities, and selectively kill species not adapted to a particular duration or intensity of flood. Most plant communities are more or less adapted to a particular flooding regime, or they occupy a specific time in a successional sequence after a major disturbance. Debris flows/torrents are also an important, typically infrequent,

and severe disturbance where topography is mountainous. Fires were probably infrequent or absent because of the combination of landscape position and site moisture, although fires within the watershed would usually have effects on the habitat through impacts on flooding, sedimentation, and large woody debris inputs. Windthrow of trees can also be significant, especially near important disturbances by changing the hydrology of a stream system through dams. Grazing by native ungulates, e.g. elk, can have a major effect on vegetation.

Succession and Stand Dynamics. Riparian, i.e., streamside, habitats are extremely dynamic. Succession varies greatly depending on the hydrogeomorphic environment. A typical sequence on a riparian terrace on a large stream involves early dominance by Sitka willow, mid-seral dominance by red alder or cottonwood, with a gradual increase in conifers, and eventual late-seral dominance of spruce, redcedar, and/or hemlock. Such a sequence corresponds with increasing terrace height above the bankfull stream stage. Some communities in bogs or depressional wetlands, as opposed to riverine, seem to be relatively stable given a particular flooding regime and environment. Successional sequences are not completely understood and can be complex. Beaver dams or other alterations of flood regime often result in vegetation changes.

Effects of Management and Anthropomorphic Impacts. Intense logging disturbance in conifer or mixed riparian or wetland forests, except bogs, often results in establishment of red alder, and its ensuing long-term dominance. Salmonberry responds similarly to this disturbance and tends to dominate the understory. Logging activities reduce amounts of large woody debris in streams and remove sources of that debris. Timber harvest can also alter hydrology, most often resulting in post-harvest increases in peak flows. Mass wasting and related disturbances (stream sedimentation, debris torrents) in steep topography increase in frequency with road building and timber harvest. Roads and other water diversion/retention structures change watershed hydrology with wide-ranging and diverse effects, including major vegetation changes. The most significant of these are the major flood controlling dams, which have greatly altered the frequency and intensity of bottomland flooding. Increases in nutrients and pollutants are other common anthropogenic impacts, the former with particularly acute effects in bogs. Reed canarygrass (Phalaris arundinacea) is an abundant non-native species in low-elevation, disturbed settings dominated by shrubs or deciduous trees. Many other exotic species occur.

Status and Trends. This habitat occupies relatively small areas and has declined greatly in extent with conversion to urban development and agriculture. What remains is mostly in poor condition, having experienced any of various anthropogenic impacts that have degraded the functionality of these ecosystems: channeling, diking, dams, logging, road building, invasion of exotic species, changes in hydrology and nutrients, and livestock grazing. Current threats include all of the above as well as development. Some protection has been afforded to this habitat through government regulations that vary in their scope and enforcement with jurisdiction. Of the 77 plant associations representing this habitat in the National Vegetation Classification, almost half are considered imperiled or critically imperiled.

Montane Coniferous Wetlands

Christopher B. Chappell

Geographic Distribution. This habitat occurs in mountains throughout much of Washington. This includes the Cascade Range, Olympic Mountains, Okanogan Highlands and Blue 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. Elevation is mid- to upper montane, as low as 2,000 ft in northern Washington, to as high as 9,500 ft. 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.

Landscape Setting. This habitat occurs along stream courses or as patches, typically small, within a matrix of Montane Mixed Conifer Forest, or less commonly, Eastside Mixed Conifer Forest or Lodgepole Pine Forest and Woodlands. It also can occur adjacent to other wetland habitats: Eastside Riparian-Wetlands, Westside Riparian-Wetlands, or Herbaceous Wetlands. The primary land uses are forestry and watershed protection.

Structure. This is a forest or woodland (>30 percent tree canopy cover) dominated by evergreen conifer trees. Deciduous broadleaf trees are occasionally co-dominant. The understory is dominated by shrubs (most often deciduous and relatively tall), forbs, or graminoids. The forb layer is usually well developed even where a shrub layer is dominant. Canopy structure includes single-storied canopies and complex multi-layered ones. Typical tree sizes range from small to very large. Large woody debris is often a prominent feature, although it can be lacking on less productive sites.

Composition. Indicator tree species for this habitat, any of which can be dominant or co-dominant, are Pacific silver fir (*Abies amabilis*), mountain hemlock (*Tsuga mertensiana*), and Alaska yellow-cedar (*Chamaecyparis nootkatensis*) on the westside, and Engelmann spruce (*Picea engelmannii*), subalpine fir (*Abies lasiocarpa*), western hemlock (*T. heterophylla*), or western redcedar (*Thuja plicata*) on the eastside. Western hemlock and redcedar are common associates with silver fir on the westside. They are diagnostic of this habitat on the east slope of the central Washington Cascades, and in the Okanogan Highlands, but are not diagnostic there. 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 devil's-club (*Oplopanax horridus*), stink currant (*Ribes bracteosum*), black currant (*R. hudsonianum*), swamp gooseberry (*R. lacustre*), salmonberry (*Rubus spectabilis*), red-osier dogwood (*Cornus sericea*), Douglas' spirea (*Spirea douglasii*), common snowberry (*Symphoricarpos albus*), mountain alder (*Alnus incana*), Sitka alder (*Alnus viridis* ssp. *sinuata*), Cascade azalea (*Rhododendron albiflorum*), and glandular Labrador-tea (*Ledum glandulosum*). 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*). Graminoids that may dominate the understory include bluejoint reedgrass (*Calamagrostis canadensis*), Holm's Rocky Mountain sedge (*Carex scopulorum*), widefruit sedge (*C. angustata*), and fewflower spikerush (*Eleocharis quinquiflora*). Some of the most abundant forbs and ferns are lady fern (*Athyrium filix-femina*), western oak fern (*Gymnocarpium dryopteris*), field horsetail (*Equisetum arvense*), arrowleaf groundsel (Senecio triangularis), two-flowered marsh marigold (*Caltha leptosepala* ssp. *howellii*), false bugbane (*Trautvetteria carolinensis*), skunk-cabbage (*Lysichiton americanus*), twinflower (*Linnaea borealis*), western bunchberry (*Cornus unalaschkensis*), clasping-leaved twisted-stalk (*Streptopus amplexifolius*), singleleaf foamflower (*Tiarella trifoliata* var. *unifoliata*), and five-leaved bramble (*Rubus pedatus*).

Other Classifications and Key References. This habitat includes nearly all of the wettest forests within the *Abies amabilis* and *Tsuga mertensiana* zones of western Washington and most of the wet forests in the *Tsuga heterophylla* and *Abies lasiocarpa* zones of eastern Washington. On the eastside, they may extend down into the *Abies grandis* zone also. This habitat is not well represented by the GAP projects because of its relatively limited acreage and the difficulty of identification from satellite images. These are primarily palustrine forested wetlands with a seasonally flooded, temporarily flooded, or saturated flooding regime. They occur in both lotic and lentic systems. Other references describe elements of this habitat.

Natural Disturbance Regime. Flooding, debris flow, fire, and wind are the major natural disturbances. Many of these sites are seasonally or temporarily flooded. Floods vary greatly in frequency depending on fluvial position. Floods can deposit new sediments or create new surfaces for primary succession. Debris flows/torrents are major scouring events that reshape stream channels and riparian surfaces, and create opportunities for primary succession and redistribution of woody debris. Fire is more prevalent east of the Cascade Crest. Fires are typically high in severity and can replace entire stands, as these tree species have low fire resistance. Although fires have not been studied specifically in these wetlands, fire frequency is probably low. These wetland areas are less likely to burn than surrounding uplands, and so may sometimes escape extensive burns as old forest refugia. Shallow rooting and wet soils are conducive to windthrow, which is a common small-scale disturbance that influences forest patterns. Snow avalanches probably disturb portions of this habitat in the northwestern Cascades and Olympic Mountains. Fungal pathogens and insects also act as important small-scale natural disturbances.

Succession and Stand Dynamics. Succession has not been well studied in this habitat. Following disturbance, tall shrubs may dominate for some time, especially mountain alder, stink currant, salmonberry, willows (*Salix* spp.), or Sitka alder. Quaking aspen and black cottonwood in these habitats probably regenerate primarily after floods or fires, and decrease in importance as succession progresses. Pacific silver fir, subalpine fir, or Engelmann spruce would be expected to increase in importance with time since the last major disturbance. Western hemlock, western redcedar, and Alaska yellow-cedar typically maintain co-dominance as stand development progresses because of the frequency of small-scale disturbances and the longevity of these species. Tree size, large woody debris, and canopy layer complexity all increase for at least a few hundred years after fire or other major disturbance.

Effects of Management and Anthropogenic Impacts. Roads and clearcut logging practices can increase the frequency of landslides and resultant debris flows/torrents, as well as sediment loads in streams. This in turn alters hydrologic patterns and the composition and structure of montane riparian habitats. Logging typically reduces large woody debris and canopy structural complexity. Timber harvest on some sites can cause the water table to rise and subsequently prevent trees from establishing. Wind disturbance can be greatly increased by timber harvest in or adjacent to this habitat.

Status and Trends. This habitat is naturally limited in its extent and has probably declined little in area over time. Portions of this habitat have been degraded by the effects of logging, either directly on site or through geohydrologic modifications. 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.

Eastside (Interior) Riparian-Wetlands
Rex C. Crawford and Jimmy Kagan

Geographic Distribution. Riparian and wetland habitats dominated by woody plants are found throughout eastern Washington. Mountain alder-willow riparian shrublands are major habitats in the forested zones of eastern Washington. Eastside lowland willow and other riparian shrublands are the major riparian types throughout eastern Washington at lower elevations. Black cottonwood riparian habitats occur throughout eastern Washington, at low to middle elevations. White alder riparian habitats are restricted to perennial streams at low elevations, in drier climatic zones in Hells Canyon at the border of Oregon, Washington, and Idaho, and in western Klickitat and south central Yakima counties, Washington. Quaking aspen wetlands and riparian habitats are widespread but rarely a major component throughout eastern Washington. Ponderosa pine-Douglas-fir riparian habitat occurs only around the periphery of the Columbia Basin in Washington and up into lower montane forests.

Physical Setting. Riparian habitats appear along perennial and intermittent rivers and streams. This habitat also appears in impounded wetlands and along lakes and ponds. Their associated streams flow along low to high gradients. The riparian and wetland forests are usually in fairly narrow bands along the moving water that follows a corridor along montane or valley streams. The most typical stand is limited to 100-200 ft from streams. Riparian forests also appear on sites subject to temporary flooding during spring runoff. Irrigation of streamsides and toeslopes provides more water than precipitation and is important in the development of this habitat, particularly in drier climatic regions. Hydrogeomorphic surfaces along streams supporting this habitat have seasonally to temporarily flooded hydrologic regimes. Eastside riparian and wetland habitats are found from 100-9,500 ft in elevation.

Landscape Setting. Eastside riparian habitats occur along streams, seeps, and lakes within the Eastside Mixed Conifer Forest, Ponderosa Pine Forest and Woodlands, Western Juniper and Mountain Mahogany Woodlands, and part of the Shrub-steppe habitat. This habitat may be described as occupying warm montane and adjacent valley and plain riparian environments.

Structure. The Eastside riparian and wetland habitat contains shrublands, woodlands, and forest communities. Stands are closed to open canopies and often multi-layered. A typical riparian habitat would be a mosaic of forest, woodland, and shrubland patches along a stream course. The tree layer can be dominated by broadleaf, conifer, or mixed canopies. Tall shrub layers, with and without trees, are deciduous and often nearly completely closed thickets. These woody riparian habitats have an undergrowth of low shrubs or dense patches of grasses, sedges, or forbs. Tall shrub communities (20- 98 ft, occasionally tall enough to be considered woodlands or forests) can be interspersed with sedge meadows or moist, forb-rich grasslands. Intermittently flooded riparian habitat has ground cover composed of steppe grasses and forbs. Rocks and boulders may be a prominent feature in this habitat.

Composition. Black cottonwood (*Populus balsamifera* ssp. *trichocarpa*), quaking aspen (*P. tremuloides*), white alder (*Alnus rhombifolia*), peachleaf willow (*Salix amygdaloides*) and, in northeast Washington, paper birch (*Betula papyrifera*) are dominant and characteristic tall deciduous trees. Water birch (B. occidentalis), shining willow (*Salix lucida* ssp. *caudata*) and, rarely, mountain alder (*Alnus incana*) are co-dominant to dominant mid-size deciduous trees. Each can be the sole dominant in stands. Conifers can occur in this habitat, rarely in abundance, more often as individual trees. The exception is ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*) that characterize a conifer-riparian habitat in portions of the shrub-steppe zones. A wide variety of shrubs are found in association with forest/ woodland versions of this habitat. Red-osier dogwood (*Cornus sericea*), mountain alder, gooseberry (*Ribes* spp.), rose (*Rosa* spp.), common snowberry (*Symphoricarpos albus*) and Drummonds willow (*Salix drummondii*) are important shrubs in this habitat. Bog birch (*B. nana*) and Douglas spirea (*Spiraea douglasii*) can occur in wetter stands. Red-osier dogwood and common snowberry are shade-tolerant and dominate stand interiors, while these and other shrubs occur along forest or woodland edges and openings. Mountain alder is frequently a prominent shrub, especially at middle elevations. Tall shrubs (or small trees) often growing under or with white alder include chokecherry (*Prunus virginiana*), water birch, shining willow, and netleaf hackberry (*Celtis reticulata*). Shrub-dominated communities contain most of the species associated with tree communities. Willow species (*Salix bebbiana, S. boothii, S. exigua, S geyeriana*, or *S. lemmonii*) dominate many sites. Mountain alder can be dominant and is at least codominant at many sites. Chokecherry, water birch, serviceberry (*Amelanchier alnifolia*), black hawthorn (*Crataegus douglasii*), and red-osier dogwood can also be codominant to dominant. Shorter shrubs, Woods rose, spirea, snowberry and gooseberry are usually present in the undergrowth. The herb layer is highly variable and is composed of an assortment of graminoids and broadleaf herbs. Native grasses (*Calamagrostis canadensis, Elymus glaucus*, *Glyceria* spp., and *Agrostis* spp.) and sedges (*Carex aquatilis, C. angustata, C. lanuginosa, C. lasiocarpa, C. nebrascensis, C. microptera*, and *C. utriculata*) are significant in many habitats. Kentucky bluegrass (*Poa pratensis*) can be abundant where heavily grazed in the past. Other weedy grasses, such as orchard grass (*Dactylis glomerata*), reed canarygrass (*Phalaris arundinacea*), timothy (*Phleum pratense*), bluegrass (*Poa bulbosa, P. compressa*), and tall fescue (Festuca arundinacea) often dominate disturbed areas. A short list of the great variety of forbs that grow in this habitat includes Columbian monkshood (*Aconitum columbianum*), alpine leafybract aster (*Aster foliaceus*), lady fern (*Athyrium filix-femina*), field horsetail (*Equisetum arvense*), cow parsnip (*Heracleum maximum*), skunk cabbage (*Lysichiton americanus*), arrowleaf groundsel (*Senecio triangularis*), stinging nettle (*Urtica dioica*), California false hellebore (*Veratrum californicum*), American speedwell (*Veronica americana*), and pioneer violet (*Viola glabella*).

Other Classifications and Key References. This habitat is called Palustrine scrub-shrub and forest in Cowardin *et al*. This habitat occurs in both lotic and lentic systems. Other references describe elements of this habitat.

Natural Disturbance Regime. This habitat is tightly associated with stream dynamics and hydrology. Flood cycles occur within 20-30 years in most riparian shrublands although flood regimes vary among stream types. Fires recur typically every 25-50 years but fire can be nearly absent in colder regions or on topographically protected streams. Rafted ice and logs in freshets may cause considerable damage to tree boles in mountain habitats. Beavers crop younger cottonwood and willows and frequently dam side channels in these stands. These forests and woodlands require various flooding regimes and specific substrate conditions for reestablishment. Grazing and trampling is a major influence in altering structure, composition, and function of this habitat; some portions are very sensitive to heavy grazing.

Succession and Stand Dynamics. Riparian vegetation undergoes "typical" stand development that is strongly controlled by the site's initial conditions following flooding and shifts in hydrology. The initial condition of any hydrogeomorphic surface is a sum of the plants that survived the disturbance, plants that can get to the site, and the amount of unoccupied habitat available for invasions. Subsequent or repeated floods or other influences on the initial vegetation select species that can survive or grow in particular life forms. A typical woody riparian habitat dynamic is the invasion of woody and herbaceous plants onto a new alluvial bar away from the main channel. If the bar is not scoured in 20 years, a tall shrub and small deciduous tree stand will develop. Approximately 30 years without disturbance or change in hydrology will allow trees to overtop shrubs and form woodland. Another 50 years without disturbance will allow conifers to invade and in another 50 years a mixed hardwood-conifer stand will develop. Many deciduous tall shrubs and trees cannot be invaded by conifers. Each stage can be reinitiated, held in place, or shunted into different vegetation by changes in stream or wetland hydrology, fire, grazing, or an interaction of those factors.

Effects of Management and Anthropogenic Impacts. Management effects on woody riparian vegetation can be obvious, e.g., removal of vegetation by dam construction, roads, logging, or they can be subtle, e.g., removing beavers from a watershed, removing large woody debris, or construction of a weir dam for fish habitat. In general, excessive livestock or native ungulate use leads to less woody cover and an increase in sod-forming grasses particularly on fine-textured soils. Undesirable forb species, such as stinging nettle and horsetail, increase with livestock use.

Status and Trends. Cottonwood-Willow cover type covers significantly less in area now than before 1900 in the Inland Pacific Northwest. The authors concluded that although riparian shrubland was a minor part of the landscape, occupying two percent, they estimated it to have declined to 0.5 percent of the landscape. Approximately 40 percent of riparian shrublands occurred above 3,280 ft in elevation pre-1900; now nearly 80 percent is found above that elevation. This change reflects losses to agricultural development, roading, dams and other flood-control activities. The current riparian shrublands contain many exotic plant species and generally are less productive than historically. Riparian woodland has always been rare and the change in extent from the past is substantial.

Coastal Dunes and Beaches

Christopher B. Chappell, David H. Johnson and Jimmy Kagan

Geographic Distribution. This habitat occurs primarily along the outer coast of southern Washington. It occurs mainly in Grays Harbor and Pacific counties, and sporadically along the inland marine waters of Clallam, San Juan, Skagit, Jefferson, Whatcom, King, Pierce, Kitsap, Snohomish, and Island counties.

Physical Setting. This habitat occurs primarily in wet, mild outer coastal climates. Precipitation, almost always rain, typically averages >80 inches annually. Summers are relatively dry, but fog is common. Elevation is at and very near sea level, only extending as high as the highest dunes. Topography is mildly to strongly undulating in the form of mostly north-south trending dune ridges and troughs. Soils, when present, are always sandy and are underlain by deep deposits of sand, thereby creating edaphically dry sites. Soils are also very poor in nutrients and organic matter. These dunes, spits, and berms are derived from sand carried by longshore drift and wind erosion. Dunes consist of several types that differ in their physical form, including foredunes, transverse dunes, parabola dunes, and retention ridges. Outlier examples away from the outer coast in the Puget Trough are small in extent, occur in a drier climate, and mainly occur in the form of sand spits and berms as opposed to dunes.

Landscape Setting. This habitat occurs in a natural mosaic with Westside Lowland Conifer-Hardwood Forest, Westside Riparian-Wetlands, and Herbaceous Wetlands. Forests adjacent to this habitat are found on stabilized dunes and are dominated by shore pine (*Pinus contorta* var. *contorta*) and Sitka spruce (*Picea sitchensis*). wooded, shrubby, and herbaceous wetlands occur in seasonally flooded deflation plains or dune troughs. Hooker's willow (*Salix hookeriana*) and slough sedge (*Carex obnupta*) are the two most characteristic species in these wetlands. This habitat is in a mosaic with the Urban habitat, as coastal areas have been developed extensively for tourism and low-density residential uses. Recreation is a major land use and includes the use of off-road vehicles. In southern Washington, the wetlands are often converted to agriculture for cranberries.

Structure. This habitat consists of a variable mosaic of structures ranging from open sand with sparse herbaceous vegetation to dense shrublands. Trees are typically absent but may be scattered. Unstabilized sand may have very little vegetation or open short grasslands or forb-dominated communities, though these are now relatively uncommon and local. Medium-tall grasslands, typically closed, are a major component in the current landscape. Tall broadleaf evergreen shrubs, typically dense, are also a significant component of the mosaic.

Composition. Where they are vegetated, Unstabilized dunes or strand are typically dominated or co-dominated by American dunegrass (*Leymus mollis*), dune bluegrass (*Poa macrantha*), or Chinook lupine (*Lupinus littoralis*). Red fescue (*Festuca rubra*) was once a major dominant on more stabilized dunes but has been largely replaced by European beachgrass (*Ammophila arenaria*), an introduced species that is now the most common dune grass. Many forb species are largely confined to herb-dominated dunes or strand and may take on local importance. Tall shrublands are dominated primarily by salal (*Gaultheria shallon*) and evergreen huckleberry (*Vaccinium ovatum*), but may also have prominent amounts of hairy manzanita (*Arctostaphylos columbiana*), kinnikinnick (*Arctostaphylos uva-ursi*), bush lupine (*Lupinus arboreus*), or California wax-myrtle (*Myrica californica*). Both Scot's broom (*Cytisus scoparius*) and gorse (*Ulex europaeus*) are exotic shrubs that dominate disturbed areas. Scattered trees are mainly shore pine (*Pinus contorta* var. *contorta*), or, less commonly, Sitka spruce (*Picea sitchensis*).

Other Classifications and Key References. Franklin and Dyrness called this habitat sand dune and strand communities. This habitat is not well represented by the Washington Gap project: it takes up small percentages of several types in the Sitka spruce zone, including conifer forest, hardwood forests, and coastline, sandy beaches, and rocky islands. Other references describe this habitat.

Natural Disturbance Regime. Erosion and deposition of sand are the primary natural processes controlling this habitat. Sand is deposited initially on beaches, and the moved into dunes through wind erosion. Wind also maintains Unstabilized dune areas. Major winter storm events may result in blowouts that create holes in existing stabilized or Unstabilized dunes, crating new areas of sand deposition.

