SPECIES:
Conservation Summaries for Strategy Species

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Introduction and Overview

It is nearly impossible and certainly impractical to attempt to inventory and manage every species in Oregon. An alternative approach is to use a "coarse filter," focused on conserving natural communities, with a "fine filter" that addresses needs for low and declining species. These approaches complement each other, with coarse filters proactively addressing the needs for broad suites of species and "fine filters" addressing the needs of individual species that might otherwise be overlooked.

In the Conservation Strategy, Strategy Species are the "fine filter". They have small or declining populations or are otherwise at risk. In coordination with the Conservation Strategy's Technical Advisory Committee and Oregon Department of Fish and Wildlife biologists, Strategy Species were identified using the methodology described in Appendix IV. Oregon's Strategy Species include 17 amphibians, 62 birds, 65 fish, 59 invertebrates, 18 mammals, 60 plants, and 5 reptiles (total = 286).

This section focuses on the requirements of Strategy Species and the actions needed to conserve them. However, to take a broader view of fish and wildlife conservation, this section also includes information on conserving native plants and invertebrates; extirpated species; general data gaps that apply to a broad array of species; naturally-occurring fish and wildlife diseases; and animal concentrations, which are locations where animals gather for important activities such as breeding, migrating or wintering.

Why Conserve Plants and Invertebrates?

From sand dunes to deep fertile soil, lush temperate rainforests to rolling sagebrush plains, the Pacific Ocean to lofty mountain tops: Oregon has a remarkable range in geology, soils, climate and vegetation. This variety of landscape features results in an amazing diversity of plant and animal species that live interdependently in combinations known as "natural communities." These communities are a large part of what makes Oregon unique. This Conservation Strategy aims to conserve these communities and their species.

Although Oregon Department of Fish and Wildlife does not have management authority for plants or invertebrates, it is committed to an inclusive, comprehensive approach to conservation. When providing guidance to the states on developing their strategies, the U.S. Fish and Wildlife Service directed state agencies to address a broad array of species, including invertebrates, and encouraged them to evaluate plants. For these reasons, this Conservation Strategy attempts to address the most critical conservation needs for multiple taxa, rather than focusing solely on vertebrates. It ensures a common vision with broad conservation goals that can be applied by landowners, other agencies, and non-profit organizations to determine issues, priorities, and actions in their area of interest.

Supporters of more charismatic species such as salmon or songbirds also have reason to be concerned with the conservation of plants and invertebrates. Vertebrates are members of an interconnected web of life, and depend upon plants and invertebrates for food and shelter. Generally, the more plant and invertebrate species found in an area, the greater number and diversity of vertebrates that area supports. A habitat-based approach to conservation is the most efficient way to conserve a variety of species, their interactions, and the processes that maintain communities. For example, prairie restoration in the Willamette Valley has the potential to benefit a whole suite of rare birds, plants, and butterflies, as well as the more common species. In addition, there are countless economic, social, ecological and aesthetic reasons

why invertebrates and plants are worth conserving for their own sake. Lastly, one of the goals of the Conservation Strategy is to prevent additional species from becoming imperiled enough to warrant listing under the state or federal endangered species acts. There are many rare species that, although not yet formally listed, are facing declining numbers. Judicious management of these species now could save time and money in the future.

Plants

Oregon harbors a huge and diverse number of native wildflowers and other plants, many of which occur primarily or exclusively in the state. In fact, Oregon ranks fifth in the nation for the number of naturally-occurring plant species. These Oregon natives, especially adapted to the region's unique habitats and climate, are an important facet of the state's natural heritage. Nature enthusiasts from around the world visit Oregon to admire, study, and photograph its rich flora. Scientists have scarcely begun to investigate the potential economic uses of local native plants in agriculture, medicines, and horticulture. Although most of Oregon's plant species are still abundant and compatible with human activities, a few others are extremely rare and susceptible to such threats as invasive non-native species (introduced pests, diseases and weeds) and habitat degradation, and habitat loss.

Oregon Department of Fish and Wildlife developed the information on plant Strategy Species in cooperation with Oregon Department of Agriculture's Native Plant Conservation Program, which has management authority for Oregon's native plants. The mission of the Native Plant Conservation Program is to conserve Oregon's native plant species on state-owned and state-managed land (OAR 603-073-0001 through 0110). "State lands" are defined by law to include any non-federal public lands in Oregon. The Program maintains a list of plant species qualifying for protection under state law (OAR 603-073-070), consistent with the requirements of the Oregon Endangered Species Act (ORS 496.171 to 192). Native plant conservation laws apply only to plants and habitat occurring on state-owned and state-managed land, and do not affect private or federal lands.

The Native Plant Conservation Program is dedicated to working with various local, state, and federal agencies to manage their lands in ways that are not detrimental to remaining populations of protected species. Also, since many of Oregon's native plants are the subject of horticultural and scientific interest, the program is responsible for regulating commercial trade and research involving listed species in order to protect them from potential harm or exploitation.

The Native Plant Conservation Program strives to generate novel, flexible, and non-controversial solutions for the conservation of protected plant species. Currently, less than 2% of Oregon's native plants are protected by state law (61 out of more than 3500 taxa). The Native Plant Conservation Program is involved in numerous conservation and protec-

What is the Difference between a Strategy Species and an Indicator Species?

To meet Congressional intent for state strategies, priority must be placed on two major categories: (1) species that are "low and declining" and (2) species that "are indicative of the diversity and health of wildlife of the state." In reality, some species are both "low and declining" and good "indicator" species, particularly those highly associated with declining habitats. Other species might fit into only one of these two categories. Understanding the differences between these categories helps to understand the goals and approach of this Conservation Strategy.

Strategy Species are identified because they are "low and declining" or are otherwise at-risk. The purpose is to prevent these species from declining further and, where possible, to restore their populations. In some cases, these Strategy Species also indicate the diversity and health of other wildlife associated with the same habitat, but they were not chosen for that reason. As an example, greater sage-grouse are indicative of healthy sagebrush habitats, and may indicate the status of other sagebrush-associated animals such as pygmy rabbits and northern sagebrush lizards.

Indicator Species are sometimes used to monitor the health of the habitat and a suite of associated species. For example, yellow warblers nest in riparian shrublands and woodlands. They indicate structural diversity and complexity, which is typical of healthy riparian systems. Structural diversity provides nesting areas for other songbirds, high invertebrate populations which are prey for birds and bats, shading for cool water temperatures favorable to fish, and cover and browse for deer and elk. Other potential indicator species or groups of species include western small-footed myotis (bat) for shrub-steppe, butterflies for grasslands, stoneflies for water quality, and lichens for air quality. As part of the Conservation Strategy's implementation, a Fish and Wildlife Monitoring Team will identify a framework to link indicators, including Indicator Species, to Strategy Species and/or Strategy Habitats. The framework will be done in a collaborative process, will evaluate the successes and failures of similar efforts in the past, and will build upon previous efforts to identify indicators, such as birds identified by the North American Landbird Plan and efforts by the Oregon Board of Forestry to identify indicators regarding forestlands. For more information, see the Monitoring Chapter.

tion efforts, including habitat improvements, population enhancements and reintroductions, population monitoring, preparation of Recovery and Conservation plans, and resolving conflicts between local groups and other agencies.

Many other Oregonians and agencies are involved in plant conservation efforts. Federal land management agencies consider plants when conducting land management activities, and both federal and private landowners are completing plant restoration projects on their lands. Private groups such as the Native Seed Network, Institute for Applied Ecology, and Native Plant Society of Oregon are also involved in native plant conservation. The following examples highlight some of the plant conservation efforts taking place in Oregon:

- Monitoring response of Cook's desert parsley and large-flowered wooly meadowfoam to prescribed fire and other management actions near Medford (The Nature Conservancy, Bureau of Land Management, Institute of Applied Ecology).
- Greenhouse propagation and reintroduction of rough allocarya (hairy popcorn) flower in Douglas County (Native Plant Conservation Program, Oregon Department of Transportation, The Nature Conservancy, Bureau of Land Management, U.S. Fish and Wildlife Service).
- Grazing management and seed banking to benefit Malheur wire lettuce in Lake County (Bureau of Land Management, Berry Botanical Garden).
- Field studies to determine appropriate methods of seed germination, plant propagation, and site preparation, and seeding/transplanting for several native plants species through the "Native Comeback Initiative" (Institute of Applied Ecology, Bureau of Land Management, U. S. Forest Service, local elementary and high schools).
- Working with growers to increase the availability of genetically-appropriate seed for upland prairie restoration (The Nature Conservancy, Heritage Seedlings, Inc.).

Invertebrates

High plant diversity translates directly into high invertebrate diversity. Whether measured by number of individuals, species, or total weight (called "biomass"), invertebrates outnumber Oregon's other forms of life. Insects make up a large percentage of invertebrates but this class of creatures also includes worms, spiders, centipedes, mites, snails, starfish, and sea urchins.

Native invertebrates benefit people in many ways, from providing food to supplying vital ecological services. Crabs, clams, and mussels, essential components of healthy marine and estuarine ecosystems, are valued as seafood and support a significant Oregon industry. Butterfly gardening, butterfly watching, and dragonfly watching are becoming increasingly popular. The interactions of invertebrates with other species form the biological foundation of all ecosystems. Worms and other soil

Culturally Important Species

Whenever people live in a location over long periods of time, they build strong ties to its natural resources because these resources touch so many aspects of their lives. Food, water, building materials, tools, transportation, and clothing all come from or are shaped by people's surroundings. These critical components of daily life then influence society, language, world view, spiritual beliefs and memories.

For at least ten thousand years, native people in Oregon have used fish, mammals, birds, berries, seeds, roots, and bark to nourish their bodies and shape their culture. For example, western interior valley people cultivated camas, tarweed, acorns, and black-tailed deer through strategic burning and judicious harvests. Coastal tribes feasted on fish, oysters, clams, and mussels, and shaped western redcedar into canoes, houses, clothing and even baby diapers. In eastern Oregon, family groups traveled to take advantage of seasonally available roots, fish, and huckleberries.

Throughout Oregon, deer, elk, lamprey, and trout were important foods for native people. Salmon were particularly important to many of Oregon's tribes, serving as both food and the basis for a lucrative trade system. Salmon migration patterns set the rhythm of activities throughout the year including seasonal travels and the First Salmon ceremonies at Celilo and Willamette falls. To this day, salmon populations are pivotal to Oregon's economy and identity. Through the Oregon Plan for Salmon and Watersheds and other programs, Oregonians have undertaken great effort to conserve and restore salmon populations.

Over the past 150 years of settlement, European settlers and their descendents also have built strong cultural ties to the resources of their adopted landscape. Beavers first attracted fur-trappers and early explorers. Douglas-fir, ponderosa pine and other trees formed the basis of Oregon's logging industry. Today, families look forward to annual clamming and whale watching on the coast, elk hunting in the Blue Mountains, and bird watching in the Malheur Basin. Together, Oregonians can conserve their fish and wildlife legacy and the cultural, aesthetic, and ecologic values provided by animals, plants, and other species.

invertebrates cycle nutrients, maintain soil structure, and improve water filtration. Bees, butterflies, beetles, and other insects pollinate crops, wildflowers, and other plants. Ants disperse plant seeds. Lacewings, ladybird beetles, predatory wasps, and hoverflies control populations of other invertebrates that damage crops. Some invertebrates can serve as indicators of ecological health. For example, aquatic insect larvae can indicate water quality, and butterfly diversity can indicate grassland health. Invertebrates are the primary food source for a variety of fish and wildlife, including birds, bats, shrews, lizards, frogs, and trout. Invertebrates supply vital ecological services for people and ecosystems.

In comparison to vertebrates and plants, much less is known about the status, distribution, and conservation needs of Oregon's invertebrates. Invertebrates present a conservation challenge in Oregon because no state agency has responsibility for their conservation. As a result, there is no coordinated effort to conserve invertebrates at the state level. However, there are many agencies and groups involved with invertebrate management. The U.S. Fish and Wildlife Service crafts conservation plans for federally threatened and endangered invertebrates. Oregon Department of Agriculture has responsibility for those that cause economic damage. Some land management agencies, the Bureau of Land Management and U.S. Forest Service are partnering with the Xerces Society for Invertebrate Conservation and other conservation groups to manage for specific invertebrate species. The Oregon Natural Heritage Information Center tracks the status of rare invertebrates and coordinates some federally-funded research and monitoring projects. Many species groups are probably under-represented on the Heritage list due to lack of funding, research, and expertise to determine their status, rather than lack of a conservation need.

The sheer number of invertebrate species also presents a conservation challenge. Oregon has many "narrow endemics" (species that occur in a limited area), which makes them especially vulnerable to habitat changes. For example a snail species may be limited to a single spring; if that spring is lost or polluted, the snail could become extinct. Other species have declined across larger ranges due to habitat loss. Because of these challenges invertebrate conservation tends to be focused on threatened and endangered species, commercially valuable species, and species groups that provide ecological services such as pollination and pest control. The following examples highlight some of the invertebrate conservation efforts taking place in Oregon:

- Habitat restoration and captive rearing of Oregon silverspot butterfly along the Coast (The Oregon Zoo, The Nature Conservancy and the U.S. Fish and Wildlife Service).
- "Farmscaping for Beneficials," a farming community-based program that provides tools for conservation-based biological control of crop pests, and restoration of habitat for pollinators (OSU's Integrated Plant Protection Center, Oregon Tilth, Oregon Master Gardner Program and Xerces Society for Invertebrate Conservation).
- Habitat restoration for Fender's blue butterfly and its host plant, Kincaid's lupine, in West Eugene (City of Eugene, Bureau of Land Management, The Nature Conservancy, Washington State University and other partners).
- Status assessment and conservation of the Mardon skipper butterfly. (Bureau of Land Management, U.S. Fish and Wildlife Service and Xerces Society for Invertebrate Conservation).
- Monitoring and habitat restoration for the Taylor's checkerspot butterfly (Xerces Society for Invertebrate Conservation, U.S. Fish and Wildlife Service and Benton County Parks).
- Water quality and watershed assessments using aquatic macroinvertebrates (Oregon Watershed Enhancement Program, Oregon Department of Environmental Quality, Xerces Society for Invertebrate Conservation, and multiple watershed groups).

Addressing the conservation needs for all species is beyond the scope of the Conservation Strategy. However, by working together to maintain and restore habitats, Oregonians can benefit a variety of species and help maintain Oregon's unique natural heritage.

What about Extirpated Species?

Some Oregon native species no longer occur throughout their historic range. These species are considered "extirpated." In contrast, "extinct" means that the species no longer occurs anywhere. "Extirpation" can be thought of as extinction at the local level.

Some species may never return to Oregon due to habitat loss or other factors. Others may return through natural dispersal or intervention by people such as "active reintroductions" of animals from other states or by restoring native plant communities.

With the exception of plants, species that no longer occur in Oregon were excluded as Strategy Species in order to focus efforts proactively on species that still occur in Oregon and need conservation attention. While there may be opportunities for reintroductions, they would need to be considered carefully case-by-case and are considered beyond the scope of this Conservation Strategy. Conservation actions implemented under the Conservation Strategy may benefit some extirpated species. Extirpated plants are included to be consistent with policies of the Oregon Department of Agriculture's Native Plant Conservation Program, which has management authority over plant conservation.

Natural Dispersal

Conservation action focused on existing populations provides the greatest benefit to the species, is preventative and the most cost efficient way to benefit multiple species. Addressing limiting factors at existing sites and providing for nearby habitat increases the chances that the populations will increase and that individuals will disperse into nearby areas. For example, Lewis' woodpecker, streaked horned lark, burrowing owl, and fisher have all been extirpated from one or more ecoregions, but still occur in Oregon. These species are all associated with Strategy Habitats, so maintaining and restoring these habitats can provide a potential home for these species, while benefiting a variety of other species.

Highly mobile species, such as birds and wolves, may disperse into Oregon and reestablish populations if enough suitable habitat is available. This can sometimes present challenging management issues. Gray wolf populations have been increasing in Idaho since their reintroduction there in 1994. In recent years, three individual wolves have dispersed into Oregon. Because wolves may return to Oregon permanently, are protected by federal and state law, and are associated with complex social, economic, and biological issues: a proactive management approach was needed. In February 2005, the Oregon Fish and Wildlife Commission adopted the Oregon Gray Wolf Conservation and Management Plan after three years of public discussion and planning. The Oregon Fish and Wildlife Commission directed that wolves would not be actively re-introduced into Oregon. Rather, the Wolf Conservation and Management Plan focuses on conservation of wolves once they arrive (disperse) on their own into Oregon. The wolf plan outlines numerous management actions and recommendations including delisting criteria, a monitoring plan, criteria for lethal take, a state-operated compensation plan for livestock lost to wolf depredation, and the future legal status for management purposes. Although wolves may currently occur in Oregon, they are not thought to have an established breeding population. For this reason and because they are addressed through this separate planning effort, they are not included in this Conservation Strategy.

Coordinated Conservation Efforts, Including Active Reintroduction, Can Help Allow Species to Recover from Near Extinction.

American Peregrine Falcon: A Success Story

The peregrine falcon is considered the fastest animal in the world, with theoretical diving speeds reaching 240 miles per hour, although 120-150 mph is more typical while hunting. It was historically distributed throughout much of North America, but its populations started dropping dramatically after World War II and the advent of DDT and similar pesticides (called organochlorines). DDT was linked to eggshell thinning in many raptors, including falcons, bald eagles, and osprey. By 1979, only a single pair of breeding peregrines remained in Oregon. DDT was banned in 1972, but it's persistence in the environment slowed recovery of peregrine falcon populations. In response, a cooperative captive rearing program was initiated. During 1981-1995, 179 captive-reared peregrine falcon chicks were released in Oregon. Other conservation efforts included nest site enhancements, habitat management and protection around known nest sites, and monitoring. The comprehensive efforts by non-profit organizations, birders, state and federal agencies, falconers, and rock climbers contributed to the remarkable recovery of peregrine falcon populations and its removal from the federal Endangered Species List in 1999.


Peregrine Falcon
Photo © Bob Sallinger, Portland Audubon Society

Sharp-Tailed Grouse: Writing a New Chapter

Biologists are hoping for a similar success story for the sharp-tailed grouse, which is now extirpated from the state and is being experimentally reintroduced in part of its historic range in northeastern Oregon. Like the greater sage grouse, the sharp-tailed grouse is a desert dancer. In late winter, male grouse gather on "dancing grounds", known as leks. They claim territories and attract females with inflating purplish neck sacs, stepping dances, rattling tails, and cackling calls. Called prairie chickens by early settlers, sharp-tailed grouse were abundant in the grassland and sagebrush steppe habitats of eastern Oregon prior to late 1800's. Exact reasons for sharp-tailed grouse decline are unknown, but possible factors include the loss of riparian and grassland habitats and uncontrolled shooting. The last confirmed Oregon sighting was in 1967. Other recent unconfirmed sightings in Baker County may be birds dispersing from Idaho. In the 1990's sharp-tailed grouse were reintroduced into grasslands in Wallowa County. The reintroduction effort was a partnership between private landowners, The Nature Conservancy, U. S. Fish and Wildlife Service, and Oregon Department of Fish and Wildlife. The reintroduced population appears to be successfully reproducing, but it has remained small and its long-term future is uncertain. Future efforts may include an evaluation of wintering habitat as a limiting factor, habitat restoration projects, and evaluation of other potential release sites. Cooperative efforts provide hope that Oregonians will continue to be able to enjoy the sharp-tailed grouse's dance.

Active reintroductions

Active reintroductions are logistically difficult, expensive, and tend to have low success rates. They are usually a last-resort effort reserved for species of particular management interest, such as endangered species or game species. Managers consider factors such as amount of suitable habitat available, disease transmission, genetics, and interactions with people, other species and the environment. Species are considered on a case-by-case basis to weigh benefits and risks.

Some species will disperse naturally into adjacent ecoregions, but others face barriers such as mountains, rivers, or inhospitable habitat. Some species do not move far, so don't have the capability to disperse. In these cases, it may be appropriate to move species from one ecoregion to another to ensure the long-term survival of the species. Recently, translocation experiments have been conducted for Oregon spotted frog, mountain quail and Columbia white-tailed deer in Oregon. These efforts are being carefully evaluated to ensure that translocation is appropriate and effective for these species.

Prioritizing conservation actions

Although there may be interest and opportunities to reintroduce species that no longer occur in Oregon, these approaches are not priority conservation actions in the Conservation Strategy. The Conservation Strategy's focuses on species that still have functioning populations within Oregon. Some of these species no longer occur in parts of their range within Oregon. For example, the western burrowing owl no longer breeds in the Willamette Valley or Klamath Mountains ecoregions, but still occurs in eastern Oregon. The Oregon spotted frog no longer occurs in the Willamette Valley, but still remains along the crest of the Cascades Mountains. For species that have lost some of their range in Oregon, the Conservation Strategy's conservation priorities are as follows:

- *High priority:* Focus conservation actions on remaining populations within the state.
- *Medium priority:* Restore suitable habitat close to existing populations to allow for passive reintroductions.
- *Medium priority:* If reintroductions are identified as a priority conservation action for a species, conduct feasibility studies to address disease and genetic concerns.
- *Medium priority:* For some species, particularly plants, surveys may be needed to determine if they are truly extirpated or if they have remaining undetected populations.
- *Low priority:* If feasibility studies indicate that translocations would be warranted and would have few risks, then conduct translocations of species from one ecoregion to another. However, because plants have low dispersal ability, translocations may be a higher priority for some plant species.

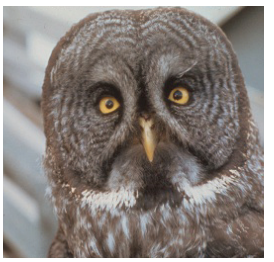

Photo © Bruce Newhouse

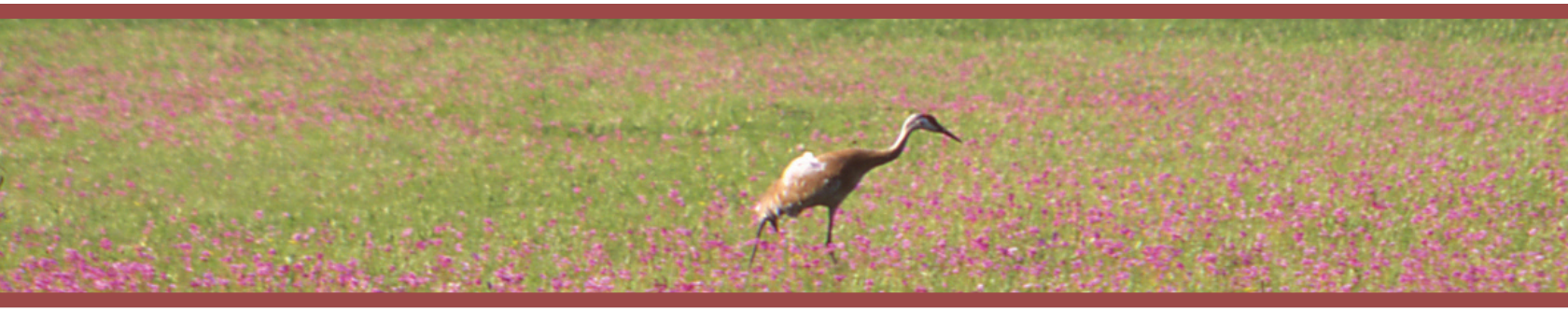

Photo © Eric W. Valentine

Conservation Summaries for Strategy Species

These tables summarize the ecoregions, special needs, limiting factors, data gaps, and key conservation actions for Strategy Species. Marine species, including marine mammals, will be addressed in the Oregon Nearshore Strategy.

Ecoregions: Strategy Species were designated by ecoregion, based on conservation need and opportunities, rather than on a statewide basis. The ecoregions listed in the table below represent the highest priorities for implementing conservation actions for individual species. However, some species also occur in ecoregions other than the ones listed in the table. Appropriate conservation actions implemented outside the listed ecoregion(s) will also contribute to the overall conservation for that species.

Key to ecoregion abbreviations:

BM = Blue Mountains
CP = Columbia Plateau
CR = Coast Range
EC = East Cascades
KM = Klamath Mountains
NBR = Northern Basin and Range
WC = West Cascades
WV = Willamette Valley

Special needs: These are the types of habitat or habitat elements that are important to the species sometime during its lifecycle. Needs may include requirements for foraging, raising young, migrating or wintering. For plants, they may also include soil, elevation or other factors that determine where a species occurs.

Limiting factors: These describe some of the issues that affect species and may limit or otherwise impact their populations. Limiting factors are often associated with changes in habitat quality or quantity, but also include disease, competition or other impacts from non-native species, disturbance during sensitive times, barriers to movement and other factors. For this Conservation Strategy, limiting factors also includes factors that make a species more vulnerable to change and/or slow to recover from population declines. For example, some species occur at naturally low densities, have very specific habitat requirements, have naturally low reproductive rates, occur in a small geographic area (endemic), or move across very large areas.

Data gaps: These are research or monitoring questions that need to be answered to better conserve a species. They may include basic life history requirements, habitat associations, or impacts from potential limiting factors. Data gaps that apply to all species or broad groups of species are presented on page 367. For example, data on baseline conservation status, estimated population size and population trends are needed for most Strategy Species.

Key conservation actions: These are priority actions recommended to conserve the species. Management actions should ideally address a species special needs and limiting factors. For some species some actions have already been implemented and should be continued. For other species, new conservation actions are identified. Conservation actions need to be compatible with local priorities, local comprehensive plans and land use ordinances, as well as other local, state, or federal laws. Actions on federal lands must undergo federal planning processes prior to implementation to ensure consistency with existing plans and management objectives for the area.

