


the OREGON CONSERVATION STRATEGY




Chapter 5: Strategy Habitats

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Oregon Department
of Fish and Wildlife

OregonConservationStrategy.org

Table of Contents – Chapter 5: Strategy Habitats

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Contact ODFW

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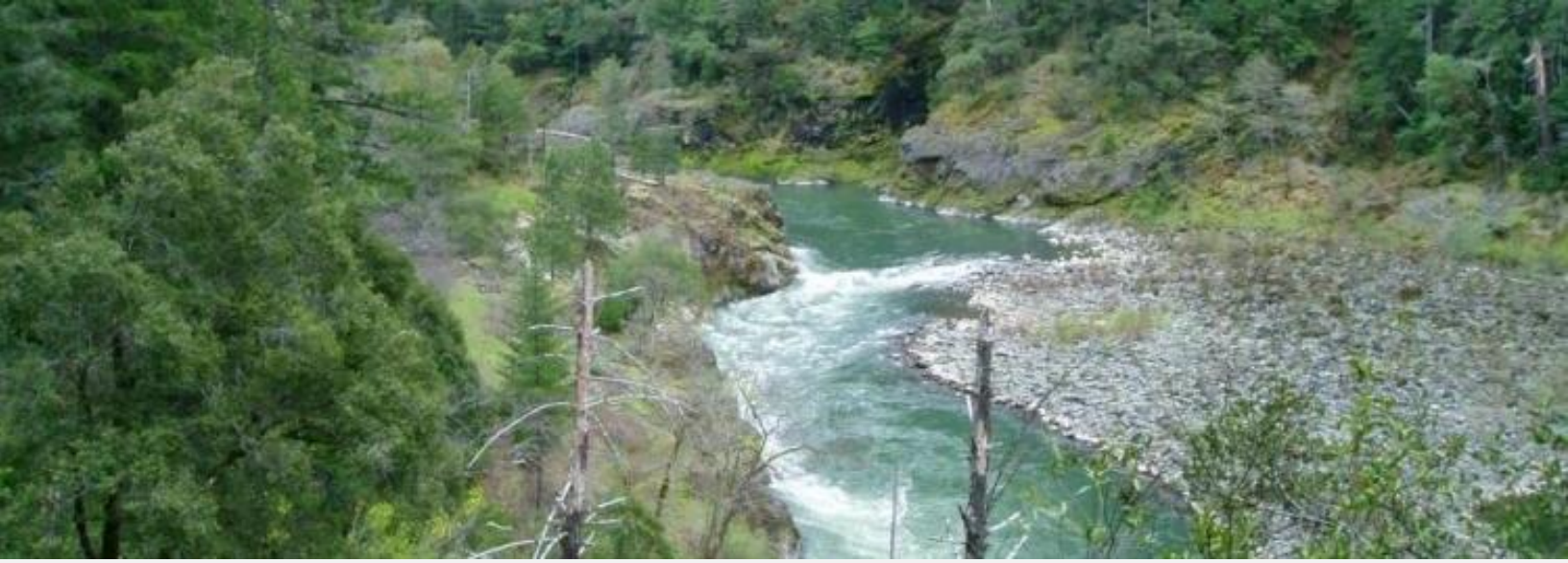

STRATEGY HABITATS

Strategy Habitats are habitats of conservation concern within Oregon that provide important benefits to **Strategy Species**. There are 11 Strategy Habitats within the Oregon Conservation Strategy, **designated by ecoregion**. Each Strategy Habitat includes a general description, conservation overview, and a list of limiting factors and recommended approaches. This information is intended to provide a broad view. Conditions may vary by site, watershed, or ecoregional level based on differences in soil, climate, and management history. Local conditions will need to be considered when determining site-appropriate conservation actions.

The Strategy describes **Specialized and Local Habitats** and **Habitat Data Gaps** that represent important landscape features not adequately addressed through the 11 Strategy Habitats.

Strategy Habitat Methodology

In the original Oregon Conservation Strategy (released in 2006), Strategy Habitats were determined in a two-step process. First, best available and most recent (in 2006) vegetation maps were compared to historical vegetation maps from 1850 to indicate vegetation types experiencing high degrees of loss since European settlement in Oregon. Second, similar vegetation types were classified into "habitats", which were then evaluated for historical importance at the ecoregional scale, emphasizing the amount of remaining habitat being managed for conservation values, known limiting factors and potential issues impacting habitats, ecological similarity of habitats, and the importance of each habitat to Strategy Species. The habitats determined to be of the most importance throughout the state were defined as Strategy Habitats, and were designated by ecoregion.

In 2016, the Strategy Habitat section was revised to incorporate new science, data, and available tools. A particular focus was placed on updating the Strategy Habitat map, which is available in several formats:

- **Download Strategy Habitat map data (GIS raster grid format)**
- **View the Strategy Habitat Map in Oregon Department of Fish and Wildlife's (ODFW) Compass**

- **Technical Supporting Document: Methodology for Updating the Strategy Habitat Map**

> For additional information on all of Oregon's native habitats and their conservation, consult the **Oregon Natural Areas Plan**.

STRATEGY HABITATS

Aspen Woodlands

Coastal Dunes

Estuaries

Flowing Water and Riparian Habitats

Grasslands

Late Successional Mixed Conifer Forests

Natural Lakes

Oak Woodlands

Ponderosa Pine Woodlands

Sagebrush Habitats

Wetlands

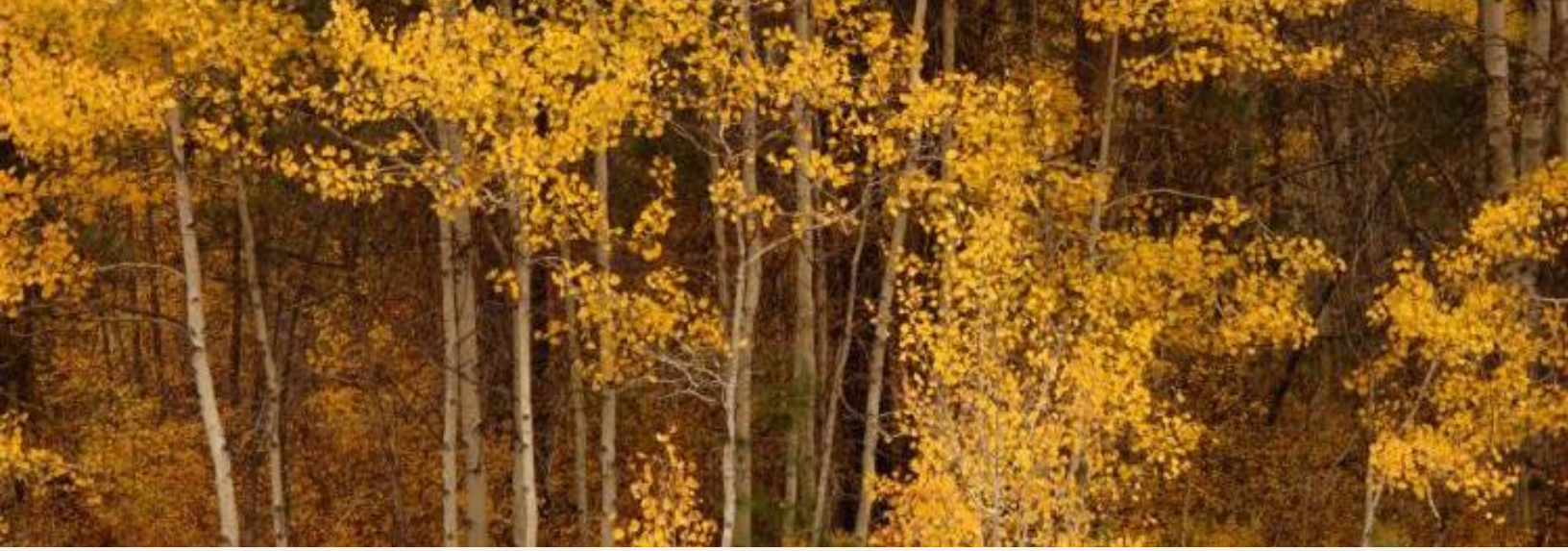

Photo Credit: USFS

ASPEN WOODLANDS

Aspen woodlands are woodland or forest communities, dominated by aspen trees with a forb, grass, or shrub understory. Aspen woodlands can also occur within conifer forests.

ECOREGIONS

Aspen woodlands are a Strategy Habitat in the **Northern Basin and Range**, **Blue Mountains**, and **East Cascades** ecoregions.

CHARACTERISTICS

In open sagebrush habitat, aspen forms woodland or forest communities, dominated by aspen trees with a forb, grass, or shrub understory. In forested mountain habitats, aspen can occur within conifer forests. Aspen primarily occur in riparian areas or in moist microsites within drier landscapes. Characteristic understory grasses include Idaho fescue, pinegrass, Great Basin wildrye, or blue wildrye, and shrubs include sagebrush, snowberry, serviceberry, and roses. Aspen habitats evolved in areas that historically experienced fire. Given sufficient moisture and light, aspen will sprout annually, and they will sprout more vigorously after fire. Without fire disturbance, aspen stands decrease in size (total acres covered) and may be lost to competition from conifer trees. Aspen do not occur in the hottest, driest portions of the Northern Basin and Range ecoregion.

CONSERVATION OVERVIEW

Aspen is on the edge of its range in Oregon and is more common further east in the Rocky Mountains and north into Canada. One of the few deciduous trees in eastern Oregon, aspen is especially important in the **Northern Basin and Range** and **Blue Mountains** ecoregions. In a landscape dominated by shrubs and grasses, aspen provide additional structure useful as nest sites and hiding cover for wildlife. Aspen stands generally have high invertebrate prey diversity and densities. Aspen is important for birds in both migration and breeding seasons. It also provides fawning and calving habitat, hiding cover, and forage

for mule deer and elk. Other wildlife that use aspen include black bear, beaver, rabbits, grouse, and bats. Tree Swallows, woodpeckers, and other birds nest in aspen cavities. Aspen stands contribute to watershed health by serving as snowdrift banks.

Throughout the west, there is concern about the loss of aspen habitats and the lack of aspen regeneration in remnant stands. In the Northern Basin and Range ecoregion, approximately 79 percent of aspen woodlands have been lost since the 1800s. Aspen stands often depend on natural fire to reduce competition from conifers and stimulate the growth of suckers from roots. Chronic overgrazing can prevent overstory recruitment, allow invasive plant species to take hold, and degrade understories. Within a stand, the aspen trees reproduce vegetatively, producing clonal root sprouts arising from a parental root system. While the aspen clone or genet may last for thousands of years, individual trees may only live for 100-150 years. Many existing trees are reaching the end of their natural life cycle, and without young aspen trees to replace them, the stands will be lost completely.

LIMITING FACTORS AND RECOMMENDED APPROACHES

Limiting Factor: Altered Fire Regimes and Encroachment From Juniper and Conifers

Fire suppression has resulted in juniper encroachment and lack of reproduction in aspen.

Recommended Approach

Carefully reintroduce **natural fire regimes** using site-appropriate prescriptions, accounting for the area size and vegetation characteristics that affect resiliency and resistance to disturbance. Use mechanical treatment methods (e.g., chipping, cutting for firewood) to control encroaching junipers, recognizing that reintroducing a disturbance regime may be necessary to reinvigorate aspen reproduction. Apply treatments appropriately with respect to season and location.

Limiting Factor: Lack of Reproduction

In addition to fire suppression, overgrazing has limited aspen recruitment. When conditions are over-grazed, aspen will sprout but not grow fully into trees. Cattle and ungulates impact the soil, herbaceous layer, and sprouts.

Recommended Approach

Limit over-grazing. Use temporary ungulate exclosures to encourage reproduction at high priority sites.

Limiting Factor: Degraded Understories

Invasive plants, introduction of non-native pasture grasses, and historical overgrazing have altered the understory of many aspen stands.

Recommended Approach

Control **invasive plants** using site-appropriate methods and reintroduce native bunchgrasses and flowering plants at priority restoration sites.

Limiting Factor: Fragmentation

While some aspen patches naturally occurred in isolated patches, habitat conversion has increased fragmentation and isolation of aspen.

Recommended Approach

Analyze historical and current aspen distribution at the watershed scale to plan restoration activities that increase connectivity of aspen patches.

Limiting Factor: Mapping Limitations

Current mapping efforts do not adequately document aspen stands due to their small patch size. Lack of adequate maps affects ability to understand size, extent, and spatial placement of aspen, and to restore connectivity of aspen patches at a landscape scale.

Recommended Approach

Support efforts to map aspen and other important habitats at fine (less than 100 feet pixel) scales.

RESOURCES FOR MORE INFORMATION

- **Oregon State University. 2010. Land Manager's Guide to Aspen Management in Oregon.**
- Earnst, S.L., D.S. Dobkin, and J.A. Ballard. 2012. Changes in avian and plant communities of aspen woodlands over 12 years after livestock removal in the northwestern Great Basin. Conservation Biology 26:862-872.
- Bates, J.D. and R.F. Miller. Restoration of aspen woodland invaded by western juniper: applications of partial cutting and prescribed fire. 16th International Conference, Society for Ecological Restoration.
- Bates, J.D., R.F. Miller, and K.W. Davies. 2006. Restoration of quaking aspen woodlands invaded by western juniper. Rangeland Ecology & Management 59(1):88-97.

Photo Credit: Rebecca Kennison, Creative Commons

COASTAL DUNES

Occurring along the Oregon coastline, coastal dunes provide habitat for species that prefer open, sandy habitats with a high degree of disturbance from winds and tides.

ECOREGIONS

Coastal dunes are a Strategy Habitat in the **Coast Range** ecoregion.

CHARACTERISTICS

The Coastal Dunes Strategy Habitat includes beaches, foredunes, sand spits, and active to stabilizing back dunes. The vegetation varies from sparse to forested, as influenced by sand scour, deposition, movement, and erosion. Species composition is also influenced by salt spray, storm tidal surges, wind abrasion, and substrate stability. Beaches and sandspits are directly influenced by tidal action and are unvegetated. Foredunes generally have unstable sand and sparse to moderate vegetative cover, including dunegrass, seashore bluegrass, gray beach peavine, large-headed sedge, beach morning glory, yellow sandverbena, and silver burweed. In dunes with greater sand stability, red fescue, seashore lupine, coastal strawberry, beach knotweed, and yarrow are dominant. With plant succession, dunes convert over time to shrublands dominated by salal and evergreen huckleberry and forests dominated by shore pine, then eventually Sitka spruce, western hemlock, and Douglas-fir.

CONSERVATION OVERVIEW

Coastal dune communities have been altered dramatically through the introduction and spread of non-native European beachgrass, which outcompetes native vegetation and stabilizes foredunes. The stabilized foredunes block movement of sand inland and artificially accelerate plant succession toward shrubland and forest. Dunes artificially stabilized by European beachgrass have contributed to commercial and residential development of sandy habitats that were once naturally active, moving

systems. In Oregon, approximately 90 percent of coastal dunes have been altered from their natural state since 1850.

Species that live in coastal dune habitats prefer open, sandy habitats with a high degree of disturbance from winds and tides. **Strategy Species** associated with coastal dunes include **Western Snowy Plover**, **pink sandverbena**, and **Wolf's evening primrose**.

LIMITING FACTORS AND RECOMMENDED APPROACHES

Limiting Factor: Beachgrass Invasion

European beachgrass stabilizes dunes, resulting in changes in vegetative communities and loss of open sandy habitats that are vital to native species.

Recommended Approach

Use mechanical and chemical treatment to control European beachgrass in priority areas, such as Western Snowy Plover nesting areas and near pink sandverbena populations. Build on existing restoration efforts to control beachgrass.

Limiting Factor: Invasive Plants

Stabilized dunes are vulnerable to invasive species, such as Pampas grass, Scotch broom, and gorse, which displace native plants and animals and accelerate succession.

Recommended Approach

Control key **invasive plants** using site-appropriate tools, such as mechanical (e.g., mowing, girdling, pulling), chemical, and biocontrol (for gorse) treatments.

Limiting Factor: Increasing Development

Stabilized dunes are being developed for residential housing.

Recommended Approach

Use **voluntary cooperative approaches**, such as financial incentives, Candidate Conservation Agreements with Assurances, and conservation easements to maintain dune habitats. Work with agency partners to support and implement Statewide Land Use Goal 18, Beaches and Dunes.

Limiting Factor: Recreational Impacts

In some areas, recreational use can cause disturbance to wildlife (e.g., **Western Snowy Plover nesting areas**). Off-highway vehicles can impact vegetation and disturb wildlife.

Recommended Approach

Work with land managers to direct recreational use away from highly sensitive areas. Provide recreational users with information on coastal dune conservation issues and low-impact uses.

RESOURCES FOR MORE INFORMATION

- **Oregon Coastal Management Program**
- **Oregon Dunes National Recreation Area Management Plan**

Photo Credit: DLCD, ODFW

ESTUARIES

Estuaries occur where freshwater rivers meet the oceanic salty waters, are influenced by tidal flooding, and experience frequent periodic changes in salinity, water levels, sunlight, and oxygen.

ECOREGIONS

Estuaries are a Strategy Habitat within the **Coast Range** ecoregion and are also discussed within the **Oregon Nearshore Strategy**.

CHARACTERISTICS

Estuaries extend inland and upstream from the mouth of a river or bay to the point where the average difference in water level caused by tidal change is 0.2 feet (0.06 meters). Many Oregon estuaries have a large freshwater tidal zone, where water is fresh but water levels fluctuate with the tides. There are 22 large estuaries and many smaller estuaries along the Oregon coast. As a planning tool, the 22 estuaries have been designated as development, conservation, or natural, which define the prominent use or activities in the estuary and specify allowed locations for various uses. Portions of the larger estuaries have been altered through dredging, filling, or diking. Estuaries designated as "conservation status" are in a more natural state. All of Oregon's estuaries are crucial to the coastal and nearshore ecology and support a diversity of habitats including open channels, tide flats, eelgrass beds, salt marshes, tidal swamps, and freshwater marshes.

Physical Environment:

Oregon's estuarine habitats can be described using the **Coastal and Marine Ecological Classification Standard** (CMECS), a federal classification system adopted in 2012 to provide a common framework using a simple, standard format and common terminology. The CMECS classifies the environment into biogeographic and aquatic settings that are differentiated by features influencing the distribution of organisms. Within these systems are four underlying components that describe different aspects of the

seascape: water column, geoform, substrate, and biotic. The components can be used to classify a given area depending on the objectives. The goal of using the CMECS is to both enhance scientific understanding and to advance ecosystem-based and place-based resource management.

The Estuarine Aquatic System is composed of both riverine subsystems and the more saline subsystems found lower in the estuary. These are divided where the average salinity during the annual low flow period is less than 0.5 practical salinity units. The species found in the tidal riverine coastal and tidal riverine open water subsystems differ greatly from those found in the more saline coastal and open water subsystems in all of the tidal zones.

Estuaries can also be classified by their geoform components. Geoforms, which are geologic in origin, include sloughs, tidal channels, creeks, deltas, fans, shoreline fans, flats, islands, lagoons, marsh platform, natural levees, and shores. There are also biogenic geoforms, such as burrows and areas of bioturbation. The CMECS also allows the classification of anthropogenic altered areas as geoforms. Such things as shorelines hardened by rip rap (e.g., large rock) structures, artificial aquaculture structures, man-made levees, docks and piers, dredge deposits, dredged and excavated channels, fill areas, and harbors, marinas, and boat ramps are some examples.

Similarly, descriptions of estuarine habitats may include the various substrate components. These components include geologic origin substrates like bedrock, gravel, sand, and mud, for example, as well as anthropogenic substrates, such as the rock of jetties or the construction materials of pilings, and the biogenic substrates, such as large fallen trees.

Biological Community:

This highly complex, productive habitat is critical for many fish and wildlife species, including salmon, crabs, and other shellfish, juvenile marine fish, marine mammals, and birds. By some estimates, estuaries support up to three-quarters of all harvested fish species, largely due to the high productivity and diversity of habitats, including those provided by eelgrass beds. Primary production in estuary habitats is among the highest of any on earth, meaning that both the visible and microscopic plants produce a tremendous amount of carbon material (from photosynthesis) that supports the base of the food web. Tidal marshes are particularly productive and produce plant material that, when it dies seasonally, is broken down by microscopic bacteria to serve as food for many organisms, which in turn are eaten by larger ones as they are distributed throughout the estuary with the tides. Tidal swamps provide complex habitat with layered vegetation, including low-growing herbaceous plants, shrubs, and trees; large quantities of above- and below-ground woody debris; deep, sheltered tidal channels; and deep soils rich in organic matter.