Succession and Stand Dynamics. The different structural variants of the mosaic within this habitat are primarily stages in succession from freshly deposited stand to completely stabilized shrub-dominated dunes. Unstabilized sand, such as foredunes with little European beachgrass, has the most open and herbaceous vegetation. Closing of the vegetation typically results in stabilization of the sand. Recently stabilized dunes are now primarily dominated by European beachgrass. Given more time without a major disturbance, shrubs and/or trees colonize the grasslands. Shrublands are sometimes an intermediate stage in succession toward forests. Pine woodlands are another very common intermediate stage. Eventually, pine woodlands are colonized by Sitka spruce or Douglas-fir and become mixed pine-spruce or pine-Douglas-fir forests. Any one of these stages can be set back to sand by a blowout or reburial by dunes, and a cyclic successional sequence is common in many areas.

Effects of Management and Anthropogenic Impacts. European beachgrass has been extensively planted for stabilization purposes and has also spread widely on its own. Unstabilized sand is now a relatively rare condition primarily because of the introduction of this species. The physical forms of dunes also have been altered by beachgrass. Forests are probably forming at a greater rate than they did in the past because of increased stabilization. Exotic species, especially sweet vernalgrass (Anthoxanthum odoratum) and common velvetgrass (Holcus lanatus), are now a nearly ubiquitous component of herb-dominated communities. The spread of such species may be related to past livestock grazing in many areas. Scot's broom and gorse are aggressive exotic shrub invaders that were planted for stabilization and have spread widely. Since both are legumes, they result in major nitrogen increases where they establish. Off-road vehicle use has resulted in complete destruction of native herbaceous communities in some areas. Trampling is a potential threat in herbaceous communities.

Status and Trends. This habitat covers a relatively limited area and major expanses of it have been converted to other uses. The vast majority of herbaceous vegetation that remains is in poor condition, being dominated by exotic species. Current tends are probably decreasing in both extent and condition because of continued development in coastal areas and continuing expansion of exotic species into the few remaining native-dominated areas. Six of 11 plant associations currently listed in the National Vegetation Classification representing this habitat are considered imperiled or critically imperiled.

Bays and Estuaries

Mikell O'Mealy and David H. Johnson

Geographic Distribution. This habitat reflects areas with significant mixing of salt and freshwater, including lower reaches of rivers, intertidal sand and mud flats, saltwater and brackish marshes, and open-water portions of associated bays. The habitat is distributed along the marine coast and shoreline of Washington. There are 34 principal bays and estuaries in Washington. The Columbia River estuary is the largest estuary in the Pacific Northwest. This habitat does not include open water areas of Puget Sound (see Inland Marine Deeper Waters). The greater Puget Sound at times is considered a very large estuary; for purposes of this project, Puget Sound is comprised of three wildlife habitats: Bays and Estuaries, Marine Nearshore, and Inland Marine Deeper Waters.

Physical Setting. Climate is moderated by the Pacific Ocean and is usually mild. Mean temperatures at coastal stations generally range from 40 to 70°F year-round with little north-south variation. Annual rainfall along the coastal zone averages 80 to 90 inches and is concentrated in winter months, producing correspondingly high river runoff to bays and estuaries. Elevation is at sea level to a few feet above. Coastal zone topography is characterized by long stretches of sandy beaches broken by steep rocky cliffs, rocky headlands, and the mouths of bays and estuaries. Organics, silt, and sand are the primary substrate components of this habitat and very in specific composition and distribution with variable physical factors.

Landscape Setting. This habitat is adjacent to Westside Riparian-Wetlands, Coastal Dunes and Beaches, Westside Lowland Conifer-Hardwood Forest, Coastal Headlands and Islets, Marine Nearshore, and Inland Marine Deeper Waters habitats. Major uses of bays and estuaries are recreation, tourism, the shellfish industry, and navigation. The terrestrial interface portions of this habitat have been extensively converted for agricultural crop production, livestock grazing, and residential and commercial development. Water channels of many areas have been dredged for ship navigation.

Structure. At the most seaward extent (e.g. river mouths), water depths are shallow (mostly <20 ft) except for dredged channels. This habitat is strongly influenced by the daily tides and currents. Depending on location, mean higher high water to mean lower low water ranges from 6.1 to 10.2 ft. Tidal currents in channels of the principal estuaries typically range from 1 to 5 knots.

Diverse habitats result from riverine discharges and tidal fluxes, salinity, mixing, sedimentation, discharge, and insolation. Unconsolidated or consolidated tideflats are composed of rocks, gravel, sand, silt and clay as well as abundant organic material. Inundated by daily tidal flows, tideflats may support eelgrass, various algal species, and invertebrate communities. Eelgrass meadows create protected environments and structured habitats for various wildlife species. Salt marshes form at the upper tidal boundary above tideflats. Salt marshes are usually open to closed graminoid or forb communities. Highly branched estuarine channels drain across salt marshes and tideflats, creating a diverse mix of structures. At the most inland extent of this habitat, transitional marsh forms between salt marshes and bordering upland vegetation dominated by grass or woody vegetation.

The Columbia River estuary is characterized as a partially mixed estuary and can be divided into three sections along the salinity gradient: from the mouth to about river mile 7 it is basically marine; from river mile 7 to mile 23 it is transitional (mixing); and above river mile 23 it is fluvial (fresh water).

Composition. Eelgrass meadows stabilize submerged tideflats and are co-dominated by surfgrass and eelgrass species. Three diagnostic surfgrass species (*Phyllospadix scouleri, P. torreyi, P. serrulatus*) occur on rocky substrates in exposed waters, whereas two species of eelgrasses (*Zostera marina, Z. japonica*) are characteristic of mud or mixed mud-sand substrates in areas sheltered from turbulent waters. Highly productive macroalgae that dominate estuarine channels include various blue-green algae, green algae (*Enteromorpha* spp.) and rockweed (*Fucus* spp.). Tideflats bordering salt marshes often are co-dominated by pickleweed (*Salicornia virginica*), arrowgrass (*Triglochin maritima*) and three-square rush (Scirpus americanus). The transition to higher areas of the low-marsh zone is indicated by the dominance of jaumea (*Jaumea carnosa*), saltgrass (*Distichlis spicata*), and Lyngby's sedge (*Carex lyngbyei*). Major components of mid- and high salt marsh areas are alkaligrass (*Puccinellia pumila*) and Canadian sand spurry (*Spergularia canadensis*). Salt rush (*Juncus lesueurii*), tufted hairgrass (*Deschampsia caespitosa*), Pacific silverweed (*Argentina egedii*) and spreading bentgrass (*Agrostis stolonifera*) are salt-tolerant upland species diagnostic of high salt marshes that experience freshwater runoff or riverine discharge.

Other Classifications and Key References. Cowardin et al. included marine and estuarine systems of the Columbia Province. Dethier described a classification for marine and estuarine habitat types in Washington. Habitat types are defined by depth, substratum type, energy level, and a few modifiers. Species (plants and animals) are described for combinations of these physical variables. Harper et al. described a shore-zone sensitivity mapping system. Proctor et al. described an ecological characterization of the Pacific Northwest Coastal Region, including physical and chemical environments as well as socioeconomic aspects of watersheds of the region. Schoch and Dethier provided high-resolution data on the physical features and associated biota of Puget Sound's shorelines using the SCALE model (Shoreline Classification and Landscape Extrapolation). Downing offered a detailed review of the geological and broad ecological development of Puget Sound.

Natural Disturbance Regime. Natural disturbance perpetuates the dynamic, transitional nature of this habitat. Tides, seasonal riverine discharges, winds, storm events, erosion, and accretion are the primary natural processes that shape this habitat. Tides are mixed, characterized by two unequal high and low tides daily, with varying intrusion into estuaries and bays at different locations along the coast. Tides and winds push saltwater wedges up through the system, causing varying degrees of mixing with incoming riverine waters and significant vertical stratification. Riverine discharges and freshwater runoff vary seasonally with precipitation and freshet regimes. Generally, a large range in annual discharge exists with high volumes of fresh water entering the system in winter and significantly reduced flows in summer. Short-term storm events produce dramatic variations in physical habitat conditions. Sudden erosion or accretion may result from strong oceanic currents at the mouth of the system or from increased freshwater discharges at the head of the system.

Succession and Stand Dynamics. General successional stages reflect unconsolidated barren tideflats to stabilized high salt marshes and salt meadows. Unvegetated tideflats are colonized by pioneer plants, commonly eelgrass, that are tolerant of extended tidal inundation and vary depending on sediment type. Initial colonization causes sediment accretion and gradual rise in land elevation, changes that shift environmental conditions and permit other plants to establish. Arrowgrass, pickleweed, sand spurry, and spike rush can invade the emerging marsh, further increasing and stabilizing substrates. Saltgrass and sedge establish on higher areas of the marsh. When initial colonizers die back, tufted hairgrass and salt rush may establish. Various exotic species have become naturalized in Washington, including spreading bentgrass and sand spurry introduced from Europe, brass buttons (*Cotula coronopifolia*), introduced from South Africa, and marsh cordgrass (*Spartina alterniflora*) introduced form the Atlantic Coast of North America. These successional stages can be disrupted by riverine or tidal scouring and succession can be reinitiated at any point.

Effects of Management and Anthropogenic Impacts. Management, water quality, contaminants, and lad-use practices have altered significant portions of this habitat and continue to impact remaining areas. The dredging and filling of marshes and tideflats to serve various human needs remove estuarine vegetation. Channel flow, tidal inundation, and freshwater discharges are disrupted by construction of seawalls, jetties, dikes, and dams. The physical and chemical conditions of these habitats are degraded by the discharge of municipal, industrial, and agricultural effluents. Functional plant and animal communities are altered by domestic and agricultural runoff of pesticides, herbicides, and fertilizers. Invasions of exotic plants (e.g. Spartina) and invertebrates (e.g. green crabs) pose significant, long-term ecological and economic threats to this habitat. Large tracts of habitat have been lost and converted for coastal development. Additionally, upland activities occurring throughout the watershed, including logging, mining, and hydroelectric power development, can have destructive impacts downstream in estuarine and bay environments.

Status and Trends. Significant quantitative and qualitative alterations of this habitat have occurred with Euro-American settlement. Although natural erosion and accretion processes continue, most habitat modification can be attributed to anthropogenic impacts. Original diking for crop production and flood control, and other more recent barriers, prevent natural recovery and re-establishment of this habitat. Remaining examples of the bay and estuarine habitat exist in various conditions, from the more natural areas, areas undergoing active restoration, to the more prevalent polluted, degraded, or overused areas throughout Washington. With increasing population pressures in coastal areas and the corresponding threats of habitat use and conversion, future trends will likely be continued degradation and reduction of remaining bay and estuarine areas.

Inland Marine Deeper Water

David H. Johnson

Geographic Distribution. This habitat is located in the northwestern portion of Washington. It includes the open waters of the Strait of Georgia, Puget sound, Hood Canal, and the Strait of Juan de Fuca. More specifically, this habitat reflects waters >66 ft. deep, found inland from a line between the Elwha River (just west of Port Angeles) on the Washington side of the Strait of Juan de Fuca, northward to Race Rocks on the southeastern tip of Vancouver Island, British Columbia. This line was independently determined based on (1) kelp distribution, (2) marine bird distribution, and (3) fish species and abundance data. With the exception of Marine Nearshore areas, waters west of this line are considered Marine Shelf.

Physical Setting. This habitat lies largely within the Puget Lowland and northward in Georgia Strait on the east side of Vancouver Island, British Columbia. Mean air temperatures generally range between 40 and 70°F year-round, with little north-south variation. Rainfall averages 20 to 80 inches annually and is concentrated in winter months, producing correspondingly high river runoff to bays, estuaries, and inland marine waters.

Landscape Setting. This habitat is commonly adjacent to Bays and Estuaries, Coastal Headlands and Islets, and Marine Nearshore habitats and merges with the Marine Shelf habitat in the Strait of Juan de Fuca. Inland marine waters are used extensively for navigation, commercial transport of goods, recreation, tourism, and fishery operations.

Structure. A diversity of underwater structures are created as swift tidal currents circulate waters of the Pacific Ocean through the reaches of Straight of Georgia, Puget Sound, Hood Canal and the Strait of Juan de Fuca. Aspects of geology are particularly important in understanding the structure and dynamics of this habitat. Glacial ice initially excavated several long, narrow valleys that today form Lake Washington, Lake Sammamish, Hood Canal, and the major basins of Puget Sound. The arrangement of the present shorelines was established 13,000 years ago when glacial ice retreated from the Puget Lowland. Organics, silt and sand are the primary substrate components of this habitat and vary in specific composition and distribution with fluctuating physical factors. Through deposition of sediments, major river deltas have advanced substantial distances into the deep basins of Puget Sound.

Composition. Marine waters dominate freshwater influences in areas away from riverine discharges or from the shoreline. Because of the water depths involved, sunlight is diffused, and few if any plants attached to the benthic substrates are capable of growing.

Other Classifications and Key References. Cowardin et al. included this region in the Columbia Province and described a hierarchical classification for wetlands and deepwater habitats in the U.S. Dethier described a classification for marine and estuarine habitat types in Washington. Habitat types were defined by depth, substratum type, energy level, and a few modifiers. Harper et al. described a shore-zone mapping system for use in sensitivity mapping and shoreline countermeasures. Proctor et al. described an ecological characterization of the Pacific Northwest Coastal Region, including physical and chemical environments as well as socioeconomic aspects of watershed units of the region. Schoch and Dethier provided high-resolution data on the physical features and associated biota of Puget Sound's shorelines using the SCALE model (Shoreline Classification and Landscape Extrapolation).

Natural Disturbance Regime. Seasonal and larger, periodically occurring disturbances shape this habitat. Seasonal variation in tidal regimes, precipitation and riverine discharges (winter highs), as well as periodic storm events cause changes in temperature, salinity, energy level, and gradual or sudden erosion and accretion in localized areas.

Successional and Community Dynamics. Diverse plant and invertebrate communities compete for a variety of habitats in this region. Succession occurs in each habitat area as disturbances create temporary vacancies, allowing opportunistic species to become established.

Effects of Management and Anthropogenic Impacts. Land conversion, use, and management have altered significant portions of this habitat. The physical, chemical, and biological condition of some habitats are degraded by both point and nonpoint discharges from municipal and industrial effluents. Functional plant and animal communities are altered by domestic and agricultural runoff of pesticides, herbicides, and fertilizers. Large portions of shoreline have been converted for residential, commercial, and port development, affecting inputs into the adjacent deeper waters. Benthic communities are significantly impacted by maintenance dredging done to support navigation and commerce. The transport of oil and chemical substances creates the potential for harmful spills that can affect these areas for extended periods of time. Passage of vessels from other regions increases the introduction rate of exotic species which, once established, can effectively outcompete native species.

Status and Trends. With the important exceptions of locally increased sedimentation rates and contaminant deposition/retention, the status and trends in the physical and biological aspects of this habitat are poorly known.

Marine Nearshore
David H. Johnson

Geographic Setting. This habitat reflects marine water areas (high tide line to depth of 66 ft) along shorelines not significantly affected by freshwater inputs (i.e. excludes Bays and Estuaries). This includes all marine shorelines of Puget Sound, Hood Canal, San Juan Islands, Straight of Georgia, Strait of Juan de Fuca, and along Washington's outer coastline. In Washington, there are 3,100 miles of this nearshore habitat. For mapping and classification purposes, this habitat does not extend into, or overlap with, shallow or intertidal areas found within Bays and Estuaries.

Physical Setting. The outer coastline of Washington can be characterized as a series of sandy beaches interspersed with rocky headlands. This coastline is oriented in a north-south direction and is subjected to long-fetch, high-energy waves. Nearshore areas within Puget Sound, Hood Canal, and elsewhere landward from the Strait of Juan de Fuca are more protected. With the exception of the far-reaching Columbia River plume, the effects of coastal streams are generally local and seasonal.

Landscape Setting. This habitat is adjacent to the Marine Shelf, Inland Marine Deeper Water, Bays and Estuaries, and a number of terrestrial-based habitats (e.g. Coastal Dunes and Beaches, Westside Lowland Conifer-Hardwood Forest, and Urban). It occurs in a mosaic with Coastal Headlands and Islets.

Structure. Fresh waters drain from lands surrounding these inland marine waters to create estuarine environments nearshore (see Bays and Estuaries habitat). Nearshore subtidal habitats are diversified by degree of wave and current action, availability of sunlight, and presence of vegetation. Submerged unvegetated habitats cover a greater area than do vegetated nearshore habitats, such as salt marshes and eelgrass beds. Various combinations of water depth, character of substrates, and exposure to tidal action create a wide range of benthic habitats. Sand, cobble, boulders, and hardpan are commonly found in areas of moderate to strong currents, whereas silt and clay settle out in protected inlets and bays

Composition. This habitat supports marine organisms capable of withstanding short-term exposure to air. Bottom substrates in exposed areas are generally rock or sand, but can include cobble or gravel. The subtidal photic zone includes the region from mean low low water (MLLW or the 0 ft depth) to about –50 ft where water is deep enough to prevent sufficient light penetration to the marine floor for primary productivity of kelp and other marine plants. The rocky-bottom intertidal habitats support kelps (*Laminaria* spp., *Lessoniopsis* spp., *Hedophyllum sessile*), brown rockweed (*Pelvetiopsis scouleri*), red algae (*Iridaea* spp.), and surfgrass (*Phyllospadix scouleri*), as well as an abundance and variety of sessile benthic invertebrates. The larger kelps, such as *Macrocystis integrifolia* and *Nereocystis leutkeana*, are found in the rocky-bottom subtidal areas. Because of constant wave action, the sandy-bottom areas of the intertidal and subtidal zones support few or no plants. The moderate to low energy intertidal and subtidal areas where sand, mud and gravel accumulate support eelgrass (*Zostera marina, Z. japonica*) and the red alga (*Gracilaria pacifica*).

Other Classifications and Key References. Dethier provided a detailed classification scheme for the estuary, intertidal, and shallow subtidal areas of Washington. The Cowardin et al. classification scheme has several limitations with regards to adopting it for marine and estuarine systems. Levings and Thom described nine categories of nearshore habitat in Puget Sound and Georgia Basin.

Natural Disturbance Regimes. This habitat is strongly influenced by tidal rhythms, wave action, storm events, light penetration, and bottom substrate. Because of these factors, this habitat is characterized by a high degree of patchiness; this patchiness leads to differences in its faunal makeup and use. Herbivory by marine invertebrates also causes significant disturbance in plant communities, as evidenced by the direct control of kelp beds by urchin populations.

Succession and Stand Dynamics. The primary natural processes that shape the nearshore habitats include tides, erosion, accretion, and storm events. The rocky surf zone of the outer coast of the Olympic Peninsula includes some of the most complex and diverse shores in the United States. Here, high wave energy provides space for habitation for species as materials are eroded away, and by increasing the capacity of algae to acquire nutrients and use sunlight. Examples of succession can be found on rocky intertidal shores where wave energy periodically disturbs established communities, or in kelp forests where herbivory or the scouring action of swift tidal currents removes vegetation.

Effects of Management and Anthropogenic Impacts. This habitat reflects the interface between land and sea, and is the site of intense commercial and navigational activities, such as seaports, marinas, ferry docks, and log booms. A significant concern is the site-by-site consideration of projects with no ability to account for and assess the cumulative environmental effects of various development activities (from small residential projects to large commercial and industrial development projects). Without the ability to measure or understand cumulative effects, managers are permitting individual activities that may result in dramatic resource losses over time. Making high-quality nearshore vegetation and shoreline characteristics inventory mapping available to land-use planners, natural resource scientists, and the public will increase opportunities to protect this habitat.

Status and Trends. Shoreline modification such as bulkheading, filling, and dredging can lead to direct habitat loss. Indirectly, it can lead to changes in the sediment and wave energy on a beach and in adjacent subtidal areas. One third of Puget Sound's shorelines, approximately 800, has been modified. The Central Puget Sound region, with high human population levels, shows the highest level of modification overall. In Washington there are 26 species of kelp, more than any other area worldwide. Data on floating kelp along the Strait of San Juan de Fuca suggest that while kelp areas are dynamic, the overall extent of kelp has remained stable during 1993-1997.

APPENDIX 12: ECOREGIONAL ASSESSMENTS

This section provides an overview of the ecoregional assessment process as well as provides a more detailed explanation of the conservation utility maps that are included in the Ecoregion Conservation Strategy Chapter VI.

Overview

Limited resources and other social or economic considerations make protection of all wildlife habitat impractical, if not impossible. To be effective, biodiversity conservation must make efficient use of limited resources. This inescapable situation can be addressed two ways. First, we must narrow our immediate attention to the most important places for biodiversity conservation. To do this we need a reliable method for prioritizing potential conservation areas. Second, we should provide organizations, agencies, and landowners with flexibility to pursue other options when particular places are too difficult to protect. Assigning a relative priority to all places in an ecoregion will inform everyone about their options for conservation.

To guide biodiversity conservation and land use planning across Washington State, WDFW and the Washington Department of Natural Resources joined The Nature Conservancy in a partnership to do an ecoregional assessment (EA) for each of Washington's nine ecoregions. An EA attempts to identify and prioritize places for the conservation of all biodiversity in an ecoregion. The relative priority of places is based on such factors as species rarity, species richness, species representation, site suitability, and overall efficiency.

The prioritization of potential conservation areas is an essential element of conservation planning (Margules and Pressey 2000). The need for prioritization is made evident by the extensive research conducted to develop better prioritization techniques (e.g., Margules and Usher 1981, Anselin et al. 1989, Kershaw et al. 1995, Pressey et al. 1996, Freitag and Van Jaarsveld 1997, Benayas et al. 2003). Ecoregional assessments follow an approach developed by The Nature Conservancy (Groves et al. 2000, Groves et al. 2002). In essence, the EA is a data analysis with significant expert input to address data gaps. The analytical tool used in the EA is an optimal site selection algorithm. Since the 1980s considerable research has been conducted on theories, techniques, and applications of optimal site selection algorithms. Over 100 articles on the subject have been published in referred, peer-reviewed journals (Cabeza and Moilanen 2001, Williams et al. 2004). Optimal site selection algorithms select a set of potential conservation areas, also known as assessment units (AUs), which satisfy conservation objectives for the least cost. "Cost" can be expressed as the monetary cost, land area, or suitability of each AU.