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
American marten (*Martes Americana*)	BM CR EC WC	Often associated with late-successional mixed conifer habitats with multi-layer stands, but can use a variety of conifer forests as long as a high density of snags and logs are available for den sites and foraging	Low survival rates in fragmented forests	Estimated population densities; differences in habitat requirements by ecoregion and forest type; basic ecology well-understood in Blue Mountains but less so in other ecoregions	Minimize fragmentation in core habitat areas; provide travel corridors between habitat blocks; maintain and create snags; maintain downed wood
California myotis (bat) (*Myotis californicus*)	BM WC CR WV EC KM NBR	Primarily forest-associated; uses large snags for day roosts; occasionally found night roosting under bridges	Reduction of large snags; patchy distribution; appears to have low populations	Seasonal movements, winter roost locations and their micro-climate conditions; distribution and trends; species distinction in relation to western small-footed bat	Maintain and create large snags during forest management activities; complete bridge replacement and maintenance when bats are absent
Columbian white-tailed deer (*Odocoileus virginianus leucurus*)	CR (Columbia River Distinct Population Segment [DPS]) KM (Umpqua population)	***Columbia River DPS*** - Riparian habitat along the lower Columbia River. ***Umpqua population -*** Lower elevation oak woodland forests. Often found in riparian habitat.	***Columbia River DPS*** - Limited to a few small separate populations. Habitat loss due to agricultural and residential development. Flooding impacts on island-dwelling and low-elevation mainland populations. ***Umpqua population*** - Disease. Collisions with vehicles. Habitat loss due to development.	***Columbia River DPS*** - Predator-prey interactions with coyotes. Agricultural land use impacts on habitat. ***Both populations*** - Susceptibility to disease (e.g., Deer Hair Loss).	***Columbia River DPS*** - Continue to implement Conservation actions identified in the Columbian white-tailed deer Recovery Plan. ***Umpqua population*** - Continue to monitor populations. Continue to manage habitat at North Bank Habitat Management Area. Evaluate transplant issues and priorities.
Fisher (*Martes pennanti*)	KM WC	Found in mature, closed canopy forests, often along riparian corridors. Uses hollow logs or brush piles for den sites. Preys on small mammals, including porcupines.	Large home range required. Low rate of reproduction. Specific habitat requirements for dens.	Are populations expanding and/or reestablishing in extirpated areas? Feasibility studies on re-introduction, if not expanding.	Maintain late successional habitats within the fishers range; improve habitat patch size and connectivity to provide for dispersal, genetic interchange, and expansion of populations. Use results of feasibility studies to guide specific conservation actions and management decisions for reintroductions.
Fringed myotis (bat) (*Myotis thysanodes*)	BM CR EC KM WC	Forest habitats; large snags and rock features for day, night, and maternity roosts (occasionally uses bridges for night roosting); caves and mines for hibernacula; beetles for prey.	Disturbance at roosts; patchy distribution and rarity; reduction of large snags	Seasonal movements; maternity & winter roost locations and characteristics; extent and effects of other limiting factors (e.g., habitat loss and degradation); distribution and trend	Use gates and seasonal closures to protect known hibernacula; maintain and create large-diameter hollow trees and large diameter, tall, newly dead snags during forest management activities
Hoary bat (*Lasiurus cinereus*)	BM NBR CR WC EC KM	Forest habitats, including late successional conifer forests which are used for roosting	Habitats loss; migratory behavior increases vulnerability to habitat changes and mortality	Basic ecology, distribution, migration patterns, habitat use, impacts of wind facilities on migratory populations	Investigate data gaps and use results to guide management actions

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
Kit fox (*Vulpes macrotis*)	NBR	Salt desert scrub	Small population at northern end of range, naturally limited by habitat, may be locally impacted by predation by coyotes and by collisions with vehicles	Population densities, current species status	This species is difficult to census; a cost-effective method is needed to determine population size and trends
Long-legged myotis (bat) (*Myotis volans*)	BM CR EC KM NBR WC	Often associated with late successional conifer forests or other forested habitat with late successional components (especially snags); uses large snags and hollow trees primarily in riparian areas for day, night, and maternity roosts; may use bridges in forested habitat for night roosting; occasionally found night roosting and hibernating in caves or mines; forages in forest riparian and forest edge	Reduction of late successional conifer forests in some ecoregions; loss of hollow trees and large diameter, tall, newly dead snags; loss of healthy riparian habitat; untimely bridge replacement	Seasonal movements, winter roost locations and their microclimate conditions; baseline population data; trends	Maintain and create large-diameter hollow trees and large diameter, tall, newly dead snags in riparian and upland habitat; maintain and restore diverse riparian areas; complete bridge replacement and maintenance when bats are absent
Pallid bat (*Antrozous pallidus*)	BM CP EC KM NBR	Dry, open habitats; crevices in cliffs, caves, mines, or bridges (occasionally uses buildings) for day, night, or maternity roosts, or hibernacula; grassland, shrub-steppe and dry forest ecotones for foraging; open water sites within the landscape; snags as day roosts in some areas	Disturbance at roosts; patchy distribution; loss of pine snags; loss of native grassland, shrub-steppe habitats and open ponderosa pine woodlands	Maternity & winter roost locations and microclimate requirements, seasonal movements, statewide distribution and trends	Use gates and seasonal closures to protect known roost sites during sensitive times (raising young and hibernation). Maintain open water sources in dry landscapes. Manage rock features such as cliffs to avoid conflict with recreational use and rock removal. Complete bridge replacement and maintenance when bats are absent. Maintain large pine snags in shrub-steppe/forest ecotones. Maintain and restore native grassland, shrub-steppe and open ponderosa pine habitats.

Fisher

Fishers are medium-sized predators and are related to otters, weasels, and minks. Historically, the fisher occurred in forested habitats throughout western Oregon, Washington and northern California. By 1940, Oregon's fisher populations were either greatly reduced or eliminated from many areas due to non-regulated trapping, accidental poisoning, and habitat loss. Fishers feed on porcupines, snowshoe hares, chipmunks and squirrels. The common name "fisher" is a misnomer because fishers do not eat fish at all. The origin of the name is not known, but may be due to confusion with the closely-related mink, which does eat fish. Fishers are an important predator of porcupines, killing by biting the porcupine's face while avoiding the sharp quills. Because of this hunting ability, fishers were reintroduced into Douglas County in the late 1970's and early 1980's. Foresters and biologists hoped that the fishers would reduce porcupine populations and the damage that porcupines cause to trees. Fishers currently occur in two small distinct populations in southwest Oregon. They favor late successional forests below 4,000 feet. From 1995 to 2002, a cooperative research project was conducted by the USFS Pacific Northwest Research Station. The study examined the fisher's genetics, food habitats, and habitat use, including natal and maternal den sites, rest sites, and effects of stand and landscape composition on habitat use and home range size. The study has provided management recommendations to maintain and restore Oregon's fisher populations.

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
Pygmy rabbit *(Brachylagus idahoensis)*	NBR	Tall dense clumps of basin big sagebrush; deep, loose soils for digging burrows; native grasses for summer forage	Habitat loss; patchy distribution and susceptible to local declines; limited dispersal capabilities; dispersal impacted by roads and cleared areas	Distribution and abundance; population dynamics	Maintain basin big sagebrush habitats; provide habitat corridors between priority populations
Red tree vole (*Arborimus longicaudus*)	CR KM WC	Found in dense, moist conifer forests; prefers large stand size; highly specialized diet of primarily Douglas-fir needles; requires large branches for protection of nests, which are typically at least 50 feet above ground	Very small home range. Poor dispersal ability. Low reproductive rate.	Reproductive success in young forests. Stand requirements for population maintenance (e.g., minimum number or size of conifer trees, connectivity). Population genetics. Home range, dipersal and migration. Clarification of subspecies status.	Continue to monitor populations in response to forest management activities. Note: a major food item for northern spotted owl
Ringtail (*Bassariscus astutus*)	KM WC	Large-diameter snags and logs for dens. Associated with late successional forests but also uses riparian and rocky areas.	Habitat loss and fragmentation (rarely uses remnant snags in timber harvest units).	Survey techniques to detect this secretive, nocturnal species	Maintain late successional reserves; maintain large-diameter snags and logs when conducting thinning; create snags when management activities reduce snag availability across landscape
Silver-haired bat (*Lasionycteris noctivagans*)	BM CR EC KM WC	Late-successional conifer forests; uses large snags and hollow trees for day, night, and maternity roosts; found in other habitats during migration	Reduction of late successional conifer forests; loss of hollow trees and large diameter, tall, newly dead snags; migratory behavior increases vulnerability to habitat changes and mortality	Distribution, migration patterns, habitat use, impacts of wind facilities on migratory populations	Maintain late successional conifer habitats; maintain and create large-diameter hollow trees and large diameter, tall, newly dead snags during forest management activities
Spotted bat (*Euderma maculatum*)	BM NBR	Crevices in cliffs, caves, and canyon walls for day & night roosting; trees adjacent to meadows for night roosting; water source within landscape; meadows and shrub-steppe for foraging	Naturally rare; disturbance at roosts; loss of natural shrub-steppe habitat	Distribution within Oregon (baseline data needed); basic ecology; habitat relations; estimated population size and trend	Maintain open water sources in desert landscapes. Manage rock features such as cliffs to avoid conflict with recreational use and rock removal. Maintain and restore native shrub-steppe habitat
Townsend's big-eared bat (*Corynorhinus townsendii*)	BM CP CR EC KM NBR WC WV	Caves, mines, & isolated buildings for day, night, or maternity roosts, or hibernacula; occasionally uses hollow trees and bridges for day or night roosting; primarily feeds on moths	Highly sensitive to disturbance at roosts; highly specific roost requirements; reduction in prey base including from non-target pesticides (e.g., btk) used for controlling Lepidoptera	Winter roost locations; seasonal movements; effects of gypsy moth and other insect control on prey base	Use gates and seasonal closures to protect known roost sites during sensitive times (raising young and hibernation). Maintain buildings used as roosts. Maintain and create large-diameter hollow trees during forest management activities. Monitor roosts.
Washington ground squirrel (*Spermophilus washingtoni*)	CP	Shrub-steppe or grassland with deep, loose, sandy loam soils; high availability of forbs; patch size large enough to maintain a colony	Habitat loss and fragmentation	Colony site dynamics (landscape/metapopulation dynamics) to understand how and why colony sites appear and disappear; genetic variability across range (including similarities to Washington populations); soil requirements	Maintain habitat patches; restore habitat connectivity where possible

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
Western grey squirrel (*Sciurus griseus*)	WV	Oak woodland and savanna; mixed oak-pine-fir woodlands; older trees with large limbs; continuous canopy for movements	Habitat loss and fragmentation; vegetation changes due to fire suppression; residential and urban development	Population locations and trends; general ecology; competition and other impacts from non-native squirrels; dispersal patterns and need for canopy travel corridors	Work with private landowners to maintain and restore oak and mixed oak/pine/fir woodlands, especially large patches; maintain continuous canopy within 200 feet of nest sites; maintain or plant mast species such as Oregon white oak and California hazel; maintain older trees with large limbs.
White-tailed jackrabbit (*Lepus townsendii*)	NBR	Bunchgrass grasslands	Distribution naturally limited by habitat; habitat loss and degradation (shrub encroachment)	Basic ecology; habitat relationships; distribution; population trends	Investigate species-specific habitat requirements and use these to guide management actions; develop methods to census (nocturnal species)

Rails

As spring melds into summer and day melds into night, Eastern Oregon marshes present an ever-changing procession of sounds: Pacific tree-frogs croak a squeaky chorus; Wilson's snipe perform spiral display flights with whistling wings; common nighthawks end diving flights with a "boom;" and rails reveal their grassy hiding places by clicks, clucks or grunts. Oregon's wetlands are home to three species of rails, all of which are extremely secretive. Stubby tails, short round wings, and a narrow body allow rails to move quietly through marsh vegetation. They generally stay close to hiding cover as they hunt for invertebrates and other foods.

Because rails are secretive and most active at dusk and dawn, they are best identified by their breeding calls. The Virginia rail's breeding call is a repeated "ki-dic ki-dic;" the sora's call sound like "ker-wee" or "kooEE;" and the yellow rail's "tic-tic tic-tic-tic" is reminiscent of tapping two pebbles together. Both Virginia rails and sora are common in freshwater and brackish marshes throughout Oregon, but the yellow rail is one of the state's rarest breeding birds. Yellow rails breed in shallow freshwater wetlands, particularly in flooded sedge meadows. In Oregon, they have a narrow distribution within Klamath and Lake Counties and occur in suitable habitats at 4,100 – 5,000 feet in elevation. They primarily build their nests under domes of the previous year's plant growth, called senescent vegetation. The total Oregon population is estimated to be less than 300 birds, which may represent 50 percent of the entire western United States breeding population. Yellow rail populations have been impacted by wetland loss and degradation. They can be sensitive to habitat changes such as drying due to a lowered water table, too much flooding, or loss of senescent vegetation. They will colonize restored wetlands, so wetland conservation and restoration will ensure that some of Oregon's marshes still "tic" with the call of the yellow rail.

Photo © Ken Popper, The Nature Conservancy

Conservation Summaries for Strategy Species – Birds (62 species):

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
Acorn woodpecker (*Melanerpes formicivorus*)	WV	Oak woodlands with a high canopy and relatively open understory; dead limbs or snags for storing acorns	Loss of oak woodlands in Willamette Valley. Small, localized populations. Competition for nesting cavities from European starlings. Colonial.	Nesting ecology, especially nest site requirements	Work with private landowners to maintain and restore oak woodlands with open understories, especially large patches; maintain snags and older trees with dead limbs
Aleutian Canada goose (*Branta canadensis leucopariea*; Semidi Island population only)	CR	In Oregon: coastal grass-dominated fields/pastures for foraging and offshore islands for roosting	This species declined historically due to non-native predators (foxes) in breeding areas of Alaska. Semidi Island breeding population has still not fully recovered. Currently in Oregon, there is a small migrant and wintering population. Currently, foraging sites are limited and occur on private land.	Estimated population size; specific migration route; use areas in the Lower Columbia River	Aleutian Canada Goose Recovery Plan provides information on conservation strategies. Use incentives and cooperative approaches to manage foraging habitat on private land. [Notes: AOU name is Aleutian cackling goose, *Branta hutchinsii leucopareia*. This species was removed from the federal threatened list in 2001 and removed from the Oregon state endangered species list in 2005. Although the primary limiting factors occur outside of Oregon, providing wintering habitat can contribute to this species' conservation.]
American bald eagle (*Haliaeetus leucocephalus*)	CR	Associated with large water bodies (rivers, lakes, ocean) which support fish populations and have large trees for nesting nearby; variable habitat for wintering based on food availability	Poor reproduction in the lower Columbia estuary which has been linked to contaminants; loss of large nesting trees	Sources of contaminants and methods to reduce/mitigate for contaminant levels (e.g., do organocloride pesticide residues remain in bottom sediments?); impacts of bald eagles on breeding seabird and great blue heron colonies where eagle populations are increasing	Continue to monitor eagle productivity and contaminant levels present in fish in the Lower Columbia; maintain large trees near suitable feeding habitat.
American peregrine falcon (*Falco peregrinus anatum*)	CR NBR	Rock cliffs for nest sites; uses offshore rocks and islands in Coast Range ecoregion	Eggshell thinning caused by organochlorine pesticides (e.g., residual DDT in Oregon's environment and possibly concentrated by prey wintering in Central and South America). Human disturbance at nests. Reductions of prey populations	Relationship between wintering locations of Oregon breeders and contaminant levels	The federal monitoring plan provides information on management and conservation actions for this formerly listed federal species. Note: Although the American peregrine falcon has been downlisted from the federal endangered species list, it has not met recovery goals in southeast Oregon.

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
American three-toed woodpecker *(Picoides dorsalis)*	BM EC	Found in forested habitats usually above 5,000 ft.; dead trees with heartrot for nesting and high densities of wood-boring beetles for foraging; often associated with large-scale forest disturbances that produce a high density of snags (*e.g.*, forest fires, disease pockets and bark beetle outbreaks)	Small, often disjunct populations. Specific habitat requirements. Reductions in snag availability due to fire suppression and forest health management	Estimated population size and trends. Habitat relationships. Nesting ecology.	Maintain areas of high snag density especially above 5,000 feet where compatible with other forest objectives (*e.g.*, maintain bark beetle infested trees in areas of low risk of insect infestation into adjacent forests)
American white pelican (*Pelecanus erythrorhynchos*)	NBR	Isolated and sparsely vegetated terrestrial nesting habitat associated with lakes and freshwater marshes; shallow water areas for cooperative feeding	Specialized nesting and foraging habitat subject to droughts, floods, and manipulated water levels; sensitive to human disturbance and mammalian predators at nest sites; colonial nester; small, disjunct populations	Identification of landscape-level breeding and post-breeding habitat needs for responding to annual site-specific changes in water levels	Minimize human disturbance in nesting areas during breeding season and in shallow feeding areas. Where appropriate, manage water levels to provide suitable foraging and nesting habitat.
Band-tailed pigeon (*Patagioenas fasciata*)	CR WC	Mineral sites; large conifer forest landscape with a variety of forest stand age and structure	Reductions in quality and quantity of mineral sites. Large area requirements. Disease.	Opportunities to enhance/create mineral sites. Distribution of nesting sites. Habitat needs. Reasons for declining trends.	Maintain existing mineral sites. Maintain, plant or otherwise manage for elderberry, cascara and other food plants
Barrow's goldeneye *(Bucephala islandica)*	EC WC	High-elevation lake or pond habitat with abundant invertebrate prey and surrounded by forests; snags or live trees with cavities for nest sites nearby; loafing sites (logs and rocks)	Relatively small breeding populations; at southern end of ranges; narrow habitat requirements (suitable snags in conjunction with suitable water bodies)	Water body characteristics suitable for nesting; impact of human recreation on nesting; variables associated with nest box use and effectiveness of nestboxes as a conservation measure	Maintain and/or create snags close to mountain lakes. Nest boxes can be used as a short-term strategy to establish and/or expand populations

Lewis' Woodpecker

Oregon is home to an interesting variety of woodpeckers, 12 species in all. Named for the famous explorer, Lewis' woodpecker is one of the more unusual of Oregon's woodpeckers. Lewis' woodpecker is striking in appearance, with an iridescent greenish-black back, gray collar and breast, rosy belly, and crimson face. Its diet varies throughout the year. In the spring, Lewis' woodpeckers feed upon insects, especially carpenter ants, bees, wasps, mayflies, beetles, and grasshoppers. Unlike most of Oregon's woodpeckers, Lewis' woodpecker does not hunt insects by drilling holes into wood or flaking off bark. Instead, they often sit on branches, snags, fence posts or telephone posts and fly out to catch insects. They also perform acrobatic maneuvers when hunting in the midst of an insect swarm. In the fall, they feed on fruits such as elderberry, currant, serviceberry, poison oak, and ash. They store acorns for their winter food by shelling and breaking the nuts and then caching the pieces in wood cracks and bark crevices.

Like all woodpeckers, Lewis' woodpeckers nest inside tree cavities. However, unlike most woodpeckers, Lewis' woodpeckers generally do not excavate their own nest holes. Instead, they use old cavities created by northern flickers and hairy woodpeckers. Open oak, ponderosa pine, and riparian cottonwood woodlands provide Lewis' woodpeckers with the combination of tree cavities and diverse food sources they need during the spring and summer. They usually spend the winter in oak habitats and often move around in response to acorn crops.

Lewis' woodpeckers were once widespread and abundant in Oregon, but have declined dramatically since the 1950's. The decline is thought to be due to loss of all three woodland types, and in particular loss of large-diameter nest and food storage trees; competition for nest cavities from introduced starlings; and a reduction in insect populations. The oak woodlands east of Mount Hood provide some of the state's last major nesting areas for Lewis' woodpecker. They also are easily viewed on ODFW's White River Wildlife Management Area. By maintaining and restoring open oak, ponderosa pine, and riparian cottonwood habitats and by managing snags, Oregonians can help bring back this colorful woodpecker.

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
Black brant (*Branta bernicla nigricans*)	CR	Eelgrass and sea lettuce beds for foraging in areas with limited human disturbance	Small wintering population that has been declining. Loss and degradation of eelgrass beds. Human disturbance activities in preferred foraging areas.	Effects of habitat quality at spring staging sites on reproductive fitness and success; historic and current abundance of submerged aquatic vegetation in Oregon's primary estuaries	Maintain existing eelgrass beds from degradation and human disturbance. Restore eelgrass beds to enhance quality and quantity; work with partners in Pacific Flyway Council to manage sport harvest timing and/or levels to minimize impacts to wintering populations
Black oystercatcher (*Haematopus bachmani*)	CR	Rocky coastal habitats with sufficient intertidal invertebrate prey	Small breeding/wintering population. High vulnerability to potential oil spills. Increased human activity and development near nesting sites	Impact of human disturbance on nesting and foraging; wintering ecology	Identify high priority sites.
Black swift (*Cypseloides niger*)	WC	Waterfalls with open access, limited light, and crevices/ledges for nest sites	Small and disjunct populations in discrete and unique nesting habitat	If waterfall nest sites (crevices and ledges) limit populations; survey potential sites to determine nesting sites	Maintain low disturbance at nesting waterfalls
Black-backed woodpecker (*Picoides arcticus*)	BM EC	Found in forested habitats usually above 5,000 ft; needs dead trees with heartrot for nesting and high densities of wood-boring beetles for foraging; often associated with large-scale forest disturbances that produce a high density of snags (*e.g.*, forest fires, disease pockets and bark beetle outbreaks)	Small, often disjunct populations. Specific habitat requirements. Reductions in snag availability due to fire suppression and forest health management	Estimated population size and trends. Habitat relationships. Nesting ecology.	Maintain areas of high snag density in wildfire and other disturbance areas, especially above 5,000 feet, where compatible with other forest objectives (*e.g.*, maintain bark beetle infested trees in areas of low risk of insect infestation into adjacent forests)
Black-necked stilt (*Himantopus mexicanus*)	NBR	Alkaline or freshwater ponds with extensive shallow water areas for foraging	Specialized nesting habitat at edge of water; nesting habitat is subject to droughts and floods; moves in response to water levels; colonial nester	Identification of landscape-level breeding and post-breeding habitat needs for responding to annual site-specific changes in water levels	Maintain suitable nesting and foraging areas across the landscape to provide habitat regardless of annual variation in precipitation and water levels
Blue-gray gnatcatcher (*Polioptila caerulea*)	KM	Scattered oak trees within a brushy chaparral community	Small population. Common cowbird host. Loss of chaparral habitat for fire hazard control	Complete population inventory. Impacts of cowbird parasitism. Impacts of fragmentation of habitat	Work with private landowners to maintain or restore low-elevation chaparral habitat, especially larger patches
Bobolink (*Dolichonyx oryzivorus*)	BM NBR	Broad leaf forbs (e.g., clover, alfalfa, false lupine, potentilla) for nesting cover and insect resources	Population declines; small scattered, colonial populations, many on private land; sensitivity to water and some agricultural practices	Annual population monitoring; possible impact of cowbird parasitism and corvid predation on small populations	Partnerships with private landowners to manage habitat: remove residual vegetation and stimulate new growth prior to breeding season; seasonally flooded meadows (prior to breeding season); delay field maintenance (e.g., mowing, haying) until after the breeding season

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
Brewer's sparrow (*Spizella breweri*)	CP	Sagebrush shrubland with canopy height less than 5 ft. Often associated with big sagebrush; also utilizes a variety of shrub habitats. Nest in thick crowns or low in brush, or in clumps of grass.	Reduction and fragmentation of suitable nesting habitat. Cheatgrass invasion.	Taxonomy. Distribution of subspecies in Oregon.	Maintain suitable shrub habitats for breeding. Maintain connectivity among habitat patches.
Bufflehead (*Bucephala albeola*)	EC WC	High-elevation lake or pond habitat with abundant invertebrate prey and surrounded by forests; snags or live trees with cavities for nest sites nearby; loafing sites (logs and rocks)	Relatively small breeding populations; at southern end of ranges; narrow habitat requirements (suitable snags in conjunction with suitable water bodies)	Water body characteristics suitable for nesting; impact of human recreation on nesting; variables associated with nest box use and effectiveness of nestboxes as a conservation measure	Maintain and/or create snags close to mountain lakes. Nest boxes can be used as a short-term strategy to establish and/or expand populations
California brown pelican (*Pelecanus occidentalis californicus*)	CR	Near-shore pelagic habitat for foraging; offshore rocks and islands, inaccessible headland areas, sandy islands, and sand spits for roosting	Forage fish availability; high potential vulnerability to oil spills	Diet; roosting ecology; effects of human disturbance	Maintain suitable conditions at known roosting sites
Caspian tern (*Sterna caspia*)	CR	Unvegetated nesting islands free of mammalian predators	Requires long-term availability of suitable nesting sites. Colonial-nesting so vulnerable to random, human-induced or natural events	Predation levels on various groups of salmonids	The USFWS Status Assessment and Conservation Recommendations Plan provides information on appropriate conservation actions for this non-listed species
Chipping sparrow (*Spizella passerine*)	WV	Open areas of herbaceous understory for foraging in understory of oak woodlands	Declining populations; loss and degradation of oak woodland habitats due to development, loss of natural fire regimes and invasive encroachment in understory; possibly cowbird parasitism	Effects of cowbird parasitism on productivity; effects of feral cats in residential nesting areas, and agricultural management in agricultural areas (e.g., orchards)	Maintain areas of open herbaceous understory in oak woodlands; control key invasive plants

Upland Sandpiper

The upland sandpiper is a medium-sized shorebird with long legs and a short bill. One of Oregon's rarest breeding birds, they occur in Oregon as a small, disjunct population, separate from the main populations east of the Rocky Mountains. They are very secretive except during the breeding season when they perform theatrical courtship flights over their nesting areas in high-elevation meadows. Their breeding meadows vary in size and type, but are often surrounded by lodgepole or ponderosa pine forests, are near a stream, and have wildflowers and other forbs. Uncontrolled shooting in the late 1800's and habitat loss led to historic population declines. Currently, conifer encroachment into meadows, the use of herbicides to control forbs, and overgrazing of some meadows in spring and summer may be affecting their populations. Upland sandpipers are no longer thought to occur in Washington, and Oregon's populations have declined from approximately 80 birds in 1984 to about 20 by the early 1990's. A thorough inventory of all potential habitat, habitat research, and appropriate management projects are needed to ensure that Oregon doesn't lose this unique species.

(Birds Cont.)