Many other fish and wildlife species also use estuaries. Elk herds graze in tidal marshes and shelter in tidal swamps; bears forage in tidal swamps; river otters build their homes here; and rails, snipe, and songbirds nest in the dense vegetation. Estuaries also provide important wintering habitat for waterfowl, including the Black Brant, and migration stopover feeding areas for many shorebirds. Native

eelgrass is an important component of an estuary, providing important habitat for several nearshore Strategy Species, including **Black Brant**, **Dungeness crab**, **black rockfish**, **copper rockfish**, and **kelp greenling**. **Eelgrass** is also an important spawning substrate for herring, an important forage fish species.

CONSERVATION OVERVIEW

Efforts to conserve healthy estuarine areas and restore degraded habitats will benefit many species, including several commercially important fish and wildlife species. For example, **coho salmon**, **Chinook salmon**, and **Dungeness crab** are Strategy Species that use estuarine habitat for at least part of their life cycle.

Estuarine habitats have been impacted by human development activities, such as urbanization, diking, ditching, and other hydrologic modifications. Tidal wetlands (e.g., salt and fresh water marshes and tidal swamps) have been diked, drained, and converted to pasture. Shrub and forested tidal swamps, once common, have been even more heavily impacted, resulting in substantial habitat loss.

In accordance with state planning laws (**Goal 16**), local government comprehensive plans and zoning ordinances have been prepared for all of Oregon's estuaries. Additionally, both estuaries and eelgrass beds are habitat types that have been designated as a Habitat Area of Particular Concern under National Marine Fisheries Service's (NMFS) **Essential Fish Habitat** regulations for salmon and groundfish species, designations that require federal agencies to consult with the NMFS before actions are taken.

In addition to the Limiting Factors and Recommended Approaches presented here, impacts to species within estuarine habitats can include the removal of animals for harvest or other purposes, which can impact populations; disturbance to various wildlife species including pinnipeds or birds from aircraft, boats, recreation, and research, which may lead to changes in animals' foraging behavior, abandoning young, or greater susceptibility to predators; and noise pollution, which can impact animal behavior.

LIMITING FACTORS AND RECOMMENDED APPROACHES

Limiting Factor: Increasing Development, Land Use Conversion, and Altered or Blocked Tidal Flow

Estuary habitat has been lost to a variety of causes, including: diking, ditching, and drainage; tide gates; inadequate flow through culverts under roads and railroads; industrial and residential development; log storage areas, pilings, docks, or bridge structures; and aquaculture practices that reduce eelgrass beds and disturb winter waterfowl. Estuarine development closer to the ocean can impact habitats as well. For example, building and maintaining jetties, piers, breakwaters, marinas, and navigation channels, including disposal of dredge materials, can alter the habitat and impact nearshore Strategy Species.

Recommended Approach

Continue to provide incentives to protect, conserve, and restore estuaries. Where appropriate, work to restore hydrology to tidal wetlands by removing dikes, filling ditches, and replacing undersized culverts. Continue successful education programs focused on the function and services provided by estuaries. Work with agency partners to support and implement existing land use regulations that preserve and restore habitats. For example, refer to seasonal in water work window for estuaries designed to minimize impacts to out-migrating salmon. Continue to develop and refine "best management practices" for aquaculture. Maintain and restore eelgrass beds as a habitat feature. (Key Conservation Issue (KCI): **Land Use Changes**)

Limiting Factor: Alteration of Freshwater Inputs Into the Estuary

In addition to the restoration of tidal flow discussed above, the amount and timing of freshwater inputs into estuaries are critical in maintaining the hydrological regime that supports the delicate estuarine balance. When either the amount or timing of freshwater input is altered, several results are possible: inundation of floodplains, increased sedimentation, decreased residence time of water (which reduces the filtering benefits of estuaries), altered fish community dynamics, and/or increased stress on juvenile fish, nekton, or other animals. Changes in hydrological regimes can make estuaries prone to invasive species, which compound the problem.

Recommended Approach

Evaluate the potential impacts of water diversions from the estuary (e.g., for agriculture, residential, or industrial purposes) on floodplain dynamics and other functions of estuaries. Prioritize basins for the acquisition of sufficient instream flows.

Limiting Factor: Degraded Water Quality

Water quality in estuaries is degraded by both point and non-point sources of pollution both within the estuary and from its contributing watershed. Runoff from residential, agricultural, and forest land, failing septic systems, animal waste, and storm events can affect water quality. Water temperature can be affected by dredging or sedimentation and stormwater runoff. Oil discharge and spills also affect water quality. Other discharges, such as runoff from boat and ship yards and fish processing operations, can also be a factor. Among other issues, estuaries are susceptible to increased bacterial loads. Low dissolved oxygen levels are often an additional concern. Estuaries are also affected by acidification effects from terrestrial input, which combined with ocean water acidification, can decrease water quality for some marine organisms in estuaries.

Recommended Approach

Continue current efforts to consider impacts on estuarine water quality in land use planning. Support efforts of the Oregon Department of Environmental Quality (DEQ) to assess water quality and develop

Total Maximum Daily Loads and water quality management plans where necessary to address issues. Continue coordination to ensure that plans and goals consider impacts to water quality sufficient to protect fish and wildlife in addition to other goals (i.e., recreation). (KCI: **Water Quality and Quantity**)

Limiting Factor: Invasive Species

Non-native invasive plants and animals can easily disrupt the estuary environment. Invasive plants can alter water circulation and sediment patterns. For example, common cordgrass poses a great threat to Oregon's estuaries. Common cordgrass has been documented in two Oregon estuaries and is well-established in Washington and California. Where it occurs, it reduces mud flat habitats, disrupts nutrient flows, displaces native plants and animals, alters water circulation, and traps sediments at a greater rate than native plants, thus altering the elevation and the resulting habitats. Three other cordgrass species have invaded the Pacific coast and threaten Oregon's estuaries. Invasive plants can alter ecological community dynamics, such as competition, predation, or even parasitic relationships with native species. Estuaries are one of the most vulnerable habitats for invasive species due to ship traffic and release of ballast water. Ballast water can also carry invasive animals, algae, protists, and potentially, bacteria. Invasive species can also be introduced into estuaries through aquaculture, recreational or commercial boating, or the aquarium trade. Examples of non-native invasive animals found in Oregon estuaries include: the parasitic Griffen's isopod which has been linked to declines of native blue mud shrimp populations, the Japanese oysterdrill, the New Zealand mudsnail, the purple varnish clam, and a colonial tunicate.

Recommended Approach

Emphasize prevention, risk assessment, early detection, and quick control to prevent new invasive species from becoming fully established. Control key invasive plants using site-appropriate tools, such as hand-pulling, covering with geotextile cloth, repeated mowing, flooding, and/or herbicides focusing on spot treatment. Monitor estuaries for potential invasive species, and use site-appropriate methods to control newly-established species for which management can be most effective. Work with partners to implement existing ballast water regulations. Develop methods to treat ballast water. Work with partners to limit the spread of invasive species that are established. Allow increased harvest of species suitable for human consumption such as purple varnish clams. (KCI: **Invasive Species**)

Limiting Factor: Coordination of Management

Many jurisdictions and agencies have management authority and interest in estuaries, which can make management more complex and difficult. In Oregon, 22 cities, 7 counties, 13 port districts, many state agencies (e.g., Oregon Department of State Lands, Oregon Water Resources Department, Oregon Department of Land Conservation and Development, DEQ, Oregon Department of Agriculture (ODA), ODFW, Oregon Parks and Recreation Department) have planning and management responsibilities for estuaries as does the federal government. Many organizations have interests in estuaries.

Recommended Approach

Coordination among agencies is a high priority. Because estuarine issues are complex, clear identification and communication of conservation opportunities, goals, and threats should precede management actions, ensuring that all interests are considered and coordinated.

Limiting Factor: Loss of Habitat Complexity

Habitat complexity provides refugia for estuarine fish and wildlife. Complex habitat supports diverse ecological communities, contributing to resiliency to climate change impacts. Removal or loss of large downed trees reduces habitat complexity, insect production, and food and cover for juvenile salmonids. Disconnection from the floodplain interrupts the natural transition zones between the aquatic, intertidal, and upland ecosystems. Dredging, ditching, channelization, and filling in estuaries alters marine and freshwater inputs and reduces habitat function. In-water (e.g., pilings, jetties, seawalls) or overwater (e.g., mooring buoys, floating docks) structures can reduce habitat complexity, as can bayside development that extends into intertidal areas. Natural factors can also reduce habitat complexity, such as damage or movement caused by seasonal runoff or significant storm events, especially where the estuary has already been compromised and floodplains have been lost.

Recommended Approach

Assure that permit application reviews consider alternative sites and practices to reduce and minimize impacts, and provide full mitigation. Encourage and participate in cooperative efforts and incentives to promote habitat complexity in estuaries. Prioritize conservation and restoration efforts to restore floodplain connectivity, tidal marshes, and swamps and to conserve eelgrass. Increase outreach and education about the importance of habitat complexity.

Limiting Factor: Climate Change

Climate change may impact estuaries in several major ways: loss of wetlands due to sea level rise, alteration of hydrology, increases in erosion and salinity, changes in storm patterns, and ocean acidification. The effects of sea level rise are being modeled in Oregon's estuaries, incorporating tectonic uplift, different levels of predicted sea level changes, and information on sediment inflow. The goal is to identify which estuarine areas are the most susceptible and where future marshes are likely to be to help restoration specialists and planners define desired future conditions and actions. Additional information is needed to understand the effects of climate change (including storm surge impacts and sediment movement patterns) on species with a variety of life stages in estuaries. Ocean acidification and the impact of anoxic (hypoxia) conditions in estuarine and nearshore areas are also of concern. Additional information is needed to determine what adaptation measures can be taken.

Recommended Approach

Use emerging models of future sea level rise and changing salinity regimes to inform conservation actions in estuaries. Work with property owners, land use planners, and restoration practitioners to focus attention on vulnerable areas. Support efforts to restore natural processes of tidal exchange and sediment deposition, which will enable tidal wetlands to maintain their elevation relative to rising sea levels. Support efforts to re-connect floodplains to adjacent uplands by removing barriers, placement of large woody debris, and planting of riparian areas. Conserve areas that will become new marshes with sea level rise. Inform communities about climate change impacts and support community preparedness. (KCI: **Climate Change**, Climate Change and Oregon's Nearshore Open Water Habitat)

Limiting Factor: Oil Spills

Oil (and other hazardous waste) spills are of concern in estuaries. If a spill occurs, oil accumulation can have lasting impacts in estuaries.

Recommended Approach

Review and update oil spill contingency plans based on new estuary maps and climate change considerations. Work with Oregon Department of Geology and Mineral Industries, DEQ, and local emergency officials to identify hazardous material use and storage sites in high risk areas and seek ways to minimize these risks.

RESOURCES FOR MORE INFORMATION

- Brophy, L.S. (Green Point Consulting). 2007. **Estuary Assessment: Component XII of the Oregon Watershed Assessment Manual**. Prepared for the Oregon Department of Land Conservation and Development, Salem, OR and the Oregon Watershed Enhancement Board, Salem, OR.
- **Oregon Coastal Atlas Estuary Data Viewer**, **associated GIS data**, and **background on CMECS classification system**
- **National Water Quality Assessment Program**
- **South Slough National Estuarine Research Reserve**
- **State of the Environment Report, Chapter 3. Summary and Current Status of Oregon's Estuarine Ecosystems**
- **ODFW Workshop on Estuaries, Climate Change, and Conservation Planning (2010)**

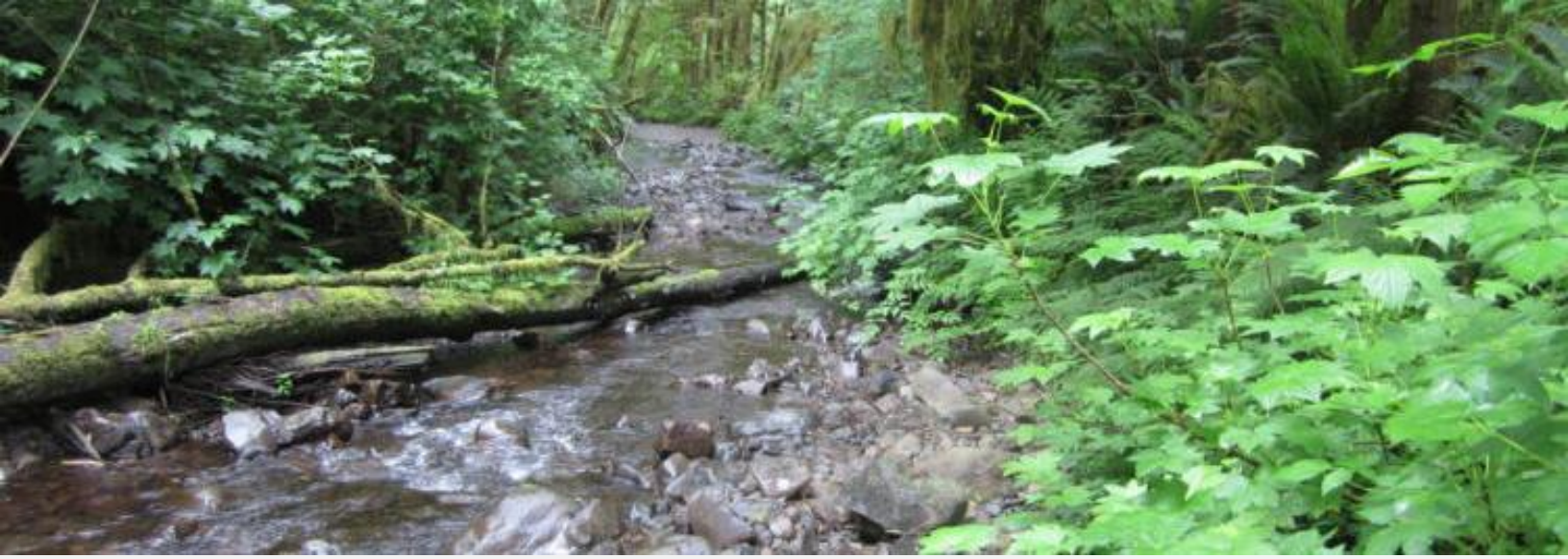

Photo Credit: Herman Biederbeck, ODFW

FLOWING WATER AND RIPARIAN HABITATS

Flowing Water and Riparian Habitats include all naturally occurring flowing freshwater streams and rivers throughout Oregon as well as the adjacent riparian habitat.

ECOREGIONS

All ecoregions.

CHARACTERISTICS

Flowing streams and rivers are a key feature of the Oregon landscape and natural resources heritage. Flowing water habitat also includes springs, seeps, and intermittent streams. Flowing water is of significant conservation concern under **climate change**, with changes in precipitation patterns, snowmelt cycles, and fire frequency. The headwaters of many streams are fed by snowmelt, and the flowing freshwater systems are crucial to iconic Northwest salmon and steelhead as well as amphibians, dragonflies, and other **Strategy Species**.

Riparian habitat zones are adjacent to flowing water in rivers and streams as well as springs, seeps, terraces, and many low-elevation alluvial floodplains. They occur at all elevations, from valley bottom floodplains to alpine torrents, and are shaped through seasonal flooding, scour, and soil deposition.

Riparian zones are the dynamic interface between land and flowing water. The plant assemblages and communities in riparian zones help buffer inputs and the cycling of nutrients. The vegetative composition and structure of riparian zones is a function of elevation, stream gradient, floodplain width, and disturbance events such as flooding.

Throughout most of the state, riparian vegetation is comprised mostly of deciduous trees and shrubs, such as big-leaf maple, alders, aspen, cottonwood, dogwood, willows, and Oregon white ash. Conifers, such as pines, firs, and spruce, dominate some riparian zones at higher elevations. The vegetative

composition of riparian zones is also influenced by elevation and precipitation patterns. Riparian shrublands may include willows, red osier dogwood, western birch, hawthorn, alder, and chokecherry. Riparian meadows are dominated by grasses, sedges, and rushes. Riparian habitats provide food, cover, and breeding sites for many fish and wildlife species throughout the year.

The Flowing Water and Riparian Strategy Habitat does not include irrigation structures or other man-made waterbodies. **Natural lakes** are covered separately, and the riparian zones around the edges of those lakes are included within the **Wetlands** Strategy Habitat.

CONSERVATION OVERVIEW

Flowing water and the riparian habitat found along its banks are defined together as a **Strategy Habitat** because their distribution and conservation roles are interconnected.

Water is crucial for all fish and wildlife, and high quality freshwater aquatic systems provide essential habitat to many at-risk species, including important spawning and rearing habitat for salmonids, breeding habitat for amphibians, and habitat for freshwater mussels and other invertebrates. Flowing water is important to connect ecosystem services from higher elevations throughout the year. In many locations throughout Oregon, water flow and hydrology have been impacted by barriers (e.g., roads, dams, and culverts) and irrigation diversions that can reduce water flow and **interfere with fish and wildlife migration**. Channelization and development can restrict the natural ability of streams to meander over time, limiting the quality and availability of these habitats, as well as affecting floodplain function.

Riparian habitats often have high species diversity and are critical for wildlife. These habitats are important to species that prefer moist shrubby or forested habitats. Riparian areas provide essential wintering habitat and travel corridors for birds, amphibians, reptiles, mammals, and other wildlife. In arid areas, such as the **Blue Mountains** and **Columbia Plateau** ecoregions, riparian habitats can provide abundant insects, plants, and moisture throughout the year. Riparian meadows include natural spring-seep habitats that are extremely important for a wide variety of species, including **Greater Sage-Grouse** chicks and butterflies.

In addition to providing habitat for birds and other wildlife, riparian habitats have important ecological functions. Healthy riparian vegetation protects banks from erosion, influences in-channel aquatic habitats, maintains favorable water temperature for fish through shading, filters runoff, and provides nutrients to support terrestrial and aquatic life. Riparian vegetation creates meanders in streams and rivers and increases habitat complexity in valley bottoms. In the **Northern Basin and Range** ecoregion, riparian vegetation can protect against scour from summer storms. Riparian habitats link upland and aquatic habitats. Upland habitats have a critical role in watershed function and affect riparian and aquatic habitats, particularly in drier, low-elevation sites.

Riparian habitats have declined from historical levels and are now greatly reduced in area and connectivity, especially those in low-elevation areas and valley bottoms. Development, logging, roads, agricultural practices, and grazing can degrade riparian habitat. Removal or reduction of riparian habitat allows runoff containing fertilizers and other contaminants to more easily reach flowing water and further impact aquatic habitat.

Oregon's Planning and Regulatory Background for Riparian Habitats

Steps have been taken through Oregon's planning and regulatory framework to address riparian habitat conservation issues. Cooperative restoration projects have benefited riparian-dependent species on forest and agricultural lands. In many cases, these efforts have focused on improving habitat quality in smaller, fish-bearing streams. Streamside buffers implemented through the **Northwest Forest Plan** (NWFP) on public land and the **Oregon Forest Practices Act** on private land are designed to protect riparian health in forested landscapes. On agricultural lands, Agricultural Water Quality Management Area Plans and Rules have been adopted across the state to address riparian conditions and other **water quality issues**. While each riparian rule is slightly different depending on the local area, the riparian rules generally require agricultural activities to allow establishment, development, and maintenance of riparian vegetation consistent with site capability to provide moderation of solar heating, filtration of overland flow, and streambank stability.

Oregon has initiated a **riparian assessment framework** to track changes in riparian condition on agricultural lands over time. Riparian areas across the state will likely be conserved by a variety of measures, including a combination of existing regulatory and non-regulatory state and federal programs. These are designed to control degradation of riparian habitats and improve water quality. The DEQ's completion of **Total Maximum Daily Loads** will also bring more specificity to the recovery process. For urban and rural residential development, some guidelines are provided through local land use ordinances adopted to address **Statewide Planning Goal 5** requirements for riparian vegetation. Given the background addressing conservation in riparian habitats, some limiting factors to conservation remain.

LIMITING FACTORS AND RECOMMENDED APPROACHES

Limiting Factor: Water Quantity

Water availability is limited in some parts of the state, and concern increases under a changing climate. Low flows are associated with higher water temperature and higher nutrient and contaminant concentrations. Riparian bottomland habitats compete for water with other uses, particularly in the Blue Mountains, Columbia Plateau, East Cascades, and Northern Basin and Range ecoregions. In eastern Oregon, agriculture consumes much of the available water. Diversions occur at all major streams, and most valley bottoms have multiple canals that divert water. As a result, riparian habitats no longer support the many channels and sinuosity that are characteristic of healthy stream systems.

Recommended Approach

Where possible, maintain flow following the natural hydrological cycle. Improve irrigation efficiency. Lease water for instream use. In cooperative voluntary approaches that allow for purchase of instream water rights, prioritize use for agricultural purposes providing the greatest economic benefit. Maintaining streamflow and water storage is especially important to riparian conservation in eastern Oregon ecoregions. Provide incentives and information about water usage and sharing at key times of low flow conditions (e.g., late summer).

