

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 America 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. Ecoregional Assessments

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

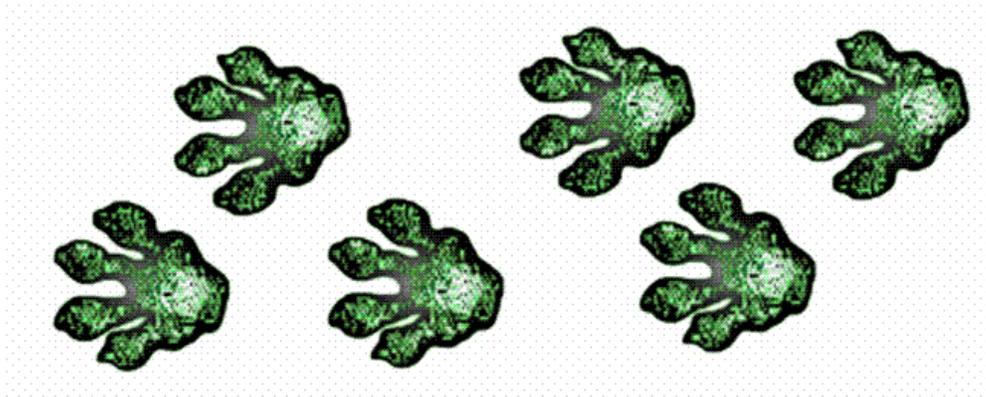
Efficient conservation strategies should begin at a regional level, but conservation decisions and actions are increasingly occurring at the local level, and local conservation efforts can be more effective when made within the context of a broader, regional-scale strategy. However, since ecoregional 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.

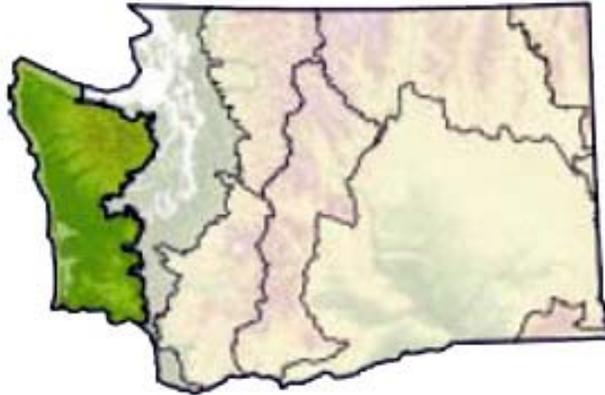
D. Ecoregional Conservation Strategies

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

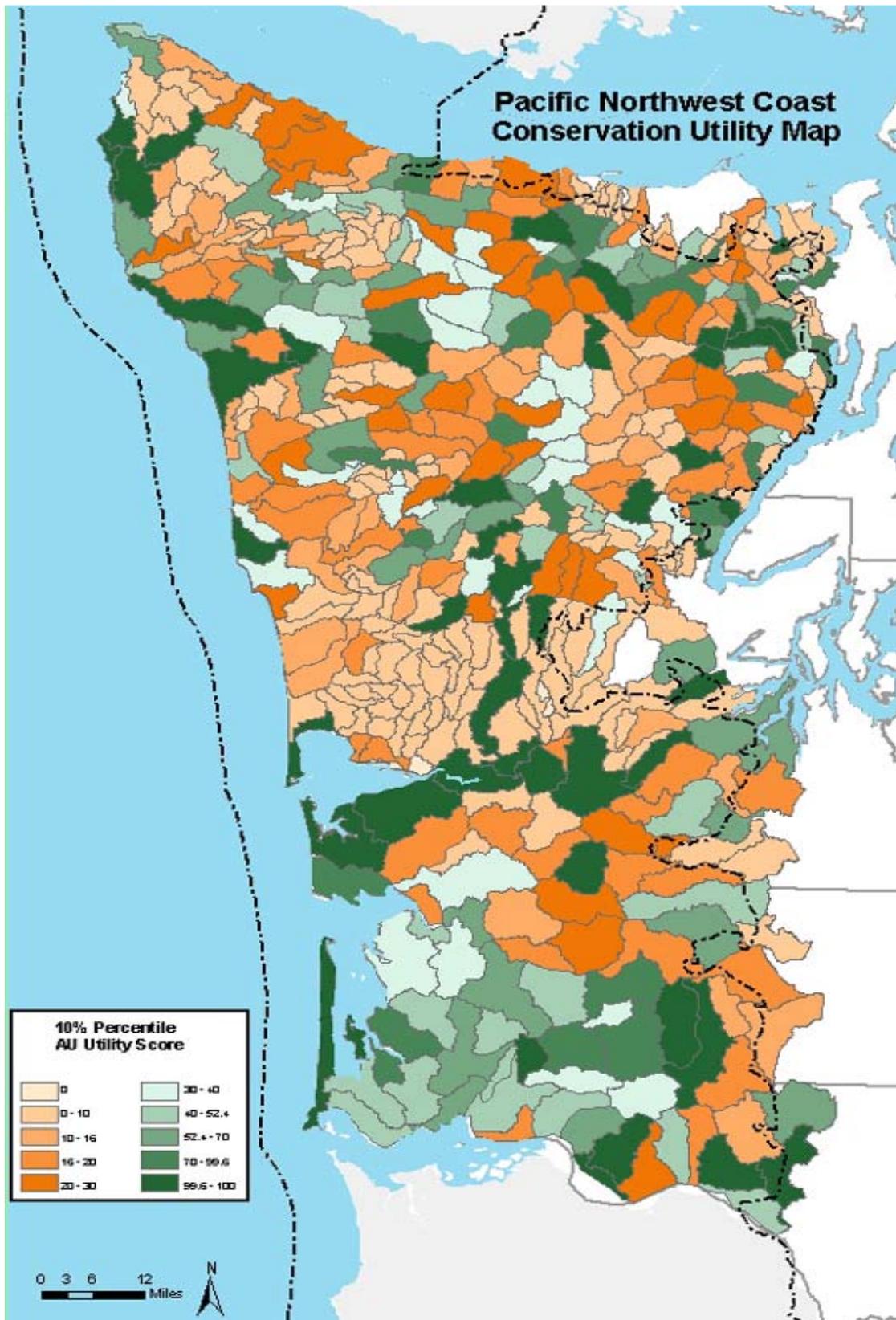
The Northwest Coast ecoregion has not experienced the rapid population growth of the Puget Trough ecoregion and still retains a high level of biodiversity. The region's temperate coniferous forests rank among the richest in the world in terms of forest and wildlife diversity. The Olympic Mountains are 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.



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.

Pacific Northwest Coast Ecoregion

Land Ownership Classes

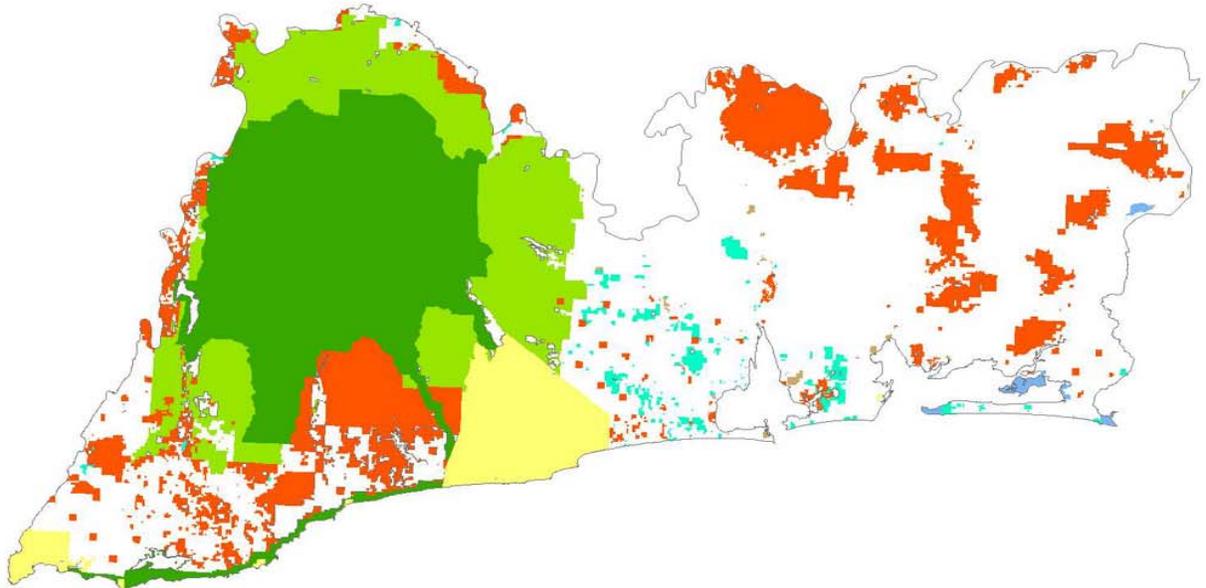
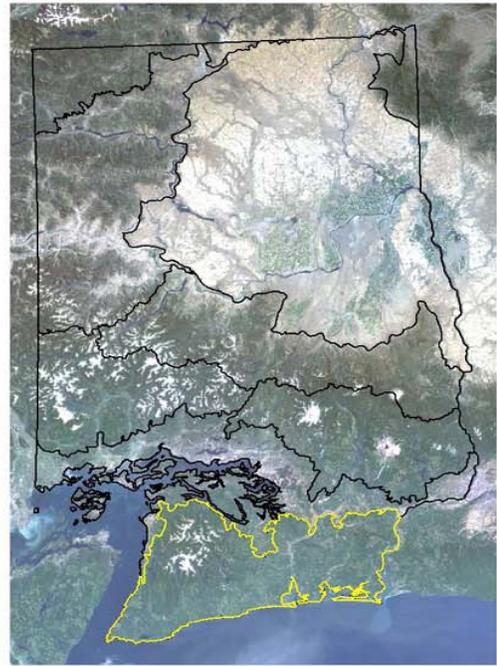
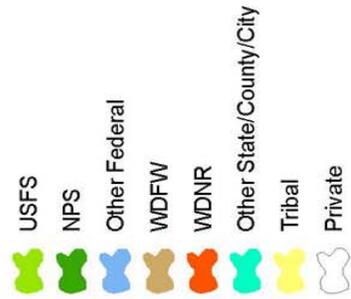


Figure 13.