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
Common nighthawk (*Chordeiles minor*)	WV	Gravel bars and other sparsely vegetated grasslands for nesting; aerial insectivore prey base for foraging	Loss of nesting habitat, increased predation by corvids, gulls and house cats; reduction in prey base (aerial insects)	Inventory of gravel bars along large rivers for nesting birds	Maintain sparsely vegetated grassland patches, restore riparian and wetland habitats for insect prey base
Dusky Canada goose (*Branta canadensis occidentalis*)	WV	Adequate food resources (high quality, high protein herbaceous plants) in sufficient spatial and temporal distibution to sustain migratory and wintering population.	Decline in this species is primarily due to poor reproduction in its breeding range in Alaska. However, this species winters in Oregon, so Oregon can contribute to its conservation. Currently, wintering habitat is being lost due to conversions from farmland to developed areas. Also, its use of private lands limits management options.	Effects of habitat loss on movements and use of private lands.	Information on conservation strategies is available in the Pacific Flyway management plan and Conservation Assessment for the Dusky Canada Goose (USFWS)
Ferruginous hawk (*Buteo regalis*)	BM CP NBR	Uses open, grassy habitats with scattered shrubs or trees, including grassland and sagebrush steppe; large area requirements; suitable nest sites in scattered juniper trees, in cottonwood trees near small streams, or on rocky sites with an expansive view; also nests on rimrock or on undisturbed ground	Populations fluctuate based on prey availability; sensitive to human disturbance during the nesting season; loss of mature juniper trees in suitable nesting areas; conversion of juniper savanna to juniper woodland in some areas due to fire suppression	Relationships with prey species, especially in agricultural landscapes; impacts of wind turbines in Columbia Plateau	Provide diverse herbaceous and low shrub vegetation to support prey populations (jackrabbits and ground squirrels); maintain known and potential nestsite trees (mature juniper); minimize human disturbance (including rodent control and chemical applications) within 0.6 miles of active nest sites from March 5 – June 15; work cooperatively with agricultural landowners to maintain average field size <40 ac and >25% of nesting areas natural vegetation at priority sites
Flammulated owl (*Otus flammeolus*)	BM EC	Requires small patches of dense thickets for roosting; small openings of grasslands or dry meadows for foraging on insect prey; medium to large snags and defective trees with existing woodpecker cavities	Habitat degradation from encroaching trees and shrubs; loss of mature ponderosa pine trees and snags; lack of recruitment of young ponderosa pine; insect control may affect prey base; snag/cavity abundance (because this species is the last cavity-nesting migrant to return)	Thorough inventory of distribution; impacts of forest management practices and habitat suitability of managed forests; basic nesting ecology and habitat use	Retain existing or manage to meet conditions of mature woodland and forest (>1 snag/1 acres >20 in dbh[1]) in areas with > one large or two small sapling thickets and > one large or two small grassy openings; minimize insect control near known sites; monitored nest box programs in snag-deficient areas to provide cavity habitat in the short term
Fork-tailed storm-petrel (*Oceanodrama furcata*)	CR	Coastal islands with deep sandy soil for burrowing amid ground cover vegetation	Small population; vulnerability of specialized nesting habitat to predation from non-native and artificially abundant native predators; high potential vulnerability to oil spills	Diet; breeding biology; foraging areas	Maintain existing closure of nesting areas to human visitation; continue implementing Environmental Assessment for mammalian predator control at Oregon seabird colonies
Franklin's gull (*Larus pipixcan*)	NBR	Relatively large marsh habitat with both emergent vegetation for nesting and deep water (to ensure foraging habitat through breeding season and to prevent access to nests by predators)	Small, disjunct breeding population; specialized nesting habitat; sensitivity to nesting disturbance and fluctuating water levels	Factors influencing dependence on upland foraging versus marsh foraging (e.g., marsh size, characteristics). Identify landscape-level breeding and post-breeding habitat needs for responding to annual site-specific changes in water levels	Minimize human disturbance in nesting areas during breeding season and in shallow feeding areas. Where appropriate, manage water levels to provide suitable foraging and nesting habitat.

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
Grasshopper sparrow (*Ammodramus savannarum*)	CP KM WV	Dry grassland habitat with low to moderate grass height and low percent shrub cover	Small, disjunct populations; loss of grassland habitats due to conversion and shrub/tree encroachment; nesting failure due to timing of land use practices (e.g., mowing, haying, spraying).	Complete population inventory and habitat evaluation; effects of habitat patch size on abundance and productivity; effectiveness of planting mixtures to favor this species; impact of grazing and agricultural management on productivity	Maintain or restore grassland habitat; increase plant diversity for greater insect diversity; maintain high percent native grass cover and <10% shrub cover in patches > 20 acres; delay mowing and other field management until after July 15 at known nesting areas; control key invasive plants
Great gray owl (*Strix nebulosa*)	BM EC	Late successional forests for nesting with nearby grassy openings for foraging; requires large-diameter snags or suitable branch structure (e.g., brooms from mistletoe) for nesting	Has large area requirements; is affected by reductions in amount of late successional forest and montane grasslands	Value of harvested forest openings as foraging habitat; effects of rodent control	Maintain late successional forest; maintain natural meadow forest openings through prescribed fire, thinning and hand-removal of encroaching conifers
Greater sage-grouse (*Centrocercus urophasianus*)	BM NBR	Require large areas of contiguous sagebrush habitat including a mosaic of conditions; wet meadows and playas during brood rearing, especially areas with native forbs	Population declines and local extirpations; disjunct populations; habitat loss and fragmentation; juniper expansion into sagebrush; impact on sagebrush of increased fire frequency and intensity because of invasive annual plants; dependence on specific conditions for suitable lek sites; human disturbance at lek sites	See detailed presentation in Greater Sage-Grouse Conservation Assessment and Conservation Strategy for Oregon (in preparation, 2005)	See detailed presentation in Greater Sage-Grouse Conservation Assessment and Conservation Strategy for Oregon (in preparation, 2005)

Red Crossbills

A bird's primary tool for finding and handling food is its beak. Depending on the type of bird, a beak (also called a bill) may serve as a spear, probe, net, knife, strainer, nut-cracker, pliers, or drill. Of Oregon's birds, the red crossbill has one of the most unusual and interesting beaks. As the bird's name implies, the upper and lower halves of the beak cross at the tip. Using the cross like a lever, the crossbill can pry seeds from partly-opened cones more efficiently than any other bird. Red crossbills primarily eat Douglas-fir, spruce, hemlock and pine seeds, but will occasionally eat deciduous leaf buds, alder cones, and insects. Red crossbills are thought to include several "groups" with slightly different bills that enable them to exploit variation in seed sizes. Because of their specialized diet, red crossbills are highly dependent on conifer seed crops.

Like most trees that produce seeds, conifers periodically have heavy seed crops. This phenomenon is called "masting" and ensures that enough seeds escape seed predators (such as insects, birds and rodents) to allow adequate tree germination. For example, ponderosa pine, which produces a cone crop every 2-3 years, produces a particularly heavy crop every 8-9 years. Red crossbills respond to variable food availability by being highly nomadic, moving across the landscape in search of seeds. They travel in flocks of a few to several hundred. Depending on the local seed crop, they can be locally common or completely absent from an area. Red crossbills breed in mature conifer forests because of the larger cone crops associated with older trees. The timing and success of crossbill reproduction is closely tied to seed availability. As a result of their food-based movements, crossbills need a mosaic of older forest types across watersheds. Some wildlife species travel across many habitats and require a landscape approach to conservation. Cooperative large-scale approaches such as watershed-based efforts can benefit crossbills and other landscape speciess with wide ranges, including forest carnivores, salmon, bats, and migratory birds.

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
Greater sandhill crane (*Grus canadensis tabida*)	EC NBR WC	Relatively large wetland-wet/dry meadow complexes with a mosaic of aquatic and herbaceous conditions for nesting and foraging	Large area requirements. Sensitive to disturbance. Reductions in wetland/wet meadow quality, quantity, and size due to hydrological changes, succession (shrub and conifer encroachment), and/or livestock grazing. Nesting failure due to timing of land management practices (e.g. mowing, grazing). Coyote predation on young. Raven predation on eggs.	Habitat area requirements relative to the quality of the habitat. Difference in food resource utilization in wet and dry meadows and at different breeding sites. Effects of pesticides on food resources. Impact of livestock grazing on habitat suitability; impact of nest predation under different habitat conditions; impacts from disturbance due to recreational use (*e.g.*, OHVs)	Maintain and/or enhance hydrological conditions to support suitable habitat conditions for nesting and foraging in tracts >20 ac. Where hydrology can be managed, include both wet and dry meadow habitat through the nesting season. Minimize disturbance during breeding season (4/15 - 7/31) at known nesting areas. Use prescribed burning or hand-felling of trees periodically to set plant succession.
Juniper titmouse (*Baeolophus ridgwayi*)	NBR	Mature juniper trees with cavities for nesting; expansive areas of mature juniper habitat, especially in winter	Small, disjunct populations; reduction and fragmentation of stands of mature juniper trees from development, wildfire, or juniper management	Distribution and estimated population size and status; habitat patch size requirements for a population, especially in winter	Maintain large stands of mature juniper within the species range; maintain mature juniper trees when thinning encroaching small juniper trees (see information about juniper age composition in Blue Mountains ecoregion and Limiting Factors section)
Leach's storm-petrel (*Oceanodrama leucorhoa*)	CR	Coastal islands with deep sandy soil for burrowing and cover of the grass *Phalaris* and other grass and forb species	Specialized nesting habitat; vulnerability of specialized nesting habitat to predation from non-native and artificially abundant native predators; high potential vulnerability to oil spills; vulnerability to plastic ingestion due to surface foraging behavior	Breeding biology; foraging areas	Maintain existing closure of nesting areas to human visitation; continue implementing Environmental Assessment for mammalian predator control at Oregon seabird colonies
Lewis' woodpecker (*Melanerpes lewis*)	BM CP EC KM	This species has 5 major habitat types: ponderosa pine, oak woodlands, oak-pine woodlands, cottonwood riparian forests, and areas burned by wildfires. In all cases, special needs are aerial insect populations for foraging; large snags for nesting, especially soft or well-decayed snags; and relatively open canopy for flycatching	Population declines and local extirpations; habitat loss and degradation; loss of old cottonwood snags; competition from starlings for nest cavities; large areas of suitable habitat on private lands	Thorough inventory of distribution and analysis of habitat relationships; impact of grazing on insect productivity in undergrowth; determine usefulness of providing nest-boxes	Maintain or restore open oak, ponderosa pine, and cottonwood woodlands along with post-fire ponderosa pine habitats that provide canopy cover <40% and shrub cover 30-80% with 6 trees/acre > 32 feet tall and 6 snags/acre > 20 in dbh
Little willow flycatcher (*Empidonax traillii brewsteri*)	WV	Brushy patches of vegetation adjacent to water for nesting and foraging	Declining populations; loss of riparian shrub habitat	Prey base requirements and site selection relative to prey base	Restore brushy patches of willow and other native shrubby habitats near water
Loggerhead shrike (*Lanius ludovicianus*)	BM CP	Tall sagebrush for nesting and roosting and openings with grasses and significant bare ground for foraging	Habitat loss; population declines; loss of sagebrush to high intensity wildfires	Post-fledging survivorship as a function of habitat quality; impacts of pesticide use on prey base, especially grasshoppers	Maintain late seral sagebrush with patches of tall shrubs (>1m) with <15% shrub cover, <20 herbaceous cover, and >30% open ground cover

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
Long-billed curlew (*Numenius americanus*)	CP NBR	Open habitats with relatively short grass and few or no trees/shrubs. In Northern Basin and Range ecoregion, much of the suitable habitat is comprised of sub-irrigated meadows created by adjoining flood irrigated meadows.	Historic habitat loss and continued conversion of grassland habitats to agriculture; population declines in some areas; human disturbance during nesting	Nest success and viability of populations nesting in agricultural fields; impact of human disturbance and land-use practices; post-fledging habitat use and survival	Partnerships with private landowners to maintain and restore large patches of short grass habitat. For example, ranching has provided much habitat for this species (*i.e.*, Lower Silvies River Valley). Minimize human disturbance during Mar 15 - July 1 at known nesting areas
Marbled murrelet (*Brachyramphus marmoratus*)	CR KM	Late-successional forest with specific nest tree characteristics	Reductions in late-successional forest. Low reproductive output combined with low reproductive success. Habitat loss due to uncharacteristically severe fire in Klamath Mountains ecoregion	Role of isolation and/or fragmentation of nesting habitat with levels of nest predation. Minimum area requirements.	The Northwest Forest Plan and Federal and State Recovery and Conservation Plans provide information on network of conservation reserves and management requirements for this listed species
Mountain quail (*Oreortyx pictus*)	NBR	Shrubby riparian habitats and adjacent to grassy uplands	Range retractions and local extirpations; small, disjunct populations	Wintering habitat requirements	Partnership programs with private landowners to maintain and/or provide suitable habitat; coordinate riparian restoration with management of suitable adjacent uplands
Northern goshawk (*Accipiter gentiles*)	EC WC	Large area requirements with a mosaic of forest stages, forest openings, and habitat components (*e.g.*, snags, down logs); open forest floor for access to ground dwelling prey	Large area requirements. Affected by reductions in amount of late successional forest	Estimated population densities	Maintain late successional forest habitat. Maintain natural forest openings through prescribed fire, thinning and hand-removal of encroaching conifers

Western Meadowlark

In 1927, Oregon's school children voted the western meadowlark as the State Bird. Meadowlarks' bright, cheerful colors, beautiful songs, and common appearance in farm and ranch lands endear them to many Oregonians. Due to habitat loss, they are no longer common in some parts of Oregon and have become particularly rare in the Willamette Valley. Other grassland birds, such as western bluebird, Oregon vesper sparrow, horned lark, grasshopper sparrow, and common nighthawk, also need open grassy areas to feed and raise their young. Along with the meadowlark, these species are declining in numbers. Grassland birds eat insects, and can serve a role in reducing economically harmful insect populations. Fortunately, most of the grassland birds can live alongside people if certain habitat features are provided, such as increased herbaceous plant diversity. Landowners can also help grassland birds by timing field maintenance either before or the breeding season and by reducing impacts by free-roaming cats. Fallow fields, lightly-grazed pastures, grass seed fields, vineyards, and Christmas tree farms can provide habitat for grassland birds and some other wildlife.

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
Northern spotted owl (*Strix occidentalis caurina*)	CR KM WC	Late successional forest or younger forest with residual late successional components	Declining. Large home range requirements. Reductions in late successional forest. Hybridization with and competition from barred owl. Sensitive to West Nile Virus. Habitat loss due to uncharacteristically severe fire in Klamath Mountains ecoregion.	Status of populations in landscapes managed for timber production (*i.e.*, where retention of trees and snags was practiced). Minimum area requirements.	The Northwest Forest Plan and Federal and State Recovery and Conservation Plans provide information on network of conservation reserves and management requirements for this listed species
Olive-sided flycatcher (*Contopus cooperi*)	CR EC WC	Open older coniferous forest, forested riparian habitat, forest openings (*e.g.*, burns, harvested forest), or forest edge with tall, prominent trees and/or snags; hemlocks or true firs for nest trees	Relatively large area requirements (compared to other songbirds). Increased predation rates in harvest units within a landscape of older forest or highly fragmented forests	Comparison of prey resources and reproductive success in burns and harvested forest and within various harvest types	Maintain scattered large dead trees in patchy wildfires; maintain natural openings but minimize harvested forest openings within landscapes of older forest
Oregon vesper sparrow (*Pooecetes gramineus affinins*)	KM WV	Grasslands for foraging and nesting, usually with scattered shrubs/trees and some bare ground	Small disjunct populations; loss and degradation of grassland habitats due to invasive plants and lack of fire; Nesting failure due to timing of land management practices (e.g. mowing, haying, spraying), predation by house cats in some areas	Impact of grazing and agricultural management on productivity	Maintain or restore grassland habitat, increase plant diversity for greater insect diversity, control key invasive plants, minimize disturbance during breeding season (4/15 - 7/15) at known nesting areas.
Pileated woodpecker (*Dryocopus pileatus*)	BM	Mixed coniferous forests, especially late successional stands; large-diameter trees and snags for nest and roost sites; large-diameter snags and logs for foraging sites	Habitat fragmentation; reductions in snag availability due to fire suppression and forest health management	Habitat suitability of managed forests with large dead wood maintained	Maintain and create large-diameter hollow trees, snags, and logs during forest management activities
Red-necked grebe (*Podiceps grisegena*)	EC	Large lakes and ponds within a forested landscape; needs both deep water and marshy emergent vegetation for nesting and foraging habitat	Small isolated population. Susceptibility to pesticide impacts on reproduction. Needs high water quality with diverse invertebrate and fish prey resources	Impacts of recreational boating on reproduction. Sources of water quality degradation at nesting site(s)	Maintain and restore marshy vegetation. Minimize disturbance to nest sites during nesting season
Rock sandpiper (*Calidris ptilocnemis*)	CR	Rocky coastal habitats with sufficient intertidal invertebrate prey	Small migrant/wintering population and regional declines. High vulnerability to potential oil spills	Basic wintering ecology. Impact of human disturbance on population distribution and health.	Identify high priority sites.
Sage sparrow (*Amphispiza belli*)	CP	Primarily occurs in big sagebrush communities; requires high shrub cover and low grass and litter cover in relatively large patches	Sensitive to fragmentation; negative association with densely growing annual invasive plants such as cheatgrass; loss of sagebrush to high intensity, high frequency wildfires because of invasive grasses; sensitive to grazing	Area requirements; conditions to maintain source populations; effects of cowbird parasitism	Maintain sagebrush cover at 10-25% and height > 20in, with <10% invasive annual grasses, and open ground cover >10% in patches >400 acres where possible
Short-eared owl *(Asio flammeus)*	WV	Large expanses of marshes and wet prairies for foraging and nesting.	Loss of large expanses of wetland (marsh and wet prairie) habitat. Small population. Nests and comunally roosts on ground, which makes species vulnerable to disturbance.	Complete breeding season inventory of suitable nesting habitat. Habitat relationships of breeding and wintering birds.	Maintain and restore wetland habitats, with an emphasis on maintaining large patches and/or expanding smaller ones. Minimize disturbance at known communal roost sites.

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
Slender-billed (white-breasted) nuthatch (*Sitta carolinensis aculeate*)	WV	Mature oak trees for foraging and nesting cavities	Fewer mature oaks, fewer cavities	Patch size requirements	Maintain large oaks >22 in. dbh., develop nest box programs for cavity habitat in the short-term
Snowy egret (*Egretta thula*)	NBR	Tree, shrub, or stout herbaceous vegetation such as hardstem bulrush for nest sites	Small, disjunct populations; declining population trends; colonial nester; sensitive to human disturbance	Factors contributing to and effects from competition with other herons and egrets, especially non-native cattle egrets	Minimize human disturbance in nesting areas during breeding season
Streaked horned lark (*Eremophila alpestris strigata*)	WV	Open, treeless expanse of sparsely vegetated grassland areas (including bare ground patches) for nesting and foraging	Declining populations; Loss and degradation of grassland habitat; Nesting failure due to timing of land management practices (e.g. mowing, haying, spraying).	Identification of factors limiting nest success and post-fledgling survival; habitat relationships of wintering birds	Maintain or restore sparsely vegetated grassland habitat, create nesting areas, increase plant diversity for greater insect diversity, control key non-native plants; designate locations to be managed for core populations; minimize disturbance during breeding season (4/15 - 7/15) at known nesting areas
Swainson's hawk (*Buteo swainsoni*)	CP NBR	Expansive open grassland habitat with occasional suitable nest trees and adequate small mammal prey populations	Declining populations; relatively large area requirements; habitat loss and fragmentation; mortality on South American wintering grounds due to improper pesticide use	Factors contributing to and effects from competition with red-tailed hawks, particularly in areas where nest trees or prey base is limited by habitat degradation	Partnerships with private landowners; protection of nest trees; maintain herbaceous conditions to support adequate abundance and diversity of small mammal and insect prey. (Note: Winter ground issues are being addressed through international cooperation).
Tufted puffin (*Fratercula cirrhata*)	CR	Coastal nest sites that are inaccessible to mammals and have steep slopes and deep soil for burrowing	Declining populations. Vulnerability of specialized nesting habitat to impacts from humans and introduced predators. High potential vulnerability to oil spills	Factors contributing to declining populations: marine or other factors?	Maintain existing sites free from introduced predators and levels of human disturbance that negatively impact nesting success
Upland sandpiper (*Bartramia longicauda*)	BM	Large breeding area requirements; wet and dry meadows in small valleys such as Logan Valley, Bear Valley and around Ukiah; medium-length grasses with high plant diversity; current habitat includes nearby lodgepole pine and sagebrush	Very small, disjunct populations; encroachment of meadows by lodgepole pine (possibly due to fire suppression and/or changes in water distribution)	Thorough inventory of distribution; analysis of habitat relationships and requirements; relationship between land use and habitat suitability	Partnerships with private landowners to determine and implement appropriate conservation on suitable habitat patches; remove encroaching lodgepole pine trees in meadows

Flammulated Owl

Petite stature, exclusively insect prey, and migratory habits make the flammulated owl unique among northwestern owls. One of the smallest owls in North America, the flammulated owl weighs just under 2 ounces. Unlike most of Oregon's owls which are year-round residents, the flammulated owl migrates to Mexico and Central America for the winter. This small owl is closely associated with older ponderosa pine woodlands, but is sometimes found in dry mixed ponderosa-conifer stands. Thickets of small trees are important for roosting habitat, and open understories, small openings, or meadows are critical for foraging. The flammulated owl nests in unused woodpecker cavities carved into medium to large-diameter ponderosa pine or, to a lesser extent, larch trees. This owl's complex habitat needs are a reminder that restoration efforts should maintain community diversity by incorporating openings, thickets, and snags into restoration plans. In addition to helping species with complex biological needs, providing diverse habitat features supports habitat for a greater variety of wildlife.

(Birds Cont.)

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
Western bluebird (*Sialia mexicana*)	WV	Grasslands and oak savannas for foraging, cavities, especially in savanna oaks for nesting, scattered trees or shrubs as hunting perches	Habitat loss, habitat degradation due to invasive non-native plants and lack of fire, competition for cavities from non-native birds, predation by house cats	Location and factors key to success for natural cavity-nesting pairs	Maintain or restore grassland and oak savanna habitat, maintain oaks >22 inches dbh, create snags from competing conifers, maintain nest box programs for cavity habitat in the short-term, design and place nest boxes to minimize use by starlings
Western burrowing owl (*Athene cunicularia hypugaea*)	CP	Burrows (created by other species, particularly badgers) for nesting; high proportion of bare ground near burrow	Reduction in adequate size and number of burrows due to habitat loss and reduction in burrowing mammal populations; illegal shooting of owls; disturbance during nesting season; collisions with vehicles; collapse of burrows by livestock trampling; control of badger populations in agricultural lands.	Value of artificial nesting structures for population expansion and/or re-introduction	Maintain open ground cover >40-70%, shrub cover <15%, and native grass cover <40% and <6 in tall in nesting areas; provide 200 m buffer zones around nest burrows where pesticide applications, rodent control and human disturbance is minimized; protect badger populations in areas where burrowing owls are present
Western meadowlark (*Sturnella neglecta*)	WV	Large expanses of grasslands for foraging and nesting due to relatively large home range requirements; scattered shrubs, trees or posts for singing perches	Declining populations; loss and degradation of grassland habitats; nesting failure due to timing of land management practices (e.g., mowing, haying, spraying).	Impact of grazing and agricultural management on productivity	Maintain or restore grassland habitat - especially large expanses of habitat (e.g., >100 acres), increase plant diversity for greater insect diversity, control key non-native plants, minimize disturbance during breeding season (4/15 - 7/1) at known nesting areas
Western purple martin (*Progne subis*)	KM WV	Abundant cavities for colonial nesting. Proximity to water or large, open areas for foraging	Loss of nesting cavities. Competition with starling for nest cavities. Adequate aerial insect prey base	Complete inventory of distribution. Ability to attract migrating birds with nesting structures	Create and maintain appropriate snags. Maintain nest box programs for cavity habitat in the short-term. Design and place nest boxes to minimize use by starlings
Western snowy plover (*Charadrius alexandrinus nivosus*)	CR NBR	Coast Range - Sandy and sparsely vegetated shoreline above high tide for nesting habitat Northern Basin and Range - Alkaline flats and salt pans associated with springs, seeps, or lake edges	Coast Range - Small and declining population. Loss and degradation of habitat from natural and human-associated factors (including European beachgrass). Human disturbance of nesting birds. Increased predator populations Northern Basin and Range - Small, disjunct populations; declining population trends; nesting sensitivity to fluctuating water levels	Coast Range - Temporal and spatial effects of predator control activities on reproductive success Northern Basin and Range - Identification of landscape-level breeding and post-breeding habitat needs for responding to annual site-specific changes in water levels	Coast Range – Draft federal recovery plan and Oregon Parks and Recreation Department's Habitat Conservation Plan for the Western Snowy Plover provide information on conservation actions. Note: federal status for this species is currently under review. Northern Basin and Range - Maintain suitable nesting and foraging areas across the landscape to provide habitat regardless of annual variation in precipitation and water levels.