The Ecoregional assessment has many steps: (1) choose conservation target (i.e., species, plant communities, ecological systems, and habitat types); (2) assemble occurrence data for the targets; (3) re-organize data and define spatial representation of each target; (4) develop a suitability index and rate assessment units; (5) run site selection algorithm; (6) assemble draft portfolios; (7) refine portfolio through expert review; (9) prioritize the potential conservation sites. All ecological systems and habitat types are targets. Target species must satisfy at least one of the following criteria: federal or state listed, globally imperiled (G1, G2, G3), endemic, disjunct, keystone, vulnerable, or wide-ranging. Usual data sources are WDFW, state natural heritage programs, federal agencies, and regional experts. The suitability index is a surrogate for cost and indicates the relative likelihood of successful conservation at each AU, based on relative human impacts across the ecoregion. Statistical models for suitability are unavailable, and therefore, much of the index is based on expert opinion (Banai-Kashani 1989). To incorporate expert opinion, we use an abbreviated version of the analytic hierarchy process (AHP; Saaty 1980). The analysis utilizes an optimization program known as MARXAN (Ball and Possingham 2000) to find the most efficient set of AUs.

Main Assessment Products

Three principal products emerge from the assessment: a comprehensive compilation of conservation data for the ecoregion, conservation utility maps, and a conservation portfolio map. A number of ancillary products are also produced that should be useful to groups asking specific questions regarding site priorities.

The data used in an assessment have been compiled from a number of other sources and are some of the most sought after products. Agencies and groups who have a stake in the conservation of the ecoregion regularly request these data, especially because it is in a GIS format and has been refined through analysis. One of the uses of the data is to determine how much known biodiversity is located in existing protected areas, a type of gap analysis which can be used to direct conservation actions to elements of biodiversity that are most in need of conservation.
Conservation utility maps are a prioritization of all assessment units (AUs) in an ecoregion based on the relative biological value and relative suitability of AUs. These maps can be used to guide ecoregion-level conservation action and can inform smaller scale conservation decisions as well. Sensitivity analyses of terrestrial conservation utility maps typically show that the ranking of highest ranked AUs is robust to changing assumptions about AU suitability. The conservation utility maps are not based on a particular set of conservation goals. They are a data analysis that is not modified by expert review.

The alternative portfolios are a simplistic illustration of the potential range of policy options for the conservation of biodiversity in an ecoregion. Three alternatives based on three different sets of conservation goals are presented. Goal formulation is not purely scientific; it involves some policy-based decisions that reflect the values of the organization formulating them. For instance, the mid-risk portfolio represents TNC's vision for conservation of the ecoregion's biodiversity. The purpose of the lower and higher risk portfolios is to depict two different visions of what biodiversity conservation could look like. The alternatives are intended to convey a fundamental message – society must make choices about the value of biodiversity and act accordingly.

The conservation portfolio map depicts a set of conservation areas that most efficiently meet a specific set of conservation goals. The goals used in the EA are developed by The Nature Conservancy, Nature Conservancy of Canada and NatureServe, and tailored for each ecoregion by the core team. The goals determine the overall size of the portfolio – lower goals will yield a smaller portfolio. The conservation areas identified in the portfolio are important for a number of reasons. First, some AUs are the only places where one or more species or plant community targets are known to occur. This is particularly true for species and plant communities associated with low-elevation, old growth coniferous forests. Second, some AUs comprise the last large, relatively undisturbed landscapes in the ecoregion. Many of these places are parks or wilderness areas. Large areas are especially important to wide-ranging species. These areas currently make irreplaceable contributions to conserving ecoregional biodiversity and possess significant potential for the maintenance of landscape-scale ecological processes.

Third, wherever possible, the assessment selects AUs that are most promising for successful conservation. The assessment uses a suitability index to map the relative likelihood of successful conservation across the ecoregion. The suitability index is a quantitative expression of several well-accepted principles of conservation biology: (1) large areas of habitat are better than small areas; (2) habitat areas close together are better than areas far apart; and (3) areas with low habitat fragmentation area better than areas with high fragmentation. The suitability index also relies on two reasonable assumptions, first, that existing public land is more suitable for conservation than private land; and second, rural areas are more suitable for conservation than urban areas. Application of these principles and assumptions guide site selection toward existing public lands and away from private land, and toward rural areas with low habitat fragmentation and away from urban areas.

Not every AU in the portfolio is irreplaceable or has exceptionally high value for biodiversity conservation. Some AUs not in the portfolio could be swapped with low value AUs in the portfolio to yield a new portfolio of equal overall value to the original portfolio. The conservation utility maps should be used in conjunction with the portfolio maps to determine which areas in the portfolio are irreplaceable or have exceptionally high value for biodiversity conservation.

As products from the ecoregional assessments become available, they will be posted on the WDFW website http://www.wdfw.wa.gov/ and the ConserveOnline website http://conserveonline.org/.

Ecoregional Assessment Process

Five technical teams of scientists and conservation specialists follow an assessment framework established by Groves et al. (2000, Groves et al. 2002). The teams include a terrestrial ecological systems team, a plant species team, an animal species team, a freshwater team, and a marine team. All the technical teams are coordinated and directed by an oversight group called the core team, made up of technical team leads and other scientists and conservation professionals from British Columbia, Washington, and Oregon. Each technical team contributes to each of the following steps described below and innovates where necessary to address specific data limitations and other challenges.

1. **Choose conservation targets** - Conservation target are the plants, animals, plant communities, and ecological systems included in the analysis. These targets are intended to encompass the full range of biodiversity in the ecoregion and include any elements of special concern.

Robert Jenkins, working for The Nature Conservancy in the 1970s, developed the concept of coarse filter and fine filter conservation targets (Noss 1987). This approach hypothesizes that conservation of multiple, examples of all plant communities and ecological systems (coarse filter targets) will also conserve the majority of species that occupy them. This coarse filter strategy is a way to compensate for the lack of detailed information on the vast number of poorly studied species.

Fine filter targets are those rare or imperiled species that cannot be assumed to be captured by coarse filter targets. Fine filter targets warrant a special effort to ensure they are represented in the conservation assessment. Fine filter targets can also include wide-ranging species that require special analysis, or species that occur in other ecoregions but have genetically important disjunct populations.

2. **Assemble location or "occurrence" data for targets** - location data are assembled from a variety of sources. Although existing agency databases make up the bulk of these data, data gaps are often filled by consulting with experts who work in the ecoregion.

Because ecoregional assessments depend on comprehensive, up-to-date data, step two is especially important.

3. **Re-organize data and define spatial representation of each target** - Data from different agencies and experts must be re-organized into a single standard format. Decisions are made regarding the best way to define a target's occurrences. Standards developed by NatureServe are used to define some target occurrences. Targets may be represented as points, which could show the locations of rare plant populations or bat roosts, or represented as polygons to show the areal extent of a species' habitat or an ecological system. The data are stored in a Geographical Information System (GIS).

4. **Set representation levels for each target** – The analytical tool used for ecoregional assessments requires "goals" for how many occurrences or how much habitat area should be captured in the assessment. Goals are set with the underlying assumption that they will be sufficient to sustain each target over a 50-100 year time period. These "goals" are used to drive the identification and prioritization of potential conservation areas.

It is essential that users of this assessment understand the function of goals in the assessment. The goals cannot be treated as conditions for ensuring long-term survival of species. They are an important device for assembling a portfolio of conservation areas that captures multiple examples of the ecoregion's biodiversity. These goals also provide a metric for gauging the contribution of different portions of the ecoregion to the conservation of its biodiversity and measuring the progress of conservation in the ecoregion over time.

5. **Develop a suitability index and rate assessment units -** Each ecoregion is divided into thousands of assessment units (AUs). AUs have been hexagons in some ecoregions but watersheds in other ecoregions. Within an ecoregion, each AU is compared to other AUs using a set of factors that correspond to an AUs suitability for conservation or the likelihood of conservation success. The factors are those likely to impact habitat quality for native species, such as road density or the proximity to urban areas, as well as factors likely to impact the cost of managing the area for conservation, such as the percent of public versus private lands or the existence of established conservation areas. The factors are brought together in an equation that yields a rating known as a suitability index.

It is important to note that the factors chosen for the suitability index influence the priority of potential conservation areas, i.e., a different set of factors can result in different priorities. Also, some factors in the suitability index require consideration of what are traditionally policy questions. For example, setting the index to favor the selection of public over private land presumes a policy of using existing public lands to conserve biodiversity wherever possible, thereby minimizing the involvement of private or tribal lands. A sensitivity analysis is done to explore how priorities change in response to changes in the suitability index.

6. **Run site selection algorithm** - An ecoregional assessment entails hundreds of different targets existing at thousands of locations. The relative biodiversity value and relative conservation suitability of thousands of assessment units must be evaluated. This complexity precludes simple inspection by experts to arrive at an efficient set of high priority conservation areas. Hence, we used an optimal site selection algorithm known as MARXAN (Ball and Possingham 2000) to assign a conservation priority to every AU. MARXAN is computer software that aids scientists in identifying an efficient set of conservation areas.

To use MARXAN, one must input data describing the biodiversity at and the conservation suitability of the thousands of assessment units in the ecoregion. The number of targets, condition of targets, and rarity of targets present at a particular place determines the biodiversity of the unit. Conservation suitability is input as a suitability index (described above) representing a set of weighted factors chosen to represent the relative likelihood of successful conservation at a unit.

MARXAN strives to minimize an objective function. It begins by selecting a random set of assessment units, i.e., a random conservation portfolio. Next, MARXAN iteratively explores improvements to this random portfolio by randomly adding or removing other units. At each iteration, the new portfolio is compared with the previous portfolio and the better one is accepted. The algorithm uses a method called simulated annealing to reject sub-optimal portfolios, thus greatly increasing the chances of converging on most efficient portfolio. Typically, the algorithm is run for 1 to 2 million iterations.

7. **Assemble conservation utility maps and draft portfolios** - Different types of analyses can be done using MARXAN. One type of analysis calculates relative irreplaceability values for all AUs in the ecoregion. Another type of analysis identifies the most efficient set of AUs that will meet particular conservation goals. The identified set of AUs is called a conservation portfolio. Both of these products are more fully described in the following sections.

8. **Refine the portfolio through expert review** – Expert review and revision are necessary to compensate for gaps in the input data or other limitations of automated selection of assessment units. Experts review the draft portfolio to correct errors of omission or inclusion by the computer-driven process. These experts also assist the teams with refining individual site boundaries. The terrestrial, freshwater, and marine portfolios are then integrated into a single final portfolio. This integrated portfolio is in turn subjected to additional expert refinement to produce the final portfolio.

9. **Prioritize the potential conservation sites** – Ideally, the conservation portfolio would serve as the conservation blueprint to be implemented over time by nongovernmental organizations and government agencies. However, in reality, the entire portfolio cannot be protected immediately and some conservation areas in the portfolio may never be protected (Meir et al. 2004). Limited resources and other social or economic considerations may make protection of the entire portfolio impractical. This inescapable situation can be addressed two ways. First, we should narrow our immediate attention to the most important conservation areas within the portfolio. This can be accomplished by prioritizing conservation areas. Second, we should provide decision makers with the flexibility to pursue other options when portions of the portfolio are too difficult to protect. Assigning a relative priority to all assessment units in the ecoregion will inform decision makers about their options for conservation.

To facilitate prioritization we used MARXAN to generate two different irreplaceability indices for all AUs in an ecoregion. In addition, we created an irreplaceability versus vulnerability scatter plot that was used to further refine priorities.

<u>Irreplaceability</u>

Useful products of an EA are conservation utility maps that depict the conservation priority of all AUs in an ecoregion. *Irreplaceability* has been defined a number of different ways (Pressey et al. 1994, Ferrier et al. 2000, Noss et al. 2002, Leslie et al. 2003, Stewart et al. 2003). However, the original operational definition was given by Pressey at al. (1994).

They defined irreplaceability of a site as the percentage of alternative reserve systems in which it occurs. Following this definition, Andelman and Willig (2002) and Leslie et al. (2003) each exploited the stochastic nature of simulated annealing algorithm to calculate an irreplaceability index.

MARXAN uses a simulated annealing algorithm that is a controlled random search for the global minimum of an objective function. Since it is random, simulated annealing can arrive at somewhat different answers for a single optimization problem. The algorithm may not converge on the optimal solution, i.e., the global minimum, but it will find local minima that are nearly as good as the global minimum (McDonnell et al. 2002). That is, the objective function value for the local minima will be nearly as small as the global minimum. The random search of simulated annealing enables it to find multiple nearly optimal solutions. An AU may belong to many different nearly optimal solutions. The number of simulated annealing solutions that include a particular AU is a good indication of that AU's irreplaceability. This is the assumption made by Andelman and Willig (2002) and Leslie et al. (2003) for their irreplaceability index. The index of Andelman and Willig (2002) was:

$$I_j = (1/n) \sum_{i=1}^{n} s_i \qquad (1)$$

where I is relative irreplaceability, n is the number of solutions, and s_i is a binary variable that equals 1 when AU_j is selected but 0 otherwise. I_j have values between 0 and 1, and are obtained from a running the simulated annealing algorithm n times at a single representation level.

Irreplaceability is a function of the desired representation or goal level (Pressey et al. 1994, Warman et al. 2004). Changing the representation level for target elements often changes the number of AUs needed for the solution. For instance, low representation levels typically yield a small number of AUs with high irreplaceability and many AUs with zero irreplaceability, but as the representation level increases, some AUs attain higher irreplaceability values. The fact that some AUs go from zero irreplaceability to a positive irreplaceability demonstrates a shortcoming of Willig and Andelman's index – at low representation levels, some AUs are incorrectly shown to have no value for biodiversity conservation. We created an index for relative irreplaceability that addresses this shortcoming. Our global irreplaceability index for AU_j was defined as:

$$G_j = (1/m)\,)\sum_{k=1}^{m} I_{jk} \qquad (2)$$

where I_{jk} are relative irreplaceability values as defined in equation (2) and m is the number of representation levels used in the site selection algorithm. G_j have values between 0 and 1. Each I_{jk} is relative irreplaceability at a particular representation level. We run MARXAN at ten representation levels. At the highest representation level nearly all AUs attained a positive irreplaceability.

Many applications of "irreplaceability" have implicitly subsumed some type of conservation efficiency (e.g., Andelman and Willig 2002, Noss et al. 2002, Leslie et al. 2003, Stewart et al. 2003). Efficiency is usually achieved by minimizing the total land area needed to satisfy the representation level. The resulting index we call area-minimized irreplaceability. Efficient conservation is more complex than simply minimizing land area. A more realistic optimization would incorporate other factors that affect the cost of conservation, such as current ownership, current land use, habitat condition, etc. With this in mind, we generated another index we call suitability-maximized irreplaceability. Suitability is an index that reflects the likelihood of successful conservation at each AU (see explanation below). Efficiency is achieved by maximizing the total suitability of AUs selected to satisfy the representation level.

<u>Interpreting Irreplaceability Values</u>

Irreplaceability is a complicated metric. The relative irreplaceability of places is based on such factors as species rarity, species representation, species richness, site suitability, and overall efficiency. The optimal site selection algorithm integrates all of these factors when selecting AUs. Knowing which factor or factors lead to the irreplaceability value of a particular AU is often difficult to determine, but some generalizations do help with interpreting irreplaceability values.

AUs obtain high irreplaceability values for a number of reasons. First, some highly rated AUs are the only places where one or more species or plant communities are known to occur. This is particularly true for species and plant communities associated with rare or imperiled habitat types such as low-elevation, old growth coniferous forests, prairies, oak woodland, and balds. Second, some highly rated AUs have high target richness and/or high target representation. High target richness means that an AU contains a high number of different target elements. High target representation means that an AU contains a large proportion of the ecoregion's total occurrences of a target species or total area of a target habitat type. High target representation is usually more important than high target richness. Third, for SMI, some highly rated AUs present the best opportunities for conservation action. These AUs contain target elements and should also be places where conservation is more likely to succeed as indicated by the suitability index.

AMI and SMI are different ways to prioritize places for conservation. AMI has been the most commonly used index (e.g., Andelman and Willig 2002, Noss et al. 2002, Leslie et al. 2003, Stewart et al. 2003), and it assumes that land area is the sole consideration for efficient conservation. SMI incorporates other factors that can effect efficient conservation such as land management and current condition. Not surprisingly, many AUs attained values of 100 for both AMI and SMI. If an AU is the only place where a species is known to occur, then it attains a value of 100. Typically, for AUs with irreplaceability values at or near 100, suitability has little influence on priority; occurrence data drive the prioritization.

AMI and SMI values can be quite different for many individual AUs at the middle and low end of the irreplaceability value range. This is useful information for prioritization. AUs at the low end of irreplaceability typically are unremarkable in terms of biodiversity value. They contribute habitat or target occurrences, but they are interchangeable with other AUs. For these AUs, prioritizing on the basis of suitability rather than biodiversity value makes most sense. That is, if an AU can be distinguished from other AUs because conservation there will be cheaper or more successful, then that AU should be a higher priority for action. In other words, SMI values should be used for their prioritization.

Irreplaceability is just one way of looking at the prioritization of AUs. Irreplaceability, both AMI and SMI, incorporates some notion of efficiency, but efficiency may not be relevant to some questions regarding biodiversity. For such questions, data from EAs can be used to prioritize AUs according to other well known metrics such as maximum rarity, average rarity, richness, maximum representation, average representation, rarity weighted richness, representation weighted richness, and rarity weighted representation. By comparing irreplaceability and these other, more conventional, metrics, managers and decision-makers can make well informed decisions for allocating limited resources to biodiversity conservation.

Conservation Portfolios

A conservation portfolio is another useful way of establishing conservation priorities. A portfolio is the most efficient set of AUs that will meet particular conservation goals. A critical difference between a portfolio and an conservation utility map is conservation goals. A portfolio is based on a particular set of goals; the conservation utility maps are based on a wide range of goals, called representation levels. The size of a portfolio, i.e., the amount of land encompassed by it, is strongly determined by goals – larger goals typically result in a larger portfolio. Another important difference is that the portfolio compensates for data gaps and anomalies by incorporating expert review of modeled data.

One challenging aspect of creating a portfolio is that there is no scientific consensus regarding what percent of habitat to protect when conserving biodiversity, or even on what fraction of biodiversity we can expect to lose with each loss of habitat. Unless assessment teams have specific biological information, they typically set as a goal protection of 30% of historical habitat (e.g., Marshall et al. 2000, Neely et al. 2001, Rumsey et al. 2003, Floberg et al. 2003). This is among the range of goals published in the literature or used by agencies and institutions. It is above average, but not the highest advocated. The sense in selecting this 30% figure is that it is risk averse, but not so high as to be untenable (which 100% might be, for example). Assessment teams believe it is unproductive to fixate on the particular number, and think a better use of scientific thinking is to design monitoring and tracking programs that will tell how well our conservation targets are faring so that conservation approaches can be modified if needed in future iterations of ecoregional assessments.

In addition, current assessments in Washington State and the Pacific Northwest have adopted a new approach, based on differing risk factors, to address this lack of scientific consensus. Currently, we create 3 different scenarios, identified as higher, mid or lower risk and representing protection of roughly 20%, 30% and 40% of historical habitat, respectively. Where we lack historic information, like in many marine regions, we set similar percentages but base them on current distributions. Both of these approaches allow all users to see the effect that varying the goal (and thus the risk level one is willing to accept) has on the selection of priority sites.

Species survival is not deterministic; it is probabilistic. A portfolio cannot ensure the long-term survival of species; it can only provide some level of assurance that species will survive. In other words, every portfolio has some level of risk that species will not survive. A goal setting process should ask the question: “what level of risk is tolerable?” Society – citizens, stakeholders, and elected officials – may ultimately make this choice, but it should be informed by the best available science and expert opinion.

Because of the uncertainty about conservation goals, not all the agencies and organizations that participate in the portfolio-building process endorse a particular portfolio. However, the mid-risk portfolio could be viewed as an acceptable starting place for establishing a conservation vision that helps coordinate conservation actions among a wide variety of partners.

Suitability

Both types of analyses – conservation utility maps and conservation portfolios – use a suitability index to help select AUs. This section explains the suitability index.

The optimization algorithm searches for the lowest cost set of AUs that will meet representation or goal levels for all target elements. "Cost" corresponds to the resources necessary to successfully maintain the targets present in each AU. The actual cost of conservation encompasses many complicated factors: acquisition or easement costs, management costs, restoration costs, and the intrinsic cost of failing to maintain a species at a site. Because determining the monetary cost of conservation for every assessment unit would be an extremely demanding task, we used a surrogate measure for cost called a *suitability index*. A place with a low "cost" for maintaining biodiversity has high suitability. Suitability indicates the relative likelihood of successful conservation at each assessment unit.

Land use suitability is a well-established concept amongst land use planners (see Hopkins 1977, Collins et al. 2001 for reviews), and there are many different methods for constructing an index (Banai-Kashini 1989, Carver 1991, Miller et al. 1998, Stoms et al. 2002). Suitability indices have been used to locate the best places for a wide range of land uses – from farms to nuclear waste sites. Suitability indices are also used to rate the quality of wildlife habitats (USFWS 1981). We used a suitability index in an optimization algorithm that will find the best places for biodiversity conservation.

Our index is based on the analytic hierarchy process (AHP; Saaty 1980, Banai-Kashini 1989). AHP generates an equation that is a linear combination of things thought to affect suitability. Each thing is represented by a separate term in the equation, and each term is multiplied by a weighting factor. AHP is unique because the weighting factors are obtained through a technique known as pair-wise comparisons through which experts are asked for the relative importance of each term in the equation. AHP has been used in other conservation assessments where expert judgments are needed in lieu of empirical data (Store and Kangas 2001, Clevenger et al. 2002, and Bojorquez-Tapia 2003).

The suitability index was based on one simple assumption: existing public land is more suitable for conservation than private land; and on three well-accepted principles of conservation biology (Diamond 1975, Forman 1995):

1) areas with low habitat fragmentation are better than areas with high fragmentation.
2) large areas of habitat are better than small areas;
3) areas close together are better than areas far apart.

The assumption was based on the work of the Gap Analysis Program (Cassidy et al. 1997, Kagan et al. 1999). Both the Oregon and Washington GAP projects rated nearly all public lands as better managed for biodiversity than most private lands. Furthermore, eminent conservation biologists have noted that existing public lands are the logical starting point for habitat protection programs (Dwyer et al. 1995). We reasoned that by focusing conservation on lands already set aside for public purposes the overall cost of conservation would be less than if public and private lands were treated equally. Therefore, existing public lands could form the core of large multiple-use landscapes where biodiversity is a major management goal.

The management of various public land managers was rated according to how it impacted biodiversity. These rating were modified from Cassidy et al. (1997) and Kagan et al. (1999). Road density and the proportion of an AU converted to intensive land uses (i.e., urban and agricultural) were typically used as surrogates for habitat fragmentation. In some ecoregions fire condition class was used as a measure of habitat quality.