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.

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
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

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
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

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 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

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

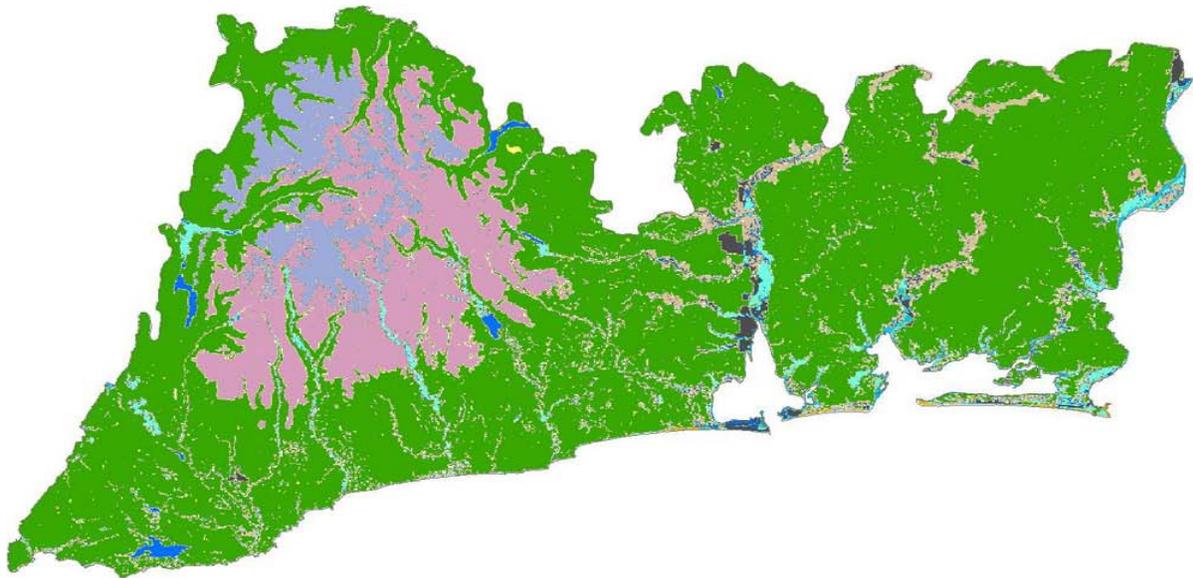


Figure 14.



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	Kee	n'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 Olymp	ic 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 Ocean by land. . . the waves appear to brake with tremendous 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 Ocean.

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	C	ommon 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	Colu	mbia 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.

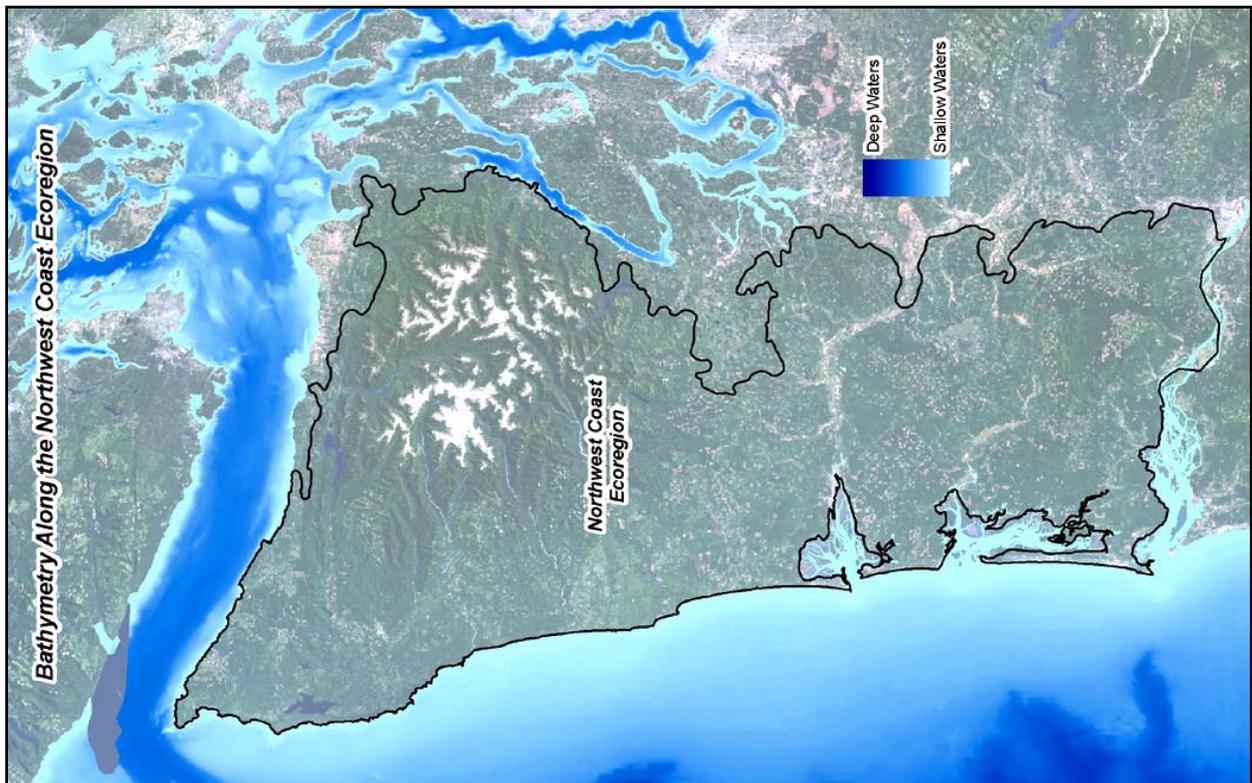
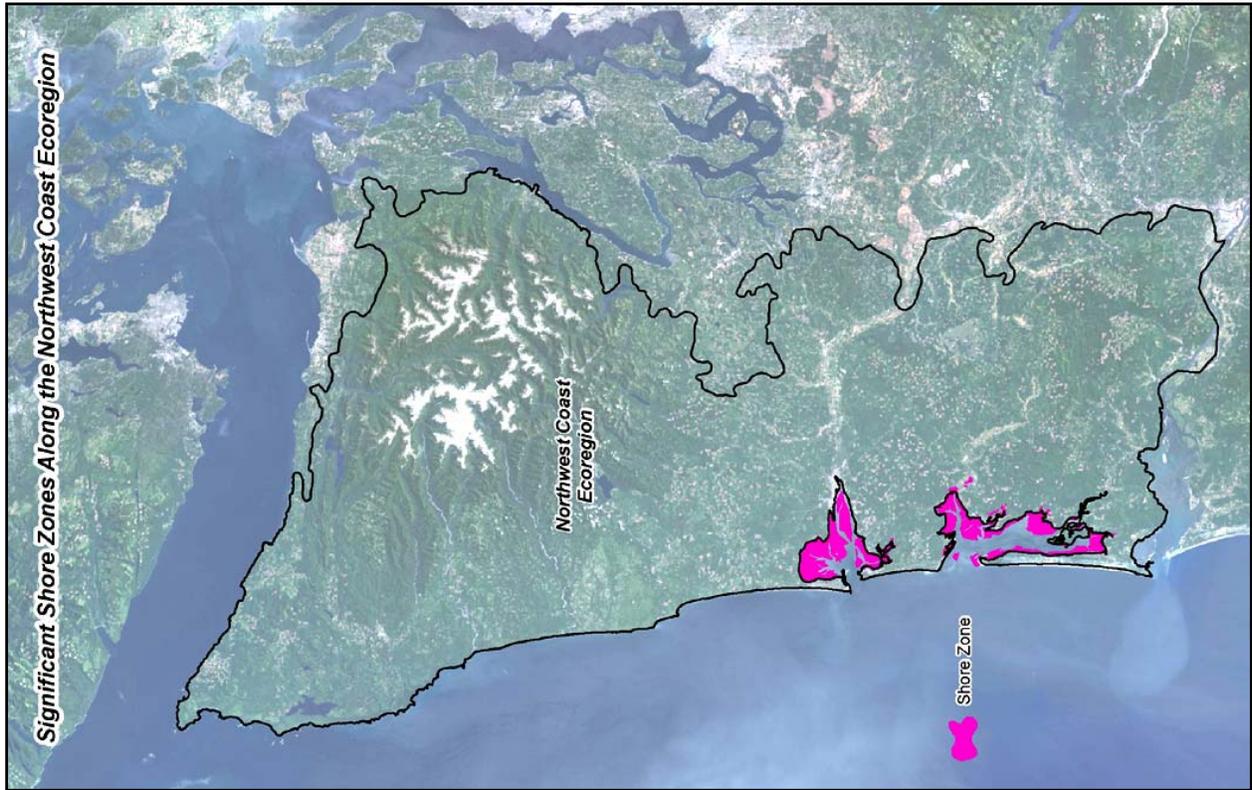
Coastal waters: Giant kelp beds float along open coasts in waters about 15 to 90 feet deep. These large brown seaweeds are so thick and well anchored to the sandy bottom that they significantly moderate wave action, helping to protect beaches from erosion. Bull kelp has long hollow stems ending in inflated 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.

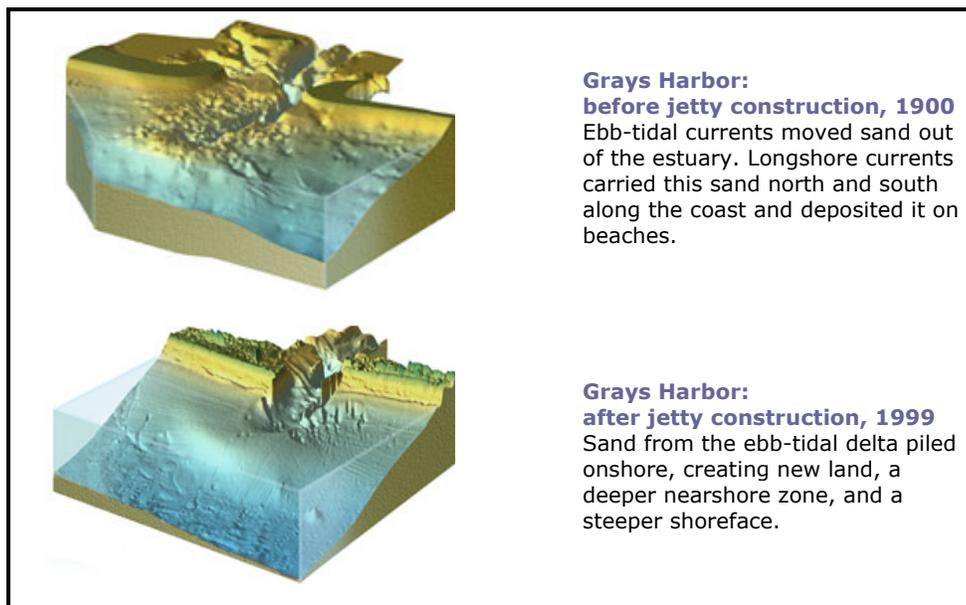
Urban Development

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.