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
White-headed woodpecker (*Picoides albolarvatus*)	BM EC KM	Large tracts of open ponderosa pine woodlands with mature trees for foraging and snags for nesting	Population declines and local extirpations. Loss of mature ponderosa pine trees and snags. Habitat degradation from encroaching trees and shrubs, and lack of recruitment of young ponderosa pine into larger size classes. Egg predation in areas of high predator (most likely chipmunks and golden-mantled ground squirrels) densities associated with shrubs and down wood	Distribution; impacts of forest management practices and habitat suitability of managed forests; predation rates by individual predator species; habitat relationships of rodent egg predators	Retain existing or manage to meet conditions of large tracts (>700 acres outside old-growth) of open (canopy closure 10-40%) mature (>10 trees/ac > 21 in dbh[1] and 1.4 snags/acre >8in dbh) woodland; Retain snags and high cut stumps in management; eliminate or restrict fuelwood cutting of stumps and snags in suitable habitat
Willow flycatcher (*Empidonax traillii adastus*)	NBR	Riparian shrub dependent; dense continuous or near-continuous shrub layer, especially of willows	Population declines; loss and degradation of riparian shrub habitat from altered hydrological regimes and invasive species; cowbird parasitism	Site and landscape factors that contribute to cowbird parasitism	Partnerships with private landowners to maintain and restore habitat and control priority invasives: dense riparian shrub patches (especially willow) > 10 square yards in size with 40-80% shrub cover > 3 ft high; discourage cowbird use of riparian areas through seasonal timing of grazing and/or maintaining high grass heights in priority areas
Yellow rail (*Coturnicops noveboracensis*)	EC	Narrow range of water depths and presence of senescent vegetation within sedge meadows	Small, disjunct population. Specific wetland types and conditions. Intensive livestock grazing that removes >50% of senescent vegetation. Hydrological changes from wetland draining or inundation	Complete inventory of other potential breeding habitats in southcentral Oregon. Prey selection and its potential relationship with preferred water levels	Maintain preferred water levels of approximately 2.4-2.8 inches during the breeding season. Maintain at least 50% of senescent vegetation from year to year
Yellow-breasted chat (*Icteria virens*)	WV	Dense brushy thickets, especially near streams	Loss of larger patches of dense riparian shrub habitat	Nesting ecology and habitat relationships in riparian habitat; patch size requirements	Restore relatively large areas of dense thickets of native shrub-dominated riparian habitats

[1] Recommended tree size is the average within the range typically used by the species.

Raptors and Grassland Songbirds

Northeastern Oregon is home to the state's largest and most intact native grasslands. This expansive open country is important to a variety of grassland-dependent birds, including raptors and songbirds. High ground squirrel populations are prey for an impressive array of raptors, including golden eagles; prairie falcons; and ferruginous, Swainson's, red-tailed, and roughlegged hawks. In fact, Zumwalt Prairie may host one of the highest raptor populations in the nation. Grasslands also feature a variety of wildflowers, which host diverse insects. The insects are food for grassland songbirds, such as savanna sparrows, western meadowlarks, horned larks, and vesper sparrows. Oregon State University researchers led by Dr. Pat Kennedy are studying bird populations in the Blue Mountains' grasslands. Current research includes landscape factors that affect raptor nest site availability and the effects of invasive plants on grassland songbirds. Such information can assist landowners and managers in providing habitat for Oregon's grassland-dependent species.

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
Common kingsnake (*Lampropeltis getula*)	KM	Associated with a variety of habitats including grassland, valley, prairie, streams. Require cover for hiding (rocks, vegetation, logs, etc).	Land use activities that fragment populations. Disturbance to riparian or leaf litter hiding substrate.	Reproduction including parental care. Home range. Predators and possible defense mechanisms.	Use research results to guide management actions to protect specific populations. Note: may occasionally prey on rattlesnakes.
Northern sagebrush lizard (*Sceloporus graciosus graciosus)*	CP	Steppe habitats with sandy soils and sparse vegetation in the grass/forb layer	Habitat loss and fragmentation. Limited ability to disperse	Estimated population size and trends. Effects of fragmented habitat on populations	Maintain habitat patches; restore habitat connectivity where possible
Western painted turtle (*Chrysemys picta*)	BM CP EC WC WV (Note: occurs only along the Columbia River in CP, EC and WC ecoregions)	Marshy ponds, small lakes, slow-moving streams and quiet off-channel portions of rivers; prefer muddy bottoms with aquatic vegetation; need open ground for nesting. Need logs/vegetation for basking	Loss of aquatic and nesting habitats (conversion, invasive species). *Particularly in the Willamette Valley: predation by bullfrogs, bass, and raccoons; competition with invasive turtles*	Impacts from disease introduced and/or spread by non-native turtles. Population dynamics and population genetics. *Especially in Willamette Valley: Impacts of raccoons and invasive species (turtles, fish and bullfrogs)*	Provide basking structures and nesting habitats; control invasive plants and animals Protect important nesting sites from disturbance. Use wire cages to protect nests from raccoons at key sites in the short-term where this is a problem
Northwestern pond turtle (*Emys marmorata marmorata*)	CR EC KM WC WV	Marshes, streams, rivers, ponds, and lakes. Sparsely-vegetated ground nearby for digging nests. Basking structures such as logs	Loss of aquatic and nesting habitats (conversion, invasive plants). *Particularly in the Willamette Valley and Coast Range: predation by raccoons, invasive bass and bullfrogs; competition with invasive turtles*	Population dynamics and population genetics. *Especially in Coast Range and Willamette Valley: Impacts of raccoons and invasive species (turtles, fish and bullfrogs)*	Provide basking structures and nesting habitats; control invasive plants and animals. Protect important nesting sites from disturbance.
Western rattlesnake (*Crotalus viridis*)	WV	Dry areas with low or sparse vegetation. Rocky areas for basking, refuge den sites and hibernacula	Habitat loss. Eradication efforts	Locations of remnant western rattlesnake populations and hibernacula	Maintain or restore low grassland habitat near rocky areas, minimize disturbance at key den and hibernacula sites

Oregon's Turtles

Oregon has only two native turtle species: the northwestern pond turtle and the western painted turtle. The northwestern pond turtle is found in lowlands throughout western Oregon, while the western painted turtle is limited to the northern Willamette Valley and Columbia River. Both turtles are dark brown or dull olive, but the western painted turtle is brightly decorated with a reddish lower shell and yellow stripes on its neck and legs. Both turtles are approximately 4-9 inches long as adults, are slow to develop and reproduce, and eat a variety of foods including plants, insects, and tadpoles. Oregon's turtles are declining in Oregon due to habitat loss, degradation of nesting areas by invasive plants, competition and perhaps disease from invasive turtles, nest predation by raccoons, and predation on young turtles by invasive bullfrogs and fish. Because turtles use both wetland and upland habitats during the year, they are particularly sensitive to habitat loss. Landowners can help Oregon's turtles by providing shallow wetland habitats, basking structures such as logs, and open grassy nesting areas.

Conservation Summaries for Strategy Species – Amphibians (17 species):

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
Cascades frog (*Rana cascadae*)	EC WC	Mountain meadows, bogs, ponds or potholes above 2,400 feet elevation. Lays eggs in shallow sunny edges of ponds, or on low vegetation near ponds where warm sunlight speeds egg development and spring rains allow hatchings to swim into ponds. Larvae "school" in large masses.	Montane species vulnerable to genetic isolation. Experiencing substantial reductions in southern parts of range (*e.g.*, CA).	Feeding habits. Possible effects of introduced fishes, pathogens, and airborne environmental pollution. Habitat characteristics that could enhance migration and gene flow. Feasibility studies on reintroduction at historic sites.	Maintain connectivity of habitat. Monitor effects of fish stocking and water quality on populations. Carefully manage livestock grazing in occupied wet meadows. Use prescribed burning or hand-felling of trees periodically to set plant succession. Reintroductions should use individuals from nearby populations; use results feasibility studies to guide further actions. Conservation actions in Oregon are particularly valuable given reductions in other parts of range.
Cascade torrent salamander (*Rhyacotriton cascadae*)	WC	Cold, fast-flowing, clear, permanent headwater streams, seeps and waterfall splash zones in forested areas. Gravel or small cobble substrate with continuous but shallow water flow for larvae and adults foraging and hiding. May only occur in streams on basalt rock. Continuous access to cold water.	Larvae take several years to reach sexual maturity. Small clutch size (7-16 eggs) and long time to hatch (up to 10 months). Larvae have minute gill surface area, so very sensitive to increased temperature and sediment.	Species-specific breeding habits (because of relatively recent taxonomic split of torrent salamanders). Dispersal	Maintain stream buffers to maintain cool water temperatures and water clarity. Little or no sediment coating or embedding rocky substrates. Replace culverts as needed to remove barriers in continuous, natural streambed and streambank habitats.
Clouded salamander (*Aneides ferreus*)	CR KM WC	Forest habitats or burned areas. Require large decaying logs, especially Douglas-fir	Limited range (occurs primarily in Oregon). Loss of large logs	Habitat relationships with burns; effects of fires on populations	Maintain large logs during forest management activities
Coastal tailed frog (*Ascaphus truei*)	CR KM WC	Cold, fast-flowing, clear streams within forested areas. Adults need streambanks, logs, headwater springs, and gravelly seeps for foraging and hiding, and small boulders in streams for egg laying. Tadpoles need permanent streams with moss- and sediment-free cobble and boulder substrate for clinging to rock surfaces while scraping diatoms and algae. *In Coast Range, may be limited to streams with hard-rock substrate rather than sandstone.*	Limited range (northwest endemic). Low reproductive rate due to several-year larval stage. Remains close to water source; low dispersal abilities may limit recovery of populations. Sedimentation. Increases in water temperature.	Growth rates after metamorphosis. Internal reproduction dynamics	Maintain stream buffers to maintain cool water temperatures and water clarity. Little or no sediment coating or embedding rocky substrates. Replace culverts as needed to remove barriers in continuous, natural streambed and streambank habitats.
Columbia spotted frog (*Rana luteiventris*)	BM NBR	Permanent ponds, marshes and meandering streams through meadows for breeding and foraging, especially with bottom layer of dead and decaying vegetation	Slow to reach reproductive maturity. Predation and competition by invasive fish and bullfrogs. Siltation. Lowering of water tables through down-cutting of stream channels	Impacts of invasive species, document dates/locales of past locales and survey to determine range status and trend. Impacts of grazing on habitat and populations.	Maintain vegetation buffers around known populations. Control bullfrogs and invasive fish at priority sites

(Amphibians Cont.)

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
Columbia torrent salamander (*Rhyacotriton kezeri*)	CR	Cold mountain streams, spring heads and seeps. Require loose gravel stream beds with specific geologic characteristics. Specific requirements for stream gradients.	Limited dispersal. Adults are highly sensitive to drying. Larvae sensitive to changes in stream flow.	Distribution. Response to management activities at varied scales	Maintain stream buffers to maintain cool water temperatures and water clarity. Minimize disturbance at known suitable sites.
Cope's giant salamander (*Dicamptodon copei*)	CR WC	Cold, fast-flowing, clear, permanent streams in coniferous forests. Deep cobble and small boulder substrate for foraging and hiding. Rocky streambanks or in-channel logs with crevices for eggs and larvae.	Limited range in Oregon. Rarely or never metamorphose, so highly vulnerable to channel dewatering and barriers to stream connectivity; very small gill surface area, so sensitive to increases in temperature and sediment.	Information on reproduction (parental care, number of clutches per female per year). Frequency of naturally occurring terrestrial individuals	Maintain stream buffers to maintain cool water temperatures and water clarity. Little or no sediment coating or embedding rocky substrates. Replace culverts as needed to remove barriers in continuous, natural streambed and streambank habitats.
Foothill yellow-legged frog (*Rana boylii*)	CR KM WC WV	Slow-moving streams with coarse-substrate gravel bars, bedrock substrate with potholes, and low-flow backwaters	Range in Oregon has shrunk due to habitat loss from inundation and other hydrologic modifications. Loss of gravel bars and low-flow nursery areas. Sedimentation	Current distribution. Non-breeding season habitat. Identify overwintering habitat. Feasibility studies on reintroduction at historic sites. Compare population dynamics and natural history between populations towards center of range (Klamath Mountains ecoregion) and those that at the northern end of the range (Willamette Valley and West Cascades ecoregion).	Maintain natural water flow patterns and streamside vegetation and protect from other impacts at priority breeding sites. *Especially for populations in West Cascades and Willamette Valley: Use results of feasibility studies to guide specific conservation actions and management decisions for reintroductions*.
Inland tailed frog (*Ascaphus montanus*)	BM	Stream breeding. Prefer clear, cold habitat with cobbles and boulders for larvae, which are adapted to cling to rocks and scrape diatoms. Adults forage for insects at night	Low reproductive rate (multi-year larval development; small number of eggs per female). Sedimentation of streams from roads or forest practices; increased temperatures due to degraded riparian habitat	Population dynamics	Modify activities to provide continual riparian cover and minimize sedimentation; maintain shade for cooler temperatures
Larch Mountain salamander (*Plethodon larselli*)	WC	Basalt talus slopes of Columbia River Gorge and northern Cascade Mountains. Adapted to well-drained, gravel to small cobble-sized talus with a significant component of fine litter and debris. May occur in late-successional forest especially with gravel or fractured rock in the soil	Specialized habitat. Low dispersal capability. Relatively small clutch size. Pesticides or fertilizers can affect salamanders and their food supply	Distribution and abundance. Reproduction and nesting ecology. Location of southern edge of species range	Avoid disturbance of talus habitats (which can cause local extinctions); consider effects of potential ground-disturbing activities. Avoid use of pesticides adjacent to talus
Northern leopard frog (*Rana pipiens*)	NBR	Wet meadows, potholes, and riparian areas with high vegetative cover. Ponds and slow streams for hibernation	Predation by invasive bullfrogs. Habitat loss particularly at edge of range	Current distribution. Population trends. Habitat requirements. Effects of contaminants (pesticides, herbicides) on populations	Control bullfrogs at known nesting areas

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
Northern red-legged frog (*Rana aurora*)	KM WV	Ponds and wetlands with shallow areas and emergent plants. Access to forested habitats (forested wetland, upland)	Loss of egg-laying habitat. Predation and competition by invasive fish and bullfrogs	Identify overwintering habitat. Clarify impacts of pollutants, ultraviolet radiation and parasites on populations.	Maintain wetland habitat with emergent plants. Maintain adjacent forested habitats. Control bullfrogs and invasive fish at key sites
Oregon slender salamander (*Batrachoceps wrightorum*)	WC	Late successional and second-growth forest where there are abundant mid to advanced decay stage, large diameter Douglas fir logs and bark debris mounds at the base of snags. Talus and lava fields that retain moisture. Can clump together in groups to remain damp.	Endemic to Cascade Mountains of Oregon. Restricted distribution; vulnerable to random events. Columbia River limits dispersal. Require habitat complexity characteristic of old-growth and unmanaged younger forests. High site fidelity for reproduction.	Maternal care, and life history. Habitat requirements. Effects of habitat fragmentation on genetics. Improved survey methods	Maintain habitat with late successional attributes suitable for this species.
Oregon spotted frog (*Rana pretiosa*)	EC WC	Permanent ponds, marshes and meandering streams through meadows for breeding and foraging, especially with shallow water and a bottom layer of dead and decaying vegetation. Springs and other sites with low, continuous water flow for overwintering	Slow to reach reproductive maturity. High fidelity to egg-laying sites. Predation and competition by invasive fish and bullfrogs. Siltation. Some populations are isolated and vulnerable to inbreeding and extinction. Livestock grazing removes cover along stream edges and allows sediment and excessive aquatic vegetation to decrease habitat value.	Impacts of invasive fish and bullfrogs. Documentation of historic sites, and current range status. Feasibility studies on reintroduction at historic sites.	Maintain vegetation buffers around known populations; control bullfrogs and invasive fish at priority sites. Carefully manage livestock grazing at occupied montane wet meadows. Install small predator exclosures over parts of isolated breeding sites. Use results of feasibility studies to guide specific conservation actions and management decisions for reintroductions.

Headwater Amphibians

Often secluded high in Oregon's mountains, headwater streams provide naturally outstanding water and habitat quality. In these often cool stream ecosystems, amphibians are cornerstone as both predators and prey. Several of Oregon's amphibians are specially adapted to life in the headwaters: Pacific giant salamanders, southern torrent salamanders, Columbia torrent salamanders, and the unique tailed frog. All prefer large amounts of large, rocky substrate in the streams, with a substantial forest buffer nearby.

Tailed frogs, recently separated into two separate species (the coastal tailed frog in the mountains of western Oregon and the inland tailed frog in northeastern Oregon), are a true evolutionary relic. Unlike any other living frog, males have a protruding 'tail' that is used for reproduction. Tadpoles have oral discs designed for sucking diatoms (microscopic algae) from rocks and boulders. Females usually produce about 50 eggs per breeding season, and larvae spend at least a year in the water before they metamorphose. At higher elevations, larvae can spend up to four years in the water and may require five to six additional years before they are sexually mature. These unique traits slow the reproductive rate and can make tailed frogs vulnerable to habitat changes.

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Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
Siskiyou Mountain salamander (*Plethodon stormi*)	KM	Restricted range to forests in Applegate drainage. Require talus deposits or rock outcrops.	Lungless salamanders breathe directly through skin so highly vulnerable to moisture loss. Highly sensitive to disturbance of talus microhabitat or forest overstory.	Genetic and taxonomic relationships to other members of the same genus.	High priority for conservation because of close dependence on forest characteristics, but occur outside existing reserve system. Within known range, ensure that land use practices retain essential characteristics of talus microhabitat.
Southern torrent salamander (*Rhyacotriton variegatus*)	CR KM	Cold mountain streams, spring heads and seeps. Require loose gravel stream beds with specific geologic characteristics. Specific requirements for stream gradients.	Limited dispersal. Adults are highly sensitive to drying. Larvae sensitive to changes in stream flow.	Distribution. Response to management activities at varied scales	Maintain stream buffers to maintain cool water temperatures and water clarity. Minimize disturbance at known suitable sites.
Western toad (*Bufo boreas*)	BM CR EC KM NBR WC	Wetlands, ponds and lakes for breeding. Extensive, sunny shallows with short, sparse or no vegetation for egg laying and for tadpole schools to move widely as they forage on organic mud and surface diatoms	Loss of breeding habitat due to changes in water level management. Egg-destroying pathogen (*Saprolegnia ferax*). Siltation. Roadkill adjacent to major breeding sites. Recreational impacts at certain sites.	Status and distribution. Impacts of *S. ferrax* and role of introduced fish in fungal spread. Causes of decline (e.g., role of ultraviolet radiation and global climate change). Survey to determine incidence of Chytrid skin fungus (*Batrachochytrium dendrobatidis*)	Maintain water levels and vegetation buffers at major breeding sites. Install culverts or drift fences at problem road crossings near major breeding sites. Inform recreationalists about the importance of minimizing shoreline impacts. Periodic control of vegetation height and density at occupied sites where these factors could interfere with breeding

Yellow-legged Frogs

Sporting a striking golden hue on its legs and belly, the foothill yellow-legged frog (Rana boylii) is particularly dependent on healthy rivers and streams. The adults often live in streamside vegetation, jumping into the water to escape danger. Females lay eggs during late March-June, usually at coarse-substrate bars or bedrock potholes where there is low velocity laminar flow. Young larvae occupy low-flow backwaters and feed on diatoms. Recent surveys of known historic yellow-legged frog sites in Oregon indicated that they may no longer exist at 51 of 90 historic localities, a 57 percent decline in known sites. Of 14 historic sites in the Willamette Valley, there is currently only one remaining known population of yellow-legged frogs. Historic sites have been altered by inundation by reservoirs, impacts from surrounding land use, and sedimentation that lowers water quality and covers coarse cobble substrates. Changes in hydrology due to water-control structures may have reduced availability of gravel bars and low-flow "nursery" areas. In addition, colonization by exotic plant species has reduced suitability of gravel bars for oviposition (egg-laying). At the northernmost edge of its range, it may be more sensitive to habitat changes in the Willamette Valley. The remaining population at the South Santiam River site appears to be small but successful, and reproduction has been documented. Conservation actions are needed immediately to ensure the continued existence of this species in the Willamette Valley.

Conservation Summaries for Strategy Species – Fish (65 species and/or populations):

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
Abert Lake tui chub (Oregon Lakes tui chub) (*Siphateles* sp. [cf. *S. obesus*])	NBR	Endemic occurring in the Lower Chewaucan River, Crooked Creek and in springs north of Abert Lake	Restricted distribution. Small isolated populations. Predation by invasive fishes.	Distribution. Habitat use. Life history. Population dynamics.	Maintain water flow and water quality. Mitigate for effects of invasive fishes.
Alvord chub (*Gila avordensis)*	NBR	Inhabits springs and spring-fed streams, and impoundments in Alvord basin	Relatively low fecundity and resilience	Genetics. Population dynamics. Habitat use.	Maintain water quality and availability. Reduce localized impacts where populations could become increasingly fragmented.
Borax Lake chub (*Gila boraxobius)* [*ODFW Native Fish Conservation Assessment pending;* ODFW surveys planned for 2005]	NBR	Restricted to Borax Lake, a unique habitat fed by geothermal springs, located on fragile salt deposits.	Vulnerable to random or localized disturbance. Habitat has been affected by some past land management practices. Off road vehicles. Water withdrawals.	Population abundance and productivity.	Continue efforts to maintain habitat. Maintain water quality.
Bull trout (*Salvelinus confluentus)* *ODFW Native Fish Conservation Assessment pending [2005]; USFWS recovery plan in draft*	Columbia Distinct Population Segment [DPS]: BM CP EC WC WV Klamath River population: EC WC	Requires cool temperatures for spawning and rearing. Requires channel complexity and available migratory corridors	Increased temperature or fine sediment. Barriers to migration. Alterations of hydrology and watershed function.	Population genetics. Distribution and life history, particularly in Malheur and Owyhee. Impacts of non-native brook trout. Continue ongoing monitoring of populations and conservation effectiveness.	Maintain or restore aquatic and riparian habitat. Continue ongoing restoration efforts involving landowners, tribes and agency partners (NOAA, NMFS, ODFW, OWEB). Finalize draft USFWS recovery plan.
Catlow tui chub (*Gila bicolor ssp.*)	NBR	Restricted to streams draining westsideof Catlow Valley (Steens Mountain rim to Catlow)	Riparian condition. Passage. Water temperature	Genetics. Population dynamics.	Continue ongoing efforts to protect headwaters and streams throughout distribution range. Support efforts to improve riparian condition on both public and private lands.

(Fish Cont.)

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
Chinook salmon (*Oncorhynchus tshawytscha)* *ODFW Native Fish Conservation Assessment pending [2005]*	Snake River ESU, spring/ summer run and fall runs: BM CP CR EC WC WV	Require streams with clean gravel, complex habitat and cool temperatures for spawning and rearing. Require access for anadromous migration.	Water quality. Alterations of hydrology and watershed function. Fish passage. Riparian condition. Marine survival.	Continue ongoing monitoring of populations and conservation effectiveness. *Especially in Blue Mountains: Abundance, distribution and productivity*.	Maintain or restore aquatic and riparian habitat. Continue ongoing restoration efforts involving landowners, tribes and agency partners (NOAA, NMFS, ODFW, OWEB)
	Lower Columbia River ESU, spring run and fall run: CR EC WC WV				
	Upper Willamette ESU, spring run: CR WC WV				
	Southern Oregon/ Northern California Coast ESU, fall run: CR KM WC				
Chum salmon (*Oncorhynchus keta)* (Pacific Coast ESU) (Columbia River ESU currently considered extinct; further survey work planned to determine status in Oregon) *ODFW Native Fish Conservation Assessment pending [2005]*	CR	Require stream gravel bars and side channels near tidewaters for spawning. Migrate to ocean soon after emergence.	Alterations of hydrology and watershed function. Fish passage. Marine survival. Loss of estuarine habitat.	Population dynamics. Population genetics. Distribution.	Maintain or restore aquatic, estuarine and riparian habitat. Continue ongoing restoration efforts involving landowners, tribes and agency partners (NOAA, NMFS, ODFW, OWEB)

(Fish Cont.)