Limiting Factor: Invasive Aquatic Species

Invasive fish species (e.g., bass, crappie, bluegill, yellow perch, bullhead, carp) can compete with, prey on, or hybridize with native fish (e.g., steelhead, rainbow trout) and amphibians. For example, in the Columbia Basin, non-native carp can overgraze aquatic vegetation and stir up sediment, depriving native fish and amphibians of egg-laying sites or preventing eggs from absorbing enough oxygen to develop. Alterations in hydrology can make the habitat more susceptible to invasive plants, invertebrates, and fish.

Recommended Approach

Restoration of aquatic habitats to conditions that support native fish and wildlife is the best strategy to prevent invasive species. Maintaining historical hydrological regimes ensures that habitat conditions best support native fish and wildlife. Work with community partners to restore flow and water input levels. Where necessary, work to minimize predation on sensitive native species. Where non-native aquatic species threaten **Strategy Species**, consider site-appropriate tools (e.g., mechanical or chemical treatment) in locations and during seasons where they will not harm native amphibians, fish, or invertebrates. Educate and inform people about the problems that can be caused by invasive species.

Limiting Factor: Passage Barriers and Channel Complexity

Fish and wildlife depend on natural flow regimes and substrates for breeding, foraging, cover, and migration. Dams, road culverts, or log puncheons can alter or affect in-stream flow. The large dams on almost all of the Cascade rivers disrupt natural hydrologic regimes, which decreases the amount of bottomland habitat, and impacts anadromous fish passage upstream and downstream. Misaligned culverts with the downstream end above the water level disconnect stream passage corridors and may force wildlife to cross roads where they are vulnerable to vehicles and predators. Undersized or improperly sized culverts can alter the transport of sediment and wood, creating an uneven distribution of habitat. These effects can degrade riparian habitat and impact riparian-associated fish and wildlife. Additionally, altered flow regimes can contribute to higher temperatures in some streams. Channel complexity is also important for fish and wildlife. Woody debris and other structures provide nutrient cycling and refugia from predators and high temperatures.

Recommended Approach

Where possible, work with landowners and regulatory agencies to restore natural flow conditions on streams impacted by barriers. **Eliminate passage barriers** or improve passage at existing barriers to provide travel corridors for fish and wildlife. Remove or replace culverts or other passage barriers with structures that mimic natural conditions as closely as possible (e.g., bridges or open-bottom arch culverts). Determine potential effectiveness of providing passage around dams for fish and wildlife (e.g., amphibians, reptiles, mammals). Develop new habitat sites where possible. Provide sufficient channel complexity to maintain ecological benefits for fish and wildlife. Support and encourage beaver dam-building activity.

Limiting Factor: Pollution

Non-point source pollution sometimes contains fertilizers, pesticides, or oil-based pollutants at levels high enough to cause significant lethal or sub-lethal effects in native fish and wildlife. Point source pollution from industrial practices can contain high levels of contaminants. Point and non-point source pollution are both of particular concern in more highly populated regions. In some areas, particularly the Rogue River and its tributaries, increasing use of recreational motor vehicles (e.g., jet boats) has the potential to degrade **water quality** with runoff, or to harass aquatic or riparian-associated wildlife.

Recommended Approach

Increase awareness of the impacts of urban runoff and pesticide applications. Increase awareness and manage timing of applications of potential aquatic contaminants. Improve compliance with water quality standards and pesticide use labels administered by the **DEQ** and **U.S. Environmental Protection Agency (EPA)**. Work on implementing **Senate Bill 1010** (ODA) and **DEQ Total Maximum Daily Load** water quality plans. Carefully consider recreational vehicle use and timing on sensitive or "wild and scenic" water bodies. Increase interaction of rivers and floodplains. Encourage opportunities for restoration of "fringe" wetlands and channel meander to increase water storage. Reduce stormwater runoff and increase permeability in urban areas, allowing more water to seep into the ground. Use stormwater catchment basins designed for larger volume, longer residence, and a high degree of shading to mimic the delay, treatment, infiltration, and cooling functions of natural wetlands. During restoration, remove pipes and provide stream channels to promote flow, nutrient, and oxygen exchange. Where possible, provide sufficient room to **restore meanders and other functions**.

Limiting Factor: Water Temperature

Aquatic animals have specific requirements for a tolerable temperature range. Moreover, warmer water holds less dissolved oxygen. Water temperature often is too warm for native aquatic life because of alterations in stream flow, thermal pollution, or reduced riparian shading. Recommending optimal water temperatures is difficult because of a lack of understanding about historical temperature regimes.

Recommended Approach

Maintain or increase riparian habitat cover to provide shading and other benefits. Where appropriate, revegetate degraded riparian areas. Minimize release of unnaturally warm water in the fall and summer by altering intake/release structures. Maintain and restore in-stream flow to help preserve favorable water temperatures. (KCI: **Water Quality and Quantity**)

Limiting Factor: Sedimentation

Sediment flows into streams from various human activities, as well as natural processes, covering eggs of native fish and amphibians, making them more susceptible to infection, and potentially burying aquatic mollusks and freshwater mussels.

Recommended Approach

Reduce run-off of sediment from logging, agriculture, grazing, roads, and other activities that could disturb soil or destabilize streambanks. For example, work with the ODA to promote implementation of area-wide water quality management plans under Senate Bill 1010 so that farmers and ranchers know which actions they can implement to address **water quality problems** in their watershed. Strategies include terracing fields, filtering run-off before it enters aquatic systems, installing sediment control basins to reduce erosion, and practicing conservation tillage. Water quality credit trading programs to control sediment loads (and other pollutants) can help to ensure good water quality levels. When constructing new roads, consider sediment removal capabilities in road design. Maintain and restore riparian and wetland vegetation to filter sediments.

Limiting Factor: Loss of Riparian Habitat, Floodplain Function, and Habitat Complexity

A high percentage of low-elevation and valley bottom riparian habitats have been altered or lost. Riparian vegetation often is lost as habitat is converted to other uses. In several areas around the state, large cottonwood trees and gallery forest have been cleared and diked, leading to altered hydrological regimes and other impacts. Development within historical floodplains can restrict the natural ability of streams and riparian habitats to meander, limiting the creation and maintenance of new aquatic and riparian habitats. In some cases, floodplains have been converted to other uses, and riparian habitats no longer exist. Non-adherence to best management practices, such as removal of riparian vegetation, can cause sedimentation that damages aquatic areas, loss of habitat complexity, and increased water temperatures that adversely affect aquatic habitat. Loss of streamside vegetation leads to bank erosion. Grazing and dam construction can degrade riparian habitats. Urban development has led to stream channelization and vegetation loss in some areas. Losses of riparian complexity and connectivity limit the value of these important places for wildlife to meet crucial life history needs.

Recommended Approach

Restore riparian zones that will provide the full array of associated ecological functions. Enhance or re-establish the extent and connectivity of existing riparian habitats. Use voluntary cooperative efforts (i.e., Conservation Reserve Enhancement Program) and incentive programs to conserve, maintain, and restore riparian habitats on private lands. Identify and apply lessons learned from successful riparian restoration efforts on private lands to future projects. Develop tools and financial incentives to assist with streambank stabilization and decrease downstream soil movement. Improvements in riparian habitats and hydrology can also improve the quality of remaining wetland habitats. Maintain and restore riparian buffers, and minimize impacts from road-building on public lands. Where appropriate, allow beavers to continue maintaining habitat complexity, particularly in the Coast Range and parts of eastern Oregon. Maintain channel integrity and natural hydrology. Where feasible, work to restore historical hydrological conditions. Ensure that adequate riparian vegetation remains following management activities, so riparian vegetation can continue to prevent erosion, preserve water quality, and promote water temperatures favorable for fish. Restore lost vegetation through planting of native trees, shrubs, and ground cover. Manage for future sources of large woody debris. Maintain and/or expand existing tracts of large trees. For example, cottonwood trees greater than 20 inches in diameter offer benefits to riparian habitat function.

Limiting Factor: Riparian Habitat Degradation

In the Blue Mountains, Northern Basin and Range, East Cascades, and Columbia Plateau ecoregions, historical overgrazing has led to soil erosion, poor regeneration of hardwood trees and shrubs, changes in plant species composition and structure, and degradation by invasive plants. Although some areas are slowly recovering, many miles of stream are still lacking adequate riparian vegetation. Ongoing grazing impacts remain in some areas, especially at low and mid elevations. Western juniper is encroaching in some riparian areas of eastern Oregon.

Recommended Approach

In cooperation with landowners, land managers, and grazing lessees, encourage approaches such as off-site watering that keep livestock out of riparian areas. Develop and implement grazing regimes that are compatible with riparian conservation objectives. Selectively fence restoration sites or other high priority areas to exclude ungulates, at least until riparian vegetation recovers. Evaluate impacts by encroaching western juniper, and remove juniper from upper reaches of higher elevation watersheds, if appropriate. Plant riparian vegetation using native species at priority sites. Continue to work with landowners and grazing permittees to support riparian conservation and land management objectives.

Limiting Factor: Invasive Plants in Riparian Habitat

Invasive plants, such as knapweeds, knotweeds, reed canary grass, and thistles, degrade riparian habitats by competing with native plants. In the Columbia Plateau and Northern Basin and Range ecoregions, pasture grasses and cheatgrass commonly dominate the understory. In some riparian areas

in the Northern Basin and Range, Columbia Plateau, and East Cascades ecoregions, overgrazing has resulted in poor regeneration of hardwood trees and shrubs.

Recommended Approach

Control key invasive plants using site-appropriate tools, including mechanical, biological, and chemical treatments. Use chemical treatments carefully and where compatible with water quality concerns, focusing on spot treatment during the dry season. In the Columbia Plateau and Northern Basin and Range ecoregions, focus control at low-elevation sites, unless near streams where seeds could flow downstream. Provide information to local governments and landowners about potential invasive plants. Where necessary (e.g., some areas in the Northern Basin and Range, East Cascades, and Columbia Plateau ecoregions), develop and implement grazing management regimes that are compatible with riparian conservation objectives.

RESOURCES FOR MORE INFORMATION

- There are many resources for riparian assessment and monitoring available through the Oregon Watershed Enhancement Board (OWEB): **http://www.oregon.gov/oweb/pages/publications.aspx**
- Oregon Riparian Assessment Framework (OWEB 2004): **http://www.oregon.gov/OWEB/docs/pubs/or_riparianassessframework.pdf**
- Oregon Water Quality Monitoring technical guidebook (OWEB 1999): **http://www.oregon.gov/OWEB/docs/pubs/wq_mon_guide.pdf**

STRATEGY SPOTLIGHT: APPLEGATE PARTNERSHIP AND WATERSHED COUNCIL

After years of arguing over the fate of natural resources in southwestern Oregon, two former battle-scarred adversaries agreed to put aside their differences and find common ground.

Jack Shipley, a passionate environmentalist, and Jim Neal, a fixture in the logging community, founded the Applegate Partnership in 1992, a community-based forum where resource management issues are discussed openly in the hopes of a resolution outside of court.

The Applegate Partnership and Watershed Council promotes ecosystem health across the 500,000-acre Applegate watershed through stewardship, education, and restoration carried out in partnership with landowners, agencies, and other interested parties while contributing to local economic and community well-being.

The Partnership's inclusive, cooperative approach to natural resource issues has produced on-the-ground success, such as the Thompson Creek Restoration Project that benefits a variety of aquatic species, including threatened coho salmon.

Volunteers from the Applegate community, Southern Oregon Fly Fishers, Middle Rogue Steelheaders, youth from The Job Council, and contractors from Plant Oregon worked with local landowners to plant nearly 9,000 trees on 22 acres along Thompson Creek and in surrounding areas to restore riparian health. Additional salmon habitat was created by placing large woody debris in streams.

Funding for the project was also a cooperative effort and included the Oregon Watershed Enhancement Board, Whole Watershed Restoration Initiative, Pacific Power's Blue Sky fund, American Forests, Title II funds, Department of Environmental Quality, the Jubitz Family Foundation, and Middle Rogue Steelheaders.

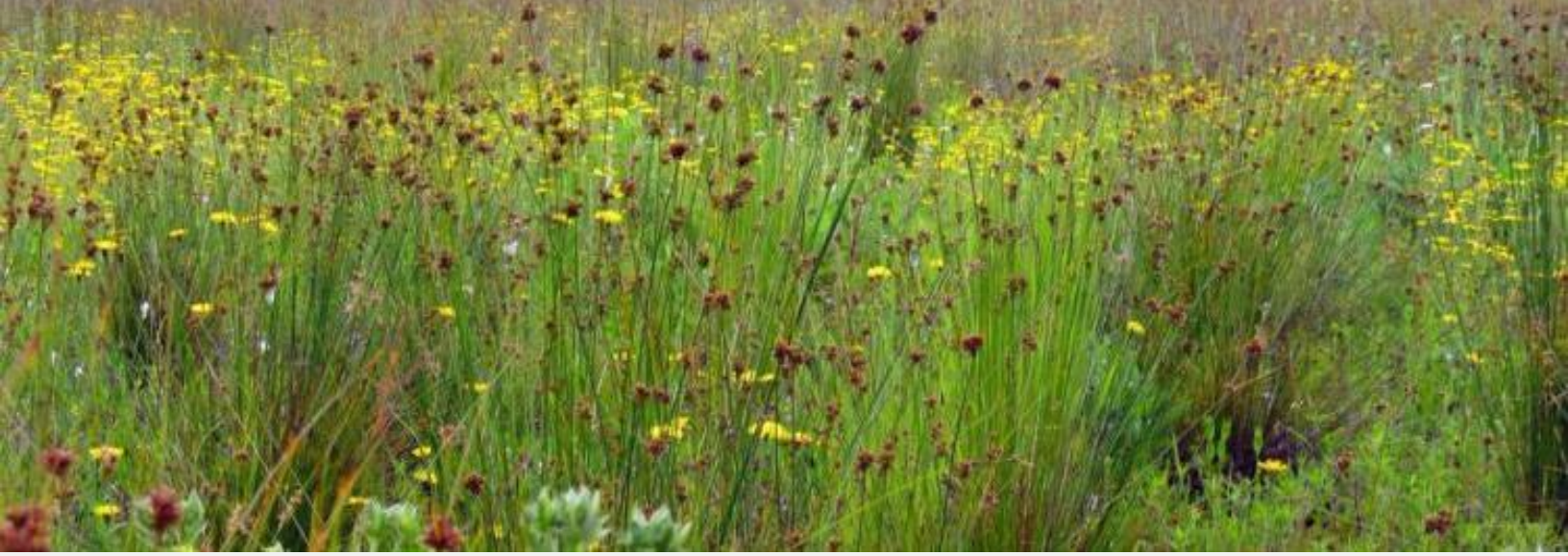

Photo Credit: West Eugene Wetlands

GRASSLANDS

Grasslands include a variety of upland grass-dominated habitats, such as upland prairies, coastal bluffs, and montane grasslands.

ECOREGIONS

Grasslands are a Strategy Habitat in the **Blue Mountains**, **Coast Range**, **Columbia Plateau**, **Klamath Mountains**, **West Cascades**, and **Willamette Valley** ecoregions. Additional grassland habitats, such as alkali grasslands, perennial bunchgrasses, and montane grasslands, can also be found in **Specialized and Local Habitats**.

CHARACTERISTICS

Grasslands generally occur on dry slopes or plateaus with well-drained sandy or loamy soils. Although dominant species vary across Oregon, perennial bunchgrasses and forbs dominate native grasslands. In some areas, grasslands are similar to wet prairies and wet meadows in structure and share some of the same prairie-associated plants and animals (wet prairies and wet meadows are included within the **Wetlands Strategy Habitat**). In all but the shallowest rocky soils, grasslands are maintained through disturbances, such as periodic fire, soil upheaval by rodents, frost heave, wind, or salt spray.

ECOREGIONAL CHARACTERISTICS

Blue Mountains

Bunchgrass grasslands occur primarily in the northeastern portion of the ecoregion, although other grassy habitats occur throughout the ecoregion. At low elevations, semi-desert grasslands are dominated by drought-resistant perennial bunchgrasses, such as needle-and-thread, dropseed, threeawn, and muhly, and may have scattered shrubs. Mid-elevation plateau grasslands include extensive bunchgrass prairies of Idaho fescue, junegrass, and bluebunch wheatgrass. At high elevations,

ridgetop balds and alpine parks are dominated by green or mountain fescue, needlegrass, and/or bluegrass species. High-elevation grasslands often are on south-facing slopes surrounded by subalpine conifer woodlands.

Coast Range

Coastal bluff and montane grasslands are dominated by low-growing vegetation, such as perennial bunchgrasses, forbs, mosses, and dwarf shrubs. They occur within a matrix of conifer forests. Outer coastal bluffs and headlands are influenced by wind and salt spray, which limit the growth of woody vegetation. Montane grasslands include dry meadows and balds and occur on dry, south- or west-facing slopes with shallow sandy or gravelly soils. They are primarily influenced by periodic fire, soil upheaval by rodents, and drought conditions.

Columbia Plateau

Grasslands include river terrace grasslands, prairies, canyon slopes, and rocky ridges. At low and mid elevations, semi-desert grasslands are dominated by drought-resistant perennial bunchgrasses, such as needle-and-thread, dropseed, threeawn, and muhly, and may have scattered shrubs. Palouse grasslands occur in flat areas with deep soils and are dominated by bluebunch wheatgrass, Idaho fescue, and other grasses and forbs. Canyon and foothill grasslands are found on the steeper, rocky slopes surrounding the major rivers in this region and are dominated by bluebunch wheatgrass, Idaho fescue, Sandberg's bluegrass, balsamroot, and other forbs.

Klamath Mountains

Grasslands are found in valley bottoms, often in a mosaic with chaparral and savanna, on open serpentine barrens, and high mountain meadows. Historically, grasslands in this ecoregion were maintained by frequent burning and included scattered deciduous and conifer trees. Oak savannas are grasslands with scattered trees that are usually large with well-developed limbs and canopies.

West Cascades

Montane grasslands include open dry meadows, grasslands, and balds. Montane grassland habitats occur in a matrix of mixed conifer forests and woodlands. Mid- and high-elevation dry meadows tend to have deeper and better-drained soils than the surrounding forests and are dominated by grasses and wildflowers, such as green, Roemer's, alpine, or western fescue, California brome, timber oatgrass, broadleaf lupine, and beargrass. Balds and bluffs generally occur on south- to west-facing slopes on shallow, well-drained soils and are dominated by bunchgrasses, forbs, and mosses.

Willamette Valley

Grasslands, also called upland prairies, are dominated by grasses, forbs, and wildflowers. Grasslands have well-drained soils and often occur on dry slopes. They are similar to wet prairies in structure and share some of the same prairie-associated plants and animals (wet prairies are included within the

Wetlands Strategy Habitat). Oak savannas are grasslands with scattered Oregon white oak trees, generally only one or two trees per acre (denser oak stands are included in the **Oak Woodlands Strategy Habitat**). Oak trees in savannas are usually large with well-developed limbs and canopies.

CONSERVATION OVERVIEW

As a whole, native grasslands are one of the most imperiled habitats in the western United States and are disappearing rapidly around the globe. In Oregon, the estimated loss of grasslands ranges from 50 percent to more than 90 percent, depending on the ecoregion. The greatest loss of grasslands has been in valley bottoms and foothills where they have been impacted by conversion to agriculture, development, and invasive plant species. In some areas, past grazing has impacted grasslands, affecting plant composition and structure. Also, non-native species were historically seeded for livestock forage in some grasslands, decreasing the abundance and diversity of native plants. However, grazing practices have become more sustainable over time, and carefully managed grazing can help to maintain grassland structure where prescribed fire is not practical or desired. Disruption of historical fire regimes has allowed for shrubs or trees to encroach, replacing grasslands with forest. In addition, some foothill grasslands have been converted to forests through tree planting.

In the **Blue Mountains**, less grassland habitat overall has been lost as compared to the other **Strategy Habitats**, but grasslands are included because they have statewide and national significance, some have been impacted by past grazing practices and need restoration, and because they face threats from invasive species. There are several important grassland sites currently being managed for wildlife and habitat conservation. High-quality grasslands remain at higher elevations and in the extensive canyons in the ecoregion. Native grasslands remain a particular concern at low elevations in this ecoregion.

In the **Columbia Plateau**, Palouse grasslands once dominated most uplands above 1,000 feet in elevation. Due to the moderate climate and deep soils, these grassland habitats are valuable for agriculture. Over 77 percent of the historical Palouse grasslands have been converted to dryland farming, especially wheat and other grains. Many remaining grasslands have been degraded by invasive plants and poorly controlled livestock grazing.