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.

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. 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 meadowlark.
- 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.

Incompatible land management practices:

- 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.

Alien and invasive plant and animal species:

- 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,

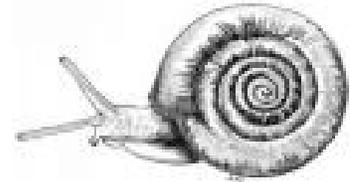


- western pearlshell, crowned tightcoil, Oregon megomphix.
- Assess and map important habitats and areas of high biodiversity in the ecoregion using ecoregional assessments, local habitat assessments, Interagency Vegetation Mapping Project, and other habitat inventories and plans. Update ecoregional 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.

Control and prevent introduction of alien and invasive species:

- 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.

Control and monitor disturbance:

- 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.

Improve enforcement of laws and regulations:

- 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.

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 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.

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.
- 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.

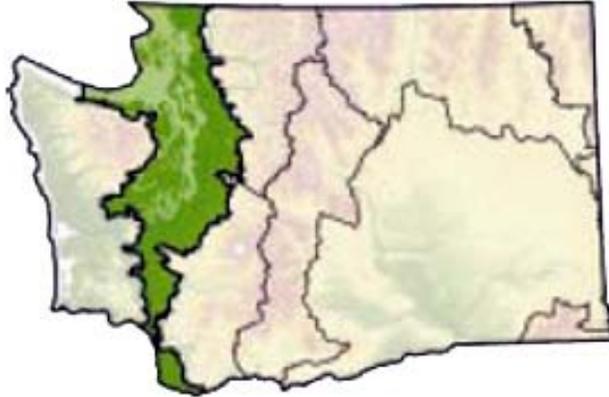
- Expand conservation education programs for both adults and children to emphasize the critical nature and vulnerability of sensitive habitats such as wetlands, oak and grassland habitats and associated wildlife.
- Connect with user groups through education to make them part of the conservation solution 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

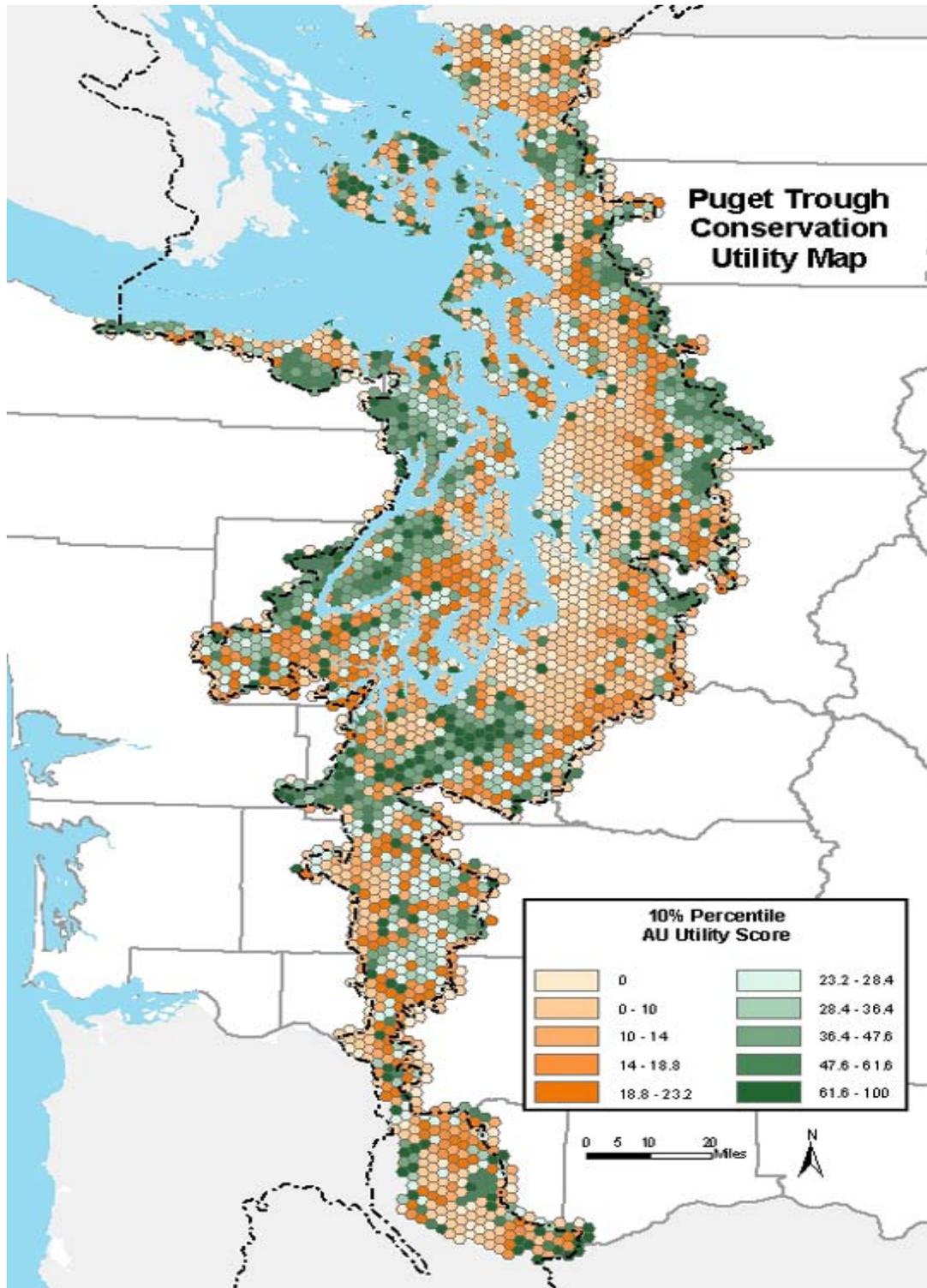
Terrestrial species are also diverse. However, a number of terrestrial plant and animal species have shown significant declines in the ecoregion over the past 100 years, primarily related to increased human development and resulting habitat loss. Population declines include amphibians endemic to the 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.

Puget Trough Ecoregion

Land Ownership Classes

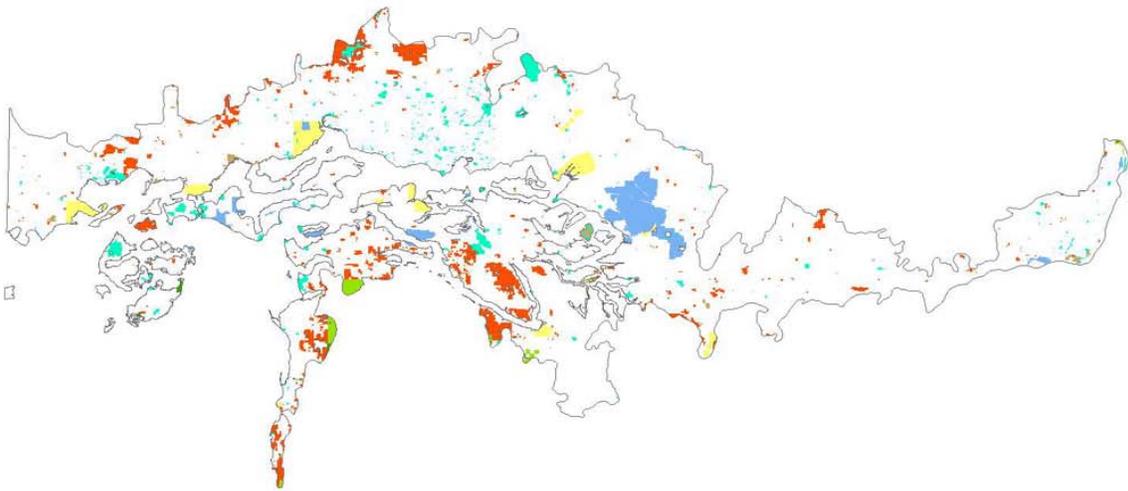
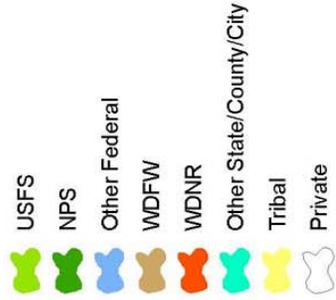


Figure 18.

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.

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
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

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
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

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
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 tailedropper (slug)		x					x				N	S4
Oregon megomphix (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 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

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



Figure 19.