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
Coastal cutthroat trout (*Oncorhynchus clarki)* *ODFW Native Fish Conservation Assessment pending [2005]*	Oregon Coast ESU: CR KM WC WV	Large woody debris, in-stream structures and vegetation important for protection while in freshwater. Juveniles prefer side channels, backwaters or pools for rearing. Clean gravel for spawning and rearing. Migratory corridors.	Habitat fragmentation or actions that increase population isolation. Water quality. Alterations of hydrology and watershed function. Loss of estuarine habitat for rearing. Ocean productivity.	Breeding and genetic relationships among different life history types. Abundance. Distribution. Population age composition, estimates and trends	Maintain or restore aquatic, estuarine and riparian habitat, providing suitable water quality and habitat complexity. Continue ongoing restoration efforts involving landowners, tribes and agency partners (NOAA, NMFS, ODFW, OWEB). Reduce localized impacts where populations could become increasingly fragmented.
	Southern Oregon/ California Coasts ESU: CR KM WC				
	Southwest Washington/ Columbia River ESU: CR EC WC WV				
	Upper Willamette River ESU: CR WC WV				
Coho salmon (*Oncorhnchus kisutch)* *ODFW Native Fish Conservation Assessment pending [2005]*	Oregon Coast ESU *[note: not native above Willamette Falls]*: CR KM WC WV	Require streams with clean gravel, complex habitat and cool temperatures for spawning and rearing. Require access for anadromous migration.	Stream complexity. Water quality. Fish passage. Riparian condition. Altered watershed processes. Marine survival.	*Consult SSRs, Coastal Coho Assessment*	Implement measures identified in Coastal Coho Assessment with landowners and agency partners NOAA; NMFS; State of Oregon (ODFW, OWEB, IMST); Coastal Coho Stakeholder Team
	Lower Columbia River/SW Washington Coast ESU: CP CR EC WC WV	Require streams with clean gravel, complex habitat and cool temperatures for spawning and rearing. Require access for anadromous migration.	Water quality. Alterations of hydrology and watershed function. Fish passage. Riparian condition. Marine survival.	Continue ongoing monitoring of populations and conservation effectiveness.	Maintain or restore aquatic and riparian habitat. Continue ongoing restoration efforts involving landowners, tribes and agency partners (NOAA, NMFS, ODFW, OWEB)

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
	Southern Oregon/ Northern California Coasts ESU: CR KM WC				
Foskett spring speckled dace (*Rhinichthys osculus ssp*) [*ODFW Native Fish Conservation Assessment pending;* ODFW surveys planned for 2005]	NBR	Restricted to lakes and low gradient stream reaches of Warner Valley	Vulnerable to random or localized disturbance. Habitat has been affected by some past agricultural and forestry practices.	Long-term habitat needs. Genetics. Population dynamics.	Secure spring waters for habitat. Maintain connectivity of habitats.
Goose Lake lamprey (*Lampetra tridentata ssp*.)	EC	Endemic to Goose Lake and its tributaries in Oregon and California. Adults live in shallow, alkaline Goose Lake where they prey on larger fishes; require gravel riffles in streams for spawning; larvae prefer muddy backwater habitats.	Relatively isolated species vulnerable to random events (e.g., drought, habitat loss through erosion). Passage upstream and downstream. Water quality	Distribution. Detailed taxonomy. Life history and habitat requirements (*i.e.*, which streams most important for spawning.	Restore flow and passage for lamprey migration (*i.e.* Lassen, Willow, and Thomas creeks); benefits many species. Use species specific habitat requirements to direct actions. Continue collaborative work-group efforts. Screening irrigation diversions (outmigrants)
Goose Lake sucker (*Catostomus occidentalis lacusanserinus)*	EC	Limited to Goose Lk; appears to be locally abundant	Restricted distribution creates vulnerability to random events (*e.g.*, reduced flow, increased temperature). Passage.	Distribution. Spawning habitat. Population dynamics.	Continue to protect known populations. Alleviate reasons for decline (e.g., restore flow, continue to provide cooling and protection from habitat degradation).
Goose Lake tui chub (*Gila bicolor thalassina)*	EC	Limited to Goose Lake and Warner Valley. Require habitat with low flow, silty organic substrate, abundant vegetation and cover	Invasive fishes (predation and competition). Fish passage. Wetland drainage. Water quality. Riparian condition. Water temperature. Channelization.	Distribution. Population biology and life history. Genetics. Taxonomy.	Maintain water quality and availability. Reduce localized impacts where populations could become increasingly fragmented. Restore flow and fish passage.
Green sturgeon (*Acipenser medirostris)* *ODFW Native Fish Conservation Assessment pending [2005]*	CR	Spawn over areas with large rocks in deep eddies or backflows	Relatively low population sizes. Affected by predation by other fish. Previous consumption by humans. Poor water quality. Dredging.	Life history and population dynamics. Diet and migration. Habitat requirements, particularly of juveniles. Recreational impacts. Anadromous in Oregon, but more readily surveyed in saltwater so freshwater status difficult to determine.	Use species-specific habitat requirements to guide management actions. Recommend recreation opportunities that will minimize disturbance.
Hutton tui chub (*Gila bicolor ssp*.)	NBR	Restricted to one spring in the Alkali Lake subbasin of the Chewaucan River.	Vulnerable to random or localized disturbance. Habitat has been affected by some	Population abundance and productivity. Long term habitat needs.	Secure spring waters. Maintain water quality. Maintain or restore migration corridors among

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
[*ODFW Native Fish Conservation Assessment pending;* ODFW population and habitat surveys planned for 2005]			agricultural and forestry practices. Located near an old waste dump site, with toxins beginning to infiltrate the water table.		habitats. Prevent infiltration of toxins into the spring water supply.
Inland Columbia Basin redband trout (*Oncorhynchus mykiss gairdneri)* *ODFW Native Fish Conservation Assessment pending [2005]*	BM CP EC NBR	Several life history types with different migratory patterns. Restricted distribution. Pools provide important habitat for all life stages.	Water temperature and flow. Channelization. Passage barriers blocking migratory corridors. Land use practices; siltation. Hybridization with introduced fish.	Population dynamics and genetics. Life history, distribution particularly in Owyhee and Catlow Valley. Reproductive isolation of SMUs.	Continue ongoing efforts to protect headwaters and streams throughout distribution, improve water quality and riparian condition. For example, create conservation population in Harvey Creek or elsewhere. Minimize contact with introduced fish that could lead to hybridization
Jenny Creek sucker (= Jenny Creek population of Klamath smallscale sucker) (*Catostomus rimiculus*)	EC	Few offspring produced per female; slow population doubling time (4-14 years). Prefers pools and runs of small to medium rivers.	Isolated above a barrier so vulnerable to habitat changes and random events (e.g., reduced flow, increased temperature)	Information on population dynamics.	Continue to conserve existing population. Alleviate reasons for decline (e.g., restore flow, continue to provide cooling and protection from habitat degradation).
Lahontan cutthroat trout (*Oncorhynchus clarki henshawi*) [ODFW assessment planned; USFWS recovery plan currently being implemented]	NBR	Restricted distribution. Found in small streams lacking numerous other fish species	Vulnerable to random disturbance or events that cause isolation. Potential hybridization with rainbow trout. Reduced flow diversions, irrigation, passage barriers, channelization)	Genetics. Taxonomy. Population dynamics.	Continue ongoing recovery efforts to: monitor water availability, improve riparian condition and channel structure (implementation of current recovery plan).
Lost River Sucker (*Deltistes luxatus)*	EC	Limited to in Upper Klamath. Spawn in rivers, streams, or springs associated with lake habitats in gravel or cobble substrate. Spawning and juvenile rearing on shoreline river and lake habitats with vegetative structure.	Limited distribution so vulnerable to random events (habitat loss, passage and flow barriers). Susceptible to predation or competition with invasive fish. Water quality. Typically do not spawn very year, even though they can live to be 45 years old.	Influences on fish reproductive behavior; for example, why fish do not spawn every year	Continue to provide for high quality water, reduce the impacts of invasive fishes, improve migration corridors between habitats and populations. Improve historical spawning locations. Improve riparian and stream function on Sprague and Lost Rivers
Malheur mottled sculpin (*Cottus bendirei*)	BM NBR	Juveniles prefer cool pools in slower-moving streams for rearing. Adults prefer deeper, faster flowing water.	Restricted distribution. Affected by increased temperature. Localized disturbance can impact interconnected populations.	Population biology and estimates. Habitat use. Interactions with other species	Maintain riparian cover and other factors that can provide thermal cooling. Reduce localized impacts where populations could become increasingly fragmented.
Margined sculpin (*Cottus marginatus)*	BM CP	Prefers cool pools in slower-moving streams. Adults can prefer deeper, faster flowing water.	Increased temperature. Localized disturbance can impact interconnected populations.	Information about interactions with other species	Maintain riparian cover to provide thermal cooling. Reduce localized impacts to avoid fragmenting populations.
Miller Lake lamprey (*Lampetra minima)*	EC	Spawn in lakes; also inhabit marshes or rivers. Adults are smaller than late-stage larvae,	Altered hydrology and flow regime. High mortality and concentration of eggs in small	Lamprey taxonomy. Species-specific habitat requirements.	Implement conservation plan adopted by ODFW in summer 2005, Also: increased

(Fish Cont.)

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
ODFW Conservation Plan adopted summer 2005		possibly because of difficulty finding food, yet still can spawn. Adults parasitic; potential role of reducing egg predators.	area.		understanding of biology will help in identifying habitat requirements and potential conservation actions. Remove barrier on Miller Creek.
Millicoma dace (*Rhinichthys cataractae ssp*)	CR	Cool swift streams; cobbles and gravel for rearing and spawning. Use beaver ponds as rearing habitat.	Lack of cobble or gravel habitat. Limited distribution.. Altered flow regimes (because of culverts, channelization). Altered sediment regimes, including changes in timing of input and ratio of particle size.	Species-specific habitat requirements	Create and maintain gravel habitats. Maintain or restore flow and sediment regimes to improve habitat quality. Maintain or improve riparian conditions, including habitat for beavers.
Modoc sucker (*Catostomus microps*)	EC	Limited to Goose Lake Basin; Thomas Creek. Requires pools and cover for spawning habitat.	Relatively isolated species vulnerable to random events (habitat loss, barriers, water diversions).	Distribution. Population biology	Continue to protect and monitor existing populations. Establish additional populations. Improve fish passage and screening Improve irrigation efficiency to allow for more flow in Thomas Creek. Improve riparian habitat
Oregon Basins redband trout (*Oncorhynchus mykiss*) *ODFW Native Fish Conservation Assessment pending [2005]*	Silvies River: BM Goose Lake SMU: EC Catlow Valley SMU; Foster Creek; Warner Valley SMU: NBR	Several life history types with different migratory patterns. Pools provide important habitat for all life stages.	Water temperature. Channelization. Water withdrawal. Riparian condition. Passage barriers. In some locations, hybridization with introduced fish	Life history. Distribution. Effects of barriers to fish passage. Potential effectiveness of re-introductions at selected sites. Methods to increase water availability during summer months.	Restore flow and riparian quality. Maintain channel complexity and pool quality. Minimize contact with introduced fish that could lead to hybridization. Implement screens and passage at critical areas. Where possible, provide passage for a longer period of time and screen high priority diversions. Pursue efforts to improve water quantity and quality.
Oregon chub (*Oregonichthys crameri*) [recovery plan currently being implemented] *ODFW Native Fish Conservation Assessment pending [2005]*	WC WV	Off-channel habitat (low flow, silty organic substrate, abundant vegetation and cover)	Predation by and competition with invasive species; passage barriers; channelization; nonpoint source pollution; drainage of key off-channel habitat; culvert cleaning	Impacts of non-native species	Implement invasive species removal programs; remove passage barriers or mitigate for effects; reduce pollution, restore flow; re-introductions may be appropriate at some sites. Implement actions recommended in current Recovery Plan.
Pacific lamprey (*Lampetra tridentate)* *ODFW Native Fish Conservation Assessment pending [2005]*	BM CP CR EC KM WC WV	May aggregate in high densities. Requires fine gravel beds for spawning. Larvae burrow in fine sediment. Timing of development closely linked to water temperature	Reduced water quality. Passage barriers. Altered flow patterns. Dredging. Rapid water draw-downs. Marine survival.	Status; population delineation; limiting factor analysis (includes passage); restoration actions; biology; population dynamics (prioritized by Lamprey Workgroup in 2005).	Improve passage. Alter timing of water draw-down. Use species-specific habitat requirements to guide management actions. See results of Lamprey Workgroup 2005 for strategies.
Pit-Klamath brook lamprey (*Lampetra lethophaga*)	EC	Limited to upper Klamath Basin; Goose Lake Basin. Nonparasitic; inhabits riffles and runs of clear streams; juveniles rear near weed beds and sand bars.	Low minimum population doubling time; low fecundity. Fish passage. Drought and summer flows. Water quality.	Population biology; population genetics. Detailed taxonomy. Determine whether reproductively isolated from other lamprey.	Protect known populations; use species-specific habitat requirements to direct actions. Improve fish passage

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
Sheldon tui chub (*Gila bicolor eutysoma*)	NBR	Endemic restricted to Guano and Catlow valleys	Vulnerable to random or localized disturbance.	Genetics. Population dynamics. Habitat use.	Maintain water quality and availability. Reduce localized impacts where populations could become increasingly fragmented.
Shortnose sucker (*Chasmistes brevirostris*)	EC	Limited to Upper Klamath. Spawn in rivers, streams, or springs associated with lake habitats; after hatching migrate to lakes; need shoreline river and lake habitats with vegetative structure during larval and juvenile rearing	Limited distribution so vulnerable to random events (barriers, diversions, habitat loss). Susceptible to predation or competition with invasive fish. Water quality.	Juvenile habitat requirements and limiting factors to juveniles	Improve migration corridors. Note that Gerber Reservoir represents the only habitat with a shortnose sucker population that does not also have a Lost River sucker population. Improve water quality and spawning habitat.
Slender sculpin (*Cottus tenuis*)	EC	Distribution restricted to tributaries of Upper Klamath Lake	Possibly susceptible to parasites; unknown consequences for populations. Water quality.	Life history. Habitat requirements.	Design specific management actions based on species specific requirements. High priority for conservation.
Steelhead (*Oncorhynchus mykiss)* *ODFW Native Fish Conservation Assessment pending [2005]*	Middle Columbia River ESU, summer run and winter run : BM CP CR EC WV WC Snake River Basin ESU: BM CP CR EC WC WV Lower Columbia River ESU, summer run and winter run: CR EC WC WV Oregon Coast ESU, summer run and winter run : CR KM WC WV	Require streams with clean gravel, complex habitat and cool temperatures for spawning and rearing. Require access for anadromous migration.	Water quality. Alterations of hydrology and watershed function. Fish passage. Riparian condition. Marine survival.	Continue ongoing monitoring of populations and conservation effectiveness.	Maintain or restore aquatic and riparian habitat. Continue ongoing restoration efforts involving landowners, tribes and agency partners (NOAA, NMFS, ODFW, OWEB)

(Fish Cont.)

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
Steelhead *(cont.)*	Southwest Washington ESU, winter run: CR WV				
	Upper Willamette River ESU, winter run: CR WC KM				
	Klamath Mountains Province ESU, summer run and winter run: CR KM WC	Require streams with clean gravel, complex habitat and cool temperatures for spawning and rearing. Require access for anadromous migration. Highly diverse genetics and life history patterns	Water quality. Alterations of hydrology and watershed function. Fish passage. Riparian condition. Marine survival. Resource extraction.	Continue ongoing monitoring of populations and conservation effectiveness. Interactions among populations and sub-populations.	Maintain or restore aquatic and riparian habitat. Continue ongoing restoration efforts involving landowners, tribes and agency partners (NOAA, NMFS, ODFW, OWEB)
Summer Basin tui chub (*Gila bicolor ssp.)*	NBR	Endemic to Summer Lake	Vulnerable to random or localized disturbance. Riparian condition. Water temperature	Genetics. Taxonomy. Distribution in Ana River.	Maintain water quality and availability. Reduce localized impacts where populations could become increasingly fragmented.
Umpqua chub (*Oregonichthys kalawatseti)* *ODFW Native Fish Conservation Assessment pending [2005]*	CR KM WC	Off-channel habitat (low flow, silty organic substrate, abundant vegetation and cover).	Restricted distribution (to Umpqua basin). Passage barriers. Channelization. Wetland drainage. Nonpoint source pollution. Culvert cleaning. Invasive species (predation)	Population dynamics. Abundance estimates and trends.	Reduce pollution. Restore flow. Reduce density of invasives in key habitat. Re-introductions useful at some sites. Limit nonpoint source pollution through TMDL process
Warner sucker (*Catostomus warnerensis*)	NBR	Lakes and low gradient stream reaches of Warner Valley.	Invasive species. Forest and agricultural practices. Road construction. Irrigation structures impede passage. Water withdrawal. Minimum flows.	Genetics. Long term habitat needs for self sustaining populations. Spawning habitat.	Maintain or restore spring waters. Maintain or restore migration corridors among habitats.
Warner Basin tui chub (*Catostomus warnerensis*)	NBR	Endemic to Warner Valley streams and lakes.	Vulnerable to random or localized disturbance. Lack of connectivity of habitat. Riparian condition. Water temperature. Invasive predators (crappie, brown bullhead)	Genetics. Taxonomy.	Maintain water quality and availability. Reduce localized impacts where populations could become increasingly fragmented. Maintain habitat connectivity.
Western brook lamprey (*Lampetra richardsoni*) *ODFW Native Fish Conservation Assessment pending [2005]*	BM CP CR EC KM WC WV	May aggregate in high densities. Requires fine gravel beds for spawning. Larvae burrow in fine sediment. Timing of development closely linked to water temperature	Reduced water quality. Passage barriers. Altered flow patterns. Dredging. Rapid water draw-downs. Marine survival.	Status; population delineation; limiting factor analysis (includes passage); restoration actions; biology; population dynamics (prioritized by Lamprey Workgroup in 2005).	Improve passage. Alter timing of water draw-down. Use species-specific habitat requirements to guide management actions. See results of Lamprey Workgroup 2005 for strategies.

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
Westslope cutthroat trout (*Oncorhychus clarki lewisi*)	BM	Specializes in foraging for invertebrates. Prefers cool, clear streams with coarse sediment.	Land use practices that reduce riparian cover; passage barriers; invasive species that can compete over food resources	Effects of habitat fragmentation	Maintain riparian cover and other factors that can provide thermal cooling. Reduce localized impacts where populations could become increasingly fragmented.
Upper Klamath Lake lamprey *(Lampetra tridentata ssp.)*	EC	Found only in Klamath Lake. May aggregate in high densities. Requires small gravel beds for spawning. Larvae burrow in fine sediment. Timing of development closely linked to water temperature.	Restricted distribution. Altered hydrology and flow regime. Water quality.	Lamprey taxonomy. Life history. Species habitat requirements.	Restore and maintain flow and water quality. Acquire more information with biological surveys.

Lamprey

Lamprey are vital symbols to Native American cultures, challenges to conservation, and fascinating evolutionary relics. Two relatively widespread species of lamprey are found in Oregon – Pacific lamprey and western brook lamprey. Similar to salmon, the Pacific lamprey migrates between rivers and streams (as young) and the ocean (as adults), returning to streams to breed and die. Pacific lamprey larvae spend up to six years buried in silt and sand before they migrate to the ocean. Like salmon, Pacific lamprey link nutrient and organic matter between the oceans and rivers. In both habitats, they provide food for a broad array of wildlife and other fish. Pacific lamprey typically are found in large river systems, such as the Columbia and Klamath, and often parasitize other fish. In contrast, western brook lamprey are not parasitic and do not migrate to the ocean to feed. Western brook lamprey are more common in smaller tributaries or river systems such as the Alsea River, and are very rare in the Columbia River above the Bonneville Dam. Western brook lamprey do not migrate very long distances and tend to have smaller and more isolated populations. They are thought to be very sensitive to pollution and habitat disturbance. Both species belong to an ancient group of fishes, which are specialized scavengers and parasites lacking jaws.

In the early 1990's, tribal fisheries managers, state agencies and other researchers began to notice an apparent decline in numbers of several lamprey populations. In particular, lamprey appear to be declining in the Upper Columbia, Snake River and Umpqua Rivers in Oregon. Lamprey have long been a part of Native American culture, viewed as a source of food and medicine as well as a powerful symbol. However, other fisheries managers have been slower to recognize the conservation needs of lamprey. Currently, state agencies are investing in several large-scale studies of lamprey, and several interested groups have requested that the USFWS consider listing lamprey. Conservation actions that benefit lamprey could therefore have dramatic impact on the future of these unique species.

Conservation Summaries for Strategy Species – Invertebrates (59 species):

Species	Ecoregion(s)	Special needs	Limiting Factors	Data gaps	Conservation actions
American grass bug (*Acetropis Americana)*	WV	Wet prairies, especially dominated by tufted hairgrass	Loss of wet prairie habitat	Undetermined	Maintain or restore wet prairie habitat
Columbia Gorge caddisfly (*Neothremma andersoni)*	WC	Small streams in Columbia Gorge	Narrow distribution (endemic); extremely isolated	Species-specific habitat requirements.	Maintain stream water quality and sediment regimes.
"Constricted" caddisfly (*Farula constricta)*	WC	Small streams in Columbia Gorge	Narrow distribution (endemic); extremely isolated	Species-specific habitat requirements.	Maintain stream water quality and sediment regimes.
Fender's blue (butterfly) (*Icaricia icarioides fenderi)*	WV	Seasonally wet native prairies; requires Kincaid's lupine as a host plant.	Habitat loss, habitat degradation due to invasive plants	Undetermined	Maintain and restore wet prairie habitat and populations of Kincaid's lupine; use caution when implementing gypsy moth control in nearby forests
Haddock's rhyacophilan caddisfly (*Rhyacophila haddocki)*	CR	Cool, clear streams with coarse sediment and little silt	Undetermined	Species-specific habitat requirements.	Maintain stream water quality and sediment regimes.
Hoary elfin (butterfly) (*Incisalia polia maritime)*	CR	Coastal bluffs	Narrow distribution (subspecies is endemic); habitat loss due to development; habitat degradation due to fire suppression; invasive plants	Life history.	Protect known sites of occurrence. Restore coastal bluff grasslands.
Insular blue butterfly (greenish blue) (*Plebeius saepiolus littoralis)*	CR	Wet, open habitats (bogs, meadows, ditches); uses coastal salt-spray meadows; uses clover as a host plant; conifer trees adjacent to meadows serve as windbreaks	Habitat loss due to development; habitat degradation due to fire suppression; invasive plants	Undetermined	Protect known sites of occurrence. Restore meadow habitats.
Johnson's hairstreak (butterfly) (*Mitoura johnsoni)*	KM WC	Mature and old-growth coniferous forest; caterpillar food plant is conifer mistletoe, a parasitic plant that grows on western hemlock and on mountain hemlock in the KM	Habitat loss. Patchy occurrence of caterpillar food plant. Poor dispersal so vulnerable to fragmentation	Population distribution (often overlooked due to occurrence high in tree canopies)	Maintain habitat patches where existing populations occur
Malheur Cave endemics: Malheur Cave amphipod (*Stygobromus hubbsi)* Malheur Cave flatworm (*Kenkia rhynchida)* Malheur isopod (*Amerigoniscus malheurensis)* Malheur pseudoscorpian (*Apochthonius malheuri*) Malheur Cave springtail (*Oncopodura mala)*	NBR	Malheur Cave is a thermal lava tube cave that contains the largest array of cave adapted species in the Pacific Northwest. Contains geothermal lake which regulates climate within the cave (making it warmer than outside surface temperature). Species have adapted to moist, warm environment and also require wood and other materials for substrate. Small mammals and bats bring this material into the cave.	Endemic; vulnerable to random or localized disturbance. Potential disturbance from pesticide drift, water diversion, or visitor disturbance.	Undetermined.	Continue to maintain suitable habitat, especially water quality. Manage recreation to minimize impacts to endemic species.

Species	Ecoregion(s)	Special needs	Limiting Factors	Data gaps	Conservation actions
Mardon skipper (butterfly) (*Polites mardon)*	KM	Meadow habitats; larvae feed on native fescue (grass)	Naturally rare with disjunct populations; loss of grassland habitats; invasive plants	Effects of invasive plant control on populations; distribution	Maintain and restore meadow habitats
Oregon cave amphipod (*Stygobromus oregonensis)*	KM	Aquatic habitat in underground cave	Limited distribution (endemic)	Undetermined	Maintain suitable habitat characteristics at known site; maintain water quality and quantity
Oregon silverspot butterfly (*Speyeria zerene hippolyta)*	CR	Salt-spray meadows; depends on 2 species of violet as host plant (early blue and western blue violets); spruce trees adjacent to meadows serve as shelter and windbreaks	Habitat loss due to development. Recreation. Fire suppression that allows grass to overshadow early blue violets	Management techniques for violet host plants	Continue to implement actions identified in recovery plan. Protect known sites, with long-term management to maintain suitable habitat characteristics and monitoring.
Roth's blind ground beetle (*Pterostichus rothi)*	CR	Cool, moist, closed-canopy conifer forests with deep, well-drained soils; soil-dweller, but requires coarse woody debris for shelter	May be sensitive to changes in canopy cover and microclimate at forest floor	Response to fire and timber harvest, especially in relation to seasonal habitat use	Maintain canopy cover and coarse woody debris at known sites
Scott's apatanian caddisfly (*Allomyia scotti)*	WC	Cold, high-elevation streams (>4,000 ft); larvae found on vertical rock faces in flowing water or on rocks in turbulent water; larvae scrape the upper surfaces of rocks to build cases from small rock fragments	Disturbances that affect flowing water in suitable rocky habitats	Information on distribution and population dynamics	Maintain freshwater habitat with sufficient algae and detritus
Siskiyou short-horned grasshopper (*Chloealtis aspasma)*	KM	Grassland areas near wooded or brushy areas	Localized disturbance. Habitat fragmentation.	Undetermined.	Maintain or restore habitat within known range. Continue to provide connections between populations

Great Arctic (Butterfly)

The number of butterfly species tends to increase as you travel south across North America, and butterflies have the greatest diversity in the tropics. Because they are dependent on sunshine for body warmth and flowers for nectar, butterflies are particularly suited to warm climates. However, Oregon has an interesting variety of butterflies. Oregon's butterflies cope with Oregon's cool winters by overwintering as eggs, larvae or adults (except for the monarch, which migrates to Mexico for the winter). The great arctic is an unusual butterfly because it is adapted to the short growing seasons of high mountains. The great arctic is a large, tawny butterfly with dark eyespots on its forewings. The female great arctic lays her eggs on native grasses. The larvae hatch from the eggs and feed upon the grass blades. Unlike most butterfly larvae, which mature and metamorphose into adults during one summer, the great arctic larvae require two full summers to mature. The larvae overwinter twice before metamorphosing into adults to mate. As a result, the adults only fly every other year. In most areas, adults can be seen during even-numbered years. Maintaining open montane grasslands and wildflower meadows benefits the great arctic and many other butterflies.

Photo © Bruce Newhouse

(Invertebrates Cont.)

Species	Ecoregion(s)	Special needs	Limiting Factors	Data gaps	Conservation actions
Taylor's checkerspot (butterfly) (*Euphydryas editha taylori)*	WV	Low-elevation upland prairies; currently using the non-native narrow-leaved plantain as a host plant.	Habitat loss, habitat degradation due to invasive plants and lack of fire	Historic native host plant	Maintain grassland habitats, increase plant diversity for nectar plants, control key invasive non-native plants
Vernal pool fairy shrimp (*Branchinecta lynchi)*	KM	Ephemeral pools; prefers smaller, cooler pools. Females leave eggs that dry out along with the pool until re-filling ("cysts")	Little genetic variability within populations. Remaining pool habitats increasingly isolated. Draining vernal pools. Modified hydrology. Stormwater run-off containing pesticides, chemical residues and other contaminants	Genetics. Mechanics of cyst dispersal.	Maintain or restore vernal pools to provide habitat. Maintain or restore water quality in vernal pool habitat.
Wahkeena Falls flightless stonefly (*Zapada wahkeena*)	WC	Larva are aquatic; adults use riparian vegetation adjacent to falls	Narrow distribution (endemic to Wahkeena Falls)	Undetermined	Maintain water quality at known location
Terrestrial mollusks:					
Chace sideband (*Monadenia chaceana*)	WC	Shrubby or shaded areas in rocky habitat, talus deposits and associated riparian areas; or associated with woody debris	Habitat disturbance that reduces coarse woody debris, shading or other refuge	Understanding of habitat requirements; population dynamics	Maintain sufficient levels of woody debris or shrub shading
Columbia Gorge hesperian *(Vespericola depressus)*; and Oregon snail (Dalles sideband) *(Monadenia fidelis minor)*	CP	Prefer talus or basalt habitat with minimal vegetation cover. In dry open basalt talus, often associated with seeps and springs; lower elevations	Restricted distribution (endemic to Lower Deschutes and/or Columbia Gorge); habitat loss due to development and road construction; roadside spraying Vulnerable to isolation or fragmentation of populations.	Distribution, specific habitat use	Maintain appropriate habitats; minimize impacts from talus mining at known populations
Dalles mountainsnail (*Oreohelix variabilis variabilis*)	CP	Prefer talus or basalt habitat with minimal vegetation cover.	Restricted distribution (endemic to Lower Deschutes and/or Columbia Gorge); habitat loss due to development and road construction; roadside spraying Vulnerable to isolation or fragmentation of populations.	Distribution, specific habitat use	Maintain appropriate habitats; minimize impacts from talus mining at known populations
Evening fieldslug (*Deroceras hesperium*)	EC	Mature closed-canopy forests (although may use moist second-growth forests); associated with gullies, draws, seeps, and springs; uses wood and rocks for cover	Undetermined	Association with second-growth forests; effects of forest management; limiting factors	Maintain canopy cover, moist microclimates, and woody debris at known sites
Green sideband (*Monadenia fidelis beryllica*)	CR KM	In deciduous trees and brush in wet, relatively undisturbed forests at low elevations	Most have restricted distributions; other limiting factors poorly understood. Disturbance to microhabitats, especially talus and moist microclimates.	Distribution and population ecology. Species-specific habitat requirements and limiting factors	Protect and maintain known sites of occurrence. Investigate species-specific habitat requirements and use these to guide management actions
Montane peaclam (*Pisodium ultramontanum*)	EC	Spring-influenced streams, lakes, or ponds; prefers sand/gravel substrates	Restricted distribution (endemic); sedimentation and nutrient input from land use practices; spring alteration and decreased flow	Undetermined	Maintain and restore appropriate water flow and quality. Prevent or mitigate for water diversions, dredging, or other activities that could increase sediment or nutrient levels.