The suitability index is a quantitative, spatially explicit expression of the assumptions and principles that form its conceptual basis. Using this index, the optimal site selection algorithm will prefer: (1) AUs in and near public lands over AUs far from public lands, and (2) AUs with less fragmented habitat. The first preference is based on both science and policy. Successful conservation of many targets will depend on large areas and existing public lands are the most practical places upon which to build large areas. The science is well founded, but the policy is debatable. That is, other organizations or stakeholders may contend that biodiversity conservation on private lands is just as feasible as conservation on public lands. Certainly, there are situations where this contention is true. However, we believe that public lands are the most sensible starting point for biodiversity conservation. The second preference accounts for only current habitat conditions. It does not consider restoration potential of an AU. Finally, we readily admit that the index cannot account for the many complex local situations that influence successful conservation, but we believe that some reasonable generalities are still quite useful for establishing priorities and assessing conservation opportunities across an entire ecoregion.

Uses for the Assessments

The ecoregional assessment is prepared to support effective long-term conservation of the ecoregion's biodiversity. It provides information for decisions and activities that occur at an ecoregional scale: establishing regional priorities for conservation action, coordinating programs for species or habitats that cross political boundaries, and evaluating the regional importance of biodiversity for any particular place. The conservation data sets, the prioritized AUs, and the conservation portfolio are each suitable for particular applications. Some of the ancillary products developed during the assessment process also can be used for conservation applications. Every effort is taken to insure that these products are catalogued and maintained for later use.

Datasets compiled for the assessment have broad utility to everyone who wants to know about specific aspects of biodiversity in the ecoregion. In addition, they are accessible for subsequent analysis to ask different conservation-related questions. The datasets are organized in GIS data layers and in easy to use formats such as spreadsheets that enhance their utility. They also have undergone broad reviews to make them more consistent with one another and to correct data errors.

The Nature Conservancy and Nature Conservancy of Canada have committed to using the "mid-risk" conservation portfolio to drive their priorities for site-based work and for identifying priority investments in "multi-site" strategies that conserve portfolio sites through policy, education, research, and other approaches. Likewise, local land trusts and public agencies can use the portfolio to gain an ecoregional perspective on local biological resource values and to quickly obtain detailed information on the biological value and conservation suitability of local portfolio sites. "On-the-ground" conservation activities will require more site-specific analysis and planning. A useful framework for site-scale conservation planning developed by The Nature Conservancy is "The Enhanced 5-S Project Management Process" and is available at http://www.conserveonline.org/2004/03/a/Enhanced_5S_Resources.

The conservation utility maps are most useful for prioritizing habitat protection and informing land use policies. Government agencies and NGOs that fund conservation projects or provide financial incentives for habitat protection could use the conservation utility maps as they consider priorities. Conservation projects occurring within high priority AUs should receive special consideration, and projects that can have siting flexibility should be located within high priority AUs whenever possible. The Washington Department of Fish and Wildlife will use the conservation utility maps to guide their development of a state Comprehensive Wildlife Conservation Strategy (CWCS) in coordination with other governmental and non-governmental organizations.

The following are some examples of how an ecoregional assessment could be used by local planners:

Urban Growth Area (UGA) expansion. A county must expand its UGA to accommodate future growth and has narrowed its options to two areas, each of which produce similar economic results. EAs provide a regional context for choosing the option most beneficial to regional biodiversity conservation.
Land Use Zoning. A county is trying to determine where to maintain natural resource zones in order to retain agriculture and forestry industries. EAs can tell them where continuation of forestry or agriculture will provide the most benefit to regional biodiversity.
Land Acquisition. A timber company is selling a block of land for residential development but the land was identified by an EA as important for biodiversity conservation. The county government could use information in the EA to write a convincing grant proposal for funding land acquisition.
Tax Incentives. Numerous landowners want property tax relief because they maintain wildlife habitats on their property. The county code has a provision regarding property tax relief, but it cannot afford to grant relief to all landowners. The county government could use EAs to help rate the biodiversity conservation value of land and grant tax relief based on this rating.

<u>Caveats for Using the Assessments</u>

- The assessment is conducted at an ecoregional scale. It provides information for decisions and activities that occur at an ecoregional scale, such as establishing regional priorities for conservation action, coordinating programs for species or habitats that cross state, county, or other political boundaries, judging the regional importance of any particular site in the ecoregion, and measuring progress in protecting the full biodiversity of the ecoregion.

- The assessment is designed to inform ongoing ecoregional conservation efforts. The assessments identify and prioritize areas that contribute the most towards conservation of existing biodiversity. At the same time, it is important to recognize what this assessment is not intended to provide, and identify several important limitations on this work. In addition to those already described, users should be mindful of the following:

- The assessment has no regulatory authority. It is simply a guide to help inform conservation decision-making across the ecoregion. The portfolio is intrinsically flexible. The sites described are approximate, and often large and complex enough to require a wide range of resource management approaches. Ultimately, the exact siting and management of any potential conservation area will be based on the policies, values, and decisions of the affected landowners, governments, and other community members.

- The assessment should be treated as a first approximation. It is more complete for some species or ecological systems than for others, reflecting the variable state of knowledge of the natural world. Generally speaking, terrestrial biodiversity is more adequately represented than that of freshwater and marine systems. The hexagons or watersheds used as assessment units should be used only as a rough starting point for the detailed site-level planning necessary to support local land-use decisions.

- Many high priority conservation areas described in EAs may accommodate multiple uses and are not intended to become parks or nature reserves set aside from economic activity. While some areas may warrant such protection, others will accommodate various activities as determined by landowners, local communities and appropriate agencies.

- The assessment is one of many science-based tools that will assist conservation efforts by government agencies, non-governmental organizations, and individuals. It cannot replace, for example, recovery plans for endangered species, or the detailed planning required in designing a local conservation project. It does not address all of the special considerations of salmon or game management, and so, for example, cannot be used to ensure adequate populations for harvest.

- The assessment does not describe all the important natural places in the ecoregion. Many places outside of the ecoregional conservation portfolio are important for natural beauty, environmental education, ecological services, and conservation of local biodiversity. These include many small wetlands, small patches of natural habitat, and other important features of our natural landscape. They should be managed to support their own special values.

- Many high priority areas will contain lower-quality habitats in need of restoration and this restoration could greatly enhance the viability of the conservation targets they contain. However, the assessment's results should not be used as the sole guide for siting restoration projects. A reliable assessment of restoration priorities would require a different approach than the one we have presented. AUs and portfolio sites were selected for the habitats and species that exist there now, not for their restoration potential.

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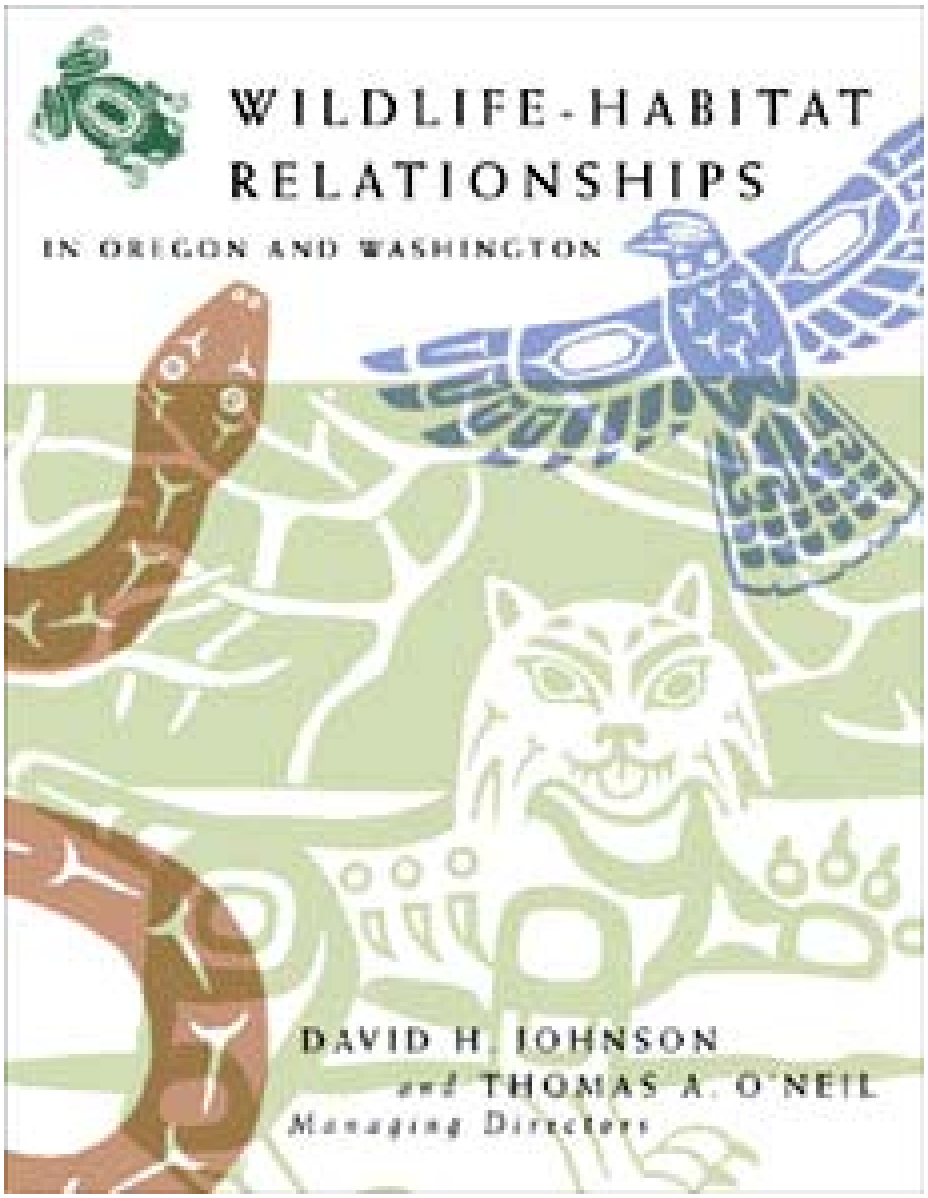
APPENDIX 13: WILDLIFE-HABITAT RELATIONSHIPS IN OREGON AND WASHINGTON

A copy of the book will accompany each copy of the Washington Comprehensive Wildlife Conservation Strategy. This page is merely a place marker.



APPENDIX 14: HABITAT CLASSIFICATION CROSSWALK

* From Ecological Systems of the United States (NatureServe, 2003)

Courtesy of Rex Crawford, Washington National Heritage Program

Ecological System-based Land Cover Types*	WHROW Habitat Classifications	WDFW Priority Habitats 1	WDFW Priority Habitats 2
Agriculture	Agriculture, Pasture and Mixed Environs		
Cultivated Crops	Agriculture, Pasture and Mixed Environs		
Invasive Annual Grassland	Agriculture, Pasture and Mixed Environs		
Invasive Forbland	Agriculture, Pasture and Mixed Environs		
Invasive Perennial Grassland	Agriculture, Pasture and Mixed Environs		
Pasture/Hay	Agriculture, Pasture and Mixed Environs		
CES204.099 North Pacific Alpine and Subalpine Dry Grassland	Alpine Grassland and Shrublands		
CES204.862 North Pacific Dry and Mesic Alpine Dwarf-Shrubland, Fell-field and Meadow	Alpine Grassland and Shrublands		
CES306.806 Northern Rocky Mountain Subalpine Dry Grassland	Alpine Grassland and Shrublands		
CES306.810 Rocky Mountain Alpine Dwarf-Shrubland	Alpine Grassland and Shrublands		
CES306.811 Rocky Mountain Alpine Fell-Field	Alpine Grassland and Shrublands		
CES306.816 Rocky Mountain Dry Tundra	Alpine Grassland and Shrublands		
CES306.829 Rocky Mountain Subalpine Mesic Meadow	Alpine Grassland and Shrublands		
CES200.091 Temperate Pacific Tidal Salt and Brackish Marsh	Bays and Estuaries		
CES200.882 North Pacific Maritime Eelgrass Bed	Bays and Estuaries	Vegetated Marine/Estuarine	
CES204.875 North Pacific Intertidal Freshwater Wetland	Bays and Estuaries	Estuary	
CES204.879 Temperate Pacific Intertidal Mudflat	Bays and Estuaries		
CES200.881 North Pacific Maritime Coastal Sand Dune	Coastal Dunes and Beaches		
CES204.088 North Pacific Hypermaritime Shrub and Herbaceous Headland	Coastal Headlands and Islets		
CES204.094 North Pacific Coastal Cliff and Bluff	Coastal Headlands and Islets	Cliffs	Talus
CES304.780 Inter-Mountain Basins Greasewood Flat	Desert Playa and Salt Scrub Shrublands		
CES304.784 Inter-Mountain Basins Mixed Salt Desert Scrub	Desert Playa and Salt Scrub Shrublands		
CES304.786 Inter-Mountain Basins Playa	Desert Playa and Salt Scrub Shrublands		
CES304.080 Columbia Plateau Low Sagebrush Steppe	Dwarf Shrub-steppe		
CES304.770 Columbia Plateau Scabland Shrubland	Dwarf Shrub-steppe		
CES306.994 Northern Rocky Mountain Lower Montane Mesic Deciduous Shrubland	Eastside (Interior) Canyon Shrublands		
CES304.083 Columbia Plateau Steppe and Grassland	Eastside (Interior) Grasslands	Prairies and Steppe	
CES304.787 Inter-Mountain Basins Semi-Desert Grassland	Eastside (Interior) Grasslands	Prairies and Steppe	

Ecological System-based Land Cover Types*	WHROW Habitat Classifications	WDFW Priority Habitats 1	WDFW Priority Habitats 2
CES304.792 Columbia Basin Palouse Prairie	Eastside (Interior) Grasslands	Prairies and Steppe	
CES304.993 Columbia Basin Foothill and Canyon Dry Grassland	Eastside (Interior) Grasslands	Prairies and Steppe	
CES306.040 Northern Rocky Mountain Plateau and Valley Grassland	Eastside (Interior) Grasslands	Prairies and Steppe	
CES306.836 Northern Rocky Mountain Montane Grassland	Eastside (Interior) Grasslands	Prairies and Steppe	
CES204.086 East Cascades Mesic Montane Mixed-Conifer Forest and Woodland	Eastside (Interior) Mixed Conifer Forest	Old-growth/mature forests	
CES306.802 Northern Rocky Mountain Western Hemlock-Western Red-cedar Forest	Eastside (Interior) Mixed Conifer Forest	Old-growth/mature forests	
CES306.805 Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest	Eastside (Interior) Mixed Conifer Forest	Old-growth/mature forests	
CES306.837 Northern Rocky Mountain Western Larch Woodland	Eastside (Interior) Mixed Conifer Forest	Old-growth/mature forests	
CES360.xxx Northern Interior Spruce-Fir Woodland and Forest	Eastside (Interior) Mixed Conifer Forest	Old-growth/mature forests	
CES304.768 Columbia Basin Foothill Riparian Woodland and Shrubland	Eastside (Interior) Riparian-Wetlands	Riparian	
CES306.804 Northern Rocky Mountain Lower Montane Riparian Woodland and Shrubland	Eastside (Interior) Riparian-Wetlands	Riparian	
CES306.832 Rocky Mountain Subalpine-Montane Riparian Shrubland	Eastside (Interior) Riparian-Wetlands	Riparian	
CES306.833 Rocky Mountain Subalpine-Montane Riparian Woodland	Eastside (Interior) Riparian-Wetlands	Riparian	
Invasive Riparian Woodland and Shrubland	Eastside (Interior) Riparian-Wetlands		
Artificial Wetland	Herbaceous Wetlands		
CES200.876 Temperate Pacific Freshwater Aquatic Bed	Herbaceous Wetlands	Instream	
CES200.877 Temperate Pacific Freshwater Emergent Marsh	Herbaceous Wetlands	Freshwater wetlands & Freshwater deepwater	
CES200.878 Temperate Pacific Freshwater Mudflat	Herbaceous Wetlands	Instream	
CES200.998 Temperate Pacific Subalpine-Montane Wet Meadow	Herbaceous Wetlands		
CES204.874 Willamette Valley Wet Prairie	Herbaceous Wetlands		
CES300.729 North American Arid West Emergent Marsh	Herbaceous Wetlands		
CES304.058 Northern Columbia Plateau Basalt Pothole Ponds [Provisional]	Herbaceous Wetlands	Freshwater wetlands & Freshwater deepwater	
CES306.812 Rocky Mountain Alpine-Montane Wet Meadow	Herbaceous Wetlands	Riparian	
CES306.831 Rocky Mountain Subalpine-Montane Fen	Herbaceous Wetlands	Riparian	
Open Water this is in Aquatic and Marine Ecological Systems	Inland Marine Deeper Water (Puget Sound)		
CES306.820 Rocky Mountain Lodgepole Pine Forest	Lodgepole Pine Forest and Woodlands		
Unconsolidated Shore - this is in Aquatic and Marine Ecological Systems	Marine Nearshore	Marine/Esturine shorelines	
CES204.063 North Pacific Bog and Fen	Montane Coniferous Wetlands		
CES204.090 North Pacific Hardwood-Conifer Swamp	Montane Coniferous Wetlands		
CES306.803 Northern Rocky Mountain Conifer Swamp	Montane Coniferous Wetlands		

Ecological System-based Land Cover Types*	WHROW Habitat Classifications	WDFW Priority Habitats 1	WDFW Priority Habitats 2
CES204.087 North Pacific Montane Shrubland	Montane Mixed Conifer Forest		
CES204.097 North Pacific Mesic Western Hemlock-Silver Fir Forest	Montane Mixed Conifer Forest	Old-growth/mature forests	
CES204.098 North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest	Montane Mixed Conifer Forest	Old-growth/mature forests	
CES204.838 North Pacific Mountain Hemlock Forest	Montane Mixed Conifer Forest	Old-growth/mature forests	
CES204.883 North Pacific Wooded Lava Flow	Montane Mixed Conifer Forest		
CES306.828 Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	Montane Mixed Conifer Forest	Old-growth/mature forests	
CES306.830 Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland	Montane Mixed Conifer Forest	Old-growth/mature forests	
CES204.092 North Pacific Volcanic Rock and Cinder Land	none	Cliffs	Talus
CES204.093 North Pacific Montane Massive Bedrock, Cliff and Talus	none	Cliffs	Talus
CES204.095 North Pacific Serpentine Barren	none		Talus
CES204.853 North Pacific Alpine and Subalpine Bedrock and Scree	none	Cliffs	Talus
CES300.728 North American Alpine Ice Field	none		
CES304.779 Inter-Mountain Basins Cliff and Canyon	none	Cliffs	Talus
CES306.809 Rocky Mountain Alpine Bedrock and Scree	none	Cliffs	Talus
CES306.815 Rocky Mountain Cliff, Canyon and Massive Bedrock	none	Cliffs	Talus
Sparsely Vegetated	none		
CES204.859 North Pacific Hardpan Vernal Pool	not explictly in any		
CES204.996 Modoc Basalt Flow Vernal Pool	not explictly in any		
CES304.057 Northern Columbia Plateau Vernal Pool	not explictly in any		
CES306.801 Northern Rocky Mountain Avalanche Chute Shrubland	not explictly in any		
CES204.085 East Cascades Oak-Pine Forest and Woodland	Ponderosa Pine Forest and Woodlands (includes EastsideOak Woodlands)	Oregon white Oak woodlands	
CES306.030 Northern Rocky Mountain Ponderosa Pine Woodland and Savanna	Ponderosa Pine Forest and Woodlands (includes EastsideOak Woodlands)	Old-growth/mature forests	
CES304.775 Inter-Mountain Basins Active and Stabilized Dune	Shrub-steppe		
CES304.777 Inter-Mountain Basins Big Sagebrush Shrubland	Shrub-steppe	Shrub-steppe	
CES304.778 Inter-Mountain Basins Big Sagebrush Steppe	Shrub-steppe	Shrub-steppe	
CES304.785 Inter-Mountain Basins Montane Sagebrush Steppe	Shrub-steppe	Shrub-steppe	
CES304.788 Inter-Mountain Basins Semi-Desert Shrub-Steppe	Shrub-steppe	Shrub-steppe	
CES204.837 North Pacific Maritime Mesic Subalpine Parkland	Subalpine Parkland		
CES306.807 Northern Rocky Mountain Subalpine Dry Parkland	Subalpine Parkland		
CES306.808 Northern Rocky Mountain Subalpine Larch Woodland	Subalpine Parkland		

Ecological System-based Land Cover Types*	WHROW Habitat Classifications	WDFW Priority Habitats 1	WDFW Priority Habitats 2
CES306.813 Rocky Mountain Aspen Forest and Woodland	Upland Aspen Forest	Aspen Stands	
Developed	Urban and Mixed Environs		
Developed, High Intensity	Urban and Mixed Environs		
Developed, Low Intensity	Urban and Mixed Environs		
Developed, Medium Intensity -	Urban and Mixed Environs		
Developed, Open Space (Parks, Golf Courses, Open Space)	Urban and Mixed Environs		
CES304.082 Columbia Plateau Western Juniper Woodland and Savanna	Western Juniper and Mountain Mahogany Woodlands	Juniper Savannah	
CES204.089 North Pacific Herbaceous Bald and Bluff	Westside Grasslands	Prairies and Steppe	
CES204.858 Willamette Valley Upland Prairie and Savanna	Westside Grasslands	Prairies and Steppe	
CES204.846 North Pacific Broadleaf Landslide Forest and Shrubland	Westside Lowland Conifer-Hardwood (Mature) Forest		
CES204.001 North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest	Westside Lowland Conifer-Hardwood Forest	Old-growth/mature forests	
CES204.002 North Pacific Maritime Mesic-Wet Douglas-fir-Western Hemlock Forest	Westside Lowland Conifer-Hardwood Forest	Old-growth/mature forests	
CES204.841 North Pacific Hypermaritime Sitka Spruce Forest	Westside Lowland Conifer-Hardwood Forest	Old-growth/mature forests	
CES204.842 North Pacific Hypermaritime Western Red-cedar-Western Hemlock Forest	Westside Lowland Conifer-Hardwood Forest	Old-growth/mature forests	
CES204.845 North Pacific Dry Douglas-fir Forest and Woodland	Westside Oak and Dry Douglas-fir Forest and Woodlands	Old-growth/mature forests	
CES204.852 North Pacific Oak Woodland	Westside Oak and Dry Douglas-fir Forest and Woodlands	Oregon white Oak woodlands	
CES204.854 North Pacific Avalanche Chute Shrubland	Westside Riparian-Wetlands		
CES204.865 North Pacific Shrub Swamp	Westside Riparian-Wetlands	Riparian	
CES204.866 North Pacific Montane Riparian Woodland and Shrubland	Westside Riparian-Wetlands	Riparian	
CES204.869 North Pacific Lowland Riparian Forest and Shrubland	Westside Riparian-Wetlands	Riparian	
Subterranean System		Caves	

APPENDIX 4: CWCS OUTREACH PLAN

Communications will be continual and outreach will be opportunistic throughout the project, but there are three primary phases or points of contact with agencies, NGOs and the public which are being built in to the CWCS planning process.