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

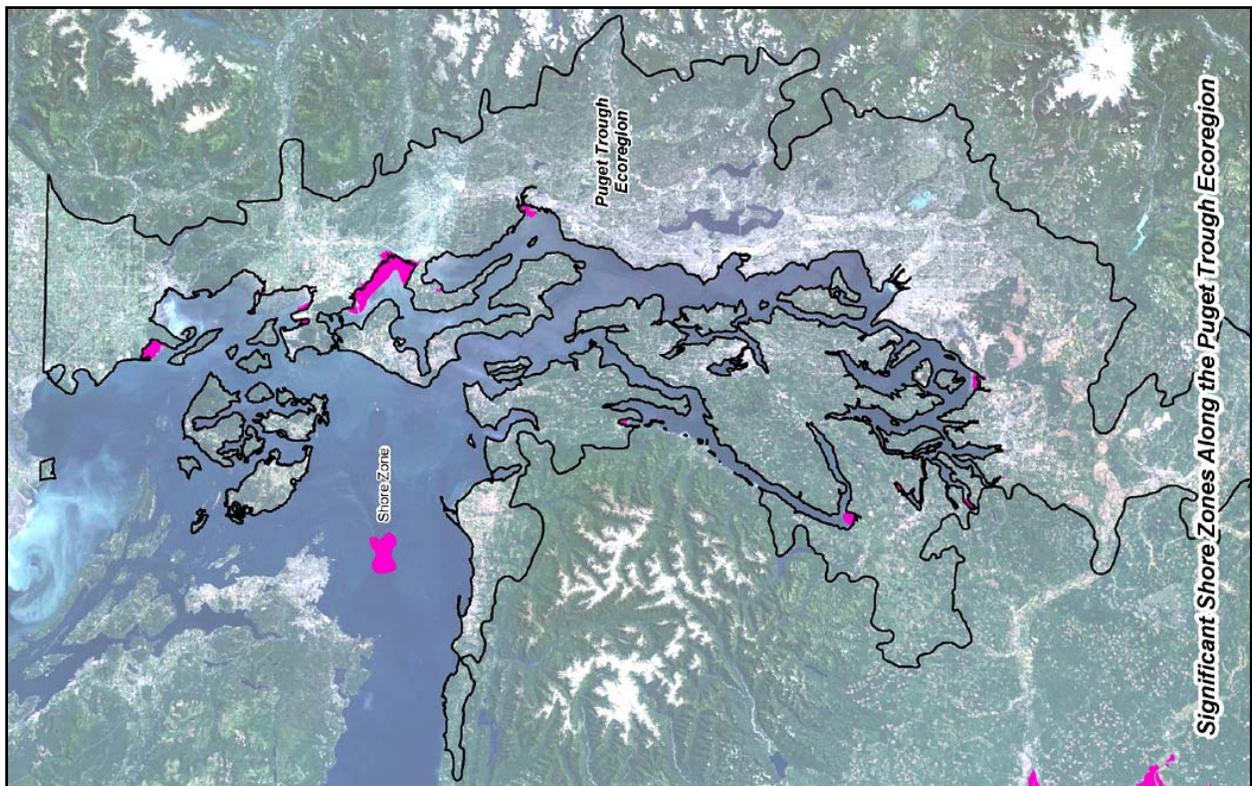
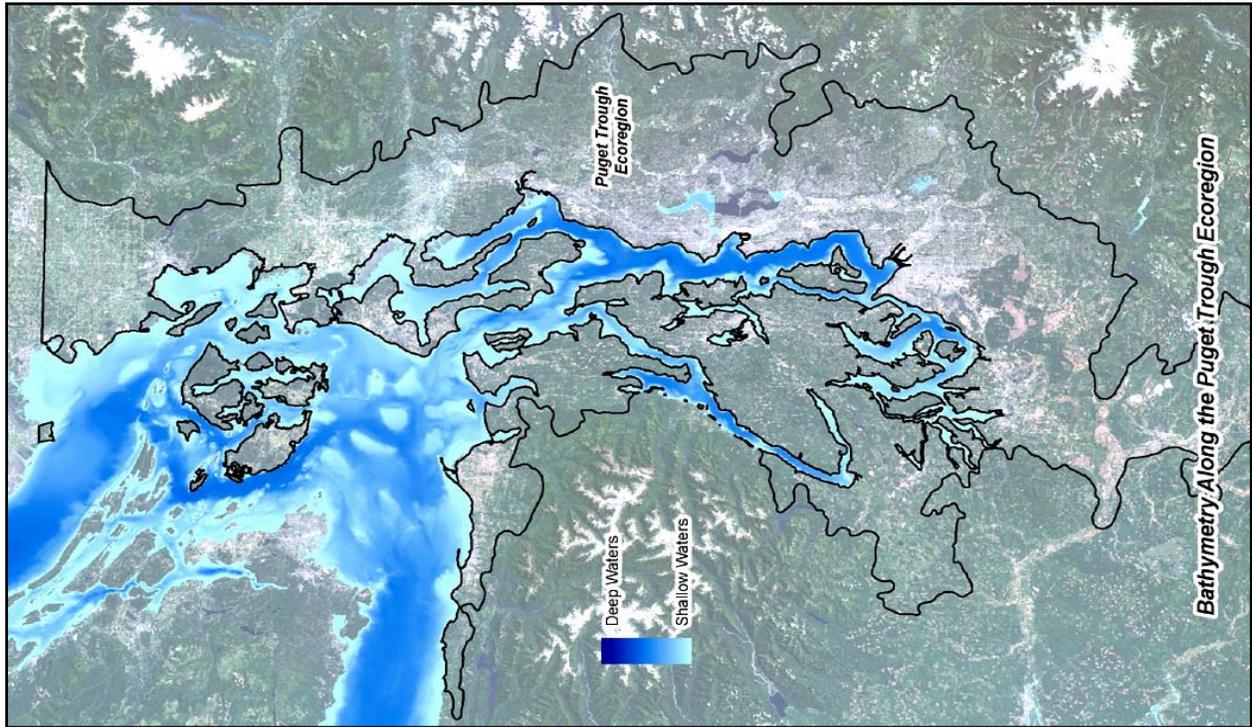
The marine systems of Puget Sound, Strait of Georgia, Hood Canal and the Strait of Juan de Fuca significantly define the climate, habitats and animals found in the greater Puget Trough ecoregion. The abundance of tidal salt water creates a home for a wide variety of resident and migratory marine fish 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 Yel	loweye 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
S lender-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	Pacific lamprey
Trumpeter swan	North Puget Sound steelhead
Yellow-billed cuckoo	South Puget Sound steelhead
Hatch's click beetle	Salish sucker
Beller's ground beetle	Pacific clubtail dragonfly
Oregon spotted frog	Long-horned leaf beetle
Western toad	

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- \geq 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 tailed dropper
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 conifer 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 tailedropper, 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).

Lack of biological information on species and habitats:

- 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 tailedropper, 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 tailed dropper, 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 murre, 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.

Conduct research, assessment and monitoring: 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 tailedropper, 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 sand lance 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 silver-spot 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 tailed dropper 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.

Improve land management practices:

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 tailed dropper 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.

Control and prevent introduction of alien and invasive species:

- 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.



Control and monitor disturbance:

- 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:

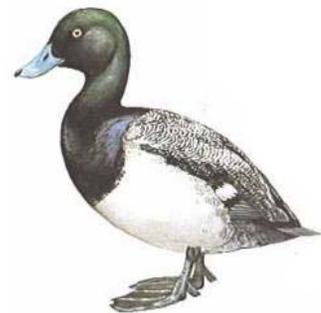
- Protect listed wildlife through enforcement, education and outreach.
- Enforce prohibition of killing bald eagle and non-permitted possession of parts through investigation and vigorous prosecution.
- Enforce restriction on transplantation of fishes to protect western pond turtle, Oregon spotted frog, 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

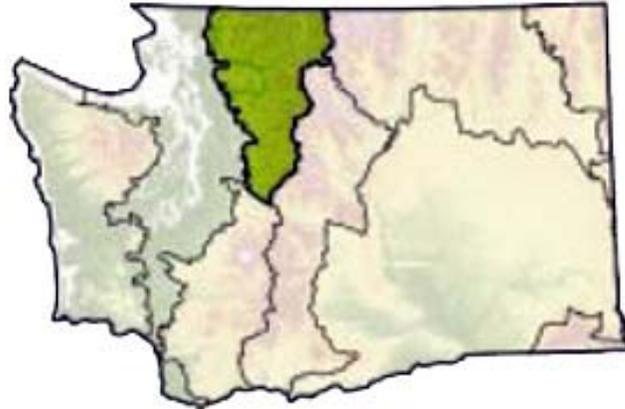


- important wintering areas in bays and estuaries.
- Develop educational materials and programs targeted to fishermen to reduce lesser scaup mortality from entanglement with discarded line and nets
 - Facilitate use of nontoxic alternatives to fishing sinkers to protect loons.
 - Use signage or fences 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.

North Cascades Ecoregion

Land Ownership Classes

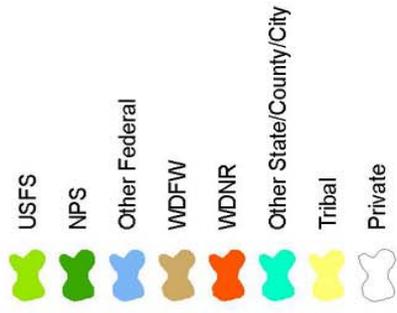
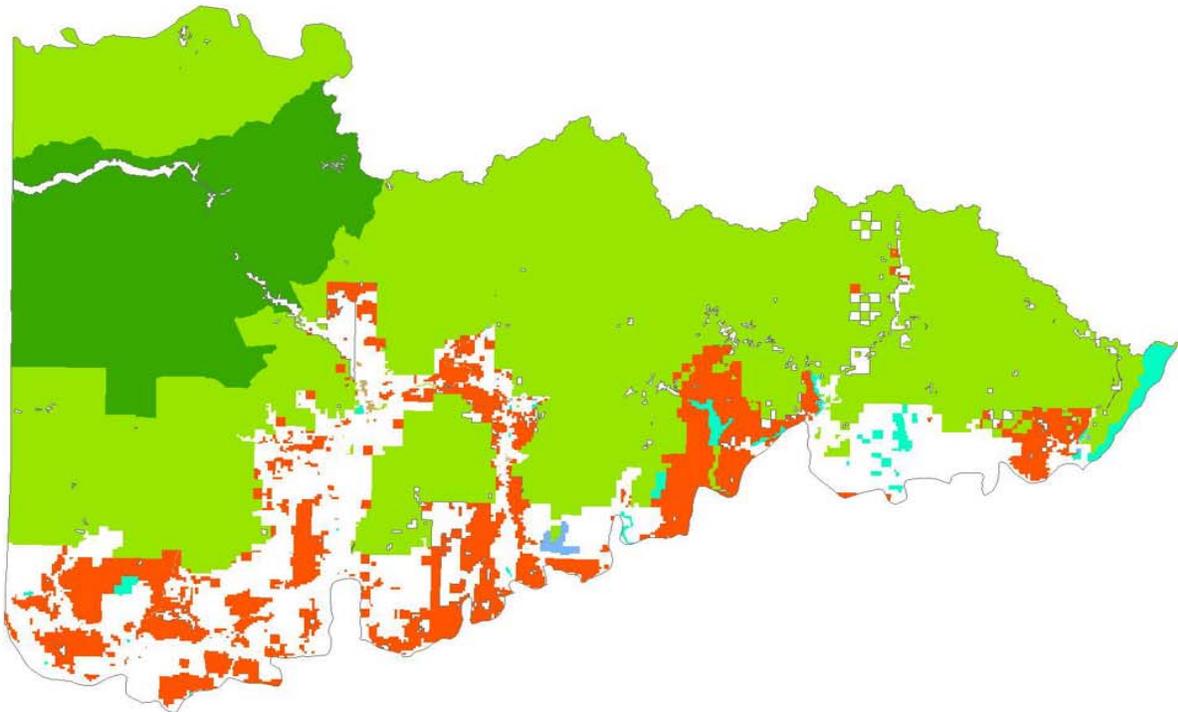


Figure 21.