In the **Coast Range**, open, grassy habitats once occurred on the marine terrace, headlands, bluffs, higher elevation ridges, and mountain peaks. In forested ecoregions, such as the Coast Range and West Cascades, grasslands are particularly important for rare plants and invertebrates. In the Coast Range, mountaintops, such as Saddle Mountain, Onion Peak, Sugarloaf Mountain, and Blue Lake Lookout, host a number of endemic plant species, including Saddle Mountain bittercress, Chambers' paintbrush, frigid shootingstar, queen-of-the-forest, and Saddle Mountain saxifrage.

Compared to historical grassland distributions, grassland loss has been extremely high in the Coast Range (99 percent estimated loss), West Cascades (99 percent estimated loss for montane grasslands and 93 percent for balds and bluffs), and Willamette Valley (99 percent estimated loss) ecoregions. Grasslands have been lost due to conversion to other uses, particularly development, vegetation

changes following fire suppression, and invasive species. In these ecoregions, grasslands are particularly fragmented and isolated. In cooperation with landowners, remnant patches in these ecoregions should be maintained and, where feasible, restored.

Strategy Species associated with grasslands vary by ecoregion but include the: **Burrowing Owl**, **Common Nighthawk**, **Grasshopper Sparrow**, **Long-billed Curlew**, **Ferruginous Hawk**, **Oregon Vesper Sparrow**, **Streaked Horned Lark**, **Western Bluebird**, **Western Meadowlark**, **Fender's blue butterfly**, **hoary elfin butterfly**, **Kincaid's lupine**, **Oregon silverspot butterfly**, **Taylor's checkerspot butterfly**, **Coast Range fawn lily**, **Cascade Head catchfly**, **Lawrence's milkvetch**, **Spalding's campion**, and **Tygh Valley milkvetch**.

In 2010, the U.S. Fish and Wildlife Service developed a **recovery plan** for grassland-dependent species that occur in western Oregon and southwestern Washington. It provides recovery goals and conservation strategies for several Strategy Species in the Willamette Valley. Information on conservation of grasslands and grassland birds can also be found in ODFW's **The Willamette Valley Landowner's Guide to Creating Habitat for Grassland Birds** and Partners in Flight **Conservation Strategy for Landbirds in Lowlands and Valleys of Western Oregon and Washington**.

LIMITING FACTORS AND RECOMMENDED APPROACHES

Limiting Factor: Altered Fire Regimes

At sites with deep soils, maintenance of grasslands is dependent, in part, on periodic fire. Fire suppression has led to encroachment by shrubs and conifer trees in some areas. In the Columbia Plateau, the introduction of cheatgrass can increase the frequency, intensity, and spread of fires. In the Coast Range, prescribed fire is difficult due to high precipitation and wet conditions. When conditions are dry enough to use prescribed fire, there are usually concerns with risk to surrounding forests. In the Klamath Mountains and Willamette Valley, prescribed fire poses challenges, such as conflicts with surrounding land use, smoke management and air quality, and safety.

Recommended Approach

Maintain open grassland structure by using multiple site-appropriate tools, such as prescribed burns, mowing, controlled grazing, hand-removal of encroaching shrubs and trees, or thinning. Re-introduce fire at locations and at times where conflicts, such as smoke and safety concerns, can be minimized. For all tools, minimize ground disturbance and impacts to native species. Minimize the spread of cheatgrass. Carefully manage livestock grazing to maintain native plants and soil crust (cryptogrammic crust) in low cheatgrass areas. Control fires in cheatgrass-dominated areas. (KCI: **Disruption of Disturbance Regimes**)

Limiting Factor: Invasive Species

Invasive plants are degrading grassland habitats, displacing native plants and animals. Depending on the area, invasive species include cheatgrass, medusahead, ventenata, rush skeleton weed, spikeweed,

Hungarian brome, yellow star-thistle, knapweeds (diffuse, spotted, and purple), leafy spurge, Canada thistle, St. John's wort, tansy ragwort, Armenian (Himalayan) blackberry, evergreen blackberry, Scotch broom, false-brome, Harding grass, and tall oatgrass. Most low-elevation grasslands are almost entirely dominated by invasive grasses, forbs, and shrubs. At higher elevations, such as montane grasslands in the West Cascades, invasive plants are less common. However, these habitats need to be monitored to detect new invasive species as livestock (e.g., cows, pack horses, riding horses) can introduce invasive plants.

Recommended Approach

Identify the best remaining native grasslands and work with landowners to maintain quality and limit the spread of invasive species. Emphasize prevention, risk assessment, early detection, and quick control to prevent new invasive species from becoming fully established. Prioritize control efforts and use site-appropriate methods to control newly-established invasive plant species for which management can be most effective. Re-seed with site-appropriate native grasses and forbs after control efforts. Conduct research to determine methods to manage established species, such as cheatgrass, medusahead rye, and Hungarian brome. Where appropriate, manage livestock grazing and recreational use to minimize new introductions in montane grasslands. Support current prevention programs, such as weed-free hay certification. (KCI: **Invasive Species**)

Limiting Factor: Land Use Conversion

Remnant low-elevation grasslands in valleys, foothills, and coastal headlands are subject to conversion to agricultural, residential, or urban uses.

Recommended Approach

Because many of these areas are privately-owned, **voluntary cooperative approaches** are the key to long-term conservation. Important tools include financial incentives, technical assistance, regulatory assurance agreements, and conservation easements. Use and extend existing incentive programs, such as the Conservation Reserve Program and Grassland Reserve Program, to conserve, manage, and restore grasslands and to encourage no-till and other compatible farming practices. Support and implement existing **land use regulations** to preserve forest land, open spaces, recreation areas, and natural habitats.

Limiting Factor: Land Management Conflicts

Resource conflicts can arise because high quality grasslands are often high quality grazing resources. Although grazing can be compatible with conservation goals, it needs to be managed carefully because Oregon's bunchgrass habitats are more sensitive to grazing than the sod-forming grasses of the mid-western prairies. Overgrazing can lead to soil erosion, changes in plant species composition and structure, and degradation by invasive plants. Grassland management practices, such as mowing,

haying, burning, and herbicide/insecticide application during the nesting season, can be detrimental to species.

Recommended Approach

Use incentive programs and other voluntary approaches to manage and restore grasslands on private lands. Manage public land grazing to maintain grasslands in good condition. Conduct research and develop incentives to determine grazing regimes that are compatible with a variety of conservation goals. Promote operation of grassland management practices (e.g., mowing, haying, burning, herbicide application) outside of the primary breeding season (roughly April-August). Restore native grassland habitat when possible, removing woody growth and invasive weeds to create a mosaic of clumped vegetation, bare ground, and a mixture of grasses and forbs with a variety of heights. Promote use of native plants and seed sources in conservation and restoration programs.

Limiting Factor: Reduction of Habitat Patch Size and Connectivity

In the Columbia Plateau and Willamette Valley ecoregions, grassland habitats often occur in small patches, such as roadsides and field edges. These patches are valuable habitat for some species, especially some plants and invertebrates. However, many grassland-obligate species (e.g., grassland birds) require large patch sizes for nesting. These species tend to avoid edge habitat and areas of dense woody vegetation, which can harbor predators. Small grassland patches also increase the potential for negative impacts from adjacent lands (e.g., herbicide and pesticide drift). Poor connectivity between remnant patches can limit dispersal capabilities for some species.

Recommended Approach

Maintain or restore grassland habitat considering patch size, shape, vegetation structure, and plant composition that best benefits **Strategy Species**. Maintain high priority patches and improve connectivity between similar habitat types. Use a landscape approach in conservation plans and incentive programs to create large, contiguous blocks of grassland habitat by expanding buffers around key grassland sites. Connect grassland habitats, such as fallow fields, pastures, and natural meadows, to create contiguous grassland habitat and improve connectivity between patches.

Limiting Factor: Loss of Habitat Complexity in Oak Savannas

In the Klamath Mountains and Willamette Valley ecoregions, large-diameter oak trees with lateral limb structure and cavities continue to be lost. **Oak woodlands** and savannas complement grassland habitat and should be maintained. Many native wildlife utilize large-diameter oaks for nesting, feeding, and shelter.

Recommended Approach

Maintain large oaks, remove competing conifers or densely-stocked small oaks, and create snags to provide cavity habitat.

Limiting Factor: Recreational Impacts

In some grasslands in the Coast Range, Klamath Mountains, Willamette Valley, and West Cascades ecoregions, recreational use impacts grassland species and vegetation. Some grassland-obligate species are highly sensitive to disturbance during the breeding season from people, pets, and recreational activities.

Recommended Approach

Work with land managers to direct recreational use away from highly sensitive areas. Provide recreational users with information on grassland issues and low-impact uses.

RESOURCES FOR MORE INFORMATION

- **Prairie Vegetation Monitoring Protocol for the North Coast and Cascades Network**
- **The Willamette Valley Landowner's Guide to Creating Habitat for Grassland Birds**
- **Partners in Flight Conservation Strategy for Landbirds in Lowlands and Valleys of Western Oregon and Washington**
- **Benton County Prairie Species Habitat Conservation Plan**
- **Declining and State Sensitive Bird Species Breeding in the Willamette Valley Grasslands: 2008-09 Status Update**

Photo Credit: David Patte, USFWS

LATE SUCCESSIONAL MIXED CONIFER FORESTS

Late successional mixed conifer forests provide a multi-layered tree canopy, including large-diameter trees, shade-tolerant tree species in the understory, and a high volume of dead wood, such as snags and logs.

ECOREGIONS

Late successional mixed conifer forests are a Strategy Habitat in the **Blue Mountains**, **Coast Range**, **East Cascades**, **Klamath Mountains**, and **West Cascades** ecoregions.

CHARACTERISTICS

Late successional mixed conifer forests are defined by plant species composition, overstory tree age and size, and the forest structure. They include characteristics such as a multi-layered tree canopy, shade-tolerant tree species growing in the understory, large-diameter trees, and a high volume of dead wood, such as snags and logs. Historically, fire was the major natural disturbance in all but the wettest climatic areas. Depending on local conditions, fires in western Oregon conifer forests were of moderate- to high-severity, with fire return intervals averaging 100 to more than 400 years. The historical fire regime created a complex mosaic of stand structures across the landscape.

ECOREGIONAL CHARACTERISTICS

Blue Mountains

A mixture of conifer species occupies many forest sites in the Blue Mountains. Mixed conifer forests can be divided in two subtypes based on temperature and moisture conditions. The warm mixed conifer type occupies the warmer and drier end of the spectrum. Douglas-fir and grand fir are the primary late successional tree species. Ponderosa pine and western larch may also be present. The cool mixed conifer type is indicated by the addition of more moisture-demanding and cold-tolerant species, such as

subalpine fir and Engelmann spruce, at upper elevations or along streams where cold-drainage and deep frost eliminate some species. The understory in the Blue Mountains generally includes huckleberry, serviceberry, oceanspray, snowberry, wild ginger, goldthread, starflower, beadlilly, and oak fern.

Coast Range

Although there are several forest types in the **Coast Range** ecoregion, two types predominate: Sitka spruce and Douglas-fir. Sitka spruce forests occur within a narrow fog- and salt-influenced strip along the coast and extending up some valleys. Soils tend to be deep, acidic, and well-drained. Sitka spruce dominates the overstory, but western hemlock, western redcedar, Douglas-fir, big leaf maple, and red alder may be present. The lush understory has salmonberry, vine maple, salal, evergreen huckleberry, sword fern, deer fern, and a high diversity of mosses and lichens. Due to high precipitation, fires are rare and the primary disturbances include small-scale windthrow and storm surges. Inland, Douglas-fir forests dominate. Characteristic species are similar to those in the West Cascades Douglas-fir forests, described previously.

East Cascades

Mixed conifer forests span the eastern slopes of the Cascade Mountains. This habitat contains a wide variety of tree species and dominance patterns. Douglas-fir, grand fir, and western hemlock are the most common forest tree species and co-dominate most overstories. Several other conifers may also be present, including western red cedar, western white pine, western larch, ponderosa pine, and lodgepole pine. Undergrowth vegetation in the East Cascades includes vine maple, Oregon grape, huckleberry, oxalis, boxleaf, thimbleberry, and twinflower. Many sites once dominated by Douglas-fir and ponderosa pine (and formerly maintained by wildfire) may now be dominated by grand fir (a fire-sensitive, shade-tolerant species).

Klamath Mountains

Mixed conifer forests in the **Klamath Mountains** ecoregion are characterized by conifers but have high tree diversity. Douglas-fir is usually dominant. Depending on site characteristics, other canopy trees include white fir, sugar pine, ponderosa pine, and incense cedar. Port-Orford cedar occurs on moist sites, such as riparian areas. Jeffrey pine and knobcone pine occur on serpentine soils. Broadleaf trees, such as tanoak, canyon live oak, golden chinquapin, and Pacific madrone, may occur in the subcanopy. Understories are mostly dominated by shrubs but can be dominated by forbs, graminoids, or may be relatively open.

West Cascades

Coniferous forests dominate the landscape of the **West Cascades** ecoregion. Late Successional Conifer Forests are older forests (hundreds of years old), generally occurring below 3,500 feet, but sometimes occurring up to 4,000 feet. Douglas-fir trees occur up to 5,000 feet but do not dominate the forests at higher elevations. Western hemlock is almost always co-dominant and usually dominates the

understory. Other common trees include grand fir and western redcedar in the northern portion of the ecoregion, or incense cedar, sugar pine, white fir, and western redcedar in the southern portion of the ecoregion. The understory has shrub and forb species, such as vine maple, salal, sword fern, Cascade Oregon grape, western rhododendron, huckleberries, twinflower, deerfoot, vanillaleaf, and oxalis. In the absence of disturbance, Douglas-fir forests eventually will convert to western hemlock.

CONSERVATION OVERVIEW

Oregon's forests have long contributed to local economies through timber harvest. However, both timber harvests and a number of large fires have replaced much of late successional forests with younger forests in western Oregon. For the **Coast Range**, **West Cascades**, and **Klamath Mountains** ecoregions, loss of late successional forests since 1850 is estimated to be near 90 percent.

Federal lands contain substantial acreages of mature and late successional forests, but many of these forests occur in a patchwork with the much younger forests that are managed with shorter rotations to generate timber products. The younger forests still maintain their capacity to become older forests, and they can often support many species. However, late successional forests support a wide array of species, many of which require large patches of older or mature forests to survive and may be sensitive to changes in the forest seral stage.

The **NWFP** and **National Fire Plan** are both large, comprehensive natural resource planning efforts that include federal forests in western Oregon. The NWFP identifies conservation priorities for species affected by loss and fragmentation of large patches of late successional forests, assessing over 1,000 species. The federal plan is expected to provide at least 50 percent probability that populations of most species would stabilize with either good or only moderately limited distributions on public lands. For the majority of species, the probability of stable, well-distributed populations is estimated at 75 percent (USDA/USDI 1994). The adaptive management component of the NWFP has not been fully implemented. Adaptive management approaches could be used to experimentally deal with risk of uncharacteristically severe wildfires, restore wildlife habitat features, and accelerate the development of characteristics such as multi-layered canopies.

Late Successional Reserves established under the NWFP were intended to ensure enough high quality habitat to sustain identified species. However, many of the federal lands that are designated as Late Successional Reserves do not include forests at the late successional stage, while others are relatively small "checkerboards" of forests embedded in a matrix of private industrial timber lands, particularly in the Coast Range and Klamath Mountains. There is potential for the amount of late successional forests to increase over time, under current state and federal policies.

Many of the Late Successional Reserves are in Fire Regime Condition Class II or Condition Class III, where the risk of loss of key ecosystem components is moderate or high (see **Disruption of Disturbance Regimes**). This risk is particularly acute in the Klamath Mountains, where recent large-scale severe wildfires have impacted wildlife habitat. In addition, all planning efforts are limited by understanding of

landscape management and by ecological data availability. The outcome of these decisions, and the ultimate long-term impacts of these plans, is unknown.

The National Fire Plan is attempting to address historical fire suppression and the impacts of recent catastrophic and uncharacteristic wildfires, recommending a variety of active management techniques for forests to increase fire safety and evaluation of their effects on fire behavior and the effectiveness of suppression. Results of implementing the National Fire Plan and its effects on both public safety and forest habitats are continually being evaluated.

In the Coast Range, three-quarters of the ecoregion is in state and private ownership. The Oregon Department of Forestry manages 550,000 acres in the Coast Range ecoregion, primarily in the Clatsop, Tillamook, and Elliott State Forests. The Northwest and Southwest State Forest Management Plans provide management direction for all Board of Forestry Land and Common School Forest Lands. The plans include management strategies for 16 resources, including fish and wildlife, timber, recreation, and water resources. The plans describe long-term desired future conditions, which include older forest structure. Most private forest lands are currently managed intensively for timber values using relatively short rotations, which will limit future development of late successional habitats in many areas.

Late successional conifer forests are particularly important for wildlife, mosses, and lichens. Depending on the ecoregion, **Strategy Species** associated with late successional conifer forests include **ringtail**, **fisher**, **American marten**, **red tree vole**, **Marbled Murrelet**, **Northern Spotted Owl**, **Oregon slender salamander**, and many others.

LIMITING FACTORS AND RECOMMENDED APPROACHES

Limiting Factor: Loss of Structural Habitat Elements

Where historical stands were perpetuated for 200 to more than 1,000 years, commercial forestlands are now commonly harvested every 60 years or less, which limits the maintenance and future recruitment of large-diameter trees. In addition, the amount of large-diameter snags and logs has been reduced over time through wildfire and timber harvest.

Recommended Approach

Develop programs, incentives, and market-based approaches to encourage longer rotations and strategically located large-diameter tree tracts. Where feasible, maintain structural elements, such as large-diameter tall trees, snags, and logs. Create snags from green trees or high-cut stumps where maintaining snags is not feasible or where snag management goals are not being met. Maintain forest stand structures on private industrial forest lands, and provide technical assistance to landowners to leave large downed wood, green trees, or snags in the upland portion of harvested forests, as well as along riparian areas, to provide benefits for a diversity of wildlife.

Limiting Factor: Impacts of Vegetation Spraying in Early Seral Stage Forest Stands

Within the past two decades, biologists have become increasingly concerned with intensive vegetation management in early seral forest stands and associated impacts on wildlife, from birds to big game.

Recommended Approach

Continue efforts to understand the impacts of vegetation management in early seral stage forest stands by advocating for scientific research on the issue. Provide outreach and technical assistance to help landowners understand the potential for impacts and alternate management techniques. More information on the importance of forest openings can be found in **Specialized and Local Habitats**.

Limiting Factor: Loss of Late Successional Stand Size and Connectivity

Late successional forest stands have been greatly reduced in size and connectivity, particularly at lower elevations. This can impact species that are highly adapted to late successional conditions and/or species that have limited ability to move over long distances to find new suitable areas. It also allows edge species to compete with ones adapted to extensive interior forest habitat.

Recommended Approach

Maintain existing plans to protect and develop habitat that has been identified as important to species of conservation concern. Use active management to accelerate development of late successional structural characteristics in key areas to expand existing late successional patches into larger areas; these will provide greater blocks of habitat for species with large area requirements or those that require interior forest habitat and are vulnerable to "edge effects". Continue to carefully plan forest practices to maintain connectivity (KCI: **Barriers to Animal Movement**), particularly when species vulnerable to fragmentation are present. Seek opportunities to coordinate management of public and private lands (e.g., All-Lands Approach) whenever possible to address conservation needs. Use voluntary conservation tools, such as financial incentives and forest certification to achieve conservation goals on private lands. Carefully-implemented land exchanges in the Bureau of Land Management checkerboard areas offer potential to improve connectivity and habitat values. Recognize that a diversity of forest types and ages should be considered to support wildlife habitat connectivity and ecosystem services at a landscape scale. Historically, late successional coniferous forests throughout Oregon were an element of a shifting mosaic of forest types and ages across the landscape.

RESOURCES FOR MORE INFORMATION

- **Northwest Forest Plan**
- **Status and Trends of Late Successional and Old Growth Forests**

Photo Credit: USFS

NATURAL LAKES

Natural lakes are relatively large bodies of freshwater surrounded by land. For the purposes of the Conservation Strategy, natural lakes are defined as standing water bodies larger than 20 acres, including some seasonal lakes.

ECOREGIONS

Natural Lakes are identified as a Strategy Habitat throughout Oregon.

CHARACTERISTICS

Natural lakes are distributed throughout Oregon, although the highest concentrations and largest lakes are found in the **West Cascades**, **East Cascades**, and **Northern Basin and Range** ecoregions. Sources of water for Oregon's natural lakes include rainfall, snowmelt, groundwater seepage, and stream flows. The diversity of natural lakes is reflected in the processes that formed them. These processes include glaciation, volcanism (calderas and lava flows), coastal dune impoundment, and riverine erosion (oxbow lakes).