1. **Initial Outreach:** Informs our various internal and external publics of the overall SWG program, including the EAs and CWCS project, and how our partners and the public can be involved in the development of the CWCS. Started with a briefing for the EMT and Fish and Wildlife Commission in December 2003 and continues with presentations to groups and various other outreach opportunities. Includes:

    - Development of a dynamic PowerPoint, CWCS outline and timeline (2003).
    - Development of a CWCS website and two full-color brochures, one for the CWCS and one for the overall SWG program (February 2004).
    - Creation of, and regular meetings with, an internal steering committee and external advisory committees (see attached CWCS committee lists).
    - Presentations to the various WDFW standing advisory committees, including the Game Advisory Council (12/13/03), Lands Advisory Council (3/27/04), and the Wildlife Diversity Advisory Council (4/24/04). These standing councils include representatives from many statewide conservation groups and they will hopefully serve as a venue to get the word out/back to these groups.
    - Presentation on EAs and CWCS process at the midwinter Wildlife Diversity Workshop
    - Presentations to Audubon Washington, The Nature Conservancy, WWRC, NW Land Trust Alliance and other wildlife conservation organizations, as opportunities arise.
    - Briefings/meetings with the Fish and Wildlife Service, USDA Forest Service and other federal agencies at their request (Spring 2004).
    - Briefings/meetings with the Washington State Assn of Counties, Washington Forest Protection Assn, and key agricultural contacts.
    - A briefing for key Congressional staff as part of March 2004 trip to Washington DC.
    - Coordination meetings with Yakama Indian Nation, Colville Confederated Tribes, and other tribes that manage large tracts of wildlife habitat, as well as smaller tribes. Work closely with Tribal Liaison Dick Stone and with WDFW Regional Directors on tribal outreach efforts.
    - A “heads up” letter from Director Koenings to all WDFW employees (May, 2004).
    - An article in the WDFW employees’ newsletter (Fall 2004).
    - Development of a CWCS link on the WDFW website (April 2004).
    - Meeting with Assistant Directors and Regional Directors on April 29 in Hyak to review CWCS process relative to Ecoregional Assessments, Subbasin Planning, Shared Salmon Strategy and other ongoing planning processes.

2. **Draft Strategy Review:** A second round of coordination and public involvement when we have a draft CWCS to review. A partial review of some components of the strategy such as species and habitat lists will also be done as we go along, by internal and external steering and advisory committees. Review will include:

    - Briefings for EMT, Regional Directors and Fish and Wildlife Commission.

- Follow-up meetings with many of the same groups and agencies as in the initial outreach phase, as well as agriculture and other groups not contacted in the initial outreach phase.
- A WDFW press release to outdoor media (June 1, 2005).
- A round of regional informational meetings to review the draft CWCS with regional stakeholders; work closely with the Regional Directors in setting up these meetings (June, 2005).
- Briefings for Governor's staff and key legislators.

3. **Post-submittal Outreach and Publicity:** Once the CWCS is submitted to and accepted by the U.S. Fish and Wildlife Service, WDFW should develop an 8 to 12-page Executive Summary and entertain a third round of outreach to the outdoor media and our various publics. The focus would be on the final CWCS and how it lays out the future course of wildlife conservation in Washington. This third round of outreach would have a number of advantages: it would let our various publics see how we used their input on the draft plan (if we did); it would give us another shot at people we missed with the draft strategy; it would give the outdoor media something shorter and more polished-looking (Executive Summary) to feature in stories; and it puts the final plan in the hands of people who can help address the resource problems identified in the strategy.

Other outreach and coordination efforts:

4. **Technical Development and Review:** Development of our Species of Greatest Conservation Need (SGCN) list and associated habitats, as well as statewide and ecoregional conservation strategies. Includes:

   - Participation in the WDFW's Ecoregional Assessment (EA) oversight committee to ensure close coordination with the EA products and the CWCS; close coordination with the EA and county planning elements of the overall SWG program.
   - Convening of ad-hoc species and habitat review committees consisting of wildlife taxa experts from WDFW, WDNR and groups such as Audubon Washington. Follow-up meetings with Harriet Allen and her staff to refine the SGCN matrix.
   - Meetings with Paul Ashley (Region 1) and David Johnson to develop ways to incorporate the subbasin planning and WHROW processes into the CWCS.

5. **National and Regional Coordination:** The International Association of Fish and Wildlife Agencies (IAFWA) and the US Fish and Wildlife Service (FWS) have initiated national and regional coordination efforts. These efforts have direct benefits for all concerned and we will participate in both national and regional coordination efforts. Defenders of Wildlife, The Nature Conservancy, and other national conservation groups will also participate in these efforts. Director Koenings will represent WAFWA on the National Advisory and Acceptance Team (NAAT) for the CWCS.

   - National coordination meetings with IAFWA, FWS, OWP and other state wildlife agencies. Includes meetings in Burnet, Texas, Washington, DC (March 2004), Spokane (April 2004), and Nebraska City, (August 2004).
   - Monthly coordination conference calls with FWS Region 1 and state conservation strategy coordinators in Region 1 states (February 2004).
   - Bimonthly meetings in the Vancouver/Portland area with FWS, Defenders of Wildlife, The Nature Conservancy, and conservation strategy coordinators from Idaho and Oregon.

APPENDIX 5: MAJOR CONSERVATION PROGRAMS AND PARTNERS

Audubon Washington
Defenders of Wildlife
Cascade Land Conservancy
Ducks Unlimited, Inc.

Indian Tribes

- Chehalis Confederated Tribe
- Colville Confederated Tribes
- Cowlitz Indian Tribe
- Hoh Indian Tribe
- Jamestown S'Klallam Tribe
- Kalispel Indian Community
- Lower Elwha Klallam Indian Tribe
- Lummi Nation
- Makah Indian Tribe
- Muckleshoot Indian Tribe
- Nisqually Indian Tribe
- Nooksack Indian Tribe
- Port Gamble S'Klallam Tribe
- Puyallup Tribe of Indians
- Quileute Indian Tribe
- Quinault Indian Nation
- Samish Tribe
- Sauk-Suiattle Indian Tribe
- Shoalwater Bay Tribe
- Skokomish Tribe
- Spokane Tribe
- Squaxin Island Indian Tribe
- Stillaguamish Indian Tribe
- Suquamish Tribe
- Swinomish Indian Tribal Community
- Tulalip Tribes
- Upper Skagit Tribe
- Yakama Nation

Intermountain West Joint Venture
Lower Columbia Fish Recovery Board
National Park Service
National Resources Conservation Service
Northwest Habitat Institute
Northwest Land Trusts
Northwest Power and Conservation Council
Pacific Coast Joint Venture
Partners in Flight
People for Puget Sound
Puget Sound Action Team
Snake River Salmon Recovery Board
The Nature Conservancy of Washington
The Rocky Mountain Elk Foundation
Upper Columbia Salmon Recovery Board

U.S. Bureau of Land Management
U.S. Bureau of Reclamation

USDA Forest Service
- Colville National Forest
- Gifford Pinchot National Forest
- Mount Baker-Snoqualmie National Forest
- Okanogan National Forest
- Olympic National Forest
- Umatilla National Forest
- Wenatchee National Forest

U.S. Department of Defense
- U.S. Army (Yakima Training Center)
- U.S. Navy (Puget Sound bases)
- U.S. Air Force (McChord and Fairchild AFBs)

U.S. Fish and Wildlife Service
- Columbia National Wildlife Refuge
- Conboy National Wildlife Refuge
- Copalis National Wildlife Refuge
- Dungeness National Wildlife Refuge
- Flattery Rocks National Wildlife Refuge
- Franz Lake National Wildlife Refuge
- Grays Harbor National Wildlife Refuge
- Hanford Reservation
- Julia B. Hansen National Wildlife Refuge
- Little Pend Oreille National Wildlife Refuge
- McNary National Wildlife Refuge
- Nisqually National Wildlife Refuge
- Pierce National Wildlife Refuge
- Protection Island National Wildlife Refuge
- Quillayute Needles National Wildlife Refuge
- Ridgefield National Wildlife Refuge
- Saddle Mountain National Wildlife Refuge
- San Juan Islands National Wildlife Refuge
- Steigerwald Lake National Wildlife Refuge
- Toppenish National Wildlife Refuge
- Turnbull National Wildlife Refuge
- Willapa National Wildlife Refuge

Washington Conservation Districts
Washington Department of Agriculture
Washington Department of Ecology
Washington Department of Natural Resources
- Washington Natural Heritage Program
- Natural Areas Program

Washington Department of Transportation
Washington Farm Forestry Association
Washington Forest Protection Association
Washington Sea Grant

Washington State Association of Counties

- Adams County
- Asotin County
- Benton County
- Chelan County
- Clallam County
- Clark County
- Columbia County
- Cowlitz County
- Douglas County
- Ferry County
- Franklin County
- Garfield County
- Grant County
- Grays Harbor County
- Island County
- Jefferson County
- King County
- Kitsap County
- Kittitas County
- Klickitat County
- Lewis County
- Lincoln County
- Mason County
- Okanogan County
- Pacific County
- Pend Oreille County
- Pierce County
- San Juan County
- Skagit County
- Skamania County
- Snohomish County
- Spokane County
- Stevens County
- Thurston County
- Wahkiakum County
- Walla Walla County
- Whatcom County
- Whitman County
- Yakima County

Washington State Conservation Commission
Washington State Parks and Recreation Commission
Washington Water Resources Association
Yakima County
Yakima Salmon Recovery Board

Washington Priority Habitats and Species List

The Priority Habitats and Species (PHS) List is a catalog of those species and habitat types identified by the Washington Department of Fish and Wildlife (WDFW) as priorities for management and preservation. Because information on fish, wildlife, and their habitats is dynamic, the PHS List is updated periodically.

The PHS List is a catalog of habitats and species considered to be priorities for conservation and management. Priority species require protective measures for their perpetuation due to their population status, sensitivity to habitat alteration, and/or recreational, commercial, or tribal importance. Priority species include State Endangered, Threatened, Sensitive, and Candidate species; animal aggregations considered vulnerable; and those species of recreational, commercial, or tribal importance that are vulnerable. Priority habitats are those habitat types or elements with unique or significant value to a diverse assemblage of species. A Priority habitat may consist of a unique vegetation type or dominant plant species, a described successional stage, or a specific structural element.

There are 18 habitat types, 140 vertebrate species, 28 invertebrate species, and 14 species groups currently on the PHS List. These constitute about 16 percent of Washington’s approximately 1,000 vertebrate species and a fraction of the state’s invertebrate fauna. Mapping of priority habitats and species was initiated in 1990 and includes about two-thirds of Washington's 43 million acres. The remaining third generally involves federal and tribal lands. Mapping consists of recording locational and descriptive data in a Geographic Information System (GIS). These GIS databases represent WDFW's best knowledge of fish and wildlife resources and occurrences. It is important to note, however, that priority species or priority habitats may occur in areas not currently known to WDFW biologists or in areas for which comprehensive surveys have not been conducted. Site-specific surveys may be necessary to rule out the presence of priority habitats or species on individual sites.

Included in the PHS system of databases are WDFW's PHS Points and Polygon Databases, StreamNet, and the Wildlife Heritage Database. Other information sources include the Department of Natural Resources Aquatic Lands Division database on kelp beds and the U.S. Fish and Wildlife Service's information on the National Wetlands Inventory (NWI).

Questions and requests for additional PHS information may be directed to:

Priority Habitats and Species
WDFW Habitat Program
600 Capitol Way N.
Olympia WA 98501-1091

Internet Access:
The PHS internet home page can be accessed via the World Wide Web at:
www.wa.gov/wdfw/hab/phspage.htm

Washington Natural Heritage Program

The Washington Natural Heritage Program (WNHP) was established by the State Legislature and placed within the Washington Department of Natural Resources (WDNR) in 1982. The main objectives of establishing the program were 1) to develop and maintain an objective classification of the state's species and ecosystems, 2) to develop an inventory of the locations of priority species and ecosystems, 3) to use the information to help guide the development of a statewide system of natural areas, and 4) to share the information with agencies, organizations and individuals for environmental assessment and land management purposes.

Since its establishment, the WNHP has been gathering information on rare species and both rare and common ecosystems. The WNHP maintains the primary statewide information system on rare plant species, managing information on more than 350 species of rare plants and more than 5,000 locations of those species statewide. The WNHP also has information and expertise on select groups of rare animal species. The WNHP zoologists work cooperatively with WDFW zoologists on individual projects and on setting species priorities. The WNHP's vegetation ecologists are responsible for the development and maintenance of the statewide ecosystems classification used in ecoregional assessments and other conservation planning purposes.

The Washington Natural Heritage Information System is a major source of information for individuals, agencies and organizations engaged in land use planning and decision making. During the recently concluded biennium (2003-2005), the WNHP provided information to more than 1,000 private companies, local governments, state and federal agencies, conservation organizations and educational institutions.

The WNHP is a member of a network of similar programs throughout the western hemisphere. The network, NatureServe, has member programs in all 50 states, all Canadian provinces, and several Latin American and Caribbean nations. All programs use the same basic methodology and data management tools to assess rarity and for setting conservation priorities. This allows for improved sharing of information and consistency of conservation efforts across political boundaries.

Questions and requests for additional information regarding WNHP can be directed to:

Washington Natural Heritage Program
Department of Natural Resources
PO Box 47014, Olympia, WA 98504-7014
(360) 902-1661 or (360) 902-1667

The WNHP home page can be accessed via the Internet at:
http://www.dnr.wa.gov/inhp/index.html

Additional information about NatureServe is available via the Internet at:
http://www.natureserve.org

Interactive Biodiversity Information System

IBIS is an informational resource developed by the Northwest Habitat Institute (NHI) to promote the conservation of Northwest fish, wildlife, and their habitats through education and the distribution of timely, peer-reviewed scientific data.

IBIS contains extensive information about Pacific Northwest fish, wildlife, and their habitats, but more noteworthy, IBIS attempts to reveal and analyze the relationships among these species and their habitats. NHI hopes to make the IBIS web site a place where students, scientists, resource managers or any other interested user can discover and analyze these relationships without having to purchase special software (such as geographic information systems) or hassle with the integration of disparate data sets. IBIS will, however, provide downloadable data for users who desire to perform more advanced analyses or to integrate their own data sets with IBIS data. Finally, NHI sees IBIS as not only a fish, wildlife, and habitat information distribution system but also as a peer-review system for species data. We acknowledge that in a system as extensive as IBIS, there are going to be errors as well as disagreement among scientists regarding the attributes of species and their relationships. NHI encourages IBIS users to provide feedback so we may correct errors and discuss discrepancies.

The IBIS web site is in the early stages of development; however, NHI staff, with the support of many project partners, has been developing the data for over five years. The IBIS database was initially developed by NHI for Oregon and Washington during the Wildlife-Habitat Types in Oregon and Washington project. IBIS data is currently being refined and extended to include all of Idaho, Oregon, Washington, and the Columbia River Basin portions of Montana, Nevada, Utah and Wyoming. IBIS will eventually include species range maps, wildlife-habitat maps, extensive species-habitat data queries, and interactive wildlife-habitat mapping applications allowing dynamic spatial queries for the entire Pacific Northwest as previously defined.

Internet Access:

The IBIS Internet Home Page can be accessed via the World Wide Web at:
http://www.nwhi.org/ibis/home/ibis.asp

Questions about IBIS may be directed to:
The Northwest Habitat Institute
P.O. Box 855
Corvallis, OR 97339
Phone:(541)753-2199
Fax:(541)753-2440
habitat@nwhi.org

Washington GAP Analysis Program

The Washington GAP Analysis Program (GAP) is a nation-wide program currently administered by the Biological Resources Division of the US Geological Survey (BRD-USGS; formerly the National Biological Service [NBS]). The overall goal of GAP Analysis is to identify elements of biodiversity that lack adequate representation in the nation's network of reserves (i.e., areas managed primarily for the protection of biodiversity). GAP Analysis is a coarse-filter approach to biodiversity protection. It provides an overview of the distribution and conservation status of several components of biodiversity, with particular emphasis on vegetation and terrestrial vertebrates. Digital map overlays in a Geographic Information System (GIS) are used to identify vegetation types, individual species, and species-rich areas that are unrepresented or underrepresented in existing biodiversity management areas. GAP Analysis functions as a preliminary step to more detailed studies needed to establish actual boundaries for potential additions to the existing network of reserves.

The primary filter in GAP Analysis is vegetation type (defined by the Washington GAP Analysis Project as the composite of actual vegetation, vegetation zone, and ecoregion). Vegetation types are mapped and their conservation status evaluated based on representation on biodiversity management areas, conversion to human-dominated landscapes, and spatial context. Vegetation is used as the primary filter in GAP Analysis because vegetation patterns are determinants of overall biodiversity patterns (Levin 1981, Noss 1990, Franklin 1993). It is impractical to map the distributions of all plants and animals, but GAP Analysis makes the assumption that if all vegetation types are adequately represented in biodiversity management areas, then most plant and animal species will also be adequately represented. The second major GAP Analysis filter is composed of information on the distribution of individual species. This filter can be used to identify individual species that lack adequate protection and, when individual species maps are overlaid, areas of high species richness. In most states, including Washington, vertebrates are the only taxa mapped because there is relatively little information available for other taxa, and because vertebrates currently command the most attention in conservation issues.

The following are general limitations of GAP Analysis; specific limitations for particular datasets are described in the appropriate sections:

GAP Analysis data are derived from remote sensing and modeling to make general assessments about conservation status. Any decisions based on the data must be supported by ground-truthing and more detailed analyses.

GAP Analysis is not a substitute for the listing of threatened and endangered species and associated recovery efforts. A primary argument in favor of GAP Analysis is that it is proactive in recognizing areas of high biodiversity value for the long-term maintenance of populations of native species and natural ecosystems before individual species and plant communities become threatened with extinction. A goal of GAP Analysis is to reduce the rate at which species require listing as threatened or endangered.

The static nature of the GAP Analysis data limits their utility in conservation risk assessment. Our database provides a snapshot of a region in which land cover and land ownership are dynamic and where trend data would be especially useful.

GAP Analysis is not a substitute for a thorough national biological inventory. As a response to rapid habitat loss, GAP Analysis is intended to provide a quick assessment of the distribution of vegetation and associated species before they are lost and to provide focus and direction for local, regional, and national efforts to maintain biodiversity. The process of improving knowledge in systematics, ecology, and distribution of species is lengthy and expensive. That process must be continued and expedited in order to provide the detailed information needed for a comprehensive assessment of the nation's biodiversity.

GAP Analysis is a coarse-filter approach. The network of Conservation Data Centers (CDC) and Natural Heritage Programs established cooperatively by The Nature Conservancy and various state agencies maintain detailed databases on the locations of rare elements of biodiversity. Conservation of such elements is best accomplished through the fine-filter approach of the above organizations. It is not the role of GAP to duplicate or disseminate Natural Heritage Program or CDC Element Occurrence Records. Users interested in more specific information about the location, status, and ecology of populations of such species are directed to their state Natural Heritage Program or CDC.

Internet Access:
The Washington GAP Analysis Internet Home Page can be accessed via the World Wide Web at: http://www.fish.washington.edu/naturemapping/waGAP/public_html/index.html

Questions about the Washington GAP Analysis Project may be directed to:
Washington Cooperative Fish and Wildlife Research Unit
University of Washington Box 355020
Seattle, WA 98195-5020
(206)543-6475

Partners in Flight

Partners in Flight was launched in 1990 in response to growing concerns about declines in the populations of many land bird species, and in order to emphasize the conservation of birds not covered by existing conservation initiatives. The initial focus was on Neotropical migrants, species that breed in the Nearctic (North America) and winter in the Neotropics (Central and South America), but the focus has spread to include most landbirds and other species requiring terrestrial habitats. The central premise of Partners in Flight (PIF) has been that the resources of public and private organizations in North and South America must be combined, coordinated, and increased in order to achieve success in conserving bird populations in this hemisphere. Partners in Flight is a cooperative effort involving partnerships among federal, state and local government agencies, philanthropic foundations, professional organizations, conservation groups, industry, the academic community, and private individuals. All Partners in Flight meetings at all levels are open to anyone interested in bird conservation.

Partners in Flight's goal is to focus resources on the improvement of monitoring and inventory, research, management, and education programs involving birds and their habitats. The PIF strategy is to stimulate cooperative public and private sector efforts in North America and the Neotropics to meet these goals.

Bird Conservation Planning Information

One of the primary activities being conducted by Partners in Flight - U.S. is the development of bird conservation plans for the entire continental United States.

The Flight Plan

The guiding principles for PIF bird conservation planning can be found in the Partners in Flight
bird conservation strategy, The Flight Plan. It is composed of four parts:
(1) setting priorities
(2) establishing objectives
(3) conservation action
(4) evaluation.

Physiographic Areas

The spatial unit chosen by Partners in Flight for planning purposes is the physiographic area. There are 58 physiographic areas wholly or partially contained within the contiguous United States and several others wholly or partially in Alaska. Partners in Flight bird conservation plans in the West use state boundaries as their first sorting unit for planning, with each plan internally arranged by physiographic area or habitat type.

Integrated Bird Conservation

A common spatial language can greatly enhance the potential for communication among conservation initiatives. Under the auspices of the North American Bird Conservation Initiative (NABCI), Partners in Flight worked with the North American Waterfowl Management Plan, the Unites States Shorebird Conservation Plan, and the North American Waterbird Conservation Plan, as well as with counterparts in Mexico and Canada, to develop a standard map of planning regions to be shared by all initiatives. These Bird Conservation Regions are intended to serve as planning, implementation, and evaluation units for integrated bird conservation for the entire continent. Future revisions of PIF Bird Conservation Plans will begin to utilize Bird Conservation Regions as the planning units, facilitating integration with planning efforts of the other initiatives.

Species Assessment
An important component in The PIF Flight Plan is the identification of priority species. PIF recognized that existing means of setting conservation priorities did not capture the complexities and needs of birds. The PIF Species Assessment process uses the best of traditional methods modified by our knowledge of bird biology to create a scientifically credible means of prioritizing birds and their habitat. It is a dynamic method that uses several criteria to rank a species' vulnerability. Numerical scores are given for each criterion, with higher scores reflecting higher vulnerability. The most vulnerable species are those with declining population trends, limited geographic ranges, and/or deteriorating habitats.