Species	Ecoregion(s)	Special needs	Limiting Factors	Data gaps	Conservation actions
Oregon shoulderband (*Helminthoglypta hertleini*)	KM WC	Rocky areas including talus deposits. Requires permanent ground cover or moisture, including: talus, rock fissures, or woody debris.	Limited distribution; Disturbance to microhabitats, i.e. talus. Disturbance that reduces coarse woody debris, shading or other refuge.	Understanding of habitat requirements; population dynamics	Maintain sufficient levels of woody debris or shrub shading Maintain suitable habitat conditions at known sites
Pacific walker (*Pomatiopsis californica*)	CR	Semiaquatic; among wet vegetation along water	Restricted distributions. Other limiting factors poorly understood	Habitat requirements and limiting factors	Protect known sites of occurrence. Investigate habitat requirements and use these to guide management actions
Salamander slug (*Gliabates oregonius*)	CR	Mature coniferous forests	Restricted distributions. Other limiting factors poorly understood	Habitat requirements and limiting factors	Protect known sites of occurrence. Investigate habitat requirements and use these to guide management actions
Sister's hesperian (*Hochbergellus hirsutus*)	CR	Undetermined	Restricted distributions. Other limiting factors poorly understood	Habitat requirements and limiting factors	Protect known sites of occurrence. Investigate habitat requirements and use these to guide management actions
Spotted taildropper (*Prophysaon vanattae pardalis*)	CR	Moist, mature forested habitat or forests in the coastal "fog" zone	Restricted distributions. Other limiting factors poorly understood	Habitat requirements and limiting factors	Protect known sites of occurrence. Investigate habitat requirements and use these to guide management actions
Tillamook westernslug (*Hesperarion mariae*)	CR	Sitka spruce forest	Restricted distributions. Other limiting factors poorly understood	Habitat requirements and limiting factors	Protect known sites of occurrence. Investigate habitat requirements and use these to guide management actions
Traveling sideband (*Monadenia fidelis celeuthia*)	KM WC	Dry, open forests at low elevations	Habitat disturbance that reduces coarse woody debris, shading or other refuge. Limited distribution; disturbance to microhabitats, especially talus and moist microclimates	Understanding of habitat requirements; distribution and population dynamics	Maintain sufficient levels of woody debris or shrub shading. Maintain suitable habitat conditions at known sites
Aquatic mollusks:					
Archimedes springsnail (*Pygulopsis archimedis*)	EC	Spring-influenced areas of large lakes	Restricted distribution. Sedimentation and nutrient input from dredging, land use practices, mining and road construction (may smother substrates or reduce egg survival). Habitat loss. Spring alteration and decreased flow. .	Distribution; species-specific habitat requirements	Maintain appropriate water flow and quality. Prevent or mitigate for water diversions, dredging, or other activities that could increase sediment or nutrient levels.
Borax Lake ramshorn (*Planoorbella oregonensis*)	NBR	Found only in Borax Lake	Endemic; vulnerable to random or localized disturbance.	Undetermined	Continue to protect known sites of occurrence.
Bulb juga (*Juga bulbosa)*	BM CP	Cold, highly oxygenated water; found in gravel-boulder riffles	Fragmentation of waterways; habitat loss due to dams; water diversions; increased water temperature; reduced oxygen levels; reduced water quality	Distribution, species-specific requirements	Maintain or restore high water quality.

(Invertebrates Cont.)

Species	Ecoregion(s)	Special needs	Limiting Factors	Data gaps	Conservation actions
Columbia Gorge Oregonian (*Cryptomastix hendersoni)*	CP	Riparian habitats: generally near seeps and springs; may be in leaf litter, under logs, in moist hardwood vegetation or in basalt talus	Restricted distribution (endemic); habitat loss due to urban development and road construction; pesticide overspray; grazing impacts to riparian vegetation	Distribution and life history requirements	Maintain and restore riparian vegetation in the Columbia Gorge and along the lower Deschutes River
Crater Lake tightcoil (*Pristiloma arcticum crateris*)	EC	Continuously wet habitat among debris, moss or vegetation	Restricted distribution. Sedimentation and nutrient input from dredging, land use practices, mining and road construction (may smother substrates or reduce egg survival). Habitat loss. Spring alteration and decreased flow. .	Distribution; species-specific habitat requirements	Maintain appropriate water flow and quality. Prevent or mitigate for water diversions, dredging, or other activities that could increase sediment or nutrient levels.
Crooked Creek springsnail (*Pyrgulopsis intermedia*)	NBR	Large, low elevation cold springs and spring-influenced creeks; generally with gravel-boulder substrate	Narrow distribution (endemic). Sensitive to changes in water quality. Water diversions from springs. Impacts from unmanaged livestock grazing.	Undetermined.	Protect known sites of occurrence. Maintain appropriate water flow and quality.
Dall's ramshorn (*Vorticifex effusus dalli)*	EC	Spring-influenced areas of large lakes; now limited to Upper Klamath Lake	Restricted distribution. Sedimentation and nutrient input from dredging, land use practices, mining and road construction (may smother substrates or reduce egg survival). Habitat loss. Spring alteration and decreased flow. .	Distribution; species-specific habitat requirements	Maintain appropriate water flow and quality. Prevent or mitigate for water diversions, dredging, or other activities that could increase sediment or nutrient levels.
Great Basin ramshorn (*Helisoma newberryi newberryi*)	EC	Spring-influenced areas in large lakes and rivers	Restricted distribution. Sedimentation and nutrient input from dredging, land use practices, mining and road construction (may smother substrates or reduce egg survival). Habitat loss. Spring alteration and decreased flow. .	Distribution; species-specific habitat requirements	Maintain appropriate water flow and quality. Prevent or mitigate for water diversions, dredging, or other activities that could increase sediment or nutrient levels.
Harney Lake springsnail (*Pyrgulopsis hendersoni*)	NBR	Small to large mildly thermal springs and spring pools that have moderate flow and are generally shallow.	Narrow distribution (endemic). Sensitive to changes in water quality. Water diversions from springs. Impacts from unmanaged livestock grazing.	Taxonomic status.	Protect known sites of occurrence. Maintain appropriate water flow and quality. Note: U.S. Fish and Wildlife Service is reviewing species status.
Highcap lanx (*Lanx alta*)	EC	Spring-influenced areas in larger rivers and tributaries	Restricted distribution. Sedimentation and nutrient input from dredging, land use practices, mining and road construction (may smother substrates or reduce egg survival). Habitat loss. Spring alteration and decreased flow.	Distribution; species-specific habitat requirements	Maintain appropriate water flow and quality. Prevent or mitigate for water diversions, dredging, or other activities that could increase sediment or nutrient levels.

Species	Ecoregion(s)	Special needs	Limiting Factors	Data gaps	Conservation actions
Klamath ramshorn (*Vorticifex klamathensis klamathensis)*	EC	Spring-influenced streams; now limited to Upper Klamath area	Restricted distribution. Sedimentation and nutrient input from dredging, land use practices, mining and road construction (may smother substrates or reduce egg survival). Habitat loss. Spring alteration and decreased flow.	Distribution; species-specific habitat requirements	Maintain appropriate water flow and quality. Prevent or mitigate for water diversions, dredging, or other activities that could increase sediment or nutrient levels.
Lined ramshorn (*Vorticifex effusus diagonalis*)	EC	Spring-fed lakes and large creeks	Restricted distribution. Sedimentation and nutrient input from dredging, land use practices, mining and road construction (may smother substrates or reduce egg survival). Habitat loss. Spring alteration and decreased flow.	Distribution; species-specific habitat requirements	Maintain appropriate water flow and quality. Prevent or mitigate for water diversions, dredging, or other activities that could increase sediment or nutrient levels.
Newcomb's littorine snail (Newcomb's Periwinkle) (*Algamorda newcombiana)*	CR	Intertidal areas in glasswort beds; needs cold, clear, well-oxygenated water on a mixed sand or sand/gravel bottom; at or just above mean high tide line	Habitat loss	Effects from invasive European green crabs	Maintain intertidal habitats; continue to eradicate and monitor for invasive Spartina species, which displace glasswort
Purple-lipped juga (Dechutes Juga) (*Juga hemphilli hemphilli*)	BM CP	Cold, highly oxygenated water; found in gravel-boulder riffles	Fragmentation of waterways; habitat loss due to dams; water diversions; increased water temperature; reduced oxygen levels; reduced water quality	Distribution, species-specific requirements	Maintain or restore high water quality.
Robust walker (*Pomatiopsis binneyi*)	CR	Perennial seeps and rivulets	Undetermined	Species-specific habitat requirements.	Protect known sites of occurrence. and use these to guide management actions
Rotund lanx (*Lanx subrotunda*)	KM	Large rivers (Umpqua) and major tributaries, generally in swift current on rocky substrate	Modifications to hydrology that disturb flow regimes. Water quality	Undetermined	Maintain or restore watershed function and flow dynamics
Scale lanx (*Lanx klamathensis*)	EC	Large spring-fed lakes and rivers	Restricted distribution. Sedimentation and nutrient input from dredging, land use practices, mining and road construction (may smother substrates or reduce egg survival). Habitat loss. Spring alteration and decreased flow.	Distribution; species-specific habitat requirements	Maintain appropriate water flow and quality. Prevent or mitigate for water diversions, dredging, or other activities that could increase sediment or nutrient levels.
Scalloped juga (*Juga acutifilosa)*	EC	Large springs and rivers	Restricted distribution. Sedimentation and nutrient input from dredging, land use practices, mining and road construction (may smother substrates or reduce egg survival). Habitat loss. Spring alteration and decreased flow.	Distribution; species-specific habitat requirements	Maintain appropriate water flow and quality. Prevent or mitigate for water diversions, dredging, or other activities that could increase sediment or nutrient levels.
Shortface lanx (*Fisherola nuttalli*)	CP	Unpolluted swift-flowing, highly oxygenated cold water in small to large rivers; on stable boulder-gravel substrates; currently occurs	Habitat loss due to dams on Columbia river; sedimentation; agricultural and industrial runoff that affects water quality	Distribution and life history requirements	Maintain or restore high water quality

(Invertebrates Cont.)

Species	Ecoregion(s)	Special needs	Limiting Factors	Data gaps	Conservation actions
		in Lower Deschutes River (possibly Columbia River)			
Sinitsin ramshorn (*Vorticifex klamathensis sinitsini*)	EC	Large, cold springs	Restricted distribution. Sedimentation and nutrient input from dredging, land use practices, mining and road construction (may smother substrates or reduce egg survival). Habitat loss. Spring alteration and decreased flow.	Distribution; species-specific habitat requirements	Maintain appropriate water flow and quality. Prevent or mitigate for water diversions, dredging, or other activities that could increase sediment or nutrient levels.
Siskiyou hesperian *(Vespericola sierranus)*	EC KM	Spring seeps; under leaf litter on ground	Restricted distribution. Sedimentation and nutrient input from dredging, land use practices, mining and road construction (may smother substrates or reduce egg survival). Habitat loss. Spring alteration and decreased flow.	Distribution; species-specific habitat requirements	Maintain appropriate water flow and quality. Prevent or mitigate for water diversions, dredging, or other activities that could increase sediment or nutrient levels.
Turban pebblesnail (*Fluminicola turbiniformis)*	EC	Cold nutrient-poor springs	Restricted distribution. Sedimentation and nutrient input from dredging, land use practices, mining and road construction (may smother substrates or reduce egg survival). Habitat loss. Spring alteration and decreased flow.	Distribution; species-specific habitat requirements	Maintain appropriate water flow and quality. Prevent or mitigate for water diversions, dredging, or other activities that could increase sediment or nutrient levels.
Willamette floater (freshwater mussel) (*Anodonta wahlametensis)*	WV	Lakes; slow-moving rivers, streams, and sloughs. Requires specific native fish that act as obligate hosts for parts of the mussel life cycle.	Reduced water flow; passage barriers; sedimentation; contaminants; habitat loss due to dams; non-native species (*e.g.,* introduced Asian clam competes with floaters; introduced fish can outcompete native fish species required by floaters to complete life cycle)	Current distribution	Retain natural flow regimes; reduce sedimentation and contamination. Monitor and conserve native fishes.

Fender's Blue (Butterfly) and Kincaid's Lupine

The story of the Fender's blue (butterfly) and Kincaid's lupine demonstrates how species can be dependent on each other. Like falling dominoes, when once species declines, other closely-associated species may decline along with it. Fender's blue is a small butterfly with shimmering sapphire wings. It occurs only in Oregon and is dependent on the Kincaid's lupine as a host plant. In the spring, female blues lay eggs on the lupine. The caterpillars hatch, feed on the lupine, go dormant for the fall and winter, then feed again on the lupine in the spring before pupating into adults.

Kincaid's lupine has small purple pea-like flowers and silvery leaves. It is limited to the Pacific Northwest and has become rare due to habitat loss and current threats from invasive plants. As the lupine became rare, so did the Fender's blue, and both species were listed under the federal Endangered Species Act in 2000. Since then, cooperative efforts by U. S. Fish and Wildlife Service wildlife refuges, Bureau of Land Management, the City of Eugene, The Nature Conservancy, and a few private landowners have improved and restored grassland habitat, and the future of both species looks more hopeful.

Conservation Summaries for Strategy Species – Plants (60 Species):

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
Applegate's milk-vetch (*Astragalus applegatei*)	EC	Flat, open, seasonally moist floodplain alkaline grasslands. Historically, habitat included sparse, native bunch grasses and patches of bare soil.	Narrow distribution (endemic to Klamath Basin in Oregon). Currently, 3 populations and low numbers make this species vulnerable to random events. Habitat loss due to agriculture and urban development. Alteration of hydrology. Invasive plants. Low reproduction.	Population dynamics and minimum population size for long-term viability. Genetic studies. Affects of burning and other management techniques. Soil ecology. Extent and impacts of herbivory.	Continue to implement actions identified in Recovery Plan, including managing and monitoring known sites. Evaluate establishing new populations in suitable habitat.
Arrow-leaf thelypody (*Thelypodium eucosmum*)	BM	Occurs with western juniper at streambanks, seasonally moist areas, seeps, and under isolated western juniper trees away from obvious moisture	Endemic species (near tributaries of John Day River). Palatable to cattle and sensitive to grazing pressure	Additional inventories to determine population size and distribution. Study soil moisture relationships. Germination and propagation requirements.	Minimize grazing at priority sites. Collect and store seeds.
Big-flowered wooly meadowfoam (*Limnanthes floccosa* ssp. *grandiflora*)	KM	Edges of vernal pools at elevations of about 1230 – 1300 ft, in Agate desert region. Soils are shallow, Agate-Winlow, and vegetation is sparse, with few tries. Overall topography of area is mound-swale, with underlying impervious layer that traps winter rains.	Destruction of vernal pool habitat, industrial and residential development, agricultural conversion, grazing and competition with invasive plants	Seed germination protocol, pollination studies, cultivation protocol, transplanting/introduction protocol	Continued population monitoring. Maintain current populations and restore vernal pool habitat at priority sites, including Denman Wildlife Management Area
Boggs Lake hedge-hyssop (*Gratiola heterosepala*)	NBR	Semi-aquatic habitats, in mud or damp soil at the edge of lakes, at around 5575 ft altitude, surrounded by sagebrush flats	Potentially disturbed by grazing	Study impacts of cattle grazing. Determine propagation and reintroduction protocol.	· Only known Oregon population on BLM habitat · Monitor existing populations · Survey for suitable habitat for the establishment of new populations
Bradshaw's desert parsley (*Lomatium bradshawii*)	WV	Wet prairies, near banks of creeks or small rivers, with shallow, poorly drained clay soils	Habitat loss, degradation due to lack of fire and competition from invasive plants, overspray of herbicides	Reproductive biology studies, seed bank formation studies, may benefit from light grazing which reduces competition from other plants – determine grazing regimes that maintain populations	Continue implementing actions in Recovery Plan. Maintain or restore grass-dominated habitats; maintain or restore hydrology; control key invasive plants; use mowing or prescribed fire to control brush and trees; maintain populations in roadsides and ditches
Cascade Head catchfly (*Silene douglasii* var. *oraria*)	CR	Grassy meadow and rocky outcrops adjacent to Pacific Ocean	Very restricted distribution, few populations, and small population size. Habitat loss and fragmentation due to development. Invasive plants. Recreational use of sites. Herbivory.	Methods to reduce leaf litter accumulations. Propagation and reintroduction methods.	Manage recreation at known sites to prevent trampling. Maintain open habitats by removing encroaching shrubs.

(Plants Cont.)

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
Cook's desert parsley (*Lomatium cookii)*	KM	Jackson Co: vernal pools in Agate Desert which range from 3-100 ft across and are no more than 12 in deep. Josephine Co: seasonally wet grassy meadows on alluvial floodplains in the Illinois Valley, with underlying soil forming clay pan.	Habitat loss and degradation, conversion to agriculture, livestock grazing, residential development, road and powerline right-of-way maintenance such as herbicide spraying, off-road vehicle use, invasive plants, mining, fire suppression resulting in shrub encroachment	Seed production, breeding system studies, cultivation protocol, transplanting/ introduction protocol	Maintain current populations and restore vernal pool habitat at priority sites, including Denman Wildlife Management Area. Manage road construction and maintenance projects to avoid impacts to hydrology in and around known populations.
Coast Range fawn-lily (*Erythronium elegans*)	CR	Open meadows, brushland, rocky cliffs, open to closed coniferous forests, edges of sphagnum bogs.	Restricted distribution (endemic to Oregon's Coast Range); only 5 known populations. Plant collection. Herbivory. Fungal infection (Douglas fir blight). Impacts to habitat from logging.	Distribution and microhabitat requirements. Historic distribution (e.g., have populations declined or always been rare?). Population genetics.	Continue efforts to protect known sites and monitor populations. Collect and store seeds. Consider re-introductions.
Crinite mariposa-lily *(Calachortus coxii)*	KM	In meadow, leaf litter and moss habitats between 1375 -3000 foot elevation. Serpentine soils in transition zones between coniferous forests and grass-shrub meadows.	Bulb collection and flower picking, grazing, seed predation, fire suppression	Propagation and transplantation protocol, reproductive biology studies to determine causes of low fecundity, research soil/microsite mechanism causing endemism to serpentine soils	Survey for potential habitat for the establishment of new populations, long-term monitoring of known populations, manage grazing and recreational activity in sensitive areas
Cronquist's stickseed (*Hackelia cronquistii*)	NBR	Sandy sagebrush slopes, sometimes on moist slopes of ravines, elevations between 2060-2460 ft	Limited distribution; grazing, herbicide and insecticide use; agricultural development; invasive plant and crop seeding competition; unregulated off-road vehicle and equestrian use.	Study of impacts of light grazing, which may open up sagebrush and create suitable habitat or may be damaging. Propagation and transplant protocols. Survey for additional populations.	Continue to implement Habitat Management Plan on public (BLM) land (manage recreational access, herbicide use, grazing, and insecticide use during flowering periods to maintain populations).
Crosby's buckwheat (*Eriogonum crosbyae*)	NBR	Rolling hills dominated by big sagebrush, on light colored tuffaceous, sedimentary sandstone, elevation 5450-5540 ft.	Cattle grazing, range improvement projects, off-road vehicle traffic, mining	Propagation and transplanting protocol, reproductive biology including pollinator studies, genetic analysis	Limit rangeland projects within its habitat, prevent off-road vehicle traffic, conduct long-term monitoring to detect seed production trends, collect and store seeds
Cusick's lupine (*Lupinus cusickii*)	BM	Loose, rocky soils, barren ash deposits	Narrow distribution (Baker Co. and Idaho); vulnerable to uncontrolled off-highway vehicle use and livestock grazing	Factors affecting plant reproduction and population density	Survey likely habitat for additional populations. Manage grazing and off-highway vehicle use at known sites.
Dalles Mountain buttercup (*Ranunculus reconditus*)	EC	Steep, rocky terrain, ridgetops in grasslands or woodland openings.	Narrow distribution (limited to Columbia River Gorge). Small number of remaining populations (only one known in Oregon).	Pollination biology, seed germination and ecology, and seedling establishment. Effects from invasive plants.	Continue to monitor existing population and conduct surveys to determine if other populations exist.
Davis' peppergrass (*Lepidium davisii*)	NBR	Hard, white clayey playas, poorly drained and often inundated with standing water. Elevation from 3100-5575 ft.	Offroad vehicles and trampling due use of habitat as watering sites for feral and domestic livestalk.	Reproductive biology, life history information, analysis of differences between isolated populations (observed morphological differences), Propagation and transplanting protocol	Fence populations on public land to reduce impacts from off-road vehicles and grazing.

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
Dwarf meadowfoam (*Limnanthes floccosa* ssp. *pumila*)	KM	Ancient basalt laval flows on Upper and Lower Table Rocks in Jackson County, above 1950 ft. Grows along edges of deep vernal pools.	Limited habitat, trail construction and maintenance	Seed germination protocol, pollination studies, cultivation protocol, transplanting/ introduction protocol	Minimize impacts from trail construction and maintenance. Continue population monitoring. Note: plant occurs only on federal land
Gentner's fritillaria (*Fritillaria gentneri*)	KM	Variable: woodlands dominated by Oregon white oak, moist riparian areas, Douglas-fir forests, serpentine sites. Most likely to be found in ecotones between forested sites and more open habitat, in open canopied forest, in permanent openings in the forest, and in large riparian zones with canopy gaps or deciduous tree canopies.	Loss of habitat and habitat degradation due to invasive plant infestations, road construction, agricultural disturbances, urban development, grazing, off-road vehicle use, trail maintenance	· Seed germination studies · Complete chromosome counts to clarify mechanism causing observed sterility · Complete pollen viability tests · Cross pollination studies between *F. recurva* and *F. affinis* (putative parents of *F. gentneri*) · Pollinator visitation studies · Molecular studies of population structure	· Minimize impacts from road maintenance and construction on existing roadside populations · Continue monitoring existing populations
Golden buckwheat (*Eriogonum chrysops*)	NBR	Exposed, rocky ridges at mid elevations	Narrow distribution (endemic to a small area in Malheur County); small population size, quarry mining.	Population status; factors limiting population distribution and size; population surveys	Monitor existing populations
Golden paintbrush (*Castilleja levisecta*)	WV	Low elevations open prairies with moist winter soil (but no standing water); often on gravelly glacial outwash or outcrops of clayey glacio-lacustrine sediment	Habitat loss due to urbanization, commercial and agricultural development; encroachment of native species as result of fire suppression; non-native invasive weed competition; trampling by recreationists; herbivory (deer, rabbits)	Breeding system and pollination studies, response to fire, long-term demographic monitoring, development of propagation and reintroduction protocol	Survey potential habitat for populations, continue experimental reintroduction. Note: thought to be extirpated from Oregon.
Greenman's desert parsley (*Lomatium greenmanii*)	BM	Subalpine grasslands on rocky sedmentary/ basalt soils	Naturally rare – localized endemic with four known occurrences on three mountain peaks in the Wallowa Mountains; one site is near a nature trail that is accessible by aerial tram so is vulnerable to unintentional trampling	Reproductive and pollination biology studies; determine seed germination, propagation and transplantation protocols; study impacts of grazing and other potential disturbances.	Construction of pathways has reduced impacts: continue to manage recreational use to minimize trampling.
Grimy ivesia (*Ivesia rhypara* var. *rhypara*)	NBR	Ash deposits, on widely scattered outcrops of welded ash tuff, roots in shallow weathered surface soil and cracks in underlying bedrock	Mining (grows on potential gold-bearing deposits), off-road vehicles, grazing	Size of 4 Oregon populations, effects of low precipitation on reproduction and survival, transplantation protocol	Survey for suitable habitat for establishment of new populations, limit insecticide spraying while plants are in bloom, monitor populations to assess population trends, fence populations on public land to prevent cattle trampling