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.

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP	
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown			
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

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
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

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 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

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

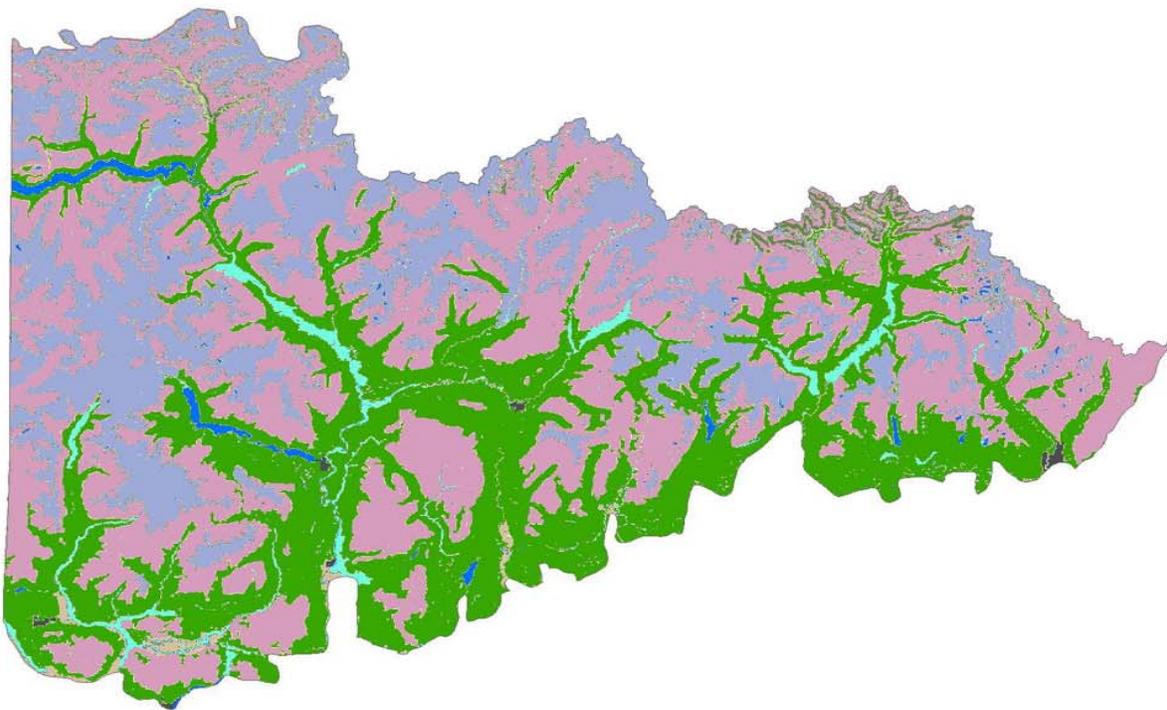
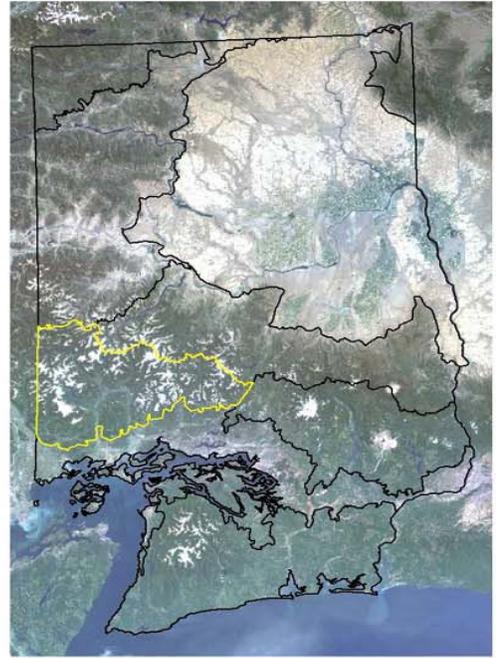


Figure 22.



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-hor ned 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.

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. 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.

Incompatible land management practices:

- 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.

Control and prevent introduction of alien species:

- 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.

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 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.

West Cascades Ecoregion

Land Ownership Classes

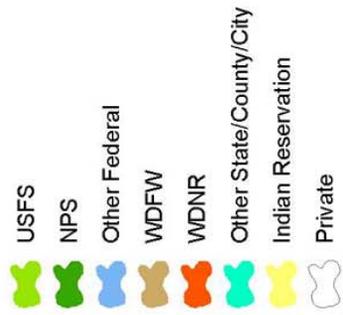
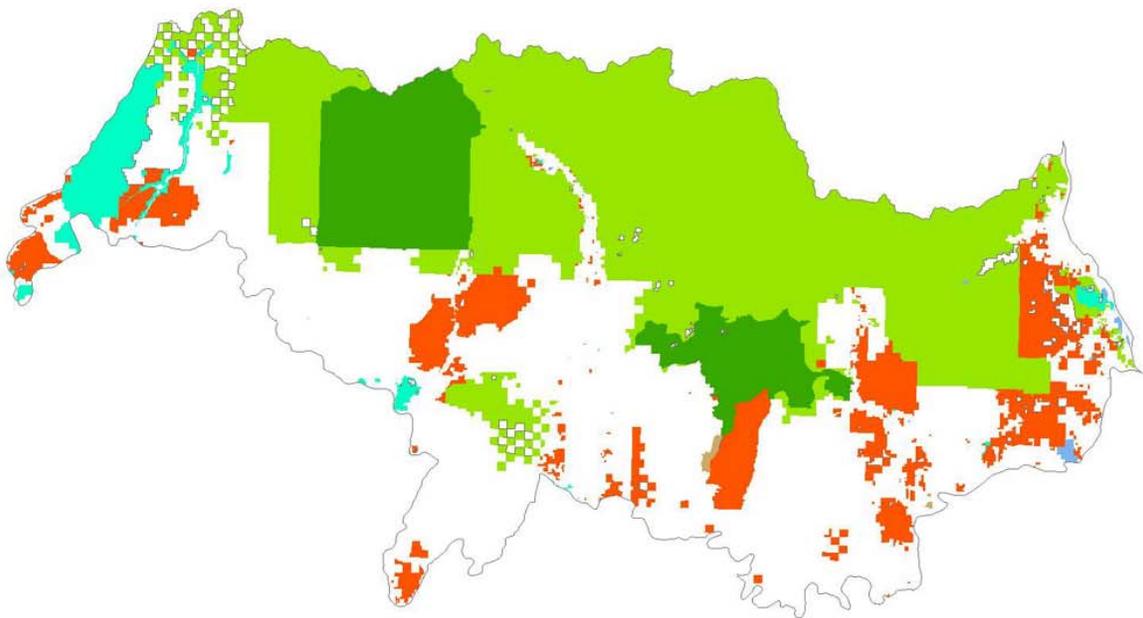


Figure 23.



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.

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 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.

Species of Greatest Conservation Need

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.

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
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

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
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

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 Environments
-  Grasslands/Shrublands
-  Agriculture
-  Urban
-  Lakes/Rivers/Reservoirs
-  Wetlands
-  Coastal Land Environments
-  Bays/Estuaries

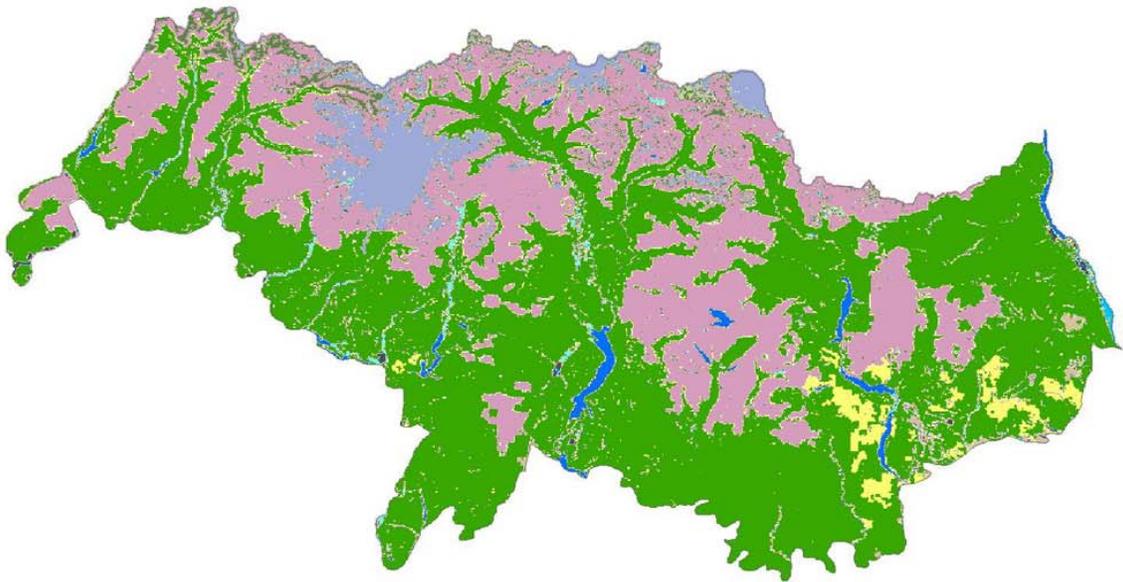


Figure 24



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 Blu	egray tailedropper (slug)
Marbled murrelet O	regon 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	Propertius' duskywing butterfly
Pileated woodpecker	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	Valley silverspot butterfly
California mountain kingsnake	Mardon skipper butterfly
Puget Sound fritillary 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 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, 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 tailed dropper.
- 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.