PIF Watch List
The Partners in Flight Watch List was developed using the Species Assessment to highlight those birds of the continental United States, not already listed under the Endangered Species Act, that most warrant conservation attention. There is no single reason why all of these birds are on the list. Some are relatively common but undergoing steep population declines; others are rare but actually increasing in numbers. The Watch List is not intended to drive local conservation agendas, which should be based on priorities identified within each physiographic area.

Species Account Resources
Species accounts that synthesize scientific literature on the life histories and effects of management practices on particular bird species are available from a variety of sources.

Bird Conservation Plans Summary Document
The development of Bird Conservation Plans is a complicated process. More detailed information about the PIF Bird Conservation Planning Process and PIF Bird Conservation Plans is provided in the recent PIF publication - Partners in Flight: Conservation of the Land Birds of the United States.

Internet Access:
The Partners in Flight Internet Home Page can be accessed via the World Wide Web at:
http://www.partnersinflight.org/

National Wetland Inventory

The National Wetlands Inventory (NWI) of the U.S. Fish and Wildlife Service produces information on the characteristics, extent, and status of the Nation's wetlands and deepwater habitats. The National Wetlands Inventory Center information is used by Federal, State, and local agencies, academic institutions, U.S. Congress, and the private sector. The NWIC has mapped 90 percent of the lower 48 states, and 34 percent of Alaska. About 44 percent of the lower 48 states and 13 percent of Alaska are digitized. Congressional mandates require the NWIC to produce status and trends reports to Congress at ten-year intervals. In addition to status and trends reports, the NWIC has produced over 130 publications, including manuals, plant and hydric soils lists, field guides, posters, wall size resource maps, atlases, state reports, and numerous articles published in professional journals.

The NWI National Center in St. Petersburg, Florida, includes a state-of-the-art computer operation which is responsible for constructing the wetlands layer of the National Spatial Data Infrastructure. Digitized wetlands data can be integrated with other layers of the NSDI such as natural resources and cultural and physical features, leading to production of selected color and customized maps of the information from wetland maps, and the transfer of digital data to users and researchers world-wide. Dozens of organizations, including Federal, State, county agencies, and private sector organizations such as Ducks Unlimited, have supported conversion of wetland maps into digital data for computer use. Statewide databases have been built for 9 States and initiated in 5 other States. Digitized wetland data are also available for portions of 37 other States. Once a digital database is constructed, users can obtain the data at no cost over the Internet, or through the U.S. Geological Survey for the cost of reproduction.

NWI maintains a MAPS database of metadata containing production information, history, and availability of all maps and digital wetlands data produced by NWI. This database is available over the Internet.

The Emergency Wetlands Resources Act requires that NWI archive and disseminate wetlands maps and digitized data as it becomes available. The process prescribed by Office of Management and Budget (OMB) Circular A-16, "Coordination of Surveying, Mapping, and Related Spatial Data", provides an avenue for increased NWI coordination activities with other Federal agencies to reduce waste in government programs. As chair of the Federal Geographic Data Committee's Wetlands Subcommittee, the NWI Project Leader is responsible for promoting the development, sharing, and dissemination of wetlands related spatial data. The Secretary of the Interior chairs the Federal Geographic Data Committee. NWI continues to coordinate mapping activities under 36 cooperative agreements or memoranda of understanding. NWI is involved in training and providing technical assistance to the public and other agencies.

NWI maps and digital data are distributed widely throughout the country and the world. NWI has distributed over 1.7 million maps nationally since they were first introduced. Map distribution is accomplished through Cooperator-Run Distribution centers.

Users of NWI maps and digital data are as varied as are the uses. Maps are used by all levels of government, academia, Congress, private consultants, land developers, and conservation organizations. The public makes extensive use of NWI maps in a myriad of applications including planning for watershed and drinking water supply protection; siting of transportation corridors; construction of solid waste facilities; and siting of schools and other municipal buildings. Resource managers in the Service and the States are provided with maps which are essential for effective habitat management and acquisition of important wetland areas needed to perpetuate migratory bird populations as called for in the North American Waterfowl and Wetlands Management Plan; for fisheries restoration; floodplain planning; and endangered species recovery plans. Agencies from the Department of Agriculture use the maps as a major tool in the identification of wetlands for the administration of the Swampbuster provisions of the 1985 and 1990 Farm Bills. Regulatory agencies use the maps to help in advanced wetland identification procedures, and to determine wetland values and mitigation requirements. Private sector planners use the maps to determine location and nature of wetlands to aid in framing alternative plans to meet regulatory requirements. The maps are instrumental in preventing problems from developing and in providing facts that allow sound business decisions to be made quickly, accurately, and efficiently. Good planning protects the habitat value of wetlands for wildlife, preserves water quality, provides flood protection, and enhances ground water recharge, among many other wetland values.

Additional sources of data are maintained by the Service to complement the information available from the maps themselves. The Service maintains a National List of Vascular Plant Species that Occur in Wetlands. This list is referenced in the Federal Manual for Identifying and Delineating Jurisdictional Wetlands, and in the Natural Resources Conservation Service's procedures to identify wetlands for the Swampbuster provision of the Farm Bill. The recent report on wetlands by the National Academy of Sciences found the National List to be scientifically sound and recommended that the Service continue development of the list. The Service has developed a protocol to allow other agencies and private individuals to submit additions, deletions, or changes to the list. The National List and Regional Lists are available over the Internet through the NWI Homepage.

NWI digital data have been available over the Internet since 1994. In the first year alone 93,000 data files were distributed through anonymous file transfer protocol (FTP) access to wetland maps digital line graph (DLG) data. To date, over 250,000 electronic copies of wetland maps are in the hands of resource managers and the general public. One-third of the digital wetlands files downloaded off Internet went to government agencies at Federal, State, Regional, and local levels. Other users include commercial enterprises, environmental organizations, universities, and the military. Users from 25 countries from Estonia to New Zealand to Chile obtained NWI maps from the Internet. This excellent partnership provides information to any government, private, or commercial entity that requires assistance to address issues throughout the world.

The National Wetlands Inventory Internet Home Page can be accessed via the World Wide Web at: http://wetlands.fws.gov/

Ecoregional Assessments

Ecoregional Assessments (EAs) are the product of a partnership between TNC and WDFW. Other major contributors to EAs are the natural heritage programs in Washington and Oregon. Ecoregional Assessments also have benefited from the participation of many other scientists and conservation experts as team members and expert reviewers. EAs use an approach developed by TNC (Groves *et al*. 2000; Groves *et al.* 2002; Groves 2003) and other scientists to establish long-term conservation priorities within the natural boundaries of ecoregions. "First iteration' or first edition assessments have been completed for over 45 of the 81 ecoregions in the U.S., and for several others outside the U.S, with the objective of completing assessments throughout the U.S. (and in many parts of Canada and other countries) by 2008. The Nature Conservancy is leading a number of these assessments, while others are led by partner organizations or agencies using the same basic methodology.

<u>Overview of the EA Process</u>
The EA process follows the basic steps described below. An EA may devise innovations where necessary to address specific data limitations or other challenges they confronted.

1. Identify conservation targets – Conservation targets are those elements of biodiversity – plants, animals, plant communities, habitat types, etc. – that are included in the analysis. Targets are selected to represent the full range of biodiversity in the ecoregion and to include any species of special concern.

Robert Jenkins, working for TNC in the 1970s, developed the concept of 'coarse filter' and 'fine filter' conservation targets for use in conservation planning (Jenkins 1996; Noss 1987). This approach hypothesizes that conservation of all communities and ecological systems (coarse filter targets) will also conserve the majority of species that occupy them. This coarse filter strategy is a way to compensate for the lack of detailed information on the vast number of poorly-studied invertebrates and other species.

Fine filter targets are those species or natural communities which can not be assumed to be represented in a conservation plan simply by including the full range of coarse filter targets. Fine filter targets warrant a special effort to ensure they are conserved. These are typically rare or imperiled species or natural community types, but can include wide-ranging species, ecoregional endemic species, species that are ecoregionally disjunct, or keystone species.

2. Assemble information on the target locations and occurrence quality – Data are assembled on target occurrences from a variety of sources. Although existing agency databases make up the bulk of this data set, data gaps are often filled by gathering previously scattered information and consulting specialists for specific target groups.

3. Determine how to represent and rank target occurrences – Decisions are made regarding the best way to describe and map occurrences of each target. Targets may be represented as points for specific locations, such as rare plant population locations, or polygons to show the areal extent of coarse filter targets. In addition, the quality of each occurrence is ranked where possible using the NatureServe element occurrence ranking system (NatureServe and TNC 2000). The data are stored in a Geographical Information System (GIS).

4. Set representation levels for each target – The analytical tool used for ecoregional assessments requires representation levels or "goals" for how many populations or how much habitat area must be conserved to sustain each target over time. These

“goals” are used to drive the next step of the process: selection of a portfolio of conservation areas. In reality, very few targets are sufficiently understood to allow scientists to estimate with a high degree of confidence the number and distribution of occurrences that will be sufficient to ensure survival. It is essential that users of ECAs recognize this limitation. The goals do not correspond to sufficient conditions for long-term survival of species. They do, however, function as analytical tools for assembling an efficient portfolio of conservation areas that captures multiple examples of the ecoregion’s biodiversity. These goals also provide a metric for gauging the progress of biodiversity conservation in the ecoregion over time.

There is another more profound reason for not setting conservation goals in a scientific assessment. Conservation goals are a policy choice that should based on societal values. Policy choices are the responsibility of those entrusted to make them: agency directors, stakeholder commissions, county commissioners, the legislature, etc. This assessment was conducted by scientists, not policy makers. Our use of goals is not a policy statement. The “goals” are simply an analytical device for mapping important places for conservation.

5. Rate the suitability of assessment units – An ecoregion is divided into thousands of “assessment units.” The assessment units can be based on watersheds, a cadastral system, or a regular rectangular or hexagonal grid. Each of these units is compared to the others using a set of factors related to suitability for conservation. Suitability is roughly equivalent to the likelihood of conservation success. Suitability encompasses surrogates for habitat quality, such as road density or the extent of developed areas, as well as factors likely to influence conservation feasibility, such as proximity to urban areas, the proportion of private lands, or the existence of established conservation areas (Davis *et al*. 1996).

It is important to note that the factors chosen for this “suitability index” strongly influence selection of conservation areas, i.e., a different set of factors can result in a different portfolio. Also, some factors in the suitability index cross into what is traditionally a policy arena. For example, setting the index to favor the selection of existing public over private land presumes a policy of using existing public lands to meet goals wherever possible; thereby minimizing the involvement of private or tribal lands.

6. Assemble a draft portfolio – An EA entails hundreds of different targets existing at thousands of widely distributed locations. The relative biodiversity value and relative conservation suitability of thousands of potential conservation areas must be evaluated. This complexity of information precludes simple inspection by experts to arrive at the most efficient, yet comprehensive, set of conservation areas. Hence, EAs use an optimal site selection algorithm known as SITES. Developed for The Nature Conservancy by the National Center for Ecological Analysis and Synthesis, SITES is computer software that aids scientists in identifying an efficient set of conservation areas. It uses a computational algorithm developed at the University of Adelaide, Australia.

To use SITES, one must input data describing the biodiversity at and the conservation suitability of the thousands of assessment units in the ecoregion. The number of targets, condition of targets, and rarity of targets present at a particular place determines the biodiversity of the unit. Conservation suitability is input as a suitability index (described above) representing a set of weighted factors chosen to represent the relative likelihood of successful conservation at a unit. The relative weighting of each of these factors is determined by the scientists conducting the assessment.

SITES strives to minimize an objective function. It begins by selecting a random set of hexagons, i.e., a random conservation portfolio. Next, SITES iteratively explores improvements to this random portfolio by randomly adding or removing other units. At each iteration, the new portfolio is compared with the previous portfolio and the better one is accepted. The algorithm uses a method called simulated annealing (Kirkpatrick *et al*. 1983) to reject sub-optimal portfolios, thus greatly increasing the chances of converging on most efficient portfolio. Typically, the algorithm is run for 1 to 2 million iterations.

Keep in mind that SITES is a decision support tool. That is, it cannot generate the ultimate conservation portfolio. Expert review and revision are necessary to compensate for gaps in the input data or other limitations of this automated part of the portfolio development process. 7. Refine the Portfolio Through Expert Review – The assessment teams and additional outside experts review the draft portfolio to correct errors of omission or inclusion by the computer-driven site selection process. These experts also assist the teams with refining individual site boundaries.

<u>Strengths and Limitations of EAs</u>
EAs are a resource for planners and others interested in the status or conservation of the biological diversity of an ecoregion. EAs improve on the informational resources previously available in several ways:

• EAs are conducted at an ecoregional scale. It provides information for decisions and activities that occur at an ecoregional scale: establishing regional priorities for conservation action; coordinating programs for species or habitats that cross state, county, or other political boundaries; judging the regional importance of any particular site in the ecoregion; and measuring progress in protecting the full biodiversity of the ecoregion.

• In order to prepare an EA, diverse data sources are drawn together into a single system. Terrestrial species and habitat information is brought together as an integrated planning resource. Expert input has been gathered, reviewed by other experts, and documented. This database is available for ongoing analyses, continued improvement of the data themselves, and application to other natural resource questions.

• An EA tells us which areas contribute the most to the conservation of existing biodiversity. It provides a baseline to measure conservation progress over time as we continue to improve our understanding of the ecosystems and species we hope to conserve. At the same time, it is important to recognize the limitations of EAs and to understand how they should be utilized. Users should be mindful of the following:

• An EA has no regulatory authority. It is simply a guide for conservation action across the ecoregion. As a guide with no regulatory authority, a portfolio is intrinsically flexible. A portfolio should not constrain decision makers in how they address local land use and conservation issues. Since many types of land use are compatible with biodiversity conservation, the large number and size of conservation areas creates numerous options for local conservation of biodiversity. Ultimately, the management or protection of the conservation priority areas will be based on the policies and values of local governments, organizations, and citizens. Decision makers should use this guide to inform their choices.

• Sites or "priority conservation areas" described in an EA are not intended to be dominated by parks or nature reserves set aside from economic activity. While some areas may require such protection, most can and will accommodate multiple uses as determined by landowners, local communities and appropriate agencies.

• An EA is one of many science-based tools that will assist conservation efforts by government agencies, non-governmental organizations, and individuals. It cannot replace, for example, recovery plans for endangered species, or the detailed planning required to design a local conservation project. It does not address the special considerations of salmon or game management, and so, for example, cannot be used to ensure adequate populations for harvest.

• EAs are an ecoregion-scale assessment. Therefore, a conservation portfolio will not include many places that are significant for the conservation of local biodiversity, such as small wetlands, riparian areas, cliffs, and small, high-quality patches of common habitat types. Due the spatial scale of an assessment, some conservation priority areas may include places that are poorly suited for conservation. Also, the boundaries ascribed to sites in a portfolio may not coincide to boundaries drawn with higher resolution data. For this reason, local assessments will be necessary and are encouraged.

• A conservation portfolio should not be used as a guide for siting restoration projects. Priority conservation areas include high-quality habitat that must be maintained as well as lower quality habitat that will require restoration. But they are not the only sites in the ecoregion that merit restoration, whether for rebuilding habitat for imperiled species, increasing salmon or game abundance, improving water quality, or other community objectives.

APPENDIX 11: CWCS COMMITTEES

CWCS ADVISORY COMMITTEE

This committee includes people from other agencies, as well as statewide wildlife organizations. Group are convened on a bimonthly or quarterly basis to review and provide input on the CWCS process. Individuals also represent their agency/organization's general interests with regard to the CWCS.

- Robert Alvarado, USDA Forest Service, Region Six, Portland, OR
- Carole Richmond, Washington Interagency Committee for Outdoor Recreation
- Chris Regan, Washington State Parks and Recreation Commission
- Craig Partridge, Washington Department Natural Resources
- Pene Speaks, Washington Department Natural Resources
- Verlyn Ebert, U.S. Fish and Wildlife Service, Region One, Portland, OR
- Dan Edwards, U.S. Fish and Wildlife Service, Region One, Portland, OR
- David Jennings, Wildlife Diversity Advisory Council
- Doug Myers, Puget Sound Action Team
- Elizabeth Gray, The Nature Conservancy of Washington
- Jane Rubey, Washington Department of Ecology
- John Marzluff, University of Washington, College of Forest Resources
- John Stuhlmiller, Environmental Policy, Washington Farm Bureau
- Karen Dvornich, Manager, Washington GAP Project
- Ken Risenhoover, Wildlife Conservation Director, Port Blakely Tree Farms
- Mark Heckert, Washington Wildlife Federation
- Nina Carter, Executive Director, Audubon Washington
- Paul Wagner, Washington Department of Transportation
- Sara Vickerman, Defenders of Wildlife, West Coast Office, West Linn, OR
- Todd Thompson, U.S. Bureau of Land Management, Spokane, WA

WILDLIFE DIVERSITY ADVISORY COUNCIL

- Angela Stringer, The Campbell Group
- Charles F. Lennox, Seattle Audubon Society
- Chris Holland Cedar River Watershed Educational Center
- David Jennings, Black Hills Audubon Society
- Doug Pineo, Washington Department of Ecology
- Dyche Kinder, The Mountaineers
- Frank and June Potter, Inland Northwest Wildlife Council
- Helen Engle, National Audubon Society
- John Fleckenstein, Washington Natural Heritage Program
- Kate Stenberg, Sammamish
- Len Steiner, Conservation Committee
- Sally Van Niel, Everett Community College
- Tom Campbell, Peace and Plenty Farm

LANDS MANAGEMENT ADVISORY COUNCIL

- Arvilla Ohlde, Belfair
- Brad Johnson, Washington Wildlife Federation
- Brian Briscoe, Montesano
- Brian Davern, Vancouver
- Burl Booker, Connell
- Dan Kinney, Yakima Valley Audubon
- John Blankenship, Olympia
- John Comes, Bothell
- Marianne Brown, Ferndale
- Neil Kayser, Washington Cattlemen's Association
- Norm McClure, Statewide CRM Task Group
- Paul Ancich, Fircrest
- Phil Mosher, Wenatchee
- Robert Stoll, Spokane
- Steve Bondi, Methow Conservancy
- Tom McCoy, Selah
- Tom Rutten, Seattle
- William White, Easton

GAME MANAGEMENT ADVISORY COUNCIL

- Angela Stringer, The Campbell Group
- B.J. Thorniley, Trappers Association
- Bill Vincent, Disabled Sportsmen of Washington
- Bob Mayton, Aberdeen
- Brad Johnson, Washington Wildlife Federation
- Bruce Johnson, Borderline Bassin' Contenders
- Cliff Barbre, Ephrata
- Dale Sharp, Renton
- Dean Cook, Washington State Archery Association
- E. Reade Brown, Olympia
- Fred Zitterkopf, Inland Northwest Wildlife Council
- Gregory Field, Washington State Muzzleloading Association
- H. Martin Keilwitz, Western Washington Wildlife Council
- Jim McGowan, Colville
- Ken Raedeke, Raedeke Associates, Inc.
- Lauren McBroom, Jr., Redmond
- Rick Liebel, Washington State Bowhunters
- Rick Lind, Tonasket
- Roger McKeel, Naches
- Rusty Hunt, Washington Grange
- Sage Lane, Tonasket
- Terry Hunt, Washington Grange
- Tony Wells, Citizens for Washington Wildlife
- Walter Christensen, Washington State Muzzleloading Association

CWCS Internal Steering and Taxa Expert Committees

CWCS In-House Steering Committee

This committee is the core of the Ecoregional Assessment Oversight Committee, with additional WDFW representation. The purpose of the Steering Committee is to provide a Department-wide sounding board for CWCS, a point of contact for all Department programs, and a mechanism to make sure the CWCS is coordinated with the other elements of the SWG program, as well as other WDFW programs.

- David Ware, Game Division Manager
- Dick Stone, Wildlife Policy Lead
- Elizabeth Rodrick, Land Conservation Section Manager
- Harriet Allen, Endangered Species Program Manager
- Howard Ferguson, Region 1 Biologist
- John Pierce, Wildlife Research Division Manager
- Mark Quinn, Lands Division Manager
- Marnie Tyler, WDFW Monitoring Coordinator
- Mary Lou Mills, Marine Ecosystems Manager
- Rocky Beach, Wildlife Diversity Division Manager
- Steve Penland, Habitat Program Division Manager
- Sue Patnude, Region 6 Regional Director
- Tim Quinn, Habitat Program Division Manager and Chief Scientist
- Tim Waters/Margaret Ainscough, Public Affairs Director

Species Taxa Expert Committee (Ad Hoc)

- Alex Bradbury, WDFW
- Ann Blakley, WDFW
- Ann Potter, WDFW
- Casey Richart, WDFW
- Chris Chappell, WNHP
- Chris Sato, WDFW
- David Hays, WDFW
- Derek Stinson, WDFW
- Don Kraege, WDFW
- Donny Martorello, WDFW
- Gary Wiles, WDFW
- Gerald Hayes, WDFW
- Jeff Azerrad, WDFW
- Jeff Lewis, WDFW
- Jerry Nelson, WDFW
- Jim Ames, WDFW
- Jim LaBonte, ODFW
- Jim Uehara, WDFW
- Joe Buchanan, WDFW
- John Fleckenstein, WNHP
- Kelly McAllister, WDFW
- Lisa Hallock, WNHP
- Marc Hayes, WDFW
- Mary Lou Mills, WDFW
- Mick Cope, WDFW
- Molly Hallock, WDFW

- Rex Crawford, WNHP
- Rocky Beach, WDFW
- Russell Rogers, WDFW
- Steve Jeffries, WDFW
- William Leonard, WSDOT

WHAT	WHEN	WHERE	WHO	WHY
NW CWCS Coordination	Oct 29, 2003	West Linn, OR	Joe La Tourrette, WDFW Holly Michael, ODFW Gail McEwen, ODFW Sara Vickerman, DOW Bruce Taylor, DOW	Initial coordination meeting with Oregon counterparts and the staff from Defenders of Wildlife, at their office in West Linn, Oregon
Washington Fish and Wildlife Commission Meeting	Dec 3, 2003	Port Townsend, WA	Joe La Tourrette Chris Sato Rocky Beach	Briefed Director Koenings and the Commission on the CWCS process; Rocky and Joe gave the PowerPoint presentation developed by Chris
NW CWCS Coordination	Dec 22, 2003		Joe La Tourrette, WDFW Holly Michael, ODFW Verlyn Ebert, FWS	Coordination and information exchange. Process is more important than the plan. Keep things at a strategic level, ecoregional OK. Make sure we address 8 essential elements WA relying heavily on WHROW. Suggested FWS tribal liaison: Scott Aikin, R1.
Game Advisory Council	Dec 13, 2004	North Bend, WA	Joe La Tourrette	Briefed Game Advisory Council on CWCS. Gave the CWCS PowerPoint, asked the Council for their help in developing and reviewing the strategy. Also in attendance were Dave Brittell, Dave Ware and Commissioner Russ Cahill
WA CWCS Coordination with WADNR	Jan 16, 2004	Olympia	Joe La Tourrette Chris Sato John Gamon	Initial meeting with John Gamon, Washington Natural Heritage Program Manager
National CWCS Coordination Meeting	Jan 21-24, 04	Canyon of the Eagles State Park, Texas	Joe La Tourrette Rocky Beach	National coordination meeting for CWCS. Diversity managers and CWCS managers were in attendance from 35 states.
Coordination between CWCS and Subbasin plans	Jan 27, 2004	Spokane, WA	Joe La Tourrette Chris Sato	Met with Paul Ashley and Shelly (?) to discuss ways to incorporate subbasin planning work into CWCS
WDFW Wildlife Diversity Division Workshop	Feb 2-4, 2004	Leavenworth, WA	WDFW diversity personnel from across the state	Short overview on CWCS and PowerPoint presentation.