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
Howell's mariposa-lily (*Calachortus howellii*)	KM	Serpentine outcrops at lower to middle elevations, often on brush covered slopes or in scattered woods	Mining, horticultural collecting, grazing	Develop propagation and transplanting protocol, research soil/microsite mechanism causing endemism to serpentine soils	Manage grazing in areas known to contain populations of this species, minimize impacts from mining
Howell's microseris (*Microseris howellii*)	KM	Slopes or flat ground with varying exposures, in rocky serpentine soils at about 1150 - 3500 ft.	Grazing, prospecting and nickel strip mining, excavation at gravel quarry	Reproductive biology, pollination studies, genetic analysis, propagation and transplanting protocol	Minimize impacts from mining
Howell's thelypody (*Thelypodium howellii* ssp. *spectabilis*)	BM	low elevation (3,000 to 3,300 ft) river valleys and moist (often alkaline) plains; occurs at edge between black greasewood and riparian habitats; may be dependent on seasonal flooding	Narrow distribution (endemic species to Baker-Powder drainage). Competition from invasive plants; habitat loss and fragmentation due to habitat conversion; changes in hydrology; sensitive to grazing pressure; mowing during growing season	Well inventoried, but taxonomic relationships need to be clarified. Seed germination and propagation protocol. Seed generation methods. Life history, growth requirements, and general ecology.	Continue voluntary cooperative efforts with private landowners. Minimize grazing and mowing during growing season at priority sites. Control key invasive plants. Collect and store seeds.
Howellia (*Howellia aquatilis*)	WV	Low elevation shaded riparian vernal pools	Habitat loss due to agricultural and urban development, changes in wetland hydrology, invasive plants (reed canary grass, purple loosestrife), aquatic vegetation succession	Determine propagation and transplant protocol, long-term population demographic studies, seed viability and distribution mechanism studies, seed bank studies, methods for storing viable seeds	Maintain or restore seasonal wetland habitats, control invasive plants at priority sites, survey for additional populations. Recovery plan identifies additional conservation actions.
Kincaid's lupine (*Lupinus sulphureus* ssp. *kincaidii*)	KM WV	Seasonally wet native prairies	Habitat loss due to urbanization and agriculture; invasive plants; elimination of disturbance regimes (flooding, fire) which maintain prairies; inbreeding depression due to small populations; road construction and maintenance affects remnant habitats	Hybridization issues need clarification	Restore prairie habitat using site-appropriate tools (e.g., burning, mechanical removal of encroaching vegetation). Long-term demographic monitoring. Survey for new populations. Limit impacts from road construction/ maintenance activities at known sites.
Large-flowered rushlily (*Hastingia bracteosa*)	KM	Bogs, moist open meadows, seeps and wetlands often overlying serpentine or peridotite rock formations. Open areas generally below 780 ft, often with gentle slope.	Severely affected by cattle grazing. Also impacts from mining, water diversion from bogs, off-road vehicle use, land development	Germination studies, propagation and transplantation protocol	Maintain California pitcher-plant bogs, which provide habitat for many rare species. Minimize water withdrawals from bog sites. Carefully manage or eliminate grazing at known population sites, collect/store seeds (including seeds from both white and purple flowers)
Lawrence milk-vetch (*Astragalus collinus* var. *laurentii*)	CP	Deep loess soils in Palouse grasslands	Habitat loss (agriculture conversion); narrow distribution (endemic to western Umatilla and Morrow counties); grazing; herbicide use; road construction; invasive plants (primarily	Reproductive biology studies, pollinator studies, development of seed germination, propagation and transplant protocols	Work cooperatively with landowners to maintain priority sites; control invasive plants

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
			knapweeds)		
MacFarlane's four-o'clock (*Mirabilis macfarlanei*)	BM	Warm, dry, open canyon slopes. Soils are sandy or rocky and are often unstable.	Narrow distribution (Hell's Canyon and northwestern Idaho). Potential inbreeding depression. Primary limiting factor is invasive plants, but other impacts occur from off-highway vehicle use, construction and maintenance of roads and trails, mining, and herbicide drift. Historically, uncontrolled livestock grazing degraded habitats but is no longer a limiting factor for this species.	Development of seed germination, propagation and transplant protocols; pollination studies, investigate extent of seed bank. Determine if inbreeding depression is a limiting factor.	Actions implemented through the Recovery Plan (1985) contributed to improved species status and downlisting from Endangered to Threatened in 1996. Continue implementing actions specified in Recovery Plan and continued monitoring at permanent plots
Malheur Valley fiddleneck (*Amsinckia carinata*)	NBR	Yellowish talus slopes and gravel accumulations at elevations of about 980 ft.	Mining, grazing and range improvements, agricultural development, hybridization and competition with *A. tessellata*	Analyze the genetic variability within and among populations, study the extent of hybridization	Only found on federal property. Continue to manage existing populations.
Malheur wire-lettuce (*Stephanomeria malheurensis*)	NBR	Eastern Oregon sagebrush steppe, tops of broad hills zabove surrounding flats, volcanic tuff layered with thin crusts of limestone	Competition from invasive plants, including cheatgrass. Small population size puts species at risk of extirpation due to random events. Herbivory. Soil compaction by researchers.	Soil seed bank survivorship studies to determine length of time seeds remain viable (in soil and in storage)	Only known site on BLM protected land. Survey for suitable habitat for reintroduction efforts. Establish additional populations. Continue to minimize mining activity near populations. Continue banking seeds for future needs.
Mulford's milk-vetch (*Astragalus mulfordiae*)	NBR	Shrub-steppe and desert shrub communities in semi-arid cold-desert region of southeastern Oregon. On moderately steep to steep southeast, south and southwest facing slopes consisting of old river deposits, sandy areas near rivers, sandy bluffs, and dune-like talus. Elevation 2100-3200 ft	Habitat degradation, urban development, livestock grazing and trampling, fires leading to invasion of cheatgrass, off-road vehicle use, invasive weeds, herbicide drift from invasive weed control, loss of pollinators due to insecticide spraying, road development and maintenance, population fragmentation and isolation leading to inbreeding depression, mining	Pollination mechanism, genetic studies of different populations (which respond differently to disturbance), grazing impact studies, propagation and reintroduction protocols	Monitoring of populations, Collect and store seeds from across range. Survey for suitable protected habitat. Establish new populations
Nelson's checker-mallow (*Sidalcea nelsoniana*)	CR WV	Wet and dry prairies, wetlands, edges of woodlands, riparian areas and remnant populations occur in roadsides and ditches	Habitat loss due to conversion, habitat degradation due to lack of fire and competition from invasive plants, overspray of herbicides. Seed predation by weevils.	Additional research on ecology of seed-predating weevils. Seed germination studies. Genetic diversity	Maintain or restore grass-dominated habitats; maintain or restore hydrology; control key invasive plants; use mowing or prescribed fire to control brush and trees; maintain populations in roadsides and ditches

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
Northern wormwood (*Artemisia campestris* var. *wormskjoldii*)	CP WC	Historically known from banks of Columbia River; found with shrub-steppe vegetation, on basalt, compacted cobble and sandy substrates	Habitat destruction due to highway construction, dam-related and other development, and floods.	Reproductive biology studies; pollinator studies; demographic studies; development of seed germination, propagation and transplantation protocols	Survey likely habitat for populations, reintroduce populations to suitable habitat
Oregon semaphore grass (*Pleuropogon oregonus*)	BM EC	Moist meadows and marshland, often comprised of gravelly silt loam or clay soil inundated by slow-moving water; around 2450-3950 ft elevation	Naturally rare with disjunct populations; palatable to cows and vulnerable to grazing due to shallow roots; loss of habitat due to drainage for agricultural use; naturally low reproductive capability.	May benefit from light grazing regimes that reduce thatch: develop grazing regimes that are compatible with maintaining populations. Develop transplanting protocol.	Manage grazing at known populations. Collect and store seed. Currently being introduced into suitable habitat on public land.
Owyhee clover (*Trifolium owyheense*)	NBR	Endemic to Owyhee Uplands, barren slopes or mounds composed of talus and loose soils derived from tuffaceaus/ashy parent material	Invasive weeds, ground disturbance by livestock, potential habitat loss from development of mining claims, spraying and seeding associated with rangeland improvements, road construction, off-road vehicle traffic	Germination and cultivation protocols (investigation of required soil symbionts), seed collection focusing on capturing potential genetic diversity, transplantation protocol	Mitigate range projects which are potentially damaging to the species, minimize ash and gravel excavation in sensitive areas, manage recreational activity in sensitive areas
Packard's mentzelia (*Mentzelia packardiae*)	NBR	Volcanic ash high in potassium, grows on loose slopes at altitudes of about 2950-5250 ft.	Mining, recreational activity disturbance, off-road vehicle use, road construction utilizing ash substrate.	Common garden studies/genetic investigation of between population variation, size/longevity of seed bank, collect/store seeds at Berry Botanic Garden, propagation and transplantation protocol	Minimize road construction into side canyons and mining activity near populations. Minimize pesticide spraying along local roadways before and during blooming period (threat to pollinators). Monitor populations annually.
Peacock larkspur (*Delphinium pavonaceum*)	WV	Slightly higher and drier microhabitats within wet prairies, shady edges of Oregon ash and Oregon oak woodlands	Narrow distribution (endemic to Willamette Valley), habitat loss, degradation due to lack of fire and competition from invasive plants, overspray of herbicides	Reproductive biology studies, pollinator studies, hybridization studies, germination requirements, propagation and transplanting protocols	Maintain or restore grass-dominated habitats; maintain or restore hydrology; control key invasive plants; use mowing or prescribed fire to control brush and trees; maintain populations in roadsides and ditches; collect and store seeds
Peck's milk-vetch (*Astragalus peckii*)	BM EC	Prefers open habitat, although associated with pine, juniper or bitterbrush communities; sandy soils; 3,000-5000 ft elevation	Limited to Deschutes and Klamath County; small number of populations; illegal off-road vehicle use	Pollinator biology studies, plant response to disturbances.	Determine and protect known sites of occurrence.
Pink sand-verbena (*Abronia umbellata* ssp. *breviflora*)	CR	Open, sandy habitats (dunes and beaches); ephemeral sites created by storms.	Narrow habitat requirements. Habitat loss due to European beachgrass invasion. Impacts to habitat and populations from off-highway vehicles. Winter storms destroy populations, but also create new habitat and disperse seeds.	Methods to recruit new plants to populations in the wild.	Continue efforts to control European beachgrass and manage off-highway vehicle use at known sites. Continue to monitor populations.

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
Pumice grape-fern (*Botrychium pumicola*)	EC	Open, flat, high elevation ridgetops to gently rolling slopes with rocky or coarse pumice soils. Clumpy distribution. Associated with alpine scree or lodgepole pine or antelope bitterbrush frost-pockets. Emerges in years when conditions are sufficiently moist.	Small size makes vulnerable to trampling. Affected by fire suppression (closing canopies); timber harvest that compacts soil. Facilities, roads, or trails can eliminate habitat	Identify protected populations (work in progress by interdisciplinary scientific team). Does Newberry pumice plume represent a special habitat? Note uncertainty of annual surveys because of unpredictable emergence patterns.	Avoid disturbing ground at known sites unless activities specifically designed to maintain or enhance populations
Red Mountain rockcress (*Arabis macdonaldiana)*	KM	Serpentine, fairly barren habitat, usually on steep unstable slopes or dry open woods below 4900 ft. Sites usually recently disturbed.	Slope erosion, road maintenance, logging, succession, nickel mining, over-collection, off-road vehicle use	Determine propagation and transplanting protocols, determine environmental variables associated with plant presence	Survey for new populations, collect and bank seeds from Oregon populations, minimize disturbance at priority sites during growing season
Red-fruited desert parsley (*Lomatium erythrocarpum*)	BM	Endemic to high elevation, open habitats in the Elkhorn Mountains. Found on steep south- and east-facing slopes in gravelly soils. Occurs primarily on one soil type (Elkhorn argillite) but occasionally on limestone soils	Naturally rare with extremely limited geographic distribution.	Highly variable population trends: need to determine population demographics, factors influencing populations, and if observed variation in population density is an artifact of census methodology. Determine seed viability, longevity, and germination rates. Determine if a recreational trail and/or grazing by wildlife affects populations.	Continue monitoring populations to determine population trends and their causes; conduct surveys to determine if additional populations exist.

Iron Mountain-Cone Peak Wildflowers

Oregon's Cascade Mountains are famous for their spectacular wildflower displays. Each summer, thousands of people visit the Cascades to view, photograph and enjoy wildflowers. The Iron Mountain-Cone Peak area, east of Sweet Home and near the Santiam Highway, is the crown jewel of Oregon's wildflower areas. Several trails maintained by the U.S. Forest Service allow visitors to explore many of Cone Peak's 20 meadows and admire the sweeping 360° view from the fire lookout on Iron Mountain. The wildflower diversity is remarkably high due to a diversity of habitats, including grassy meadows, rock faces, outcroppings, scree, snowfields, forests, and streamsides. Beginning with trilliums and bleeding hearts in late June and ending with goldenrod and asters in August, the kaleidoscope of color changes throughout the summer. Butterfly watching, a relatively new and quickly growing hobby, is also popular here because the wildflowers are host to a wide variety of butterflies and other insects. Along with birding trails, wildflower viewing and butterfly watching offer opportunities for promoting tourism in rural communities.

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(Plants Cont.)

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
Rough allocarya (Rough popcorn flower or hairy popcorn flower) *(Plagiobothrys hirtus)*	KM	Unshaded seasonally wet pools (vernal pools)	Habitat loss due to conversion of wetlands to agricultural fields and urban development, fire suppression, invasive plants, livestock grazing	Extent of distribution, potential for hybridization with other species in the same genus	· Avoid herbicide spraying on roadside populations · work cooperatively with private landowners to maintain populations on private land · acquire land with quality habitat for population creation projects · continue monitoring existing populations · carefully manage grazing and fence priority populations, if necessary
Saltmarsh bird's-beak (*Cordylanthus maritimus* ssp. *palustris*)	CR	Salt marsh, particularly at edges of salt pan with occasional tidal inundation	Impacts to habitat and populations from off-highway vehicles. Habitat loss due to draining and filling, land use conversion.	Study affects of pollution. Methods for germination, propagation, and reintroduction. Monitor to determine population trends.	Manage off-highway vehicle use at known populations.
Sexton Mountain mariposa-lily (*Calochortus indecorus*)	KM	Serpentine soils	Over-collection, grazing, agricultural development	Surveys to document whether or not extirpated, taxonomic review of species	If populations are located, determine conservation actions needed to maintain them
Shiny-fruited allocarya (Shiny-fruited popcorn flower) (*Plagiobothrys lamprocarpus*)	KM	"moist places along roads", specific habitat needs unknown	Agricultural and urban development	Surveys to document whether or not extirpated, taxonomic review of species	If populations are located, determine conservation actions needed to maintain them
Silvery phacelia (*Phacelia argentea*)	CR	Unstabilized or semi-stabilized sand dunes, bluffs, and bases of coastal headlands; above the high tide level but below 65 ft in elevation	Habitat loss due to European beachgrass invasion and urban development. Impacts from off-highway vehicle use.	Life history and biology. Propagation and reintroduction protocols	Continue efforts to control European beachgrass and manage off-highway vehicle use at known sites. Continue to monitor populations.
Smooth mentzelia (*Mentzelia mollis)*	NBR	Dry, open, green or grey montmorillonite-derived soil from the Succor Creek formation, with abnormally high potassium content (popcorn clay). Elevation about 4590 ft.	Roadwork, off-road vehicles, grazing, range improvement practices, trampling by hikers, climatic fluctuations, absence of pollinators, mining, range fires	Reproductive biology, propagation and transplanting protocol, analyze genetic variation within and among populations, morphological comparison of northern and southern populations	Ban significant ground disturbing activities, fence populations on public land to reduce impacts grazing, photo-monitoring of trampling caused by researchers, experimentation with revegetation in disturbed sites.
Snake River goldenweed (*Pyrrocoma radiata*)	BM NBR	Arid shrub-steppe rangeland, loam soils on steep rocky hillsides	Livestock grazing	Propagation and transplanting protocol	Minimize grazing at priority sites
South Fork John Day milk-vetch (*Astragalus diaphanus* var. *diurnus*)	BM	Occurs on barren ash in stream bottom habitats in the South Fork of the John Day River.	Habitat loss; road construction.	None – the restricted distribution is well-understood	Voluntary conservation projects with private landowners, since most sites are privately-owned and habitats have low economic value
Spalding's campion (*Silene spaldingii*)	BM	Bunchgrass-dominated grasslands with deep soil	Invasive plants, especially knapweeds	Distribution on private land not well documented	Control invasive plants; limit grazing in late summer when in bloom

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
Sterile milk-vetch (*Astragalus cusickii* var. *sterilis*)	NBR	Endemic to Owyhee Uplands, along Owyhee River, bare gravelly and clay soils derived from weathered volcanic ash substrates	Grazing by domestic livestock, mining, habitat invasion by weeds	Seed collection focusing on capturing potential genetic diversity, propagation and transplanting protocol	Fence populations on public land to reduce impacts from off-road vehicles and grazing. Long-term monitoring. Limit range improvement projects in sensitive areas.
Tygh Valley milk-vetch (*Astragalus tyghensis*)	CP	Dry, rocky soils with thin, sandy surface soil; occurs in bunchgrass grasslands, mounded prairies or open juniper habitats	Habitat loss; narrow distribution (endemic to Wasco County); competition from invasive plants; roadside vegetation control (spraying) impacts a few roadside populations	Develop propagation and transplant protocols	Use mowing rather than herbicide spraying to control vegetation at known populations; control invasive plants; manage grazing at priority sites
Umpqua mariposa-lily (*Calachortus umpquaensis*)	KM WC	Grassland-forest ecotones on serpentine soils, can be found in a broad range of habitat from closed canopy coniferous forests to open grass-forb meadows	Grazing, logging, road construction, herbicide drift from adjoining private land applications, bulb digging by collectors, fire suppression, nickel mining, competition from invasive plants	Study factors limiting distribution (reproduction, fecundity, etc.), propagation and transplanting protocol	Continue to implement interagency Conservation Agreement. Manage grazing and logging in sensitive areas, establish long-term monitoring, collect/store seed from all populations, survey for new populations
Wayside aster (*Aster vialis*)	KM WC WV	Variable habitat: relatively open areas in the understory of mixed coniferous/ hardwood forests, along roadsides, and on open slopes and prairie balds	Habitat loss due to residential development and timber harvesting activities. Fire suppression leading to understory brush encroachment. Competition from invasive plants. Road maintenance; habitat fragmentation; and unregulated off-road vehicle use	Biology of species (seed production, breeding system/ pollination, hybridization issues), population demographics and trends, determine ecological and habitat requirements, genetic analysis	Limit road maintenance during growing season at priority sites. Conduct surveys for new populations. Maintain and restore habitat at priority sites.
Western Lily (*Lilium occidentale*)	CR	Bogs composed of damp, slightly acidic and organic soils; prefers small shrubs with nearby sunlight and may use shrubs for mechanical support	Habitat loss due to bog draining and filling; land conversion for agriculture, urban development, and road construction. Soil compaction. Plant collecting and flower picking. Grazing. Habitat degradation due to fire suppression (encroaching shrubs and trees block sunlight and can change hydrology.)	May benefit from light grazing regimes that reduces competition from other plants: develop grazing regimes that are compatible with maintaining populations. Effects from foraging by wildlife (e.g., small mammals, deer, elk) Reproductive biology. Population genetics.	Continue current efforts, such as grazing management, propagation, and experimental vegetation management habitat (e.g., prescribed fire, mowing). Maintain and restore bog hydrology. Avoid herbicide application during the growing season for roadside populations and use "No Spray" signs at known populations for educational purposes
White rock larkspur (*Delphinium leucophaeum*)	WC WV	Well-drained areas within open lowland prairies, dry roadside ditches, along river banks and bluffs, open areas atop basaltic shelves; loose, shallow soils with high content of organic matter	Habitat loss due to urban and agricultural development; habitat degradation due to loss of natural fire regimes and invasive encroachment in understory; herbicide use and other roadside maintenance; small population numbers and sizes	Pollinator studies, hybridization studies, development of transplanting protocol	Restore habitat using site-appropriate methods (control encroaching trees and shrubs, control key invasive plants).

(Plants Cont.)

Species	Ecoregion(s)	Special needs	Limiting factors	Data gaps	Conservation actions
White-topped aster (*Aster curtus*)	WV	Open grassland habitats (seasonally wet prairies; oak savanna)	Habitat loss, degradation due to lack of fire and competition from invasive plants, overspray of herbicides	Pollinator studies, seed sowing protocol	Maintain or restore grass-dominated habitats; control key invasive plants; use mowing or prescribed fire to control brush and trees; maintain populations in roadsides and ditches; collect and store seeds.
Willamette daisy (*Erigeron decumbens*)	WV	Heavy soils in seasonally wet native or dry upland prairie grasslands	Narrow distribution (endemic to Willamette Valley), habitat loss, degradation due to lack of fire and competition from invasive plants, overspray of herbicides	Reproductive biology, long-term demographic monitoring to determine population dynamics, determine appropriate frequency for fire regime to maintain habitat, perform genetic analysis to determine extent of cloning	Maintain or restore grass-dominated habitats; maintain or restore hydrology; control key invasive plants; use mowing or prescribed fire to control brush and trees; maintain populations in roadsides and ditches; collect and store seeds
Wolf's evening-primrose (*Oenothera wolfii*)	CR	Found on patches of Cenozoic-era marine deposits that are well-drained but have adequate moisture. Habitats include grasslands, coastal strand, roadsides, and coastal bluffs.	Disjunct distribution because of highly specific habitat requirements. Hybridization with garden evening-primrose (Oenothera glazioviana), a closely-related non-native ornamental plant. Habitat loss due to urban development and road construction. Herbicide use.	Feasibility of starting new populations from cultivated plants; determine extent of hybridization	Avoid herbicide application and roadside/park maintenance activities during the growing season. Public outreach about the problems caused by garden evening-primrose in areas where hybridization is a problem.

Carnivorous Plants

In the plot of the musical comedy "Little Shop of Horrors," a human-eating plant bit the hand that fed it. While this film is nothing more than science fiction, it is loosely based on a group of plants that have an appetite for invertebrates and other minute animals. Found worldwide, carnivorous plants mostly eat insects, although tropical ones might eat an occasional frog. Carnivorous plants have two broad approaches for trapping insects. "Passive" methods include pitfall traps and glandular hairs that act as sticky flypaper. "Active" methods involve trap-door movement to catch insects. The most famous "active" carnivorous plant is the venus flytrap, which grows in the southeastern United States.

Oregon has several intriguing carnivorous plants. California pitcher-plants, butterwort, and sundews are found in the Klamath Mountains ecoregion. California pitcher-plants, also called cobra lilies, grow along the southern Oregon coast and more commonly in bogs throughout the Siskiyou and Klamath Mountains. The pitcher-plant is showy, with purplish-green flowers and pitcher-like modified leaves that are up to 20 inches tall. Flies, bees and other insects are drawn to nectar glands near the pitcher's entrance. Clear windows in the pitcher's hood are thought to confuse insects looking for a way out. Insects land inside the pitcher, and downward-pointing hairs and slippery walls prevent them from escaping. Insects eventually drown in a liquid pool in the pitcher's base. Bacteria living in the pool digest the insects, freeing up nutrients for the plant to absorb. California pitcher-plants can be seen at Darlingtonia State Natural Site. Located a few miles north of Florence, Darlingtonia State Natural Site is Oregon's only state park dedicated to the conservation of a single plant species. A short walking trail offers photo opportunities and interpretive signs tell the story of these interesting plants.

Carnivorous plants trap insects primarily for a source of nitrogen. Like all plants, carnivorous plants need nitrogen as a basic building block for proteins. Many carnivorous plants grow in nutrient-rich bogs where nitrogen availability is limited by high acidity. Because bogs are uncommon and are home to rare and unusual plants, they are of special conservation interest.

Species Data Gaps: Research and Monitoring Needs

In addition to the "data gaps" identified for individual Strategy Species, the following data gaps apply to multiple species across Oregon:

Species management and monitoring:

- Determine baseline conservation status, estimated population size and trends for Strategy Species. Develop and implement survey and monitoring methodology for species lacking protocols, such as woodpeckers, some owls, snails, and many salamanders.
- Estimate Strategy Species carrying capacities based on current and restorable habitat conditions in Oregon and determine population goals. Monitor species periodically to compare status against population goals.
- Develop measurable indicators of high quality habitat. For example, develop framework for using species and habitat indicators to assess habitat status and trends
- Determine relationships between population dynamics and habitat dynamics
- Refine methodology to evaluate and rank the health of plant populations for monitoring via occurrence databases (e.g., ORNHIC's efforts to develop occurrence ranks).
- Evaluate effectiveness of providing passage around barriers for fish and wildlife (including amphibians, reptiles, mammals) to enhance migration or habitat connectivity.
- Determine the status and preferred habitat of aquatic macroinvertebrates and freshwater mussels. Further investigate impacts of channelization, sedimentation, and passage barriers on aquatic invertebrates. Determine factors controlling the distribution and abundance of mussels.
- Develop and evaluate propagation methods for native plants (Strategy Species and species needed for habitat restoration).
- For Strategy Species dependent on habitats that have high degrees of fragmentation or isolation, determine patch sizes and configuration for maintaining viable populations
- Determine the utility of indicator species or "umbrella species" to manage habitat for associated species. For example, if you manage for high quality greater sage-grouse habitat, will other sagebrush-dependent species' populations be maintained or increase?
- Understand fish habitat needs for resident fish species to improve the effectiveness of restoration and enhancement activities that support these species

Interactions between species

- Determine population dynamics and impacts of native predators that increase with human activity on native species (e.g., crows, gulls, jays, ravens, and raccoons).
- Evaluate impacts of invasive animals on priority native animals.
- Determine appropriate management actions. Examples:
  - Invasive squirrel species on native squirrels (western gray, Douglas, and flying squirrels) and cavity-nesting birds.
  - Invasive turtle species on northwestern pond turtle and western painted turtle.
  - Bullfrogs on native amphibians, reptiles, and fish.
  - Carp on native plants, invertebrates, fish, and amphibians.
- Determine the habitat or limiting factors that keep cowbird parasitism and nest predation on Strategy species to a minimum.
- Determine whether introduced wild turkeys compete with native species (for example with native grouse and quail or with species that use acorn resources in oak habitats).

Species-landscape interactions:

- Evaluate the effects of patch size, configuration, and distribution on populations of Strategy Species.
- Increase understanding of how to manage species and habitats at multiple scales. For example, improved methods for manag-

ing stream and pond amphibians at landscape and watershed scales.

- Landscape-level habitat relationships between water levels and species that move in response to water levels, especially birds: (1) Identification of landscape-level breeding and post-breeding habitat needs for species; (2) Thresholds of use or non-use by breeding birds; and (3) Distribution of aquatic habitats across landscape as influenced by annual variation in precipitation and evaporation.
- Participate in ongoing evaluations of the effects on wildlife and other ecological values of forest management practices that reduce the risk of uncharacteristic fire
- Participate in efforts to develop decision-making tools to help land owners and land managers assess and compare the short-term risks to wildlife of forest management practices to reduce the risk of uncharacteristic fire against the long-term risks to wildlife and habitat posed by uncharacteristic fire.