Lack of biological information on species and habitats:

- 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 tailed dropper, 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 tailed dropper 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.

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.
- 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.

Human disturbance and recreational impacts:

- 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 tailedropper 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 tailed dropper, Oregon meadowlark 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 tailed dropper* 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.

Control and prevent introduction of alien and invasive species:

- 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.

Improve coordination, planning, permitting and mitigation:

- 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.

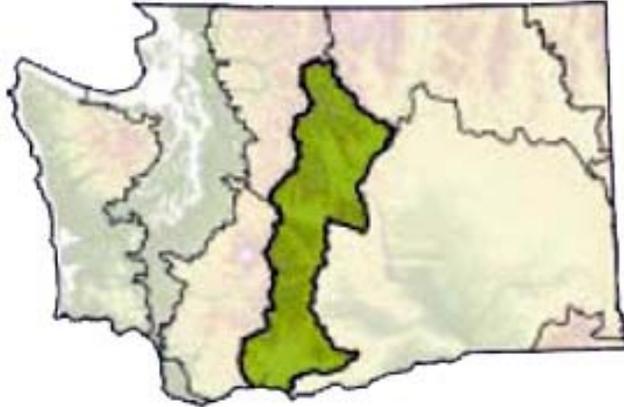
Improve wildlife conservation education: includes outreach, volunteer and watchable wildlife programs.

- 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.

East Cascades Ecoregion

Land Ownership Classes

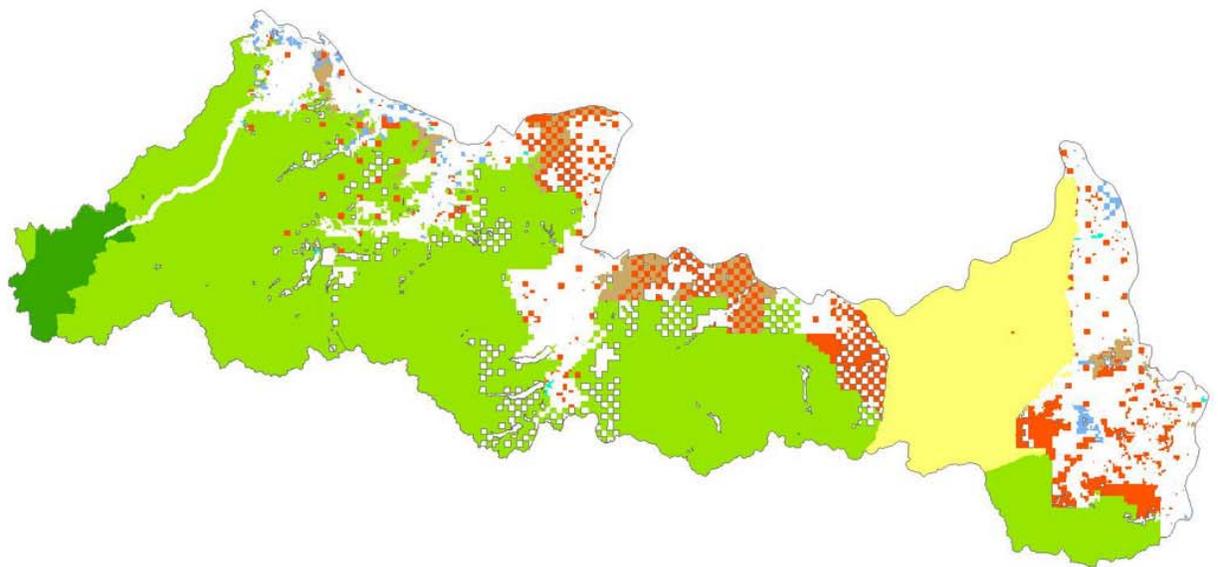
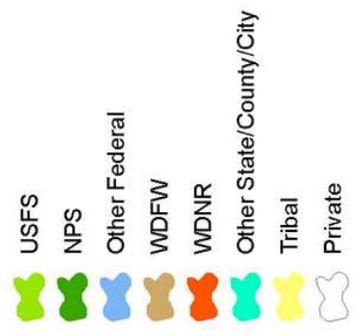
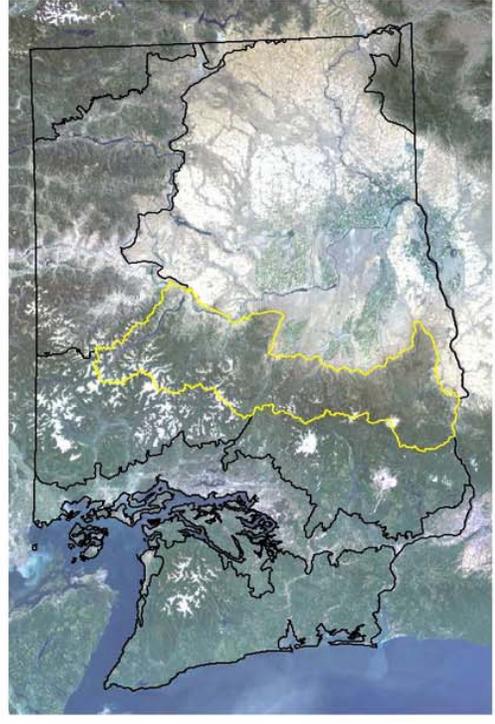


Figure 25.



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.

Species of Greatest Conservation Need

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.

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
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

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 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

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

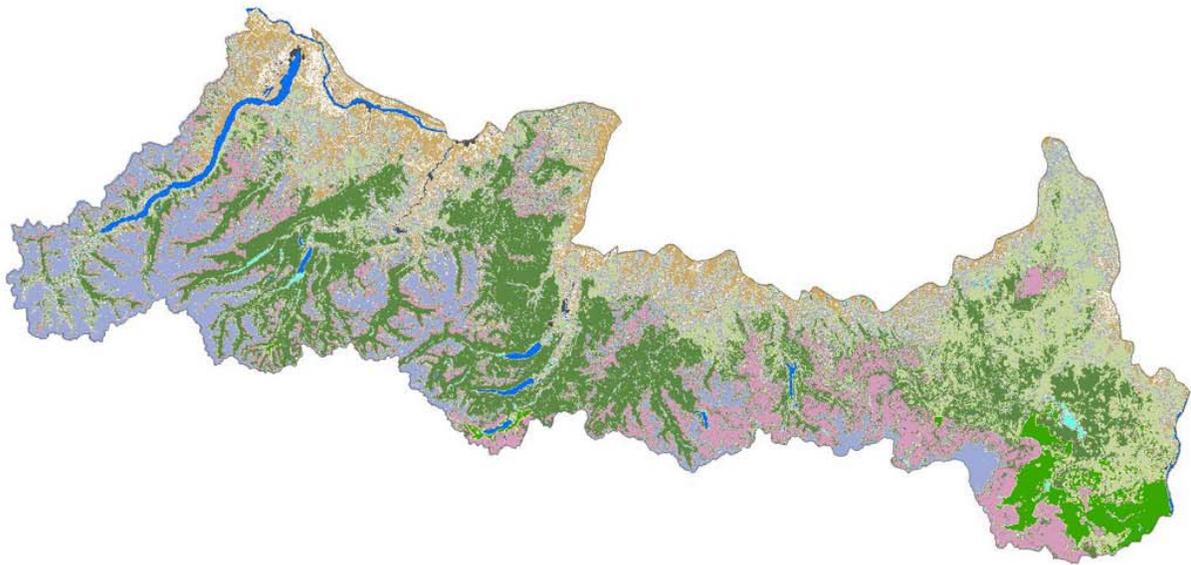
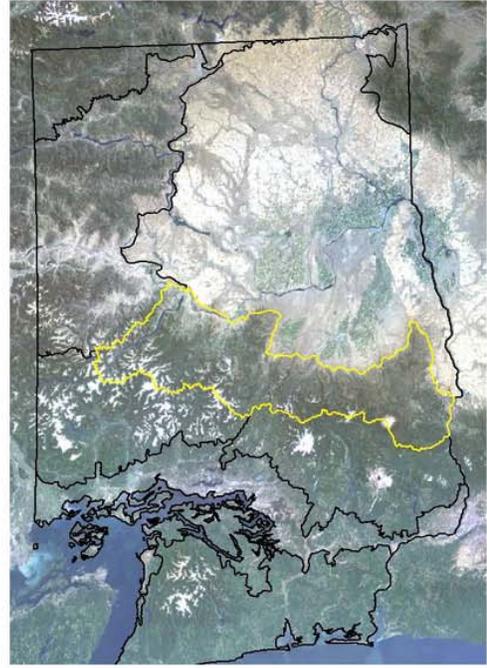


Figure 26.



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	Fla	mmulated 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.

Hydropower

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 may 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 manage 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.

Protect, restore and connect habitats:

- 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.

Control and prevent introduction of alien and invasive species:

- 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.

Improve enforcement of laws and regulations:

- 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 transplanted 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.