WHAT	WHEN	WHERE	WHO	WHY
NW CWCS Coordination	Feb 17, 2004	Phone conference	David Bunn, CA Christen Mitchell, HI Rita Dixon, ID Holly Michael, OR Rocky Beach, WDFW Joe La Tourrette, WDFW Sara Vickerman, DW Verlyn Ebert, FWS	Establishment of regularly scheduled conference calls to update each other on plan developments, successes and failures, and coordination between shared ecoregions.
Meeting with Chris Parsons at CTED re CWCS	Feb 18, 2004	Olympia	Joe La Tourrette	Overview of CWCS; requested Chris be on our Advisory Committee
National/NW CWCS Briefings for Congressional contacts in Washington, DC	March 1-4, 04	Washington, DC	Joe La Tourrette	Briefed staff from Washington Congressional Delegation, as well as Senate Interior Appropriations staff on Washington state's approach to CWCS; gave out draft copies of CWCS and SWG brochures developed by WDFW. Had a lunch meeting on May 1 with Naomi Edelson and Dave Chadwick with IAFWA regarding CWCS coordination.
NW CWCS Coordination	Mar 16, 2004	Phone conference	Joe La Tourrette Chris Sato Rocky Beach Rita Dixon, ID Gayle Berger, CNMI Sara Vickerman, DW Dana Dolsen, UT Verlyn Ebert, FWS Chris McKay, FWS	ID: Adapted WA PowerPoint; got good interest from state and federal agency leaders. Will use for other working groups. Met with governor's office, got approval to publish revised IAFWA brochure. WA: Jo went to DC. WA on track with timeline, working on committees, species matrix refinement, plan review, BM pilot. Marianas: Just getting started. UT: Using species approach, fine filter. Doing intensive habitat planning for restoration efforts, will use these detailed plans for CWCS approach. DW: How can NGOs help? When to engage, help with business & industry. Possibility of having OWP monitoring workshop in western states in May or June. Verlyn will check on possibilities. Meanwhile, Dana and Holly will critique OWP workshop in Ohio.
Colville Confederated Tribes	March 17, 2004	Spokane, WA	Joe Peone, CCT	Commissioner Pelly was meeting with Colville tribal

WHAT	WHEN	WHERE	WHO	WHY
			Lisa Pelly, WA FWL Comm	wildlife managers on wildlife coordination issues. She asked me to join her and brief them on WDFW's project to develop a CWCS, as well as how the tribes could access their own SWG funds
North American Wildlife Conference	March 18, 04	Spokane, WA	Rocky Beach Joe La Tourrette	Represented Washington on Teaming With Wildlife committee meeting at North American Wildlife Conference. Included directors, diversity managers and CWCS managers from other states, as well as IAFWA and NGO staff
CWCS Steering Meeting #1	Mar 23, 04	NRB, Olympia	Joe La Tourrette Chris Sato Rocky Beach Elizabeth Rodrick Steve Penland Dick Stone Mick Cope Harriet Allen Mary Lou Mills	CWCS status update, hand out outline, timeline, brochure samples. Discuss steering team's role, review steering team roster. Review advisory committee member list. Review 3rd draft outreach and communications plan.
Lands Management Advisory Council	March 27, 04	Cle Elum, WA	Joe La Tourrette	Briefed Lands Management Advisory Council on CWCS. Gave the CWCS PowerPoint, asked the Council for their help in developing and reviewing the strategy. Also in attendance was Mark Quinn from WDFW
NW CWCS Coordination	Apr 1, 04	Vancouver, WA	Joe La Tourrette, WDFW Chris Sato, WDFW Alan Holt, TNC Chris Robbins, TNC Holly Michael, ODFW Kevin Church, IDFG Bruce Taylor, DW Marcelo Bonte, DW Verlyn Ebert, FWS	Shared information and suggestions between groups. Highlights: DATs for information only. All FWS have been sent letters telling them to cooperate with CWCS. WA outline, OR using similar approach. Focal species concept for ecoregions, WA's Blue Mountains pilot. How interstate EAs will match; heavy reliance on subbasin planning. WA species matrix; OR going public with data collection Remember that CWCS is strategic level.

WHAT	WHEN	WHERE	WHO	WHY
				WA outreach will follow plan used for Biodiversity Initiative. Worked well. Advisory teams will provide liaison to outside groups. Message to tribes: help us to help you; tribal grant applications are usually high quality. WA SWG brochure. Everybody wants copy. Salmon: OR is going to overlay StreamNet with terrestrial NHP. OR and WA need to coordinate. ID will roll monitoring into periodic NHP assessments, defaulting to NHP; they use EO records. Monitoring a thorny issue – need to set objectives in order to develop monitoring. ID says NatureServe will develop tools within next 2-3 years for abundance monitoring. NHP can provide standardized qualitative measures of habitat or plant community. Discussion on outreach for farming, hook & bullet groups. Public outreach (inform only) versus public involvement (can you help us, what do you think?)
Wetland Ventures Newsltr	April, 04	PCJV/IWJV	Statewide newsletter – goes to over 15,000 people	Short article on CWCS; contact WDFW (Chris Sato)
CWCS Steering Meeting #2	April 8, 04	NRB, Olympia	Joe La Tourrette Chris Sato Margaret Ainscough Rocky Beach Harriet Allen Dick Stone John Pierce Elizabeth Rodrick David Ware Sue Patnude Howard Ferguson Mary Lou Mills	CWCS status update, review updated steering committee roster, review advisory committee member list update. Review revised outreach and communications plan. Review species matrix, discuss possible criteria.
Wildlife Diversity Advisory Council	April 24, 04	Cle Elum, WA	Rocky Beach Joe La Tourrette	Briefed Diversity Council on CWCS. Gave the CWCS PowerPoint, asked the Council for their help in developing and reviewing the strategy.

WHAT	WHEN	WHERE	WHO	WHY
NW CWCS Coordination	Apr 26, 04	Phone conference	David Bunn, CA Rita Dixon, ID Holly Michael, OR Dana Dolson, UT Joe La Tourrette, WDFW Sara Vickerman, DW Verlyn Ebert, FWS	Regularly scheduled conference call to update each other on plan developments, successes and failures, and coordination between shared ecoregions. Holly and Dana discussed recent OWP meeting in Ohio.
Meeting with WDFW Regional Directors on CWCS and EA Coordination	Apr 29, 04	Hyak, WA	Rocky Beach Elizabeth Rodrick George Wilhere Erik Sutherlin Chris Sato Joe La Tourrette	Met with six regional directors to discuss regional outreach for CWCS and EAs as well as coordination between CWCS, EAs and other planning efforts such as subbasin plans.
Coordination w/USFWS	May 7, 04	Phone Call	Ken Berg - USFWS	Called and left message re CWCS and Ken serving on our Advisory Committee – no response as of 5/21
National CWCS Coordination	May 11, 04	Conference Call	Rocky Beach Joe La Tourrette	Subject was national summary document and national rollout strategy for CWCS. IAFWA and about six states were represented
Coordination with Puget Sound Management Plan	May 12, 04	Puget Sound Water Quality Action Tm GA Bldg - Olympia	Joe La Tourrette Chris Sato Doug Myers, PSWQAT	Met with Doug Myers to discuss coordination between the WPG EA and other plans for habitat conservation in Puget Sound. Doug recommended we tie our efforts to the PS Plan as much as possible
NW CWCS Coordination	May 18, 04	Vancouver, WA	Holly Michael, ODFW Rita Dixon, IDFG Chris Robbins, TNC Marcelo Bonte, DW Verlyn Ebert, FWS	Information exchange and updates. Highlights: Holly brought the workbooks from the OWP monitoring workshop. Some good pointers, I think. She will give us copies. She said the workshop was a good refresher but she was hoping for more

WHAT	WHEN	WHERE	WHO	WHY
			Joe La Tourrette Chris Sato	options. ID's final draft of their strategic plan is online. WA had an outreach meeting with their regional directors. We pent a lot of time talking about species selection, habitats. ID is working with PIF on population estimates. Holly brought a bunch of her work plans and left them with WA. WA brought up the NAAT guidelines.
Pacific Coast Joint Venture – Washington State Steering Committee	May 20, 2004	Tacoma, WA	Cross-section of wildlife professionals from state and federal agencies and statewide wildlife groups	Provided an overview of the Washington CWCS process; provided copies of CWCS material to the Steering Committee
CWCS Advisory Committee	May 27, 04	Olympia - NRB	Nina Carter Karen Dvornich Verlyn Ebert Elizabeth Gray David Jennings Dr. John Marzluff Chris Parsons Craig Partridge Chris Regan Carole Richmond Dr. Ken Risenhoover Paul Wagner	First meeting of CWCS Advisory Committee. Gave an overview of CWCS, discussed the role of the advisory committee. Had a spirited discussion of the species list that drives the CWCS. Agreed to meet either bi-monthly or quarterly.
Washington Wildlife Federation Board of Directors	June 2, 04	Issaquah Hatchery	Mark Heckert John McGlenn Ronni McGlenn John Douglas Ken Hilton Bob Johnson Ed Forslof	Gave overview of CWCS, showed PowerPoint. Asked the Board to provide a review of the planning materials. Also asked if they would like to have someone represent WWF on our Advisory Committee; President Mark Heckert volunteered. WWF is developing a website that will showcase the state's habitats and ecoregions; they would like to work with us and make it compatible with the results of the CWCS process
Intermountain West Joint Venture – Washington State Steering Committee	June 10, 2004	Ephrata, WA	Cross-section of wildlife professionals from state and [illegible]	Provided an overview of the Washington CWCS process; provided copies of CWCS material to the Steering Committee

WHAT	WHEN	WHERE	WHO	WHY
			statewide wildlife groups	
Washington Forest Protection Association	June 23, 2004	Olympia, WA	Joe La Tourrette Elizabeth Rodrick Tom Davis George Wilhere Ann Goos (WFPA) Bill Garvin (WFPA)	Elizabeth and George gave an overview of Willamette Valley-Puget Trough-Georgia Basin EA, Joe gave brief overview of CWCS; will schedule a longer meeting for July 30, 2004
Washington Forest Protection Association	July 15, 2004	Olympia, WA	Joe La Tourrette Bill Garvin (WFPA)	Follow-up to June 23 meeting, with specific focus on CWCS. Bill Garvin suggested other contacts within the agriculture and business communities.
Office of the Governor	July 20, 2004	Olympia, WA	Joe La Tourrette Bob Nichols	Bob is Senior Environmental Policy Advisor to Governor Gary Locke. Joe briefed him on the CWCS and the relationship to the Washington Biodiversity Council and other on-going processes.
Pacific Environmental Education Institute (PEEI)	July 21, 2004	Olympia, WA	Joe La Tourrette Margaret Tudor Lynn Ferguson Barbara Macgregor Heath Packard	Margaret and Lynn are staffing the new PEEI. Barbara is with WDNR, Heath is with Audubon Washington. The group wanted to find out more about CWCS and how it relates to the Washington Biodiversity Council and PEEI.
CWCS "One Year Out" Conference	Aug 2-4, 2004	Nebraska City, NB	Jeff Koenings Rocky Beach Joe La Tourrette Chris Sato	National conference on CWCS. Forty seven states represented, as well as NGOs and UWFWS people, including Director Steve Williams. Director Koenings represented NAAT and WAFWA. Joe La Tourrette gave a presentation on August 2 about Washington's process.
Tribal Letter Out	Aug 6, 2004		Letter to Washington Indian Tribes from Director Koenings	Invites Tribes to meet with WDFW and coordinate the development of the CWCS
Region Six USDA Forest Service	Aug 19, 2004	Olympia, WA	WDFW: Director Koenings, ADs Dave Brittell, Lew Atkins and Greg Hueckel, Marnie	General "meet and greet" to strengthen working relationship between the agencies. Joe gave a brief overview of the CWCS process, handed out

WHAT	WHEN	WHERE	WHO	WHY
			Tyler, Rocky Beach, Joe La Tourrette. FS: Alan Christensen, Grant Gunderson, Sarah Madsen	brochures and 6/page handouts of CWCS PPT. FS personnel pledged to work closer with us on CWCS. Followup calls and tentative discussion of a September 14 meeting in Vancouver. Rob Huff will attend next Advisory Committee meeting on September 23 in Olympia.
Washington Farm Bureau	August 25, 2004	Olympia, WA	WDFW: Tom Davis and Joe La Tourrette. WA Farm Bureau: John Stuhlmiller, Assistant Legislative Director	Tom Davis set up the meeting in NRB with John Stuhlmiller of Farm Bureau, Rebecca McMillen of the WA Grange and Kristen Sawin of Assn of WA Business. Only John showed up for the meeting. Joe gave an overview of CWCS and assured John that CWCS was not oriented to more regulation. John agreed to be on our Advisory Committee. Joe will try to reschedule with Grange and AWB.
Defenders of Wildlife	August 25, 2004	Olympia, WA	Director Koenings, Rocky Beach, Joe LaTourrette. DOW: Sara Vickerman	Meeting to discuss relative role of DOW and other NGOs and IAFWA related to CWCS development and monitoring.
CWCS Advisory Committee	Sept 23, 2004	Olympia – Nisqually National Wildlife Refuge	Nina Carter – Audubon WA Karen Dvornich – WA Gap Verlyn Ebert - USFWS Elizabeth Gray - TNC John Stuhlmiller - WFB Doug Myers - PSWQAT Chris Parsons – WA CTED Pene Speaks – WA DNR Chris Regan – State Parks Carole Richmond - IAC Dr. Ken Risenhoover – WFPA Paul Wagner - WSDOT Jane Rubey – WA Ecology Sara Vickerman - Defenders Mark Heckert - WWF	Second meeting of CWCS Advisory Committee. Gave a presentation on development of a Species of Greatest Conservation Need list, general update on development of Washington CWCS. Agreed to meet again later in 2004.
Intermountain West Joint Venture – Washington Steering Committee	October 7, 2004	Columbia National Wildlife	Ivan Lines - DU Ron Frieze – WDFW Mike Livingston – WDFW	Regular meeting of Washington Steering Committee. Presentation on CWCS with emphasis on how it relates to all-bird planning being done by IWJV

WHAT	WHEN	WHERE	WHO	WHY
		WA	Ernie Holt – NRCS Teri Pieper – Audubon WA Bob Flores – USFWS Tracy Hames – Yakama IN Howard Browers - USFWS Jim McGowan - USFS	
Washington Biodiversity Council	October 14, 2004	Olympia, WA	Full Biodiversity Council appointed by Governor Locke – about 30 people	First official meeting of the WA Biodiversity Council. Presentation on how WDFW and conservation partners are using CWCS development as a venue for addressing biodiversity conservation in Washington state.
Oregon/Washington Working Group of Partners in Flight	October 26, 04	Troutdale, OR	Regular meeting of OR/WA Working Group	Gave an update on development of OR and WA CWCS. Holly Michael from ODFW was unable to attend due to a back injury.
Forest Service/BLM Species Coordination Group	October 29, 04	Portland, OR	Management personnel from both agencies engaged in fish and wildlife species listing	Gave an overview of Washington CWCS to the group, in particular our process for developing a Species of Greatest Conservation Need list. FS and BLM are interested in adopting our list. In attendance were: Rob Huff, Interagency Conservation Planning Coordinator; Barb Hill, BLM State Office Wildlife Biologist; Sarah Madsen, Forest Service (FS) TES Species Program Manager; Elaine Rybak, FS TES Wildlife Bioloigst; Carol Hughes, Interagency Special Status/Sensitive Species (SSS) Specialist; Russ Holmes, FS Regional Botanist; Kelli VanNorman, Interagency Inventory Coordinator; Marianne Turley, Statistician; Kathy Anderson, SSS Program Transition Coordinator.

WHAT	WHEN	WHERE	WHO	WHY
CWCS Monitoring Workshop	November 10, 04	Portland, OR	Representatives from UWFWS, Defenders of Wildlife, The Nature Conservancy, Oregon Natural Heritage Program, Oregon State University, Oregon Watershed Enhancement Board, Oregon Department of Fish and Wildlife, Idaho Department of Fish and Game, and the Missouri Department of Conservation.	Workshop was co-hosted by the US Fish and Wildlife Service and Defenders of Wildlife. Defenders of Wildlife has a contract from the Doris Duke Foundation to help develop a framework for state agencies to use in monitoring landscape-level habitat changes over time. Their consultants were also in attendance and they expect to have a report out by the end of 2004.
WA State Association of Counties	November 18, 04	Olympia, WA	Briefed Paul Parker and Scott Merriman of WSAC staff on EAs and CWCS. Joe La Tourrette, Elizabeth Rodrick, Erik Neatherlin, George Wilhere and Tom Davis from WDFW	Counties are primary protectors of critical FWL habitat via Growth Management Act. Focus on how we are using EAs to develop both the CWCS and county-level assessment information for GMA. Paul and Scott gave us valuable feedback; one note was to make sure we don't overlook the importance of the cities.
WDFW Habitat Program	November 29, 04	Olympia	Habitat Program Staff	Brought Habitat Program up to speed on EA and CWCS processes. Asked Habitat to give critical review of our ecoregional writeups.
The Nature Conservancy	December 2, 04	Seattle	Joe La Tourrette, WDFW Elizabeth Rodrick, WDFW George Wilhere, WDFW Elizabeth Gray, TNC John Floberg, TNC Bill Robinson, TNC	Coordination meeting to resolve issues related to content and use of Ecoregional Assessments for CWCS.
NW CWCS Coordination Conference Call	December 8, 04	Phone conference	Anita Shaul, NV Chris Sato, WA	Regularly scheduled conference call to update each

WHAT	WHEN	WHERE	WHO	WHY
			Christen Mitchell, HI Dana Dolsen, UT Gayle Berger, Marianas Holly Michael, OR Rita Dixon, ID Sara Vickerman, Defenders Verlyn Ebert, FWS	and coordination between shared ecoregions. Reviewed results of CWCS monitoring workshop, each state gave an update of their progress.
WDFW Fish Program	December 8, 04	Olympia	Fish Program Staff	Brought Fish Program up to speed on EA and CWCS processes. Asked Fish Program to give critical review of our ecoregional writeups.
Northwest Indian Fisheries Commission – Wildlife Committee	December 14, 04	Olympia, plus teleconferencing with Forks and Mt. Vernon offices of NWIFC	Joe La Tourrette, WDFW Chris Madsen, NWIFC	Briefed Committee on CWCS. We will do follow-up meetings with individual tribes when draft CWCS chapters are ready to be reviewed. Representatives today from Point No Point Treaty Council, BIA, and the Squaxin, Skokomish, Elwha, Makah, Swinomish, Sauk-Suiattle, Quinault, Hoh, Stillaguamish, and Quilayute Tribes.
Washington State Legislature	January 13, 05	Olympia	Joe La Tourrette	Briefed Ken Jacobsen, Chair of the Senate Natural Resources, Oceans and Recreation Committee on CWCS. He requested a follow-up briefing on the SGCN list and a committee briefing later in the legislative session on the CWCS.
WDFW – Region Three	January 26, 05	Yakima	Joe La Tourrette	Briefed Regional Director Jeff Tayer and Regional Wildlife Program Manager Lee Stream on CWCS ecoregional chapters and review process for Region Three staff and stakeholders.
Yakama Indian Nation	January 27, 05	Toppenish	Joe La Tourrette	Briefed YIN Wildlife Department Manager Arlen Washine and his wildlife staff on CWCS process. Will give them an opportunity to review drafts of ecoregional chapters that in include Tribal lands.
WDFW – Region Two	January 28, 05	Ephrata	Rocky Beach	[illegible]

WHAT	WHEN	WHERE	WHO	WHY
			Joe La Tourrette Chris Sato	Wildlife Program Manager Matt Monda and Regional Habitat Program Manager Chris Parsons on CWCS ecoregional chapters and review process for Region Two staff and stakeholders.
WDFW – Wildlife Diversity Division Workshop	February 2, 05	Alderbrook Lodge, Union	Rocky Beach Joe La Tourrette John Pierce	Updated division field staff on SGCN list and other components of CWCS. Discussed review process and instructions for ecoregional chapters of CWCS.
US Fish and Wildlife Service National Wildlife Refuge Managers	February 8, 05	Nisqually NWR, Olympia, WA	Joe LaTourrette Dave Brittell	Gave overview of CWCS to Washington refuge managers, all of whom are developing Comprehensive Conservation Plans (CCP) for their refuges. Follow-up will be required.
CWCS Advisory Committee	February 14, 05	Snake Lake Nature Center, Tacoma, WA	Joe La Tourrette Chris Sato CWCS Advisory Committee	Provided an update on CWCS process and ecoregional chapter format to Committee.
Western States NatureServe Conference	April 13, 2005	Blaine, WA	Natural Heritage Managers from 13 Western states	Discussed CWCS process with Natural Heritage managers
WDFW – Region Four	April 19, 2005	Mill Creek, WA	Region Four Regional Director, Wildlife, Habitat, and Fish Program staff	Briefed Puget Sound regional staff on status of CWCS. Reviewed draft North Cascades and Puget Trough ecoregional chapters, asked for comments.
Washington Biodiversity Council	April 22, 2005	Olympia, WA	Lynn Helbrecht, Executive Director	Briefed new Executive Director on CWCS, how CWCS process links with the role of the WA Biodiversity Council
WDFW – Region Six	April 25, 2005	Montesano, WA	Joe LaTourrette, Region Six Regional Director, Wildlife, Habitat, and Fish Program staff	Briefed Coastal regional staff on status of CWCS. Reviewed draft NW Coast and Puget Trough ecoregional chapters, asked for comments.
Planning Association of Washington – Annual Convention	April 28, 2005	Spokane, WA	Joe LaTourrette, state affiliate of American Planning Association. Land use	Gave a presentation to city and county planners about CWCS and the relationship of this planning process to the ecoregional assessments and the