Crater and Waldo Lakes are Oregon's largest clear lakes, both located in the West Cascades ecoregion. Many small volcanic lakes in the Cascade Mountain Range are also notably clear. The eastern half of the state contains several playa lakes, formed when runoff from precipitation and mountain snowpack flows into low-lying areas, then evaporates and leaves mineral deposits. Natural lakes provide important habitat for **Strategy Species**, contribute to ecosystem services, and attract visitors for tourism and recreation year-round throughout Oregon's communities.

The Natural Lakes Strategy Habitat does not include irrigation ditches, reservoirs, or other man-made water bodies. The wet zone around the edges of many of Oregon's natural lakes is mapped as **Wetlands Strategy Habitat**. Natural lakes have riparian zones that differ somewhat than those associated with running waters.

CONSERVATION OVERVIEW

Many of Oregon's larger natural lakes are important destinations for tourism and recreation, especially in the summer, and many are desirable locations for year-round commercial and residential development. These uses can impact water quality and quantity. Along Oregon's Coast Range, abundant coastal lakes are highly sought out for development, and many are now surrounded by houses or pastures. Some of Oregon's lakes contain unique species assemblages and habitat features that have high conservation value. For example, many amphibian and fish Strategy Species rely upon Oregon's lakes for breeding each year.

LIMITING FACTORS AND RECOMMENDED APPROACHES

Limiting Factor: Water Quality

Non-point source pollution sometimes contains fertilizers, pesticides, or oil-based contaminants at levels high enough to cause significant lethal or sub-lethal effects in native fish and wildlife. Non-point source pollution can enter lakes through runoff from surrounding lands or streams, and from groundwater. In some lakes, use of recreational watercraft can degrade **water quality** through pollution.

Recommended Approach

Carefully consider recreational vehicle use and timing of use in sensitive water bodies. Continue compliance with water quality standards and pesticide use labels (DEQ and EPA). Implement Senate Bill 1010 (ODA) and DEQ Total Maximum Daily Load water quality plans.

Limiting Factor: Water Quantity

Water is limited in some parts of the state, and is projected to become scarcer under a changing climate and expanded human use. In standing waterbodies, water scarcity can lead to higher concentrations of contaminants, lowering water quality as less fresh water is available to dilute nutrients or pollutants. Airborne pollutants and runoff from recreational water vehicles are potential sources of contaminants in natural lakes. Late summer is a time of particular concern.

Recommended Approach

Where possible, follow the natural hydrological cycle for stream flow into lakes. (KCI: **Water Quality and Quantity**)

RESOURCES FOR MORE INFORMATION

- **The Center for Lakes and Reservoirs at Portland State University**
- **Oregon Lake Watch, 2014 Annual Report**

- **Atlas of Oregon Lakes**
- **Oregon Lakes Association**
- For information on boating safety and information about invasive species and other concerns, see the **Oregon State Marine Board**

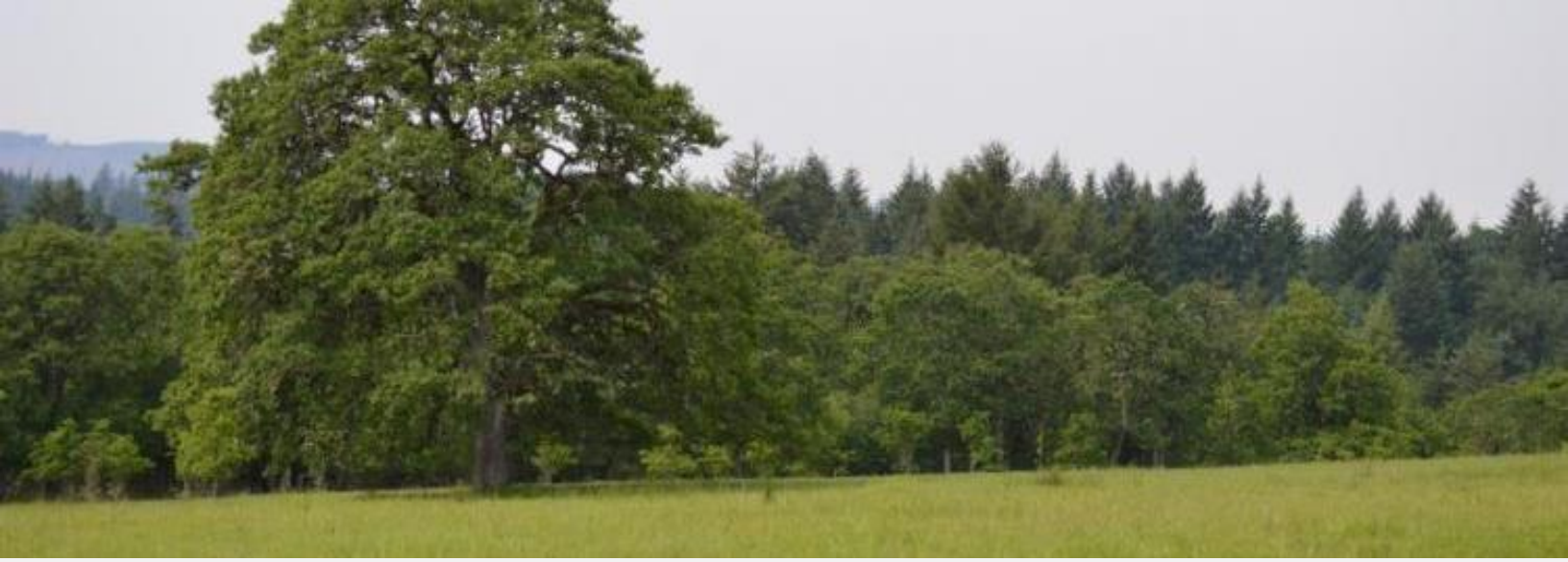

Photo Credit: Shawn Woods, ODFW

OAK WOODLANDS

Oak woodlands are characterized by an open canopy dominated by Oregon white oak.

ECOREGIONS

Oak woodlands are a Strategy Habitat in the **Coast Range**, **East Cascades**, **Klamath Mountains**, **West Cascades**, and **Willamette Valley** ecoregions.

CHARACTERISTICS

Depending on the ecoregion and site characteristics, oak woodlands may also have ponderosa pine, California black oak, Douglas-fir, and canyon live oak. In general, the understory is relatively open with shrubs, grasses, and wildflowers. The tree canopy of an oak woodland obscures 30-70 percent of the sky. Oak habitats are maintained through periodic, low-intensity fire, which removes small conifers and maintains a moderate cover of low shrubs.

Oak woodlands grade into oak savannas. Oak savannas are characterized primarily by upland prairie with widely-spaced, large Oregon white oak and conifers. Oak savannas are discussed in the **Grasslands Strategy Habitat**. Oak woodlands also grade into pine-oak habitats in the Klamath Mountains, with more information found in the **Ponderosa Pine Strategy Habitat**.

ECOREGIONAL CHARACTERISTICS

Coast Range

Oak woodland habitats are found in drier landscapes, such as south-facing slopes and foothills bordering the Willamette Valley.

East Cascades

In the East Cascades ecoregion, oak woodlands occur primarily on the north end of the ecoregion and in the Klamath River Canyon. They are located at the transition between ponderosa pine or mixed conifer forests in the mountains, and the shrublands or grasslands to the east. Oak habitats in the East Cascades are different in structure and composition than those in western Oregon but are just as important to a variety of wildlife and rare plants.

Klamath Mountains

Oak woodlands are found in lower elevations, on dry sites, or in areas with frequent, low-intensity fires. Oak woodlands may occur in a mosaic with **chaparral** and dry conifer woodlands.

West Cascades

Oak woodland habitats are found in drier landscapes, such as south-facing slopes and foothills bordering the Willamette Valley.

Willamette Valley

In the Willamette Valley, oaks were originally found in a mosaic of prairies, oak savanna, and riparian habitats throughout the valley floor and low-elevation slopes. Oaks were most common on flat to moderately rolling terrain, usually in drier landscapes, and often between prairie remnants and conifer forests. Today, oak woodlands generally are found in small, isolated pockets surrounded by other land uses, such as development or agriculture.

CONSERVATION OVERVIEW

Oak woodlands once covered almost 1 million acres in the Coast Range and 400,000 acres in the Willamette Valley. However, the Coast Range now has less than 6 percent of its estimated historical oak woodlands, and the Willamette Valley has less than 5 percent. Habitat loss has been less severe in the East Cascades, where fire suppression may have led to expansion of oaks into former shrub-steppe and grassland habitats.

Oak woodlands have been impacted by conversion to other land uses, invasive species, and vegetation changes due to fire suppression. As a result of conifer plantings and changes in fire frequency and intensity after European settlement, Douglas-fir now dominates in many areas of the Coast Range and Willamette Valley foothills. Oak habitats are being converted to agriculture, residential, and other uses in the Willamette Valley, the Coast Range foothills, and the coastal hills in southern Oregon. Although loss of oak woodland in the Klamath Mountains is not currently as severe as in the Willamette Valley, increasing development threatens these habitats. The same rolling hills and scenic landscapes that indicate healthy pine-oak habitat also attract new residents and developers.

Because much of the remaining oak woodlands are in private ownership and maintenance of these habitats requires active management, cooperative incentive-based approaches are crucial to conservation.

Loss of oaks, particularly large-diameter, open-structured trees valuable to wildlife, is of particular concern because oak trees have a slow growth rate, slowing restoration success. In addition, reproduction and recruitment of younger trees are poor in many areas.

Depending on the area, **Strategy Species** associated with oak woodlands include **Columbian white-tailed deer**, **Chipping Sparrow**, **White-breasted Nuthatch**, **Lewis's Woodpecker**, **white rock larkspur**, and **wayside aster**.

LIMITING FACTORS AND RECOMMENDED APPROACHES

Limiting Factor: Fire Suppression and Fir Encroachment

With fire suppression, Douglas-fir encroaches into oak habitats and eventually shades out oak trees and seedlings, as well as other plants that require open growing conditions. Many oak woodlands are now dominated by Douglas-fir. Without active management, these areas will eventually become conifer forests. In some areas of the East Cascades, fire suppression combined with grazing has influenced fine fuel production and led to encroachment by conifers and establishment of dense patches of small, shrubby oaks.

Recommended Approach

Use multiple tools, including prescribed fire, mowing, grazing, and selective harvest to maintain open canopy oak-dominated woodlands. Ensure that tools are site-appropriate and implemented to minimize impacts to native species. Re-establish site-appropriate native grasses, herbaceous plants, and shrubs. (KCI: **Disruption of Disturbance Regimes**)

Limiting Factor: Land Use Conversion and Continued Habitat Loss

Particularly in the Willamette Valley and Klamath Mountains ecoregions, oak woodlands continue to be converted to agricultural (especially vineyards), rural residential, and urban uses.

Recommended Approach

Much of the remaining oak woodland habitat occurs on private land and requires active management, so **cooperative incentive programs** are the best approach. **Work with private landowners** to maintain and restore oak habitats. Develop oak products compatible with conservation to promote maintenance of oak as an economic use. Work with local communities to plan development in a manner that conserves critical habitats. (KCI: **Land Use Changes**)

Limiting Factor: Loss of Habitat Structure

Large-diameter oak trees with lateral limb structure and cavities have been lost. In many areas, there are not sufficient numbers of replacement trees to maintain these habitat elements over time. In the absence of fire, densely-stocked regenerating oaks often do not develop open-grown structures due to shading. In the East Cascades, grazing or very hot fires can lead to development of brushy-structured trees. The shaded or grazed oaks do not develop the lateral limbs, cavities, and higher acorn crops of open-grown trees, and are thus less valuable to wildlife. Woodcutting often removes snags.

Recommended Approach

Maintain a diversity of tree sizes and ages across the stand, with emphasis on large oak and ponderosa pine trees. Remove conifers that are competing with larger oaks. Maintain snags and create snags from competing conifers to provide cavity habitat. Encourage oak reproduction through plantings or protective exclosures. It may be appropriate to use nest boxes as temporary cavity habitat in oak restoration project areas. Improve methods to promote oak reproduction and creation of open-grown structures.

Limiting Factor: Invasive Species

Depending on the ecoregion and site, invasive plants, such as Armenian (Himalayan) blackberry, evergreen blackberry, Scotch broom, English hawthorn, false brome, yellowstar thistle, diffuse knapweed, and puncturevine, invade and degrade oak woodlands. In many oak woodland stands, the overstory is intact but the understory is highly degraded.

Recommended Approach

Identify the best remaining native oak woodlands and work with landowners to maintain habitat quality. Emphasize prevention, risk assessment, early detection, and quick control to prevent new invasive species from becoming fully established. Prioritize control efforts and use site-appropriate methods to control newly-established invasive plant species for which management can be most effective. Re-seed with site-appropriate native grasses and forbs after control efforts. Prescribed burning may be useful for management of some invasive species, particularly shrubs. (KCI: **Invasive Species**)

Limiting Factor: Climate Change

By the 2080s, the mean annual air temperature in the Pacific Northwest is projected to increase by 2.5-3.4 °C. This warming is projected to be the highest during the summer. Annual precipitation patterns in the Pacific Northwest may also be changing. While there is always uncertainty in projections, the general trend shows winter precipitation to increase and summer precipitation to decrease. Recent climate models have shown conflicting results regarding the effect of projected **climate changes** on oak habitats throughout Oregon.

Recommended Approach

Protect and restore a diverse portfolio of oak habitats. Continue efforts to restore currently degraded areas and re-establish former oak habitats. Engage in strategic, landscape-scale planning efforts to create a connected and resilient network of oak habitats. Identify where future climate conditions may support oak habitats, including areas upslope of their current range where they were not historically found. Identify data gaps and support research needs. See **Adding climate change to the mix: using climate futures in conservation planning for Oregon's oak-dominated habitats** for more information.

RESOURCES FOR MORE INFORMATION

- **Pacific Coast Joint Venture Willamette Valley Implementation Plan**
- **OR-WA Partners in Flight Landbird Conservation Strategy**
- **OR-WA Partners in Flight Eastslope Cascades Conservation Strategy**
- **Land Manager's Guide to Bird Habitat and Populations in Oak Ecosystems of the Pacific Northwest**
- **Oregon White Oak Restoration Strategy for National Forest System Lands East of the Cascade Range**
- **Cascadia Prairie-Oak Partnership**

Photo Credit: USFS

PONDEROSA PINE WOODLANDS

Ponderosa pine woodlands are dominated by ponderosa pine, but may also have lodgepole pine, western juniper, aspen, western larch, grand fir, Douglas-fir, mountain mahogany, incense cedar, sugar pine, or white fir, depending on ecoregion and site conditions. Their understories are variable combinations of shrubs, herbaceous plants, and grasses.

ECOREGIONS

Ponderosa pine woodlands are a Strategy Habitat in the **Blue Mountains**, **East Cascades**, and **Klamath Mountains** ecoregions.

CHARACTERISTICS

Throughout Oregon, the open structure of ponderosa pine habitats was historically maintained by frequent, low-intensity surface fires, with some intermittent higher-intensity fires. The structure and composition of ponderosa pine woodlands vary across the state, depending on local climate, soil type and moisture, elevation, aspect, and fire history. In the Blue Mountains, East Cascades, and Klamath Mountains ecoregions, ponderosa pine woodlands have open canopies (approximately 10-40 percent canopy cover).

ECOREGIONAL CHARACTERISTICS

Blue Mountains

Ponderosa pine habitats also include savannas, which have widely-spaced trees (canopies of less than 1 percent) that are generally more than 150 years old. The structure of a savanna is open and park-like with an understory dominated by fire-adapted grasses and forbs as well as shrub fields. Ponderosa pine habitats generally occur at mid elevation and are replaced by other coniferous forests at higher elevations.

East Cascades

Ponderosa pine habitats generally occur at mid elevation and are replaced by other coniferous forests at higher elevations.

Klamath Mountains

Pine or pine-oak woodlands occur on dry, warm sites in the foothills and mountains of southern Oregon. Here, pine woodlands are usually dominated by ponderosa pine, but may be dominated by Jeffery pine, depending on soil mineral content, fertility, and temperatures. The understory often has shrubs, including green-leaf manzanita, buckbrush, and snowberry. Pine-oak woodlands are found primarily in valley margins and foothills on rolling plains or dry slopes. The structure is park-like with an open grassy or shrubby understory.

CONSERVATION OVERVIEW

Ponderosa pine habitats historically covered a large portion of the Blue Mountains ecoregion as well as parts of the East Cascades and Klamath Mountains. Ponderosa pine is still widely distributed in eastern and southern Oregon. However, the structure and species composition of woodlands have changed dramatically. Historically, ponderosa pine habitats had frequent, low-intensity fires that maintained an open understory as well as some high-intensity fires. Due to past selective logging and fire suppression, dense patches of smaller conifers have grown in the understory of ponderosa pine forests. Depending on the area, these conifers may include shade-tolerant Douglas-fir, grand fir, white fir, and lodgepole pine. These dense stands are vulnerable to drought stress, insect outbreaks, and disease. Many of these mixed conifer forests are located in **Fire Regime Condition Class** II or Condition Class III areas where the risk of loss of key ecosystem components is moderate or high.

Of particular concern is the loss of large-diameter pine habitats. Most old-growth ponderosa pine stands are greatly reduced in size and connectivity, occurring in a patchwork with much younger forests that are managed with shorter rotations to generate timber products. Younger stands can provide habitat for some wildlife species; however, old-growth ponderosa pine forests support species such as the **White-headed Woodpecker** that require large-diameter trees and an open understory and are sensitive to changes in the forest seral stage.

On federal land, ponderosa pine habitats are increasingly being restored or managed consistent with wildlife conservation goals through fuel reduction treatments, retention of large-diameter trees, and high snags densities.

Ponderosa pine habitats are important for wildlife that prefer open, dry forests. The White-headed Woodpecker, a Strategy Species, is entirely dependent on open late-successional ponderosa pine woodlands. Some **Strategy Species** associated with ponderosa pine habitats include the **Flammulated Owl**, **Lewis's Woodpecker**, **long-legged myotis**, **pallid bat**, and many others.

LIMITING FACTORS AND RECOMMENDED APPROACHES

Limiting Factor: Altered Fire Regimes and Addressing Risk of Uncharacteristically Severe Wildfire

Past forest practices and fire suppression have resulted in either dense growth of young pine trees or dense, young mixed conifer stands, depending on local site conditions and natural climax species. These dense stands are at increased risk of uncharacteristically severe wildfires, disease, and damage by insects. Over time, some stands will convert to Douglas-fir and grand fir forests, which do not provide adequate wildlife habitat for species dependent on open ponderosa pine habitats. Particularly in the Blue Mountains and East Cascades ecoregions, dense understories and insect-killed trees make it difficult to reintroduce natural fire regimes. In parts of the East Cascades and Klamath Mountains, increasing home and resort development in forested habitats makes prescribed fire difficult in some areas and increases risk of high-cost wildfires.

Recommended Approach

Use an integrated approach to forest health issues that considers historical conditions, including roads and human use, wildlife conservation, natural fire intervals, and silvicultural techniques. Develop implementation plans for prescribed fire that are acceptable for management of both game and non-game species. Evaluate individual stands to determine site-appropriate actions, such as monitoring in healthy stands, or thinning, mowing, and prescribed fire in at-risk stands. Implement fuel reduction projects to reduce the risk of forest-destroying wildfires. Reintroduce fire where feasible. Thin stands where appropriate, and develop markets for small-diameter trees.

Implement fuel reduction projects to reduce the risk of forest-destroying wildfires, considering site-specific conditions and goals. Consider prescribed fire where appropriate, given safety and wildlife management concerns. Fuel reduction strategies need to consider the habitat structures that are required by wildlife, including snags, downed logs, and hiding cover. Design frequency and scale of prescribed fire to improve regeneration and establishment of native shrubs. However, lower log and shrub densities may be desirable in priority White-headed Woodpecker areas, so sites need to be evaluated for appropriate understory vegetation management. Maintain areas of multi-species, dense woody plant hiding cover in patches. Support community-based forest health collaboratives to increase the pace and scale of forest restoration. Monitor forest health initiatives and use adaptive management techniques to ensure efforts are meeting habitat restoration and forest-destroying fire prevention objectives with minimal impacts on wildlife. Work with homeowners and resort operators to reduce vulnerability of properties to wildfires while maintaining habitat quality. Highlight successful, environmentally-sensitive fuel management programs. Retain features that are important to wildlife, including snags, downed logs, forage, and hiding cover for wildlife species, and replant with native shrub, grass, and forb species. Manage reforestation after wildfire to create species and structural diversity based on local management goals. (KCI: **Disruption of Disturbance Regimes**)

Limiting Factor: Loss of Size and Connectivity of Large-structure Ponderosa Pine Habitats

Particularly in the Blue Mountains and East Cascades ecoregions, old-growth ponderosa pine habitats have been greatly reduced in size and connectivity by timber harvest, conversion to rural residential uses, and other activities. Few large blocks of habitat remain.