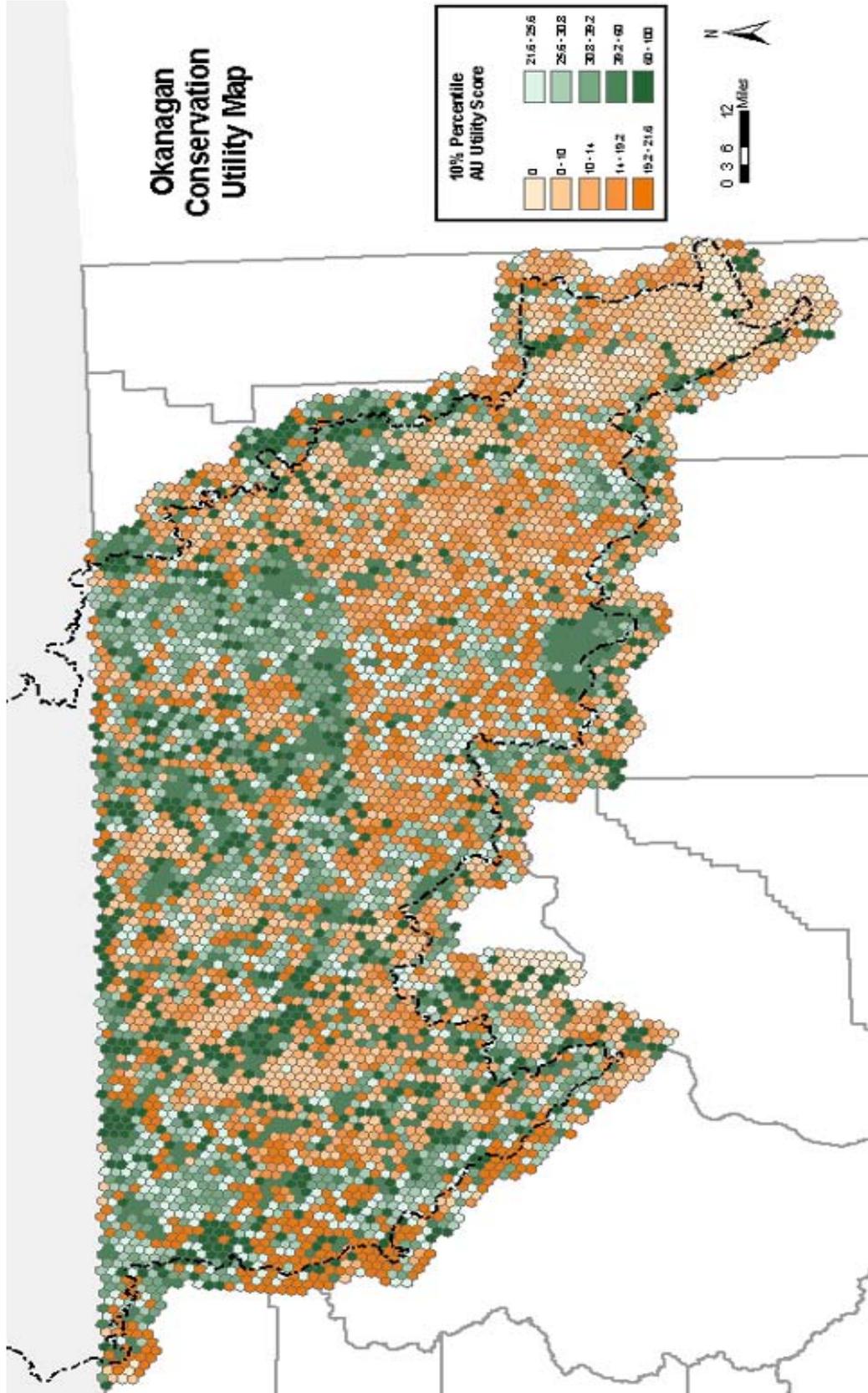
Fish and Wildlife Diversity

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 spadefoot 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.



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.

Okanogan Ecoregion

Land Ownership Classes

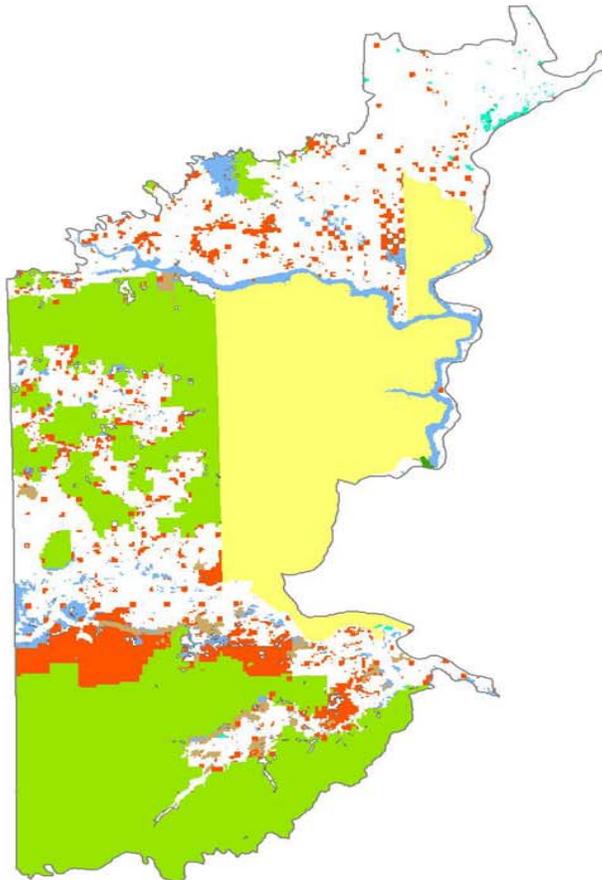
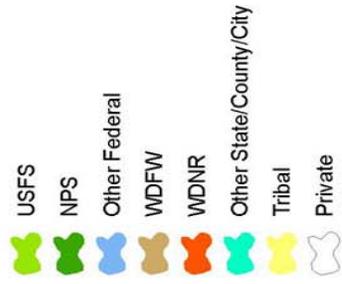


Figure 28.



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.

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
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

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
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

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
Boreal whiteface (dragonfly)		x								x	N	S1
Subarctic bluethroat (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

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 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

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



Figure 29.



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	N	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 darter, 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 darter, 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.

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.
- 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 darter, 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 darter, 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 darter, 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 darter, 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.

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, 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.

Control and prevent introduction of alien and invasive species:

- 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.

Improve coordination, planning, permitting and mitigation:

- 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.

Improve enforcement of laws and regulations:

- 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.

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 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.

Canadian Rockies Ecoregion

Land Ownership

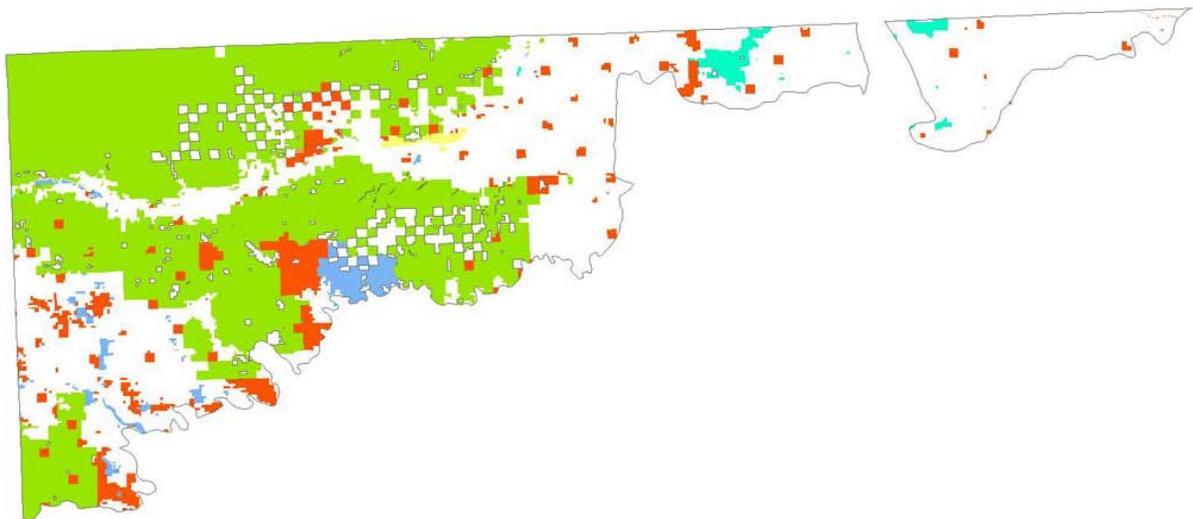
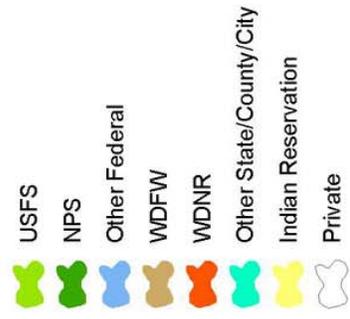


Figure 30.



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.

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
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

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
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

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 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

Canadian Rockies Ecoregion

Wildlife Habitat Classes

- Wetland Lowland Conifer/Hardwood
- Wetland Oak/Dry Douglas-Fir
- Montane Mixed Conifer
- Engelmann Mixed Conifer
- Lodgepole/Pine/Jarvis Pine/Cascade Oak
- Subalpine/Alpine Environments
- Grasslands/Groenlandia
- Agriculture
- Urban
- Lakes/Rivers/Reservoirs
- Wetlands
- Coastal Land Environments
- Bay/Estuaries



Figure 31.



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	L	ynx
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
Vaux's swift

Silver-bordered fritillary butterfly

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
Northern leopard frog

Great blue heron
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.

Incompatible land management practices:

- 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.

Alien and invasive plant and animal species:

- 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.

Protect, restore and connect habitats:

- 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.

Control and prevent introduction of alien and invasive species:

- 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.

Improve enforcement of laws and regulations:

- 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.

Improve landowner assistance:

- 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.

Blue Mountains Ecoregion

Land Ownership Classes

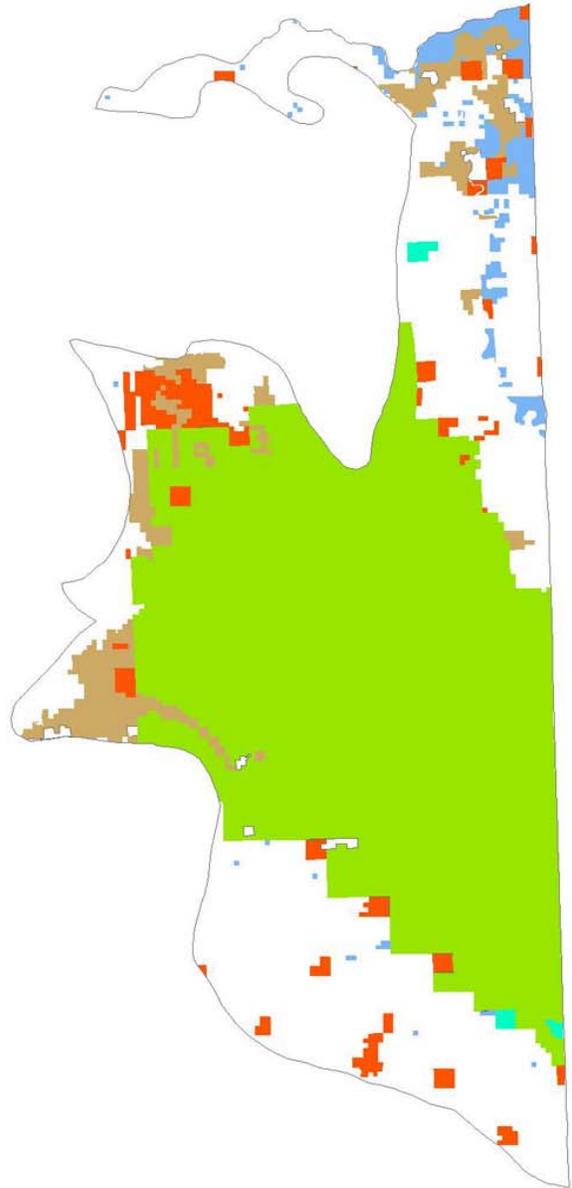
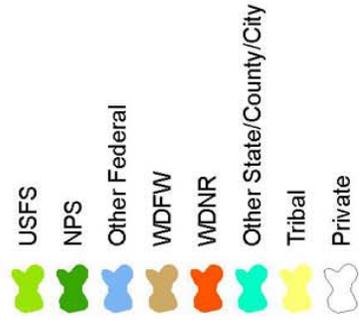


Figure 32.