WHAT	WHEN	WHERE	WHO	WHY
			counties all over Washington state	the ecoregional assessments.
Pacific Coast Joint Venture (PCJV) – Management Board	May 4, 2005	Harrison Hot Springs, British Columbia	Joe LaTourrette, state, federal and private wildlife managers from BC and five western states	Provided an update of CWCS process. PCJV is a partnership focused on habitat conservation projects in the Pacific Coast biome.
WDFW Press Release	June 1, 2005	Statewide	WDFW Public Affairs Office's statewide list of newspapers and other media	Statewide press release went out regarding posting of draft CWCS on WDFW website (www.wdfw.wa.gov/wlm/cwcs) and details of upcoming public meetings throughout the state.
WDFW Wildlife Diversity Advisory Committee	June 4, 2005	Olympia, WA	Joe LaTourrette, Rocky Beach. WDAC advises the Director of Fish and Wildlife on wildlife diversity program	Briefed WDAC on draft CWCS progress—unveiled components of draft CWCS to the committee.
Public Informational Meeting on CWCS – WDFW Regional 3 Office	June 7, 2005	Yakima, WA	Joe LaTourrette, stakeholders invited by WDFW staff, plus notified by June 1 press release	Gave an overview of CWCS background, process, and draft document. Answered questions. Asked attendees to access the draft CWCS on the CWCS website and to get comments to WDFW by June 30, 2005.
CWCS Advisory Committee	June 9, 2005	Olympia, WA	Joe La Tourrette Chris Sato CWCS Advisory Committee	Unveiled the draft CWCS to Advisory Committee; asked them to access draft via website and get comments to WDFW by June 30; deadline later extended to July 8, 2005.
Public Informational Meeting on CWCS – WDFW Regional 1 Office	June 9, 2005	Spokane, WA	Joe LaTourrette, stakeholders invited by WDFW staff, plus notified by June 1 press release	Gave an overview of CWCS background, process, and draft document. Answered questions. Asked attendees to access the draft CWCS on the CWCS website and to get comments to WDFW by June 30, 2005.
[illegible]	June 13, 2005	Ephrata, WA	[illegible]	Gave an overview of CWCS background, process,

WHAT	WHEN	WHERE	WHO	WHY
on CWCS – WDFW Regional 2 Office			stakeholders invited by WDFW staff, plus notified by June 1 press release	and draft document. Answered questions. Asked attendees to access the draft CWCS on the CWCS website and to get comments to WDFW by June 30, 2005.
Public Informational Meeting on CWCS – WDFW Regional 5 Office	June 14, 2005	Vancouver, WA	Joe LaTourrette, stakeholders invited by WDFW staff, plus notified by June 1 press release	Gave an overview of CWCS background, process, and draft document. Answered questions. Asked attendees to access the draft CWCS on the CWCS website and to get comments to WDFW by June 30, 2005.
Washington DNR Natural Heritage Program Staff	June 21, 2005	Olympia, WA	Joe LaTourrette, Chris Sato, managers and staff of WA Natural Heritage Program	Unveiled the draft CWCS to Natural Heritage staff, acknowledged their contribution to CWCS via WA Natural Heritage Plan, asked them to access draft via website and get comments to WDFW by July 8, 2005
WA Forest Protection Assn (WFPA)	June 22, 2005	Olympia, WA	Joe LaTourrette, WDFW, Josh Weiss, Env Policy Dir, Dr. Ken Risenhoover, Port Blakely Timber Resources	WFPA is an association of large timber companies. Briefed WFPA on draft CWCS, especially sections related to timber management, asked for comments back by June 30, 2005 (comments rec'd on July 1)
Public Informational Meeting on CWCS – WDFW Regional 6 Office	June 22, 2005	Montesano, WA	Joe LaTourrette, stakeholders invited by WDFW staff, plus notified by June 1 press release	Gave an overview of CWCS background, process, and draft document. Answered questions. Asked attendees to access the draft CWCS on the CWCS website and to get comments to WDFW by June 30, 2005.
Game Advisory Committee	July 1, 2005	Letter	From Jim McGowan, Colville National Forest	Mr. McGowan provided comments as a member of a "super committee" of WDFW advisory committees
Anadromous and Marine Sport Fishing Advisory Committee	July 6, 2005	Phone Contact	Between Polly Fisher and Rocky Beach of WDFW	Ms. Fisher provided comments as a member of a "super committee" of WDFW advisory committees.
Washington Farm Bureau	July 6, 2005	Olympia, WA	Joe LaTourrette, John Stuhlmiller, Env Policy Director	John Stuhlmiller is on CWCS Advisory Committee but was unable to make our June 9 meeting.

WHAT	WHEN	WHERE	WHO	WHY
				related to agricultural impacts, asked for comments back by July 8, 2005 (comments rec'd on July 8)
Pacific Coast Joint Venture	July 7, 2005	Tacoma, WA	Joe LaTourrette, Washington State Steering Committee of PCJV	Unveiled the draft CWCS to state PCJV working group.
USDA Forest Service and Bureau of Land Management	July 11, 2005	Portland, OR	Joe LaTourrette, combined wildlife policy group from Region 6 Forest Service and BLM	Asked Forest Service and BLM in June to review draft CWCS and prepare comments for WDFW. July 11 meeting was to review draft CWCS and combined FS/BLM comments
US Fish and Wildlife Service	July 12, 2005	Lacey, WA	Joe LaTourrette, State Director and staff of Washington Ecological Services Office of USFWS	Review draft CWCS with Ken Burg and his staff, discuss their comments on draft document
Washington Treaty Indian Tribes	August 5, 2005	Statewide	29 Tribal Chairs and Directors	Letter from Director Jeff Koenings providing another opportunity for the Tribes to review and provide comments to WDFW on the draft CWCS
Department of Defense Installation Commanding Officers	August 9, 2005	Statewide	Commanding officers of nine major Army, Navy and Air Force installations	Letter from Director Jeff Koenings providing another opportunity for the military to review and provide comments to WDFW on the draft CWCS
Washington State Association of Counties	August 19, 2005	Olympia, WA	Paul Parker, Assistant Executive Director	Met with Mr. Parker and his staff earlier in the CWCS development process. Contacted him again to make sure he had a chance to review and comment on the draft CWCS.

NEWS RELEASE

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE
600 Capitol Way North, Olympia, Washington 98501-1091
Internet Address: http://wdfw.wa.gov

June 1, 2005

Contact: Joe La Tourrette, (360) 902-2247
or Rocky Beach, (360) 902-2510

Public review under way for proposed wildlife conservation funding strategy

A series of informational meetings will be held across the state this month as part of a public review process for the Washington's draft Comprehensive Wildlife Conservation Strategy (CWCS).

Citizens have until June 30 to comment on the draft strategy. The CWCS will be posted by June 7 at **http://wdfw.wa.gov/wlm/cwcs** on the Washington Department of Fish and Wildlife (WDFW) website. Written copies may be obtained by contacting Joe La Tourrette at (360) 902-2247.

Washington and other states must submit a CWCS to the U.S. Fish and Wildlife Service this October to be eligible for new federal funds aimed at addressing unmet needs of wildlife and habitat conservation, with emphasis on species not hunted or fished. The new funds come from Wildlife Conservation and Restoration and State Wildlife Grants programs adopted by Congress in 2000 and 2001.

"This strategy identifies Washington species and habitats in greatest need of assistance," said WDFW Director Jeff Koenings, "It builds on other planning efforts, emphasizes non-regulatory approaches and provides a framework for future management of many wildlife species that have been overlooked or underfunded in the past."

Local informational meetings on the CWCS are scheduled for:

- June 7, Yakima, 7 – 9 p.m., WDFW South Central Regional Office, 1701 S. 24th Ave.
- June 9, Spokane, 7 – 9 p.m., North Spokane County Library, 44 E. Hawthorne Rd.

- June 13, Ephrata, 7 – 9 p.m., WDFW North Central Regional Office, 1550 Alder St. N.W.

- June 14, Vancouver, 7 – 9 p.m., WDFW Southwest Regional Office, 2108 Grand Blvd

- June 22, Montesano, 7 – 9 p.m., WDFW South Sound/Olympic Peninsula Regional Office, 48 Devonshire Road

- June 23, Mill Creek, 7 – 9 p.m., WDFW North Puget Sound Regional Office, 16018 Mill Creek Blvd

Development of Washington's CWCS has been under way since early 2004 with input from other natural resource management agencies and a variety of interest groups, all represented in a CWCS Advisory Committee, explained WDFW's project manager, Joe La Tourrette.

La Tourrette noted that the draft CWCS incorporates information and policies from many other recent efforts, including Washington Biodiversity Committee recommendations, eco-regional assessments developed in cooperation with The Nature Conservancy and Washington Department of Natural Resources, and the Northwest Power and Conservation Council's sub-basin plans.

Comments on the draft CWCS should be sent by June 30 to Joe La Tourrette, CWCS Project Manager, WDFW, 600 Capitol Way N., Olympia, WA 98501-1091, or via e-mail to latoujel@dfw.wa.gov

# # #

"In the end we will conserve only what we love;
We will love only what we understand;
We will understand only what we have been taught."

-- Baba Dioum, Senegalese ecologist

Comprehensive Wildlife Conservation Strategy

For more information, contact:
Washington Department of Fish and Wildlife
600 Capitol Way N, Olympia, WA 98501
www.wdfw.wa.gov (360) 902-2515

About the Comprehensive Wildlife Conservation Strategy

Washington is home to a remarkable variety of fish and wildlife species. But changes to the landscape and native habitat as a result of human activity have put many of these species at risk.

In 2000, Congress established a new Wildlife Conservation and Restoration Program to help state and tribal wildlife agencies address the unmet needs of wildlife and associated habitats including conservation, education and wildlife-associated recreation. To be eligible for federal grants, each state must develop a Comprehensive Wildlife Conservation Strategy to be submitted to the U.S. Fish and Wildlife Service by October 2005.

The Washington Department of Fish and Wildlife is currently developing the state's wildlife conservation strategy in partnership with other government agencies, nongovernment organizations and the public. Washington's statewide strategy will be a landscape-based document that addresses a full array of the state's fish and wildlife, with a focus on species and habitats in greatest need of conservation.

Guiding principles for Washington's conservation strategy include conserving species and habitats with greatest conservation need, recognizing the need to keep common species common, and building and strengthening conservation partnerships with other conservation agencies, tribes, local governments and nongovernment organizations.

In developing Washington's Comprehensive Wildlife Conservation Strategy, the Department of Fish and Wildlife (WDFW) will incorporate information from other species plans, inventories and habitat assessments, including:

- Ecoregional Conservation Assessments
- Washington Natural Heritage Program
- Northwest Power Conservation Council subbasin plans
- Partners in Flight
- Intermountain West Joint Venture
- Puget Sound Action Plan
- Shared Salmon Strategy
- Washington Biodiversity Conservation Strategy
- WDFW 2003-2009 Game Management Plan
- WDFW threatened and endangered species recovery plans
- Freshwater and marine fish management plans

Some of these plans may be viewed on the Washington Department of Fish and Wildlife's website at www.wdfw.wa.gov or may be obtained in hard copy by contacting the Washington Department of Fish and Wildlife at (360) 902-2515.

Eight Essential Elements

1. Include information on the distribution and abundance of wildlife species, including low populations and declining species, which are indicative of the diversity and health of wildlife of the state.

2. Identify the extent and condition of wildlife habitats and community types essential to the conservation of priority species.

3. Identify problems that may adversely affect priority species or their habitats. Identify factors and research that may help to conserve priority species and habitats.

4. Determine actions needed to conserve priority species and their habitats. Establish priorities for implementing such conservation actions.

5. Provide for periodic monitoring of species and habitats, as well as the effectiveness of conservation actions. Adapt conservation actions as needed to respond to new information or changing conditions.

6. Coordinate the development, implementation, review, and revision of the Strategy, to the extent feasible, with federal, state, and local agencies and Indian tribes which manage significant areas of land or water within the state.

7. Incorporate public involvement in the development, revision and implementation of the Strategy.

8. Provide for the review of the Strategy and, if appropriate, revision, at intervals of not more than 10 years.

Washington Wildlife Conservation Strategies

WDFW Species and Habitat Goals:

- Protect a full range of fish and wildlife diversity
- Maintain healthy fish and wildlife populations and habitats
- Recover endangered and threatened species
- Provide sustainable harvest of game and commercial species

Washington's diverse topography, exposure to Pacific Ocean currents and weather patterns, and location on the migratory path of many wildlife species make it one of the most biologically diverse states in the nation, encompassing seacoast, shrub-steppe, native prairie, parts of four major forested mountain ranges, and Puget Sound.

In fact, Washington contains most of the major ecosystem types found in the western United States, including two found nowhere else in the world: the Olympic rainforest and the channeled scablands of eastern Washington. These landscapes and the biological diversity they support are contained within nine continental ecoregions that extend from the Pacific Northwest Coast and Puget Sound in the west to the Columbia Plateau and Northern Rocky Mountains in the east. Washington's ecoregions are defined by similarities in flora and fauna, resulting from similar soils, geology, hydrology, and landforms.

The Washington Department of Fish and Wildlife has a responsibility to protect this unique legacy. The conservation strategies outlined in this brochure are integral to the preservation of our rich natural heritage for current and future generations.

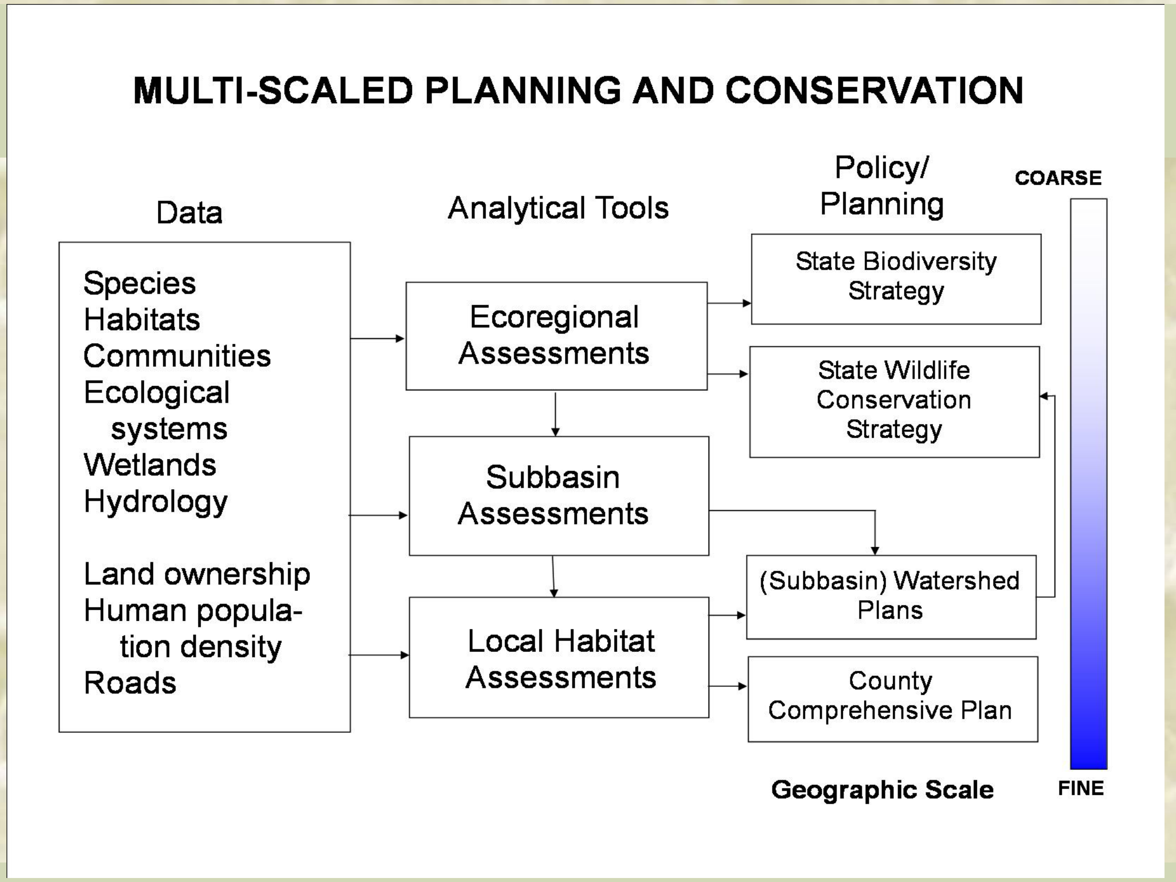
For more information, contact:
Washington Department of Fish and Wildlife
600 Capitol Way N, Olympia, WA 98501
wdfw.wa.gov (360) 902-2515

State Comprehensive Wildlife Conservation Strategy

In 2000, Congress established a new Wildlife Conservation and Restoration Program to help state and tribal wildlife agencies address the unmet needs of wildlife and associated habitats, for conservation, education and wildlife-associated recreation.

To be eligible for these federal grants, each agency must develop a state Comprehensive Wildlife Conservation Strategy to be submitted to the U.S. Fish and Wildlife Service by October 2005.

Washington Department of Fish and Wildlife is currently developing a Comprehensive Wildlife Conservation Strategy in partnership and consultation with other government agencies, nongovernment organizations, and the public. Washington's strategy will be a statewide, landscape-based effort that addresses future conservation of all the state's fish and wildlife--with a focus on species and habitats in greatest need of conservation. In developing this strategy, the Department of Fish and Wildlife will incorporate information from other inventory and planning efforts, including ongoing ecoregional conservation assessments and subbasin plans.



Washington Biodiversity Recommendations

The 2002 Washington Legislature enacted Engrossed Substitute Senate Bill 6400, which mandated, among other things, improved coordination of public and private biodiversity information and conservation actions. The 2002 legislation was recommended by Defenders of Wildlife, implemented by The Nature Conservancy, and supported by a number of state and federal agencies (including the Department of Fish and Wildlife), Indian tribes and conservation organizations.

Under contract to the State, The Nature Conservancy of Washington convened a public/private biodiversity committee to review existing public and private programs and develop recommendations for a state biodiversity strategy by October 2003. The resulting 2003 Biodiversity Conservation Strategy Report includes recommendations to the Governor and Legislature for a standing biodiversity council, an integrated data management system, a public education and outreach program, more technical assistance to local governments, and a series of new landowner incentives. In March 2004, Governor Gary Locke signed an Executive Order establishing a standing Washington Biodiversity Council, and the Legislature subsequently appropriated funds to the Council to begin implementing the recommendations included in the October 2003 report.

Ecoregional Conservation Assessments

The Washington Department of Fish and Wildlife is working in partnership with The Nature Conservancy on assessments of nine ecoregions that cover the entire landscape of Washington. These ecoregional assessments identify sites and landscape features that are important for conserving the full range of the state's biodiversity. They do not replace individual species recovery plans or management plans for harvested species, but are designed to ensure that the highest priority biodiversity sites are identified and protected first.

The ecoregional assessments compile existing biodiversity information, conduct a spatial analysis, and design alternative conservation portfolios for sites and landscapes of high priority. Data are compiled and analyzed for species and habitat types, as well as land ownership and other geographic features. Species and locations are rated for their habitat quality and suitability for conservation. These data are then analyzed with a computer algorithm that allows scientists to optimize the selection of preferred conservation areas. Terrestrial, aquatic and marine conservation portfolios are developed for expert review by scientists from agencies, tribes, academic institutions, and nongovernmental organizations. Nine ecoregional conservation assessments covering Washington state will be completed by 2006.

The Department will use ecological assessments to guide habitat protection, influence management of public lands, assist counties in land use planning and guide priorities for grant programs.

Subbasin Planning

Subbasin planning is a process coordinated by the Northwest Power and Conservation Council as part of the Council's 2000 Columbia Basin Fish and Wildlife Program. The Council was created in 1980 by Congress to give the states of Idaho, Montana, Oregon and Washington a voice in how the region plans for its energy needs, while at the same time mitigating the effects of the hydropower system on fish and wildlife in the Columbia River Basin.

The Council's 2000 Program included a new project review and selection process that relies on the development of local subbasin plans to guide project funding. Subbasin plans are being developed in most of the Columbia River Basin's 62 tributary subbasins through an open public process that includes the participation of state, federal, local and tribal governments, landowners, and other stakeholders. In the future, implementation and funding of the Program will be directly linked to subbasin plans, since the plans will become part of the Council's fish and wildlife program.

Each subbasin plan includes an assessment of historical and existing conditions, with identification of significant data gaps and future information needs; an inventory of past and ongoing fish and wildlife projects as well as programs undertaken by counties, state and federal agencies, tribes and other entities; and a 10- to 15-year management plan that includes a vision, biological objectives, strategies, and recommendations for research, monitoring, and evaluation.

Local Habitat Assessment

Local communities have an important role in wildlife conservation. Counties do growth management planning; administer the conservation futures and open space property tax incentive programs; and support local conservation districts, land trusts, and watershed councils that provide assistance to private landowners. As Washington communities take a more active role in planning their futures, the Washington Department of Fish and Wildlife is striving to provide more comprehensive fish and wildlife information in formats that are useful for local planning and that address broad-scale land use issues.

The Department currently maintains a list of Priority Habitats and Species, which gives counties data on the location of priority fish and wildlife habitats as well as habitat management recommendations. But the current PHS approach does not address larger landscape issues such as habitat connectivity, prioritization of habitat areas, cumulative effects of development, or multi-county habitat coordination. This project will increase the Department's capability to help local governments connect sites of ecoregional importance with habitats of local significance.

The local assessment is a Geographic Information System-based procedure that integrates, synthesizes and models existing data and information such as vegetation and land cover maps, Priority Habitats and Species, ecoregional assessments and state Natural Heritage locations to produce digital maps that portray the relative importance of habitat across the landscape.

Understanding specific habitat function within the broader landscape can better inform land use decisions, and projecting future habitat conditions will help local decision makers to understand where habitat is likely to be lost or gained under various land-use plan alternatives.