Recommended Approach

Maintain large blocks of large-diameter ponderosa pine habitat. Plan reforestation efforts to allow for **corridors** between habitat blocks. In areas of the East Cascades experiencing rapid development, work with local communities to minimize development in large blocks of intact habitat.

Limiting Factor: Invasive Species

In parts of the Blue Mountains and East Cascades, invasive species, such as diffuse and spotted knapweed and Dalmatian and common toadflax, are invading and degrading some ponderosa pine woodlands. Also in the Blue Mountains, cheatgrass and medusahead rye can result in an invasive plant understory that is highly susceptible to burning and provides a "high-fuel" content that carries wildfire more easily than the native vegetation. Armenian (Himalayan) blackberry, Scotch broom, and several grasses are an issue in the Klamath Mountains.

Recommended Approach

Emphasize prevention, risk assessment, early detection, and quick control to prevent new **invasive species** from becoming fully established. Prioritize efforts and control key invasive species using site-appropriate methods. Control wildfires in cheatgrass-dominated areas of the Blue Mountains. Fortunately, many areas of the Blue Mountains and East Cascades still have few invasive species currently threatening ponderosa pine habitats. In these areas, invasive plants should be monitored and controlled as they first arrive when control is more efficient, practical, and cost-effective. Reintroduce site-appropriate native grasses and forbs after invasive plant control. Prescribed burning may be useful for management of some invasive species in the Klamath Mountains.

RESOURCES FOR MORE INFORMATION

- **Oregon Department of Forestry Forest Practices Research and Monitoring Program**
- **Partners in Flight Conservation Strategy for Landbirds in the Northern Rocky Mountains of Eastern Oregon and Washington**
- **Partners in Flight Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington**
- **Managing for Cavity-Nesting Birds in Ponderosa Pine Forests**

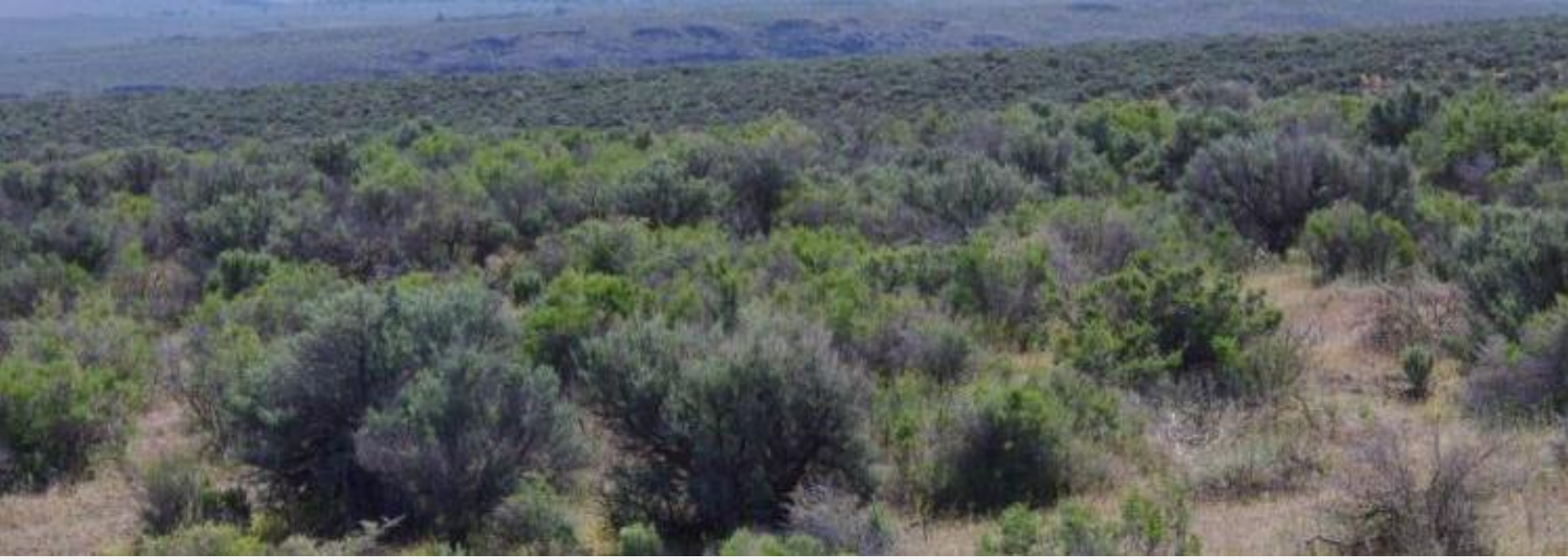

Photo Credit: Martyne Reesman, ODFW

SAGEBRUSH HABITATS

Sagebrush habitats include all sagebrush steppe- and shrubland-dominated communities found east of the Cascade Mountains.

ECOREGIONS

Sagebrush habitats are a Strategy Habitat in the **Blue Mountains**, **Columbia Plateau**, **East Cascades**, and **Northern Basin and Range** ecoregions.

CHARACTERISTICS

Sagebrush-dominated communities differ greatly in structure and species composition, depending on ecoregion, elevation, soils, moisture regimes, and fire history. In general, sagebrush habitats occur on dry flats and plains, rolling hills, rocky hill slopes, saddles, and ridges where precipitation is low.

Sagebrush steppe is dominated by grasses and forbs (more than 25 percent of the area) with an open shrub layer. In sagebrush steppe, natural fire regimes historically maintained a patchy distribution of shrubs and predominance of grasses. In shrub-steppe habitats of the Columbia Plateau and Blue Mountains ecoregions, a soil crust (called a microbiotic or cryptogrammic crust) composed of lichens, mosses, fungi, and bacteria reduces soil erosion and moisture loss.

Sagebrush shrublands are dominated by shrubs, with less area covered by grasses and forbs than in steppe habitats. In many, but not all, sagebrush shrublands, natural fire regimes created a mosaic of stand ages and structures.

ECOREGIONAL CHARACTERISTICS

Blue Mountains

Big sagebrush steppe communities in the Blue Mountains ecoregion are similar to those of the Columbia Plateau. Sagebrush shrubland species vary by elevation and soils but include low sagebrush, silver sagebrush, rigid sagebrush, basin big sagebrush, Wyoming big sagebrush, mountain big sagebrush, threetip sagebrush, **bitterbrush**, and rabbitbrush. Soils vary in depth and texture but are non-saline.

Columbia Plateau

Shrub-steppe habitats are open grass-dominated communities and are usually found on loamy, wind-deposited (loess) soils. In this ecoregion, shrub-steppe communities can be broadly divided into two elevational types. Within 10 miles of the **Columbia River**, sandy shrub-steppe communities occur on unstable, well-drained soils. These include grasslands dominated by needle-and-thread, shrub-steppe habitats dominated by **bitterbrush** and needle-and-thread grass or Indian rice grass, and sand dune communities characterized by sagebrush, bitterbrush, and western juniper. There is usually a component of bare ground or open sand present. Further from the Columbia River, big sagebrush steppe communities include basin big sagebrush, needle-and-thread grass, basin wildrye and bluebunch wheatgrass steppe, and Wyoming sagebrush and bluebunch wheatgrass (which formerly occupied the low-elevation, loess uplands in the Columbia Plateau).

East Cascades

The number of species and acreage dominated by sagebrush is lower in the East Cascades ecoregion than most other east side ecoregions, especially the Northern Basin and Range. Five of the eleven sagebrush species are found in the East Cascades ecoregion at various elevations and soil types. Low sagebrush generally grows less than 2 feet and is found from low to high elevations in shallow, rocky soils. Silver sagebrush grows 1-6 feet tall and enjoys wetter conditions than most sagebrush species. It is found throughout the ecoregion in seasonally-waterlogged soils. Basin big sagebrush generally grows from 5-7 feet tall and is an indicator of deep, well-drained soils. Mountain big sagebrush and Wyoming sagebrush grow from 2-4 feet and are found from mid to high elevations. The two species are difficult to tell apart and readily hybridize. Both are found along the north/south axis of the ecoregion, but Wyoming sagebrush is mainly found along the eastern edge.

Northern Basin and Range

Big sagebrush habitats include mountain, basin, and Wyoming big sagebrush shrublands and shrub-steppe. Structurally, these habitats are composed of medium-tall to tall (1.5-6 feet) shrubs that are widely-spaced with an understory of perennial bunchgrasses. Basin big sagebrush communities occur on deep silty or sandy soils along stream channels, in valley bottoms and flats, or on deeper soil inclusions in low sagebrush or Wyoming big sagebrush stands. Wyoming big sagebrush communities occur on shallower, drier soils. Mountain big sagebrush communities occur at montane and subalpine elevations

on deep-soiled to stony flats, ridges, nearly flat ridge tops, and mountain slopes. The fire frequency in big sagebrush habitats ranges from 10-25 years for mountain big sagebrush and 50-100 years for Wyoming big sagebrush.

Although these particular sagebrush communities are considered the priorities for the Conservation Strategy, other sagebrush types also provide important habitat for wildlife and may need to be considered at the local and watershed scale, or for the conservation of particular species like the **Greater Sage-Grouse**. Low sagebrush habitats cover large areas of the Northern Basin and Range ecoregion. They are characterized by very shallow, poorly developed soils and dominated by low sagebrush, perennial forbs, and Sandberg's bluegrass. Low sagebrush provides critical wildlife habitat for many sagebrush-obligate species. Because of the poor, shallow soils, low sagebrush communities are slow (150-300 years) to recover from significant soil disturbance or fire. Soil disturbance in these sites often results in establishment of invasive annual grasses.

CONSERVATION OVERVIEW

Sagebrush habitats in eastern Oregon are both extensive and diverse, ranging from low-elevation valleys to high mountain areas and from grassland-like shrub-steppe to relatively dense shrublands. In addition, there are many species and subspecies of sagebrush, which are associated with different grasses and herbaceous plants, depending on site conditions. General ecology and conservation issues vary by sagebrush community type, so conservation actions must be tailored to local conditions and conservation goals. Detailed descriptions of the different sagebrush plant communities are available from sources included in the references.

Although sagebrush habitats are still common and widespread in eastern Oregon, some sagebrush habitat types have high levels of habitat loss and are of conservation concern. These types vary by ecoregion. In the **Blue Mountains**, valley bottom sagebrush types, including threetip or basin big sagebrush, that occur on deep soils are particularly at risk. Also important are the valley margin steppe types with Wyoming sagebrush, squaw apple, and **bitterbrush**. Overall, the sagebrush habitats in the Blue Mountains ecoregion have declined by approximately 82 percent since 1850.

In the lower elevations of the **Columbia Plateau**, shrub-steppe communities have been almost entirely replaced by irrigated agriculture. Remnant habitats occur on public lands, such as the Boardman Bombing Range, and in scattered patches along roadsides and fields. Loss of sagebrush habitats in the Columbia Plateau is estimated at 87 percent compared to historical acreages.

In the **Northern Basin and Range** ecoregion, several types of big sagebrush are combined into a single priority habitat for this Conservation Strategy, including mountain, basin, and Wyoming big sagebrush shrublands and shrub-steppe. This part of Oregon has some of the largest blocks of high-quality sagebrush habitat left in the United States, but it is estimated that 59 percent of this habitat has been lost since the 1800s. Basin big sagebrush communities have had the greatest loss as compared to historical distribution. These communities historically occurred on deep soils and have been converted

to agriculture in some areas. The deep soils of basin big sagebrush are important for pygmy rabbits to create burrows.

Although Wyoming big sagebrush habitats are still common and widespread in the Northern Basin and Range, they have been altered to some degree by unmanaged grazing, invasive species, and altered fire regimes. With overgrazing and fire suppression, shrub (mostly sagebrush) density increases, bunchgrass and forb density decreases, and invasive annual grasses increase. In many areas, these habitats have shifted from mosaics of native perennial grasses, forbs, and shrubs to landscapes heavily dominated by shrubs and invasive annual forbs and grasses. Juniper encroachment is an important issue in mountain big sagebrush communities between 4,500 and 7,000 feet.

Big sagebrush habitats have high structural diversity, thus more places to forage, hide, and build nests. As a result, the number of bird species generally increases with sagebrush height. Habitat values are also dependent on a diverse understory of bunchgrasses and flowering plants.

Throughout eastern Oregon, loss of grassland-shrub mosaics across landscapes and the degradation of understories have contributed to the decline of species dependent on high-quality sagebrush habitats. **Strategy Species** associated with sagebrush include the **Greater Sage-Grouse**, **Ferruginous Hawk**, **Loggerhead Shrike**, **Sagebrush Sparrow**, **Brewer's Sparrow**, **northern sagebrush lizard**, **Washington ground squirrel**, and **pygmy rabbit**. Pygmy rabbits often burrow along the interface where low sagebrush mixes with mountain big sagebrush. More information on the Greater Sage-Grouse and sagebrush habitats can be found in the ODFW's **Greater Sage-Grouse Conservation Assessment and Strategy for Oregon: A Plan to Maintain and Enhance Populations and Habitat**.

LIMITING FACTORS AND RECOMMENDED APPROACHES

Limiting Factor: Altered Fire Regimes and Local Issues with Prescribed Fire

Fire suppression has resulted in undesirable changes in vegetation and contributes to increases in the intensity of wildfires. In some fire-suppressed areas, western junipers encroach into sagebrush habitats. Dense juniper stands are not suitable for species that require open sagebrush habitats. While a useful tool when tailored to local conditions, prescribed fire is not necessarily suitable for all sagebrush habitat types. Some sagebrush habitats, such as low sagebrush, are extremely slow to recover from disturbance such as prescribed fire. Fire, both prescribed and natural, can increase dominance by invasive plants.

Recommended Approach

Carefully evaluate sites to determine if prescribed fire is appropriate. Consider landscape context and landscape diversity when planning conservation actions. Be particularly cautious in low productivity needlegrass sites where recovery times are prolonged or in sites with invasive annual grasses. If determined to be ecologically beneficial, reintroduce natural fire regimes using site-appropriate prescriptions. Use prescribed fire to create a mosaic of successional stages and avoid large prescribed

fires. In areas where prescribed fire is undesirable or difficult to implement, use mechanical treatment methods such as mowing to maintain shrub cover at desired levels. To control encroaching junipers, use chipping or cutting for firewood. Develop markets for small juniper trees as a special forest product to reduce restoration costs. Maintain juniper trees with old-age characteristics, which are important nesting habitat for birds and other wildlife.

Limiting Factor: Invasive Species

Depending on the area, invasive plants, such as yellow-star thistle, knapweeds (diffuse, spotted, and purple), rush skeleton weed, spikeweed, leafy spurge, and perennial pepperweed, invade and degrade sagebrush habitats. The introduction and spread of the **invasive species** cheatgrass and medusahead can increase the frequency, intensity, and extent of fires. Sagebrush and native bunchgrasses are adapted to infrequent, patchy fires, so they are eliminated by hot fires. The dominance of invasive species thus increases, further increasing wildfire risk.

Recommended Approach

Emphasize prevention, risk assessment, early detection, and quick control to prevent new invasive species from becoming fully established. Prioritize control efforts and use site-appropriate methods to control newly-established species for which management can be most effective (e.g., leafy spurge and perennial pepperweed). Cooperate with partners through habitat programs and County Weed Boards to address invasive species problems. Reintroduce shrubs, grasses, and forbs at control sites through seeding and/or planting. In some cases, it may be desirable to use "assisted succession" strategies, using low seed rates of non-invasive, non-native plants in conjunction with native plant seeds as an intermediate step in rehabilitating disturbances to sagebrush habitat. Prevent and control wildfires in areas where cheatgrass dominates in the understory. Conduct research to determine methods to manage established species such as cheatgrass and medusahead. Minimize soil disturbance in high priority areas to prevent establishment of invasive species.

Limiting Factor: Damage to Microbiotic Soil Crusts

In the Columbia Plateau and Blue Mountains ecoregions, unmanaged grazing can damage soil crusts, which leads to soil erosion, changes in plant species composition and structure, and degradation by invasive plants.

Recommended Approach

Because most of the Columbia Plateau ecoregion is privately-owned, **voluntary cooperative approaches** are the key to long-term conservation in this ecoregion. Use tools such as financial incentives, technical assistance, regulatory assurance agreements, and conservation easements to achieve conservation goals. Continue to work with public land managers to ensure grazing is carefully managed. Conduct research and develop incentives to determine grazing regimes that are compatible with a variety of conservation goals.

Limiting Factor: Conversion to other Land Uses

In the Columbia Plateau ecoregion, remnant shrub-steppe habitats are subject to conversion to agriculture. In the Blue Mountains and East Cascades ecoregions, rapidly growing human populations near Bend, Redmond, and Madras, and slowly but steadily growing populations near Baker City and La Grande, are resulting in land use conversion, habitat loss, and habitat fragmentation.

Recommended Approach

Use tools such as financial incentives and conservation easements to conserve priority sagebrush habitats. For example, re-establishing the shrub component of lands enrolled in the Conservation Reserve Program has helped to restore habitat structure. Work with community leaders and agency partners to ensure that development is planned and consistent with local conservation priorities. Support and implement existing **land use regulations** to preserve farm and range land, open spaces, recreation areas, and natural habitats from incompatible development.

Limiting Factor: Loss of Habitat Connectivity

In the Columbia Plateau, shrub-steppe habitats often occur in small patches, such as roadsides and field edges. These patches are valuable habitat for some species, especially some plants. However, small size and poor connectivity of remnant patches limit dispersal for sagebrush-associated species.

Recommended Approach

Maintain high priority patches and improve connectivity. (KCI: **Barriers to Animal Movement**)

RESOURCES FOR MORE INFORMATION

- **Partners in Flight Conservation Strategy for Landbirds in the Columbia Plateau of Eastern Washington and Oregon**
- **Characteristics of Western Juniper Encroachment into Sagebrush Communities in Central Oregon**
- For information from the Bureau of Land Management about rangeland issues, fire management, and fire and invasive species assessment tools, see: **http://www.blm.gov/wo/st/en/prog/more/sagegrouse/documents_and_resources.html**.
- Convened by the Governor's Office, the **Sage-Grouse Conservation Partnership** (SageCon) is a diverse group of stakeholders working together since 2012 to develop an "all lands, all threats" plan to address sage-grouse conservation needs and support community sustainability in Oregon.

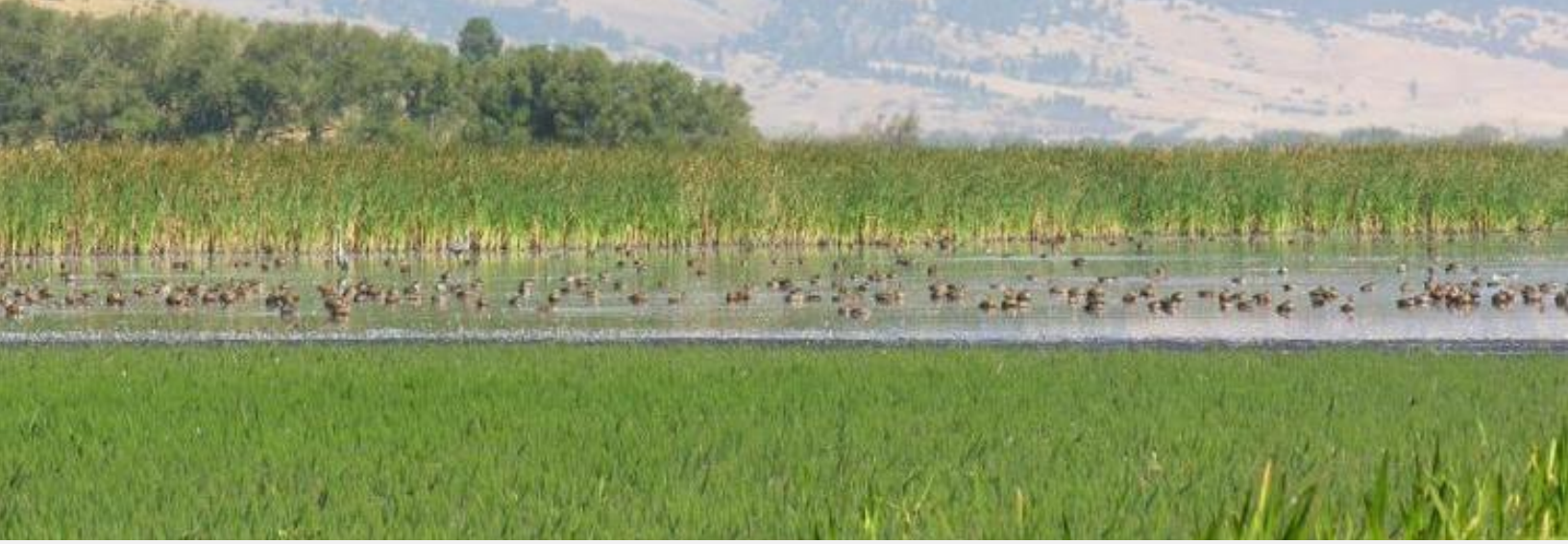

Photo Credit: Cathy Nowak, ODFW

WETLANDS

Wetlands are covered with water during all or part of the year. Permanently wet habitats include backwater sloughs, oxbow lakes, and marshes, while seasonally wet habitats include seasonal ponds, vernal pools, and wet prairies.