Data management and information sharing:

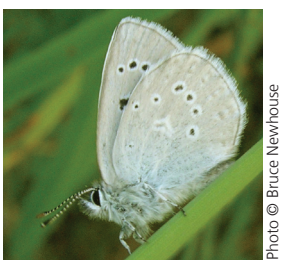
- Create and maintain centralized database to track occurrence data for Strategy Species. Standardize database formats to ensure compatibility and facilitate information sharing between organizations and researchers. Facilitate greater interactions between researchers and data users and decision-makers. For more information on data management, see the Monitoring chapter.

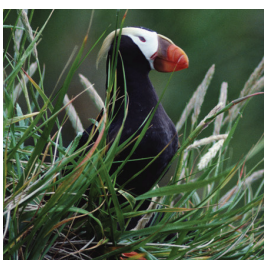
Determining status:

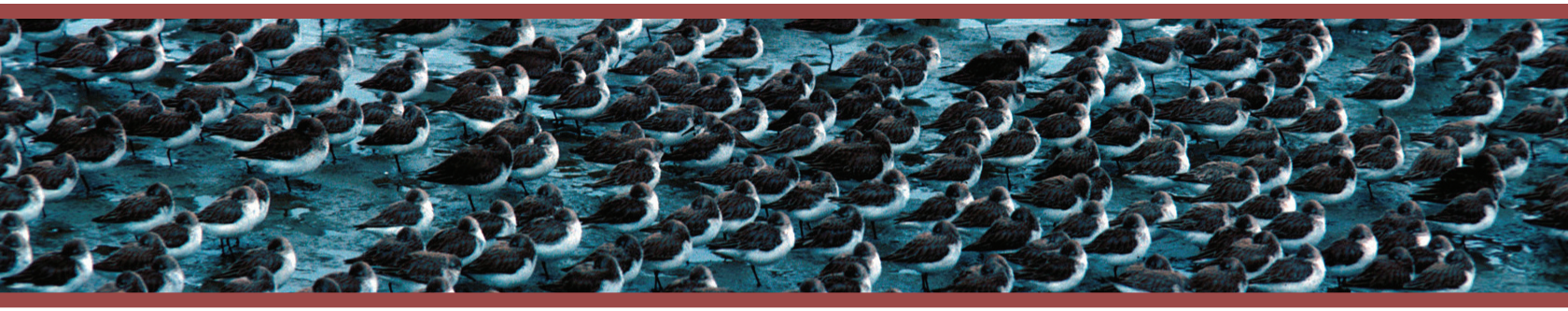
- For some animals, basic information such as where they occur and basic habitat associations is not known. It isn't possible to determine whether they are truly at risk or what should be done about it. Basic surveys for distribution, habitat associations, and general abundance are needed. More information is needed to determine the conservation status of the following species:
    - **Blue Mountains:** California wolverine, Preble's shrew, white-tailed jackrabbit, white sturgeon, Blue mountain-snail, Columbia pebblesnail, Johnson's hairstreak, southern tightcoil (snail). In addition, there are four birds, eight invertebrates and 39 plant species on ORNHIC's Heritage List 3 (=unknown conservation status).
    - **Coast Range:** fisher, Gold Beach pocket gopher, Pistol River pocket gopher, ringtail, white-footed vole, river lamprey, and crowned tightcoil, marsh walker, Nerite ramshorn (snails). In addition, there are 11 invertebrate species and 25 plant species on Oregon Natural Heritage Program's Heritage List 3.
    - **Columbia Plateau:** hoary bat, spotted bat, white-tailed jackrabbit, Woodhouse's toad, and Columbia pebblesnail. In addition, there are two invertebrates and nine plant species on ORNHIC's Heritage List 3.
    - **East Cascades:** California wolverine, fisher, Preble's shrew, spotted bat, white-tailed jackrabbit, flammulated owl, blotched tiger salamander, Dalles juga (snail), Puget Oregonian (snail), and salamander slug. In addition there are two birds, three invertebrates, and 16 plant species on ORNHIC's Heritage List 3.
    - **Klamath Mountains:** flammulated owl, white-footed vole, marsh walker (snail). In addition, there are eight invertebrates and 38 plant species on ORNHIC's Heritage List 3.
    - **Northern Basin and Range:** Preble's shrew, white-tailed antelope ground squirrel, white-tailed jackrabbit, black rosy finch, blotched tiger salamander, Great Basin spade-foot toad, Woodhouse's toad, Harney Basin duskysnail, and Donner und Blitzen pebblesnail. In addition, there is one bird, four invertebrates and 56 plant species on ORNHIC's Heritage List 3.
    - **West Cascades:** California wolverine, white-footed vole, barren juga (snail), Columbia sideband (snail), Mardon skipper (butterfly), Nerite ramshorn (snail), Puget Oregonian (snail), and salamander slug. In addition, there are two birds, 22 invertebrates, and 24 plant species on ORNHIC's Heritage List 3.
    - **Willamette Valley:** hoary bat, pallid bat, sandroller, stickleback, white sturgeon, barren juga (snail), Columbia pebblesnail, Nerite ramshorn (snail), Oregon giant earthworm, and Puget Oregonian (snail). In addition, there is one bird, five invertebrates and 12 plant species on ORNHIC's Heritage List 3.
- In other cases, it is not clear whether a group of animals are a population of one species or are a distinct other species. Information is needed to help determine the taxonomic status of these species. If they are determined to be distinct species, then data on range and habitat associations are needed to determine conservation status.
    - **Blue Mountains:** Blue Mountains dusky snail, Blue Mountains juga, Crooked River juga, Deschutes sideband, Disc Oregonian, Hells Canyon mountainsnail, and Opal Springs juga.
    - **Columbia Plateau:** Information is needed to help determine the taxonomic status of these snails: Columbia duskysnail, Columbia springsnail, Crooked River juga, Deschutes mountainsnail, Deschutes sideband, Oak Springs

Hesperian, purple juga, three-band juga, and Tuscan pebblesnail. If they are determined to be distinct species, then data on range and habitat associations are needed to determine conservation status.

- **East Cascades:** Modoc sideband, Modoc peaclam, Klamath taildropper, and these snail complexes: duskysnails (genus Colligyrus), pebblesnails (genus Fluminicola), jugas (genus Juga), and springsnails (genus Pyrgulopsis). Determine whether Silver Lake tui chub warrants species status. If warranted, implement conservation actions for this species. Shortnose sucker, Lost River sucker, Klamath Largescale sucker and Klamath smallscale sucker can be difficult to distinguish morphologically. Develop and refine identification methods, possibly using the tools of molecular genetics. Need more detailed information about the taxonomy and systematics of these four species. Are species reproductively isolated?
- **Klamath Mountains:** Keene Creek pebblesnail and the Klamath tail-dropper.
- **Northern Basin and Range:** species in the Pyrgulopsis complex (Lake Abert springsnail, Malheur springsnail, Owyhee hot springsnail), and hotspring physa (snail) and Malheur pebblesnail.
- **West Cascades:** Columbia duskysnail and species in these snail species complexes: Fluminicola (Diminuitive, Fall Creek, Keene Creek, Lake of the Woods, Nerite, Pinhead, and Toothed pebblesnails); and Juga (Basalt, Brown, and Three-band jugas).
- **Willamette Valley:** bald hesperian (snail) and Columbian duskysnail.







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Animal Concentrations

Klamath Lake hosts the largest concentration of wintering bald eagles in the continental United States, with up to a thousand eagles. At Dean Creek Wildlife Viewing area, numerous elk congregate in marshy fields during the winter. During autumn evenings, up to 35,000 migrating Vaux's swifts swirl and funnel into an old chimney at Chapman School in Portland. Dozens of people gather each night to enjoy this display of the largest known Vaux's swift roost in the world. People have long appreciated the spectacle of thousands or millions of animals gathered in one area. Oregonians can now enjoy fish and wildlife viewing at several popular festivals that celebrate seasonal animal gatherings, including wintering bald eagles and migrating salmon, songbirds, shorebirds, or waterfowl.

Fish and wildlife often gather in concentrations for critical activities such as feeding, breeding, or migrating. Some species breed in colonies, perhaps due to limited, specialized breeding sites or as a strategy to deter predators. Animals also congregate when their food is concentrated. Migrating animals flock to a feeding site to refuel and rest. Or, animals might gather when an important resource is naturally limited in the landscape, such as freshwater in the desert or mineral springs in mineral-poor areas. Frogs and toads that breed in seasonal ponds tend to gather together for a short burst of spring breeding because they have a limited window of opportunity for egg-laying while the ponds stay wet. When Pacific treefrogs gather to breed, a springtime chorus erupts as males sing to attract mates.

When animals gather in these large groups, they can become particularly vulnerable to habitat alteration and to human disturbance. Because of the large number of individuals involved, any factors that impact highly critical sites can affect a large proportion of a species or an entire suite of species.

Identifying the most important sites is the first step in conserving animal concentrations. Approaches include The Audubon Society's Important Bird Area program, which recognizes the importance of migration stopovers and other areas where birds concentrate (for more information see www.oregoniba.org or The Audubon Society of Portland). The Conservation Strategy's Conservation Opportunity Areas include many, but not all, of Oregon's animal concentrations. For animal concentrations, appropriate conservation actions will depend on the species and site, but will focus on maintaining or restoring important habitat features. The table below summarizes important habitat types and features for some of Oregon's animal concentrations.

Animal Concentration	Important Habitat Types	Important Habitat Features
Bald eagles: wintering	Large lakes and rivers	Large trees or snags for communal roosts
Band-tailed pigeons	Estuaries and mineral springs	Mineral concentrations
Bat roost sites (particularly hibernacula, maternal roosts, or diurnal roosts)	Depending on bat species, includes caves, mines, cliffs, bridges, buildings, large hollow trees, or snags with loose bark	Suitable temperature and humidity. Lack of human disturbance is critical for Townsend's big-eared bat and pallid bat.
Deer and elk key winter range areas	Winter range characteristics vary by ecoregion, but usually included warmer sites such as lower valleys and southern slopes	Diverse forested landscapes with openings and a variety of age classes, perennial grasslands, and sagebrush steppe habitats. Woody vegetation for foraging (e.g., bitterbrush, aspen, alder, willow, oak). Cover for insulation and for hiding. Shrubs are important where snow is deep during winter.

Animal Concentration	Important Habitat Types	Important Habitat Features
Deer and elk herds (migration routes and transition range)	Varies by ecoregion and combines features of summer and winter range; travel corridors that are unobstructed by roads and urban areas	Varies, but includes both forage and cover to provide safe passage between winter and summer ranges
Freshwater mussel beds	Aquatic habitats	Clean water with low contamination and sedimentation; natural water flow regimes. Freshwater mussels are important to tribal culture; filter water; are indicators of high water quality; and are an important food source for fish, mink, otters, and raccoons
Great blue herons: nesting colonies (rookeries)	Riparian habitats	Large trees near foraging areas (open grassy and wetland habitats); low levels of human disturbance during the nesting season. Great blue heron nesting colonies are declining and at risk in some areas, particularly in the Willamette Valley.
Lamprey (juveniles concentrate in high densities)	Freshwater habitats. Potential preference for low-gradient floodplain habitats and lower mainstem river channels.	Unknown.
Pond-breeding amphibians (toads, frogs, salamanders)	Ponds and other shallow wetlands. In many areas, these ponds are created by winter and spring rains, then dry up each summer. These temporary ponds provide essential breeding habitat for amphibians living nearby.	Critical breeding habitat, particularly during spring and early summer. Must remain wet long enough for tadpoles to metamorphose; be relatively free of predators or disturbance; and, provide sufficient food.
Raptors: migrating and wintering	Fields and pastures, grasslands and prairies, sagebrush steppe, wet meadows; ridges are important during migration	Habitats where prey are concentrated (e.g., open grassy areas for rodents; riparian and deciduous shrub communities for songbirds; lakes for waterfowl); thermals over ridges for soaring
Salmon juvenile rearing areas	Estuaries or low-gradient stream reaches.	Suitable habitat complexity, temperature, and low fine sediment loads
Salmon adult holding areas	Stream reaches	Prefer stream reaches with suitable temperature and habitat complexity.
Sage-grouse leks	Big sagebrush	Cover of 15-50 % cover for nesting. Open areas used by males for courtship. Areas rich in forbs such as playas, meadows, and higher elevation sagebrush steppe habitats are important for brood rearing.
Seabird nesting colonies	Coastal bluffs; offshore islands and rocks; and sandy islands	Depending on species may include deep soil for burrowing (tufted puffin and storm-petrels), rocky ledges (common murres), or unvegetated sandy areas (Caspian terns). Isolation from mammalian predators and human disturbance is critical.
Seal and sea lion haul-outs and pupping areas	Flat offshore rocks and isolated beaches	Isolation from human disturbance is important.
Shorebirds: migrating and wintering	Wet prairies, flooded fields, mudflats, shorelines of wetlands and reservoirs, estuaries, sandy ocean shore	Open, moist muddy or sandy areas with high invertebrate prey density
Songbirds: migrating	Deciduous and mixed deciduous-conifer forests; high- elevation deciduous or mixed shrub communities, especially near water; riparian habitat	Deciduous trees and shrubs with high invertebrate prey density and cover for insulation and hiding. Forested buttes are important in urban and agricultural landscapes
Tadpole aggregations (for example, Western toads)	Shallow areas in mountain lakes and ponds	Maintain shallow mountain lake habitats, including native aquatic and lakeside vegetation.
Waterbird nesting colonies	Lakes and marshes with both deep and shallow water	Varies by species, but includes isolated and sparsely vegetated islands (American white pelican); trees (snowy egret; emergent vegetation (eared grebes). Isolation from mammalian predators and human disturbance is important.
Waterfowl and other waterbirds: migrating and wintering	Wetlands, lakes, reservoirs, and estuarine bays	Diverse water features with high food availability (aquatic plant, invertebrate, or fish) and open water for security
Vaux's swift roosts	Late successional conifer; urban and suburban	Large hollow trees and snags for nesting and roosting; chimneys (which imitate hollow trees)

Naturally Occurring Fish and Wildlife Diseases

Just like people, fish and wildlife can get sick. Diseases caused by viruses, bacteria, fungi, and protozoans can cause illness or death. Usually only a few animals are affected. However, some conditions can cause large numbers of animals to be susceptible, affecting populations. For example, disease spreads quickly when large numbers of animals are concentrated naturally during migration or artificially due to unnatural food sources. People can prevent unnatural disease outbreaks by not feeding wildlife, vaccinating pets, and, in some cases, managing habitat.

Listed below are the diseases of greatest management concern in Oregon. This table focuses on fish and wildlife diseases that occur naturally within Oregon. However, some of the greatest disease concerns center around non-native diseases. Non-native diseases can have devastating effects on wildlife, human health and local economies. Recent reported cases of West Nile virus in Oregon underscore the state's vulnerability to invasive disease-causing organisms. Non-native diseases will be addressed in a implementation tool that evaluates ecological impact and management approaches for invasives.

Disease or Disease-Causing Organism	Vulnerable Fish or Wildlife Species	Conditions that Promote Disease Issues	Management Approaches
Wildlife			
egg-destroying pathogen (*Saprolegnia ferax,* a watermold)	All amphibians, although some species may be more vulnerable	Conditions that weaken immune response (e.g., UV-B light, pesticides)	Maintain high water quality; investigate role of introduced fish in spread between water bodies
Chytrid skin fungus (*Batrachochytrium dendrobatidis*)	All amphibians, although some species may be more vulnerable	Conditions that weaken immune response (e.g., UV-B light, pesticides)	Maintain high water quality, investigate the natural distribution of Chytrid to determine if it is spreading to new areas
Amphibian deformities (multiple legs and other deformities caused by a trematode, *Ribeiroia* sp.)	All amphibians, but seen most often in some frog species	High nutrient levels that increase densities of intermediate hosts (snails)	Maintain high water quality; monitor incidence of amphibian deformities
Avian cholera (caused by a bacterium, *Pasturella multicoda*)	Waterfowl especially, but can also impact gulls, terns, coots, and crows	Concentration of waterfowl during migration. Waterfowl concentrations increase when the amount of open water is reduced (e.g., during drought, freezing temperatures, or due to habitat loss). Freezing temperatures also increase vulnerability by weakening immune systems	Maintain and restore wetland habitats important for migratory waterfowl; manage major die-offs to minimize impacts to populations
Avian Influenza	Many wild bird species are hosts	Waterfowl and other wild bird species may serve as hosts to non-pathogenic strains of the virus; Mutated or pathogenic strains can have devastating impacts to poultry industry and human health	Monitor and conduct surveillance in captured or translocated birds such as mountain quail, turkeys and farmed game birds.
Botulism (caused by a nerve toxin produced by bacterium, *Clostridium botulinum*)	Waterfowl and shorebirds	Associated with shallow wetland habitats during warm weather; can be made worse by fluctuating water levels; sometimes associated with carcasses (e.g., fish kills)	Manage water levels at important migration areas to prevent botulism; manage major die-offs to minimize impacts to populations
Mycoses (diseases caused by fungi, including toxins produced by mold): Aspergillosis, Aflatoxins	Many bird species; waterfowl and shore birds are very susceptible	Transmitted from moldy corn or acquired from soil or damp organic materials; stressed or diseased animals may have increased susceptibility	Monitoring and surveillance; manage major die-offs to minimize impacts to populations

Disease or Disease-Causing Organism	Vulnerable Fish or Wildlife Species	Conditions that Promote Disease Issues	Management Approaches
Avian Influenza	Many wild bird species are hosts	Waterfowl and other wild bird species may serve as hosts to non-pathogenic strains of the virus. Mutated or pathogenic strains can have severe impacts to the poultry industry and human health.	Monitor and conduct surveillance in captured or translocated birds such as mountain quail, turkeys and farmed game birds.
Canine distemper	Raccoons, foxes, skunks, coyotes; note: can infect unvaccinated dogs	Occurs in raccoon populations when densities are high or raccoons are concentrated; less of an issue for other wildlife	Continue to promote prevention (e.g., by not feeding raccoons); use caution when moving nuisance raccoons; promote vaccination programs in domestic pets
Rabies	Raccoons, skunks, bats, foxes; note: can infect unvaccinated dogs and domestic cats; public health issue	Exposure to unvaccinated domestic pets; occurs naturally at low levels in wildlife populations	Continue to promote vaccination programs in domestic pets; outreach regarding avoiding sick animals or those behaving unusually
Parvovirus (includes several closely-related viruses such as feline panleucopenia)	Bobcat and cougar; note: can infect unvaccinated domestic cats	Exposure to domestic cats (e.g., abandoned cats and feral cat colonies)	Promote pet vaccination programs. Promote benefits to cats, wildlife and people when cats are kept indoors.
Leptospirosis	Marine mammals (seals and sea lions)	A bacterial disease transmitted from contaminated urine and infected animals	Outreach regarding the importance of avoiding contact with sea lions and sea lion carcasses Oregon's beaches
Salmonellosis and Mycoplasma conjunctivitis	Songbirds, primarily finch species	Concentration of birds at bird feeders; contaminated feeder surfaces and fecal contaminated bird food	Outreach regarding prevention methods
Fish			
Infectious Hematopoietic Necrosis virus	Most salmonid stocks	Stress situations such as spawning or adverse environmental conditions	Reduce movements of infected fish and track different isolates of the virus
Erythrocytic Inclusion Body Syndrome	Several salmonid stocks	Unknown, but condition depresses immune system and other diseases become patent	Nutrition may affect severity of infection
Viral Hemorrhagic Septicemia virus	North American strain causes little mortality in salmonids but can cause high losses in marine species like herring, sardines, and mackerel	Young immuno-incompetent fish and spawning adults. Fish spread the virus horizontally. May be passed on to progeny	Avoidance by limiting exposure. Monitor for the presence of the European strain which is much more virulent
Infectious Pancreatic Necrosis virus	Most salmonid stocks and few other marine species	Fish to fish transmission and vertically transmitted from parent to progeny	Avoidance by limiting exposure. Screen spawning adults for virus and cull eggs from positive parental groups
White Sturgeon Iridovirus White Sturgeon Herpesvirus	White sturgeon and possibly other related species	Likely vertically transmitted from parents to progeny. High stress environmental conditions may lead to outbreaks	Limit transfer of known carriers. Examine fish and stock history
Bacterial Kidney Disease caused by *Renibacterium salmoninarum*	Salmonid stocks	Exposure to infected fish and transferred within the egg from infected females	In hatcheries reduce the pathogen by culling eggs from infected females and using antibiotic injections and feedings
Columnaris Disease caused by the bacterium *Flavobacterium columnare*	All fish	Warm water conditions, exposure to other infected individuals	Where possible, augment water flows to increase quantity and decrease temperature
Furunculosis caused by the bacterium *Aeromonas salmonicida*	Salmonid stocks, Some other species	Exposure to infected fish.	Antibiotic treatments where possible.
External fungal infections caused by multiple species of fungi	All fish	Stress situations such as spawning, low water, high temperature, body injuries	Fungal spores ubiquitous and no possible control of environmental conditions. Educate about condition
Tapioca disease, caused by myxosporean *Henneguya salmincola*	Several species but most noted in Chinook and coho salmon	Unknown, rarely detrimental to fish but a concern for anglers due to cysts in flesh	Educate about the parasite and the safety of consuming flesh
Ceratomyxosis caused by the myxosporean *Ceratomyxa shasta*	Salmonid stocks	Exposure to infectious stage of parasite that originates in a worm. Warm, slow water and low flows can increase contact with agent	Where possible, augment water flows to increase quantity and decrease temperature
White Spot caused by the protozoan *Ichthyophthirius multifillis*	All fish	Exposure to infected individuals, warm water conditions	Where possible, augment water flows to increase quantity and decrease temperature
Black Spot caused by Strigeid trematodes (Neascus)	All fish	Exposure to infected snails. Complex life cycle involving birds, increased snail populations	Education on the source of the parasite and that it does not affect humans.
Yellow Grub caused *by Clinostomum marginatum*	All fish	Exposure to infected snails Complex life cycle involving birds, increased snail populations	Education on the source of the parasite and that it does not affect humans.
White Grub caused by *Posthodiplostomum minimum*	All fish	Exposure to infected snails Complex life cycle involving birds, increased snail populations	Education on the source of the parasite and that it does not affect humans.

Disease or Disease-Causing Organism	Vulnerable Fish or Wildlife Species	Conditions that Promote Disease Issues	Management Approaches
Salmon Poisoning Disease. The disease in canids is caused by a rickettsial organism which is present in the worm *Nanophyetus salmincola*	All fish are susceptible to the worm. Only canids and some bears are susceptible to the rickettsia	Normal exposure of fish to the infective stage of the worm life cycle. All worms and their progeny are infected with the rickettsia. Increased snail populations	Education on the possible effects of dogs eating parasitized fish, getting infected with the rickettsia and the availability of antibiotic treatments
Tapeworms caused by *Proteocephalus* sp., *Diphyllobothrium* sp.	All fish	Ingestion of intermediate host carrying infectious stage of the parasite.	Education on the source of the parasites and the proper handling of fish for consumption
Copepods, Fish Lice and Anchor Worms caused by *Salmincola* sp., Argulus sp., *Lernea* sp.	All fish	Exposure to infected individuals, low water conditions or overpopulation.	Where possible, augment water flows to increase quantity and decrease temperature

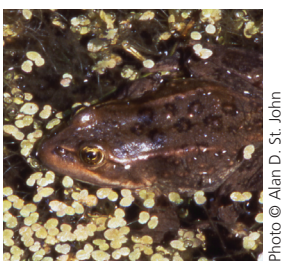

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Photo © Bruce Newhouse

The Importance of Species Monitoring: the Example of Declining Amphibian Populations

Amphibian Declines: A Global Concern

Interest in global amphibian (frogs, toads, and salamanders) conservation has greatly increased since 1989, when herpetologists began to notice that populations of amphibians in several separate locations across the globe were dwindling without explanation. However, not all species or populations of amphibians were thought to be declining, adding to the mystery. A recent study (2005) synthesized data from around the world and concluded that many amphibian populations are indeed declining in significant numbers: globally, 32% of amphibian species are threatened, compared to about 12% of bird species and 23% of mammal species. Of particular concern are declines noted in areas with no detectable changes in habitats, such as remote wilderness areas (for example, the "cloud forest" in Monteverde, South America). The causes are still poorly understood and currently being researched and debated. Potential causes that are being investigated include contaminants, invasive species, diseases, habitat loss, climate change, ultraviolet radiation, acid rain and other atmospheric deposition, or the interaction of multiple causes.

Why might these animals be so sensitive to changes in the environment? All amphibians have several unique characteristics that could make them particularly susceptible to environmental impacts: they have very thin, moist and sensitive skin; their eggs and larvae develop in water, where many pollutants concentrate; and, they also have a terrestrial component of their life cycle, making them vulnerable to environmental change in multiple habitats. Amphibians have been called modern-day "canaries in the coalmine," possibly presenting us with early warning signals of environmental damage that could affect other fish and wildlife, as well as people.

Amphibians in Oregon and Importance of Monitoring

With its diverse habitats and relatively mild climate, Oregon is home to many native amphibians. Some species are common and widespread, with healthy populations. These include the Pacific tree frog and rough-skinned newt. However, others such as the Oregon spotted frog and foothill yellow-legged frog have declined. Although many of these species are monitored, there is still little known about their behavior and habitat use. For example, where they spend the winter months is poorly understood for many amphibians. This basic information is needed to better maintain, manage and restore Oregon's amphibian habitats. Taking up the challenge of long-term monitoring also will be essential to determine amphibians' status and trends over time. Both nationally and in Oregon, the U.S. Geological Survey's Amphibian Research and Monitoring Program is working to increase understanding of amphibian biology (http://armi.usgs.gov). Also, the USGS's FrogWatch USA program offers an opportunity for citizens volunteers to gather information on frogs and toads (www.frogwatch.org). For many reasons, Oregon's amphibians are worth watching.

Photos © (top) Bruce Newhouse; (bottom) Chris Carey