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.

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 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.

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP**
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
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

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 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

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 Environments
- Grasslands/Shrublands
- Agriculture
- Urban
- Lakes/Rivers/Reservoirs
- Wetlands
- Coastal Land Environments
- Bays/Estuaries



Figure 33.

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	N	northern goshawk
Great gray owl		Pygmy nuthatch
White-headed woodpecker		

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	

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.

Protect, restore and connect habitats:

- 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.

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.
- 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 regimens 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, *flamulated 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, flamulated 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.

Control and prevent introduction of alien and invasive species:

- 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.

Control and monitor disturbance:

- 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.

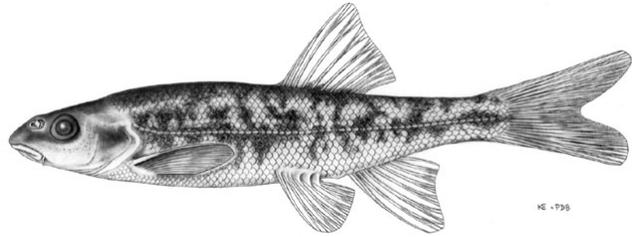
Improve transportation and energy development:

- 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 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:

- 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.

Columbia Plateau Ecoregion

Land Ownership Classes

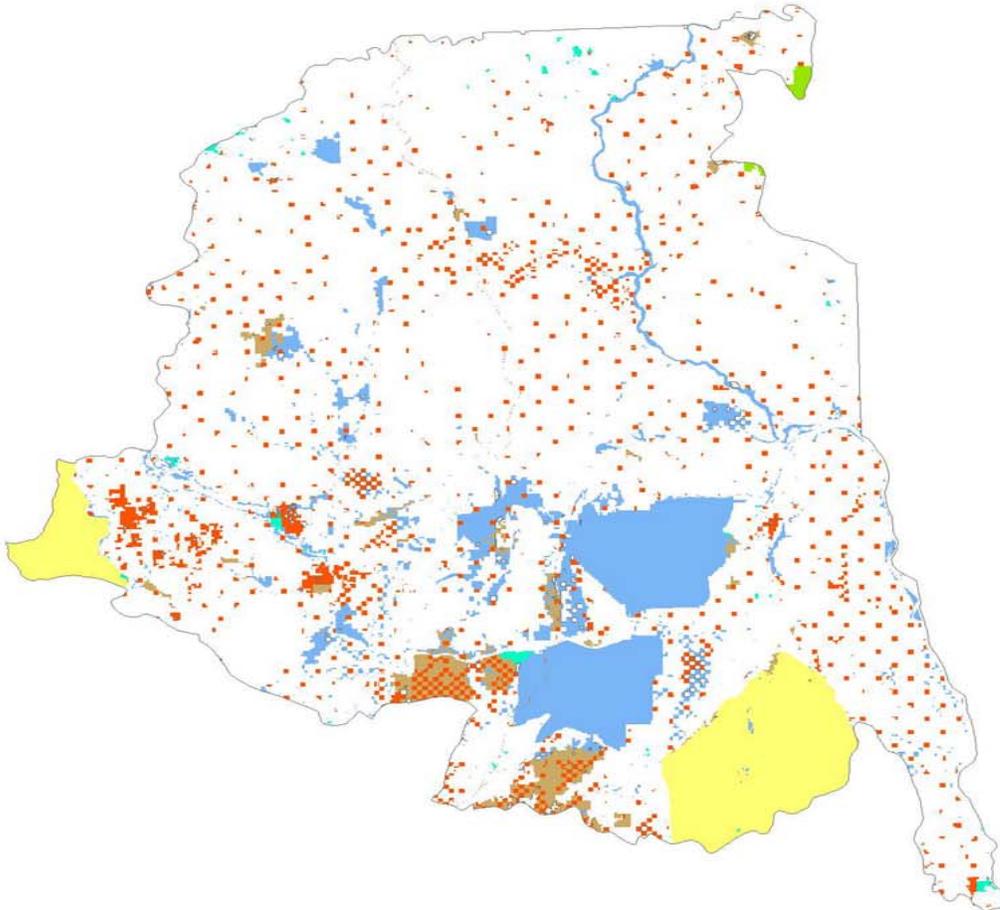
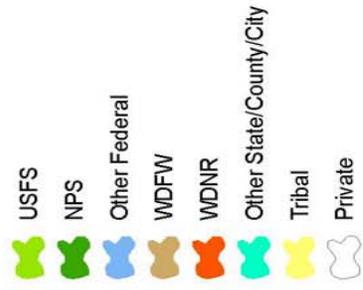


Figure 34.



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.

Species of Greatest Conservation Need

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.

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
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

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 Environments
-  Grasslands/Shrublands
-  Agriculture
-  Urban
-  Lakes/Rivers/Reservoirs
-  Wetlands
-  Coastal Land Environments
-  Bays/Estuaries

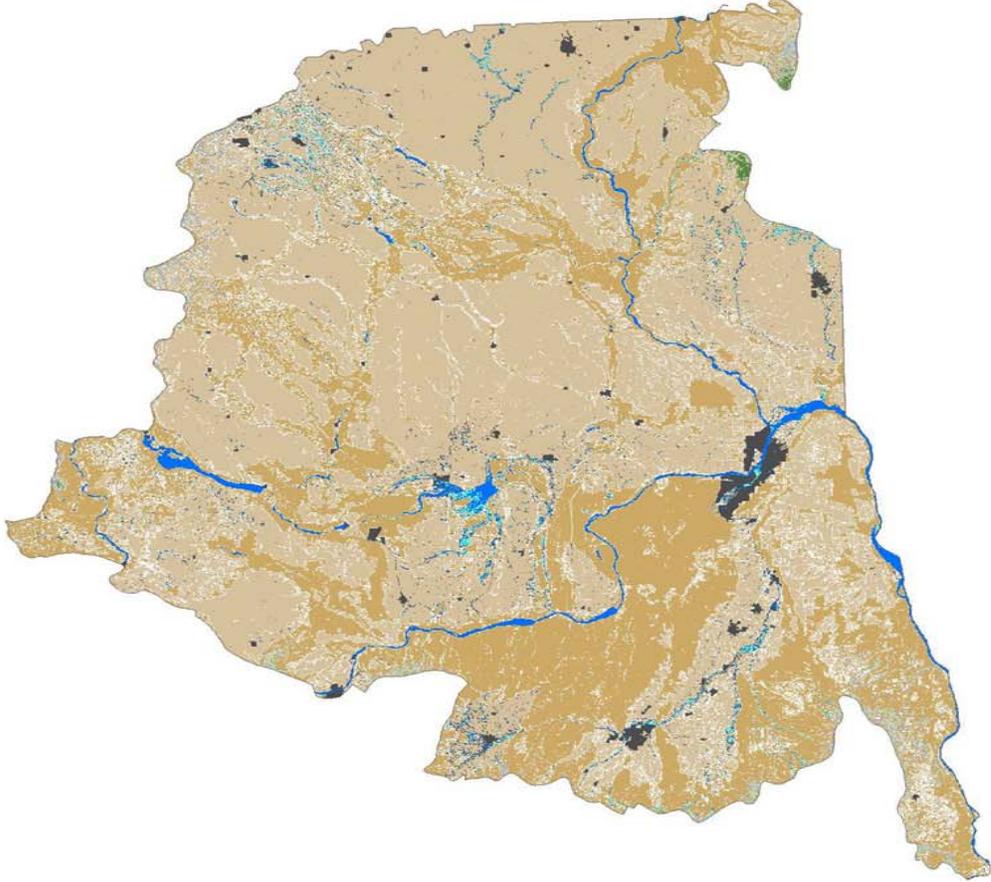
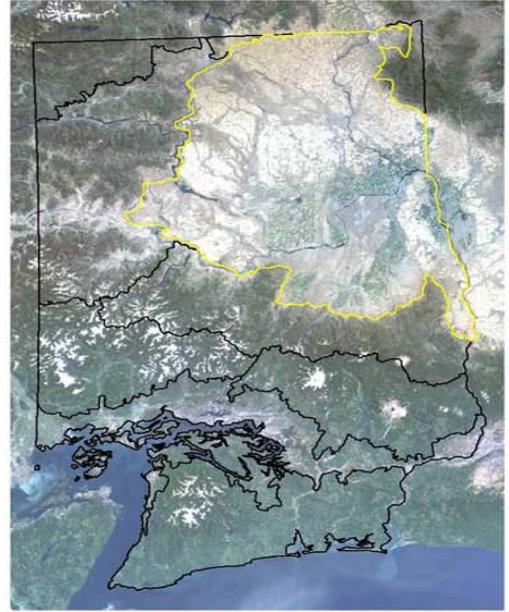


Figure 35.



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 N	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 microbotic 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 microbotic 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.

Incompatible land management practices:

- 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.

Alien and invasive plant and animal species:

- 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.

Human disturbance and recreational impacts:

- 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.

Environmental contaminants:

- 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 sites 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.