ECOREGIONS

Wetlands are identified as a Strategy Habitat throughout Oregon.

CHARACTERISTICS

Wetland habitats are highly diverse and include the following types:

Alkaline wetlands occur in depressions in more arid areas and are intermittently saturated. An impermeable soil layer prevents water from percolating through the soil, concentrating salts in some areas. Soil salinity varies greatly by soil moisture and type and affects the composition of plant species. Plant species are tolerant of saline conditions due to the concentration of salts by water evaporation. Alkaline wetland vegetation includes salt-tolerant grasses, rushes, sedges, and shrubs such as black **greasewood**. Examples of this habitat type are found in the Klamath Lake and Goose Lake areas of the **East Cascades** ecoregion, and in the **Northern Basin and Range** ecoregion.

Deciduous swamps and shrublands are located in depressions, around lakes or ponds, or on river terraces. They generally flood seasonally with nutrient-rich waters and are dominated by woody vegetation, including willows, hardhack, alder, red osier dogwood, Pacific crabapple, and ash.

Marshes (including emergent marshes) occur in depressions (ponds), fringes around lakes, and along slow-flowing streams, especially in valley bottoms. Marshes are seasonally or continually flooded and have water-adapted plants, such as sedges, bulrushes, spikesedges, rushes, cattails, and floating vegetation. Marshes can have mucky soils, resulting in water with high mineral content and vegetation dominated by herbaceous species, often including wildflowers.

Off-channel habitat, such as oxbow lakes, stable backwater sloughs, and flooded marshes, are created as rivers change course. In these areas, water moves slowly, providing quiet aquatic habitats. These areas provide important rearing habitats for young fish as well as refuge from high flow events, especially during the migration of young salmon to the ocean.

Playas, found in the **Northern Basin and Range** ecoregion, are sparsely vegetated (generally less than 10 percent plant cover) with grasses, and are surrounded by a ring of shrubs. They are seasonally flooded and have highly saline soil. Plant species composition depends on soil salinity and moisture. Characteristic species include iodine bush, black **greasewood**, spiny hopsage, saltbush, alkali grass, wildrye, and saltgrass.

Seasonal ponds and vernal pools hold water during the winter and spring but typically dry up during the summer months. Vernal pools occur in complexes of networked depressions that are seasonally filled with rainwater. They host a variety of plant and animal species with unique adaptations. These habitats can be very important for native invertebrate species (e.g., **vernal pool fairy shrimp**), plants (e.g., **big-flowered wooly meadowfoam**, **Cook's desert parsley**), and **amphibians**. For example, native amphibians may be able to reproduce in the short timeframes when water is present in seasonal ponds, while invasive non-native bullfrogs cannot. This reproductive advantage can help native amphibians that are sensitive to competition and predation from bullfrogs.

Wet meadows (including montane wet meadows) occur on gentle slopes near stream headwaters, in mountain valleys, bordering lakes and streams, near seeps, in large river valley bottoms, and in open wet depressions among montane forests. They are dominated by tufted hairgrass, sedges, reedgrass, spikesedge, rushes, and wildflowers. Montane wet meadows may have shallow surface water for part of the year, are associated with snowmelt, and are not typically subjected to disturbance events such as flooding.

Wet prairies occur in lowlands, especially in floodplains, whereas wet meadows occur in depressions surrounded by forests and are associated with snowmelt. Wet prairies are dominated by grasses, sedges, and wildflowers.

ECOREGIONAL CHARACTERISTICS

Blue Mountains

In the Grand Ronde and Baker Valleys, much of the lower elevation wetlands have been drained and converted to agriculture. Most remaining wetlands in this ecoregion are found at higher elevations, although some important valley bottom wetlands occur on private land.

Coast Range

Wetlands are vulnerable to development as more people relocate to be near the coast. Although wetland drainage is now discouraged, continuing development is a threat to some remaining wetlands. In addition, the ecological processes that create coastal wetlands, such as landslides, beaver activity, or logjams blocking streams, often are not compatible with current land uses, especially in more developed areas. Early planning that allows for appropriate riparian buffers along coastal rivers and streams can maintain many important wetland and stream functions, including flood control, water retention and storage, shading, and decreased contaminant inputs. Many of these functions will help to maintain higher stream flows and lower water temperatures in months with less precipitation.

Columbia Plateau

Historical wetlands along the **Columbia River** have been inundated by reservoirs, while floodplain wetlands along the Umatilla and Walla Walla rivers and other tributary streams have mostly been developed for agriculture. This ecoregion once had extensive springs and vernal pools, many of which have been lost as water tables lowered. Currently, many wetlands in this ecoregion are man-made, such as marshes established along the edges of reservoirs and wetlands created as a result of crop irrigation practices. The Wanaket Wildlife Area, managed by the Confederated Tribes of the Umatilla, is a network of wetlands created through irrigation of pastureland that provides important habitat for many wetland-dependent species. Similarly, ponds on the Umatilla National Wildlife Refuge use runoff from the fish hatchery to seasonally water shallow pools for migrating shorebirds and to provide breeding habitat for amphibians. Irrigation wetlands in this ecoregion can provide important habitat but can also be adversely impacted by runoff containing fertilizers or other chemicals.

East Cascades

The upper Klamath Basin once had an extensive shallow lake and marsh system, but much of that system has been lost due to drainage and conversion to agriculture and urban uses. These changes have contributed to the complex issues surrounding water use and species conservation in the basin. The remaining wetlands in the Klamath Basin support one of the largest concentrations of waterfowl in North America, with over three million ducks and a half-million geese migrating through the basin annually. The area is a critical migratory staging area for 80 percent of all Pacific Flyway waterfowl. In the winter, the Klamath Basin hosts the largest wintering population of Bald Eagles in the continental United States. The Klamath Basin provides Oregon's only permanent nesting areas for **Red-necked Grebes** and **Yellow Rails**.

Klamath Mountains

Most low-elevation seasonal wetlands have been lost to habitat conversion to agricultural, urban, and rural residential uses. Upland activities or altered hydrology impact many remaining wetland habitats. Rare vernal pool wetlands in the Agate Desert near Medford support several rare plant and animal

species. These and other vernal pool types of wetlands are formed in areas with unusual topography and soil layering, and are very difficult to replace when ground is leveled for development.

Northern Basin and Range

The **Northern Basin and Range** ecoregion contains several large, deep freshwater marshes. Significant large wetlands are associated with the large lake basins, including: Abert, Summer, Malheur, and Harney Lakes, and the Warner Basin. However, many of the ecoregion's smaller historical wetlands have been lost due to conversion or degradation from stream channelization, water diversions, and historical overgrazing. Creation of watering holes for livestock and wildlife has altered the hydrology at many major playas, making them one of the most altered habitat types in the ecoregion.

In some areas, flood-irrigation of private pasture and hay meadows provides important seasonal habitat for migrating and breeding birds. In areas where flood irrigation is being applied to row crops, converting flood irrigation to piped sprinkler systems can improve water quality, reduce sedimentation, and reduce water loss due to evaporation. However, loss of flood irrigation without restoring wetlands in the landscape will negatively affect wetland species now dependent on flooded habitats. Cooperative projects, such as settling ponds designed for cleaning flood irrigation "tail water", may offer a way to address water quality and wetland habitat issues.

West Cascades

Wetlands are generally in excellent condition, although some areas, such as those located around Mt. Hood, can be impacted by uncontrolled livestock grazing, camping, or off-highway vehicle use.

Willamette Valley

Almost all remaining wetlands in this ecoregion have been degraded to some degree by altered water regimes, pollution, and invasive plants and animals. Wetlands in the Willamette Valley serve important ecological functions for communities, provide habitat for amphibians, turtles, birds, and fish, and offer key bird and fish migratory pathways.

CONSERVATION OVERVIEW

Wetlands and wet meadows provide important habitat for migrating and breeding shorebirds, waterbirds, waterfowl, songbirds, mammals, amphibians, and reptiles. Floodplain wetlands and backwater sloughs and swamps are important rearing habitats for juvenile salmon. Wetlands have direct value for people because they improve water quality by trapping sediments and pollutants, recharge aquifers, store water, and reduce the severity of floods. Seasonal wetlands that dry up during the summer provide important ecological functions, such as supporting water quality and sequestering carbon.

Restoration and careful management of wet meadow systems and other wetlands can increase sustainable production of forage for livestock and increase late-season stream flows. Restoration and retention of wetlands, especially those with high water storage potential in arid regions, may help to maintain ground water levels into drought periods.

In general, most wetland habitat loss has occurred at lower elevations and valley bottoms. Many of these wetlands have been drained and converted to agriculture or eliminated due to urban growth.

LIMITING FACTORS AND RECOMMENDED APPROACHES

Limiting Factor: Habitat Loss

A high percentage of low-elevation and valley bottom wetlands have been lost or degraded through diking and draining, particularly in the Klamath Mountains and Coast Range ecoregions. In other areas, overgrazing can lead to soil compaction, changes in plant species composition, and spread of invasive plants. In some cases, due to short growing seasons and other factors, degraded wet meadows can be slow to recover if overgrazed.

Wetlands in the East Cascades and Northern Basin and Range ecoregions provide vital habitat for migrating shorebirds and waterfowl. Limited or degraded wetland habitat in the Pacific Flyway could potentially have large impacts on bird populations. In the East Cascades ecoregion, significant bird nesting habitat has already been lost. Early season haying in wetland habitats on private and public land can result in poor reproduction of ground-nesting birds due to destruction of nests and direct mortality of young. Many wetlands are lost through urbanization and direct fill for development. Unfortunately, this removes wetlands from locations where the functions they may provide might have the most value for humans and fish and wildlife. Maintaining wetland and surrounding upland habitat near communities can provide: flood water storage and delay capacity, water quality opportunities to allow infiltration and exposure to treat possible contaminants before reaching streams and ground water, temperature regulation when vegetation and shading are retained, safe passage corridors for fish and wildlife, and transportation routes for people.

Recommended Approach

Protect and conserve priority wetland habitat that provides vital breeding habitat for **Strategy Species** and stopover sites for migrating species (KCI: **Barriers to Animal Movement**). Identify wetlands that have been altered or lost, and determine their potential for restoration.

Build upon current cooperative efforts to maintain and restore wetlands in partnership with private and public landowners. **Cooperative voluntary approaches** are important for wetland **conservation on private lands**. Continue to provide incentives to protect, maintain, or restore wetlands, such as the **Wetland Reserve Program** offered through the Natural Resources Conservation Service and private mitigation banking. Develop and implement grazing regimes that are compatible with wet meadow

conservation objectives. Use cooperative efforts and incentive programs to establish semi-permanent livestock exclusion zones in priority areas. In partnership with landowners, implement later haying dates in critical bird nesting areas (see **The Willamette Valley Landowner's Guide to Creating Habitat for Grassland Birds**). Manage **beaver** populations to contribute to wetland creation and maintenance, when compatible with existing land uses.

Continue successful programs to educate individuals about the function and services provided by wetlands. As part of mitigation programs, restore or create wet prairie, vernal pool, and other seasonal and permanent wetland habitats. Promote awareness of the importance of temporary pond habitat.

Facilitate discussions within communities, including city and county planners, agricultural groups, and forest industries, regarding the functions performed by wetlands. Work with the **local planning process** to promote the value of maintaining wetlands and habitat corridors, especially along floodways, where they can best function to protect structures, infrastructure, and water quality.

Limiting Factor: Water Availability

Water is extremely limited in much of the Blue Mountains, East Cascades, and Northern Basin and Range ecoregions. As a result, there is competition for water resources, particularly in late summer. Lowered water tables affect wetland habitats. Competition for water harms both ecological and economic goals. Water diversions for other uses change the seasonality of flooding, slow habitat recovery, and increase invasion of non-native grasses. Drought years intensify water shortages.

Recommended Approach

Use cooperative efforts and incentive programs, such as financial incentives for wetlands restoration, water rights acquisition, and wetland mitigation banking, to manage water allocation and wetland habitats. Recognize importance of irrigated wetland habitats, and maintain benefits to species when considering various management and irrigation options. (KCI: **Water Quality and Quantity**)

Limiting Factor: Degraded Water Quality

Although wetlands have a role in purifying water, water quality is poor in some wetland systems. High temperatures affect water quality in some areas. Non-point source runoff from agricultural and residential areas contains pollutants that can affect water quality and nutrient levels, and these levels may increase as water evaporates throughout the season. High nutrient loads can contribute to toxic algal blooms.

Recommended Approach

Provide economic incentives to decrease and manage the release of potential contaminants, such as fertilizers or pesticides, by controlling the timing of application. Use incentives to promote substitutes that are less toxic to wildlife and break down quickly in the environment. Work with agency, landowner, and business partners to implement the federal **Clean Water Act**. Promote the creation of stormwater

treatment projects, fencing of aquatic habitats to exclude livestock, and restoration of riparian buffers and additional wetlands to increase filtering capacity. Support irrigation systems that conserve, re-collect, and re-use water more effectively, use gray water, and provide shaded treatment areas that can provide cooling and habitat. In the Willamette Valley, adopt critical actions recommended by the **Willamette Restoration Initiative** on Clean Water, such as: reduce the levels of toxins and other pollutants in the Willamette Basin, provide economic incentives to decrease water pollution, and promote education and outreach programs for homeowners, farmers, and developers. (KCI: **Water Quality and Quantity**)

Limiting Factor: Invasive Species

Invasive species, such as reed canarygrass, purple loosestrife, and Japanese knotweed, invade and degrade wetlands, thereby displacing native plants, reducing plant community diversity, reducing sources of food for wildlife, and altering water flow and storage function. For example, perennial pepperweed and purple loosestrife have affected important wetlands including Malheur Lake. Invasive, non-native carp can impact wetlands by consuming important plants and by increasing turbidity, disturbing sediments, and altering biological dynamics for sediment-associated plants and animals. Turbidity also contributes to higher water temperatures and lower levels of dissolved oxygen.

Recommended Approach

Emphasize prevention, risk assessment, early detection, and quick control to prevent new invasive species from becoming fully established. Control key invasive plants using site-appropriate tools, such as flooding (reed canary grass), biological control (purple loosestrife), and mechanical treatment including mowing. Use chemical treatment carefully and where compatible with water quality concerns, focusing on spot treatment during the dry season. Adjusting water levels can also help to control invasive carp. Consider screening to control carp. Use revegetation and other means to establish and maintain healthy plant communities that are relatively resistant to invasion and that also meet other land use objectives. (KCI: **Invasive Species**)

RESOURCES FOR MORE INFORMATION

- **Oregon Department of State Lands, Wetlands**
- **Oregon Wetland Monitoring and Assessment Strategy**
- **Oregon Wetland Program Plan**
- **Oregon Explorer Wetland Restoration Planning Tool**
- **Practical Guidelines for Wetland Prairie Restoration in the Willamette Valley, Oregon: Field-tested Methods and Techniques**

STRATEGY SPOTLIGHT: NATIVE TURTLES BMPS

The Oregon Department of Fish and Wildlife released a comprehensive guide focused on conserving Oregon's native turtles and their habitats. It includes Best Management Practices (BMPs) to protect and conserve Oregon's two native turtle species, the western painted turtle and the western pond turtle.

Guidance for Conserving Oregon's Native Turtles Including Best Management Practices is intended primarily for natural resource and land managers, land use planners, and project managers, but landowners and the general public can also benefit from this resource. The guide was peer-reviewed, and the BMPs are practical and cost-effective so they can be readily used.

The guide can help with planning projects in or near permanent or seasonal wetlands, ponds, and other water bodies that are within the known range of native turtles. Actions that involve ground disturbance, changes in water levels, riparian habitat restoration, or use of heavy equipment are just a few examples known to affect native turtles.

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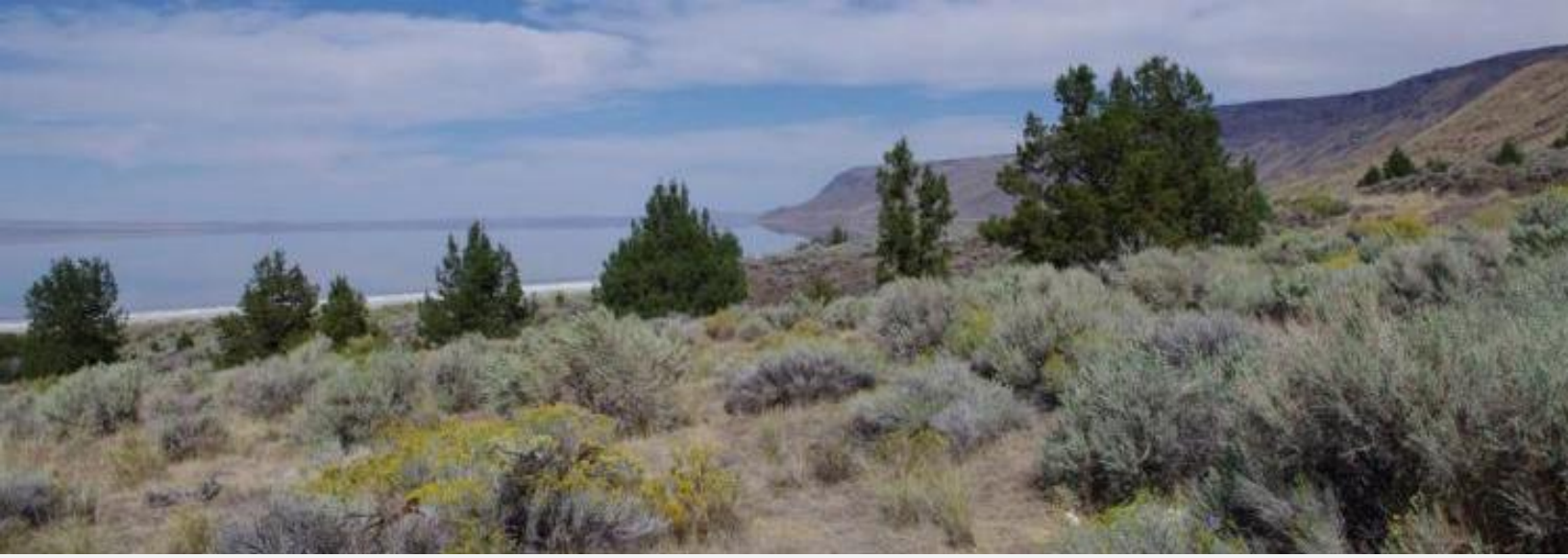

Photo Credit: Martyne Reesman, ODFW

SUMMARY BY ECOREGION

STRATEGY HABITATS: SUMMARY BY ECOREGION

List of Strategy Habitats designated by ecoregion. The ecoregions designated for each habitat represent the highest priorities for implementing conservation actions on the ground, and are not intended to indicate presence/absence.

Strategy Habitat	Blue Mountains	Coast Range	Columbia Plateau	East Cascades	Klamath Mountains	Northern Basin & Range	West Cascades	Willamette Valley
Aspen Woodlands	BM			EC		NBR		
Coastal Dunes		CR						
Estuaries		CR						
Flowing Water and Riparian Habitats	BM	CR	CP	EC	KM	NBR	WC	WV
Grasslands	BM	CR	CP		KM		WC	WV

Strategy Habitat	Blue Mountains	Coast Range	Columbia Plateau	East Cascades	Klamath Mountains	Northern Basin & Range	West Cascades	Willamette Valley
Late Successional Mixed Conifer Forests	BM	CR		EC	KM		WC	
Natural Lakes	BM	CR	CP	EC	KM	NBR	WC	WV
Oak Woodlands		CR		EC	KM		WC	WV
Ponderosa Pine Woodlands	BM			EC	KM			
Sagebrush Habitats	BM		CP	EC		NBR		
Wetlands	BM	CR	CP	EC	KM	NBR	WC	WV

Photo Credit: Janna Nichols

SPECIALIZED AND LOCAL HABITATS

Some natural communities and landscape features are not adequately represented through **Strategy Habitats**. These communities and features often occur at the local scale and have a patchy distribution across the landscape. They may be difficult to map from satellite data and may not be represented well in those datasets. Some communities are highly specialized to the local environment and host a suite of rare or endemic species. To address the conservation needs of these communities and their associated species, "local and specialized habitats" were determined through review of geographic vegetation data, rare plant or animal occurrences, importance to **Strategy Species**, and occurrences of animal concentrations, such as migrating or wintering birds.

ALPINE HABITATS: MEADOWS, DWARF SHRUBLANDS, ALPINE TUNDRA, AND WHITE BARK PINE

Ecoregions	**BM**, **EC**, **KM**, **NBR**, **WC**
Comments	Alpine habitats provide important foraging and breeding areas for many mammals and birds as well as critical resources for birds during migration periods. They are especially at risk as the climate changes and as recreational demand increases. Alpine habitats provide important resources for many at-risk species, such as white bark pine that is particularly vulnerable to white pine blister rust, outbreaks of mountain pine beetles, and fire suppression resulting in replacement by more shade-tolerant tree species.
Conservation Actions	Support efforts to address climate change and to provide refugia for fish and wildlife. Manage recreation, human disturbance, and domestic sheep grazing to minimize impacts to plant communities. Monitor and control invasive plants. Re-introduce fire into the ecosystem as feasible and appropriate to the local area.

AQUATIC VEGETATION BEDS

Ecoregions All

Comments Habitat for invertebrates that are the base of the aquatic food chain

Conservation Actions Retain and restore natural water flow regimes. Control invasive plants such as reed-canary grass. See **Flowing Water and Riparian Habitat**.

ASH FLOWS AND ASH BEDS

Ecoregions **BM**, **EC**, **NBR**

Comments Habitat for endemic and other rare plants, and important fossil localities

Conservation Actions Manage grazing, mining, and off-highway vehicle use to minimize conflicts with rare plants.

BALDS AND BLUFFS

Ecoregions **BM**, **CR**, **EC**, **KM**, **WC**, **WV**

Comments Habitat for unique plant communities and invertebrates such as butterflies. In the Coast Range ecoregion, includes coastal bluffs and headlands. In the Klamath Mountains ecoregion, includes serpentine barrens and outcrops.

Conservation Actions Control encroaching conifers and shrubs at priority sites. Monitor for and control key invasive plants at priority sites. In serpentine barrens, minimize disturbance (e.g., trail or road construction) to rare plant communities.

BAYS

Ecoregions **CR**, **NS**

Comments Winter habitat for waterfowl and other waterbirds. Rearing area for juvenile anadromous salmonids.

Conservation Actions Provide areas of low disturbance during critical time periods. Also see **Estuaries**.

BITTERBRUSH COMMUNITIES

Ecoregions **BM**, **EC**, **NBR**

Comments Bitterbrush is an important habitat component that provides forage, cover, and nesting habitat for a variety of wildlife. In the Northern Basin and Range ecoregion, bitterbrush is found in canyons, often in areas with more moisture, in a mosaic with sagebrush and rabbitbrush.

Conservation Actions Continue restoration efforts. Improve understanding of bitterbrush regeneration methods.

CANYON SHRUBLANDS

Ecoregions **BM**, **CP**, **EC**, **NBR**

Comments Also known as moist deciduous shrublands, these areas provide nesting habitat for songbirds, and winter habitat for Sharp-tailed Grouse.

Conservation Actions Maintain healthy stands and restore degraded stands. Some degraded stands can benefit from prescribed fire, removal of encroaching invasive junipers, or management of grazing season timing.

CAVES AND OLD MINES

Ecoregions **BM**, **CR**, **EC**, **KM**, **NBR**, **WC**

Comments Habitat for rare invertebrates and cave-roosting bats, such as Townsend's big-eared bat and several *Myotis* species. In the East Cascades ecoregion, includes lava tubes.

Conservation Actions Use gates or seasonal closures to protect known roost sites from recreational caving and other disturbance. When mines are closed for human safety, provide for bat entry and exit.

CHAPARRAL AND CEANOTHUS SHRUBLAND

Ecoregions **BM**, **CR**, **KM**, **WC**, **WV**

Comments Nesting and foraging habitat for songbirds. Important for kingsnakes, some butterflies, and other invertebrates. May occur in early successional habitats or at high elevations, where temperatures and other factors inhibit tree growth. In the Klamath Mountains ecoregion, it is often removed as a fire hazard. It is increasingly removed with development, particularly in lowland valleys. Where not removed, often it becomes senescent without the fires needed for regeneration. Unusual habitat in the Willamette Valley, which makes existing sites important for local diversity.

Conservation Actions Maintain shrub diversity during forest management activities. Delay replanting with conifers where shrub habitat is limited. Control key invasive plants (e.g., Scotch broom and Armenian (Himalayan) blackberry) at priority sites.

EELGRASS BEDS

Ecoregions **CR**, **NS**

Comments Basis for aquatic food chain. Important rearing area for juvenile fish, including commercially important species. Foraging habitat for Black Brant.

Conservation Actions Maintain and restore eelgrass habitats. Also see **Estuaries**.

FEN PEATLANDS

Ecoregions **BM**, **EC**, **WC**

Comments Fens are peat-accumulating wetlands that form where groundwater discharge is low but constant, and where appropriate geologic conditions occur, such as glacial plus pumice deposits. Fens provide habitat for sensitive plant species and provide long-term carbon storage in the form of peat. They are highly sensitive to climate change, which may reverse the process of peat accretion and lead to carbon loss.

Conservation Actions Maintain groundwater recharge areas, especially at higher elevations. Use conservation incentives, and where applicable, maintain existing protection standards to provide buffers around fen area. Seek opportunities to enhance recharge from local aquifers supporting the fens.

FOREST OPENINGS

Ecoregions **CR**, **EC**, **WC**

Comments Forest openings provide essential structural complexity and plant diversity. These structures provide foraging and nesting habitat for Olive-sided Flycatchers, Willow Flycatchers, and Common Nighthawks. Open areas with snags are important for Purple Martins and Western Bluebirds. Clouded salamanders live in large logs and stumps in openings, and their populations increase following wildfires. Disturbances, such as wildfire, disease, and insect outbreaks, reset succession and often result in large or small openings with high forb and shrub diversity and structure (e.g., large snags and logs). With management emphasis on older successional stages on public land and more intensive management of private forestlands, openings with structural complexity and plant diversity are now rare. This has resulted in a loss of nesting and foraging habitat for some songbirds.

Conservation Actions During salvage logging or other timber harvest, minimize ground disturbance, and maintain and create snags and downed logs. Look for opportunities to create forest openings and maintain natural forb, grass, and shrub species. Openings of 5 acres or greater provide the most benefit to songbirds and other wildlife. Control key invasive plants in openings. After burns, reseed with native grasses and forbs, and delay replanting with conifers. Carefully evaluate salvage logging in burned late successional forests.

UNIQUE GRASSLAND HABITATS

Ecoregions **EC**, **NBR**

Comments Includes alkali grasslands, perennial bunchgrass, and montane grasslands. Important for raptors, grassland birds, and rare plants.

Conservation Actions Maintain and restore these features using site-appropriate tools. Monitor for invasive species. Manage grazing to minimize impacts to native species.

GREASEWOOD FLATS AND WASHES

Ecoregions **BM**, **CP**, **EC**

Comments Typically found in flats, washes, and terraces with saline soils and shallow water tables. They flood intermittently, but remain dry for most growing seasons, and provide habitat for rare plants. High estimated habitat loss in the Blue Mountains ecoregion but still common in Baker and Grande Ronde Valleys. Very high estimated loss in Columbia Plateau (greater than 96 percent) and East Cascades (greater than 9 percent) ecoregions.

Conservation Actions Maintain and restore greasewood habitats. In Blue Mountains, include black greasewood habitats when managing for a mosaic of valley bottom habitats.

INLAND DUNES

Ecoregions **CR**

Comments Includes unvegetated to moderately vegetated (10-30 percent plant cover), active, and stabilized dunes. Habitat for reptiles, small mammals, and rare plants.

Conservation Actions This habitat type currently has few limiting factors but could be impacted by uncontrolled off-highway vehicle use in the future. Monitor priority sites.

INTER-DUNAL LAKES AND WETLANDS

Ecoregions **CR**

Comments Shallow lakes and wetlands located in areas between coastal sand dunes. These habitats are outcroppings of the water table, so water levels are controlled by hydrology of the unconfined sand dune aquifers which are recharged by local precipitation. These wetlands support breeding habitat for Strategy Species, including northern red-legged frogs and wetland plant communities.

Conservation Actions Maintain groundwater recharge areas at sand dune aquifers. Protect from off-road vehicle use and other impacts.

INTERTIDAL MUDFLATS

Ecoregions **CR**, **NS**

Comments Foraging habitat for shorebirds; critically important during migration. Habitat for invertebrates such as clams.

Conservation Actions Manage water flows to maintain mudflat habitats. Maintain or restore water quality and natural sedimentation patterns to maintain habitat quality for invertebrates. See **Estuaries**.

MOUNTAIN MAHOGANY WOODLAND AND SHRUBLAND

Ecoregions **BM**, **EC**, **NBR**

Comments Mountain mahogany communities may spread with fire suppression but depend on fire for long-term maintenance. Expanding in some areas but lacking regeneration in others. Threatened by juniper encroachment in some areas, especially in Northern Basin and Range. Many stands have non-native understory vegetation. In East Cascades ecoregion, mountain mahogany is more diverse than other ecoregions. Here, it includes birchleaf mountain mahogany, which covers moist shrublands in the southern portion of the ecoregion. Mountain mahogany is important nesting habitat for birds because it provides tree structure in open shrub-dominated landscapes.

Conservation Actions Develop methods to manage mahogany stands and encourage regeneration. Restore understory vegetation at priority sites.

OFF-CHANNEL HABITAT

Ecoregions All inland ecoregions

Comments Provides critical habitat for juvenile salmonids and other fish, western pond turtles, freshwater mussels, dragonflies, and other invertebrates.

Conservation Actions Raise awareness so that activities can be managed for minimal impact. Maintain current off-channel habitat and restore, where possible. Maintain or restore stream hydrology. Manage beaver populations to provide for beaver-created habitats, while minimizing conflicts with other land uses. See **Flowing Water and Riparian Habitat**.

OFF-SHORE ROCKS (E.G., SEA STACKS)

Ecoregions **CR**, **NS**

Comments Critical nesting habitat for seabirds. Haul-outs for marine mammals. Roosting areas for Peregrine Falcons.

Conservation Actions Implement existing restrictions and continue successful outreach efforts to minimize disturbance during sensitive nesting and pupping seasons.

PORT-ORFORD CEDAR FORESTS

Ecoregions **KM**

Comments Endemic to Klamath Mountains; associated with serpentine soils and characterized by unusual plant and animal associations. Severely impacted by the invasive Port-Orford root-rot, particularly near the coast.

Conservation Actions Maintain existing habitat. Minimize vehicular traffic and/or new road construction where potential exists to spread the invasive root pathogen.

ROCK HABITATS: CLIFFS, RIMROCK, ROCK OUTCROPS, AND TALUS

Ecoregions **BM**, **CR**, **CP**, **EC**, **KM**, **NBR**, **WC**, **WV**

Comments Habitat for Peregrine Falcons and other cliff-nesting birds, cliff-roosting bats, rare plants, and wildlife that use rocks for shelter and/or foraging areas. Talus is habitat for Larch Mountain salamander, pika, and unusual invertebrates. In the Willamette Valley, hibernacula for snakes, including western rattlesnakes. In dry ecoregions, rock habitats are particularly important for salamanders as a refuge from hot, dry weather.

Conservation Actions These habitats have few limiting factors in most ecoregions. In the East Cascades, residential development at the edge of rims alters vegetation and disturbs nesting birds. Work with local planners to implement existing setback distance standards. Rock mining should be avoided in talus areas where known populations of Larch Mountain salamander and rare invertebrates occur. For all ecoregions, if important roosts or nest sites are known, minimize disturbance (such as rock climbing) during the breeding season.

ROCKY SHORE AND TIDEPOOLS

Ecoregions **CR**, **NS**

Comments Rocky shores are habitat for marine invertebrates and shorebirds, such as Black Oystercatcher, Rock Sandpiper, and Surfbird. Tidepools are habitat for marine invertebrates and fish.

Conservation Actions Minimize disturbance during shorebird nesting season. Work with local communities and land management agencies to minimize impacts from tidepool viewing.

SALT DESERT SCRUB

Ecoregions **NBR**

Comments This low-to-medium shrub habitat can be found on dry sites with saline soils, such as dry lake beds, flat desert pavements, low alkaline dunes, around playas, or on gentle slopes above playas. It provides habitat for kit fox and suits reptile and small mammal species that are primarily or exclusively associated with this habitat.

Conservation Actions Cheatgrass invasion and increasing surface fuel accumulation are problems at some locations. Microbiotic soil crusts are particularly critical in these habitats, so it is important to minimize activities that cause soil disturbance.

SAND SPITS, SAND BARS, AND SPARSELY VEGETATED ISLANDS

Ecoregions **CR**, **EC**, **NBR**, **NS**

Comments Sparsely vegetated sandy habitats that are isolated from disturbance due to humans and mammalian predators are important roosting and nesting sites for colonial waterbirds, such as American White Pelicans, Brown Pelicans, and Caspian Terns. In eastern Oregon, this habitat occurs around large lakes and wetlands. Sparsely vegetated island habitat can be surrounded by either saltwater or freshwater.

Conservation Actions Maintain open habitat characteristics and minimize disturbance at key sites.

SPRINGS, SEEPS, AND HEADWATERS

Ecoregions All inland ecoregions

Comments Habitat for amphibians, invertebrates, and rare plants. The isolated nature of springs is one of the factors resulting in high levels of invertebrate endemism in the East Cascades. In dry ecoregions, spring and seep habitats are important as a source of water for wildlife and as habitat for amphibians and invertebrates. These habitats have been impacted by livestock watering and agricultural uses.

Conservation Actions Use incentives, and where applicable, maintain existing protection standards to provide buffers around springs, seeps, and stream headwaters during forest management and road building activities. Maintain groundwater recharge areas. Use open-bottomed culverts or bridges when building roads or upgrading culverts to allow fish and amphibian passage. In dry ecoregions, use cooperative incentive programs to fence spring heads, which provides benefits to wildlife but allows water to be available for other uses.

SPRING-FED STREAMS

Ecoregions **BM**, **EC**, **KM**, **WC**, **WV**

Comments Streams dominated by groundwater rather than surface runoff have nearly constant discharge, low water temperatures, and distinct geomorphologic characteristics, such as few or no gravel bars and wood which remains in the channel. These streams support cool-water species such as bull trout and may provide refugia for other temperature-limited species.

Conservation Actions Maintain groundwater recharge areas, especially at higher elevations. Maintain and restore natural water flow regimes. Maintain supporting aquifers.

WESTERN JUNIPER SAVANNA WITH MATURE TREES; LATE SUCCESSIONAL WESTERN JUNIPER WOODLANDS

Ecoregions **BM**, **CP**, **EC**, **NBR**

Comments Western juniper savanna consists of scattered, often large, juniper trees within shrub-steppe. Late successional juniper woodlands may have a higher density of trees but are characterized by large-diameter trees. These juniper habitats are important for songbirds and raptors. In the Columbia Plateau ecoregion, the remaining Ferruginous Hawk nest sites are primarily juniper trees.

Currently, about 3-5 percent of Oregon's juniper woodland is considered late successional. A high percentage of old-growth juniper in Central Oregon near Bend, Redmond, and Madras has been lost. Remaining stands are highly fragmented and are threatened by encroaching small junipers. In contrast, recruitment of juniper in sandy shrub-steppe of the Columbia Plateau is naturally poor, so young juniper trees are not replacing older ones lost to cutting or natural death.

Conservation Actions Remove small-diameter encroaching juniper trees while maintaining larger diameter junipers and connectivity of juniper patches. Reintroduce fire where practical. Need better spatial data on distribution of mature juniper savanna. In the Columbia Plateau, maintain existing large juniper trees and examine factors affecting tree recruitment. Research is underway to determine the age, composition, structure, and wildlife usage of old growth juniper woodlands (for more information, see the **Eastern Oregon Agricultural Research Center website**).

WESTERN LARCH FOREST AND WOODLAND

Ecoregions **BM**, **EC**

Comments Occurs on cool, moist sites interspersed with ponderosa pine habitats; may have been much more common historically in the Blue Mountains ecoregion.

Conservation Actions Maintain large-diameter larch trees and patches of larch forest to provide local diversity. Control key invasive plants.

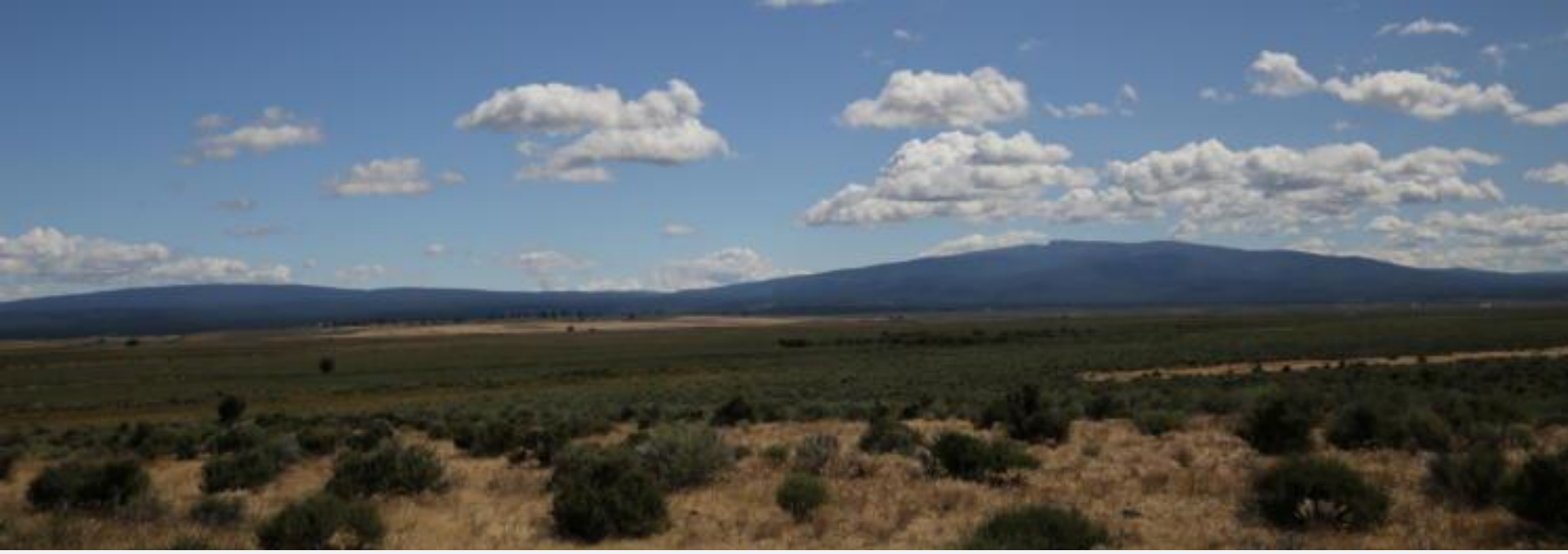

Photo Credit: Keith Kohl, ODFW

HABITAT DATA GAPS

Native habitats provide many values for people, fish, and wildlife in Oregon. In the last few decades, great progress has been made in understanding how Oregon's habitats function. In addition, landowners, land managers, and restoration experts have learned on-the-ground lessons through experimentation and sharing information. However, there are still data gaps that need to be addressed in order to effectively restore and manage native habitats in Oregon. Below are some broad themes for data gaps identified for **Strategy Habitats**. This list is not meant to be comprehensive, but represents some high priority information needs.

ALL HABITATS

- Determine disturbance factors (e.g., fire, flooding, winter storms) and regimes that historically maintained Strategy Habitats.
- Increase understanding of how to manage habitats at multiple scales. For example, improve methods for managing wetland and riparian habitats across landscape and watershed scales.
- Continue to refine habitat distribution maps. Improve ability to map specialized and local habitats.
- Continue to update historical vegetation maps as additional information is developed regarding temporal and spatial ecosystem dynamics.
- Develop innovative management techniques and markets with potential to support job creation and local economies while restoring habitats (e.g., markets for small-diameter trees removed during forest restoration).
- Establish propagation methods for native plants for restoration. Collaborate with partners to develop sustainable markets for native plant producers in order to provide a reliable supply of restoration materials (e.g., Native Seed Network's programs).

- Determine most effective methods to restore natural hydrological conditions to streams, rivers, and wetlands, including seasonal wetlands (e.g., vernal pools, wet prairies, and playas).
- Determine distribution and spread rates of priority invasive species.
- Develop measurable indicators of high quality habitat.
- Improve our ability to measure the change in habitats, as well as our ability to measure habitat quality and habitat quality indicators.
- Increase our understanding of how management decisions impact habitats. For example, continue development of state-and-transition models.

TERRESTRIAL HABITATS

- Improve bitterbrush and mountain mahogany regeneration.
- Control encroaching native vegetation (e.g., conifers in oak woodlands, western juniper in sagebrush) and effects on native plant composition and ecological function (e.g., transpiration impacts on surface water flows caused by western juniper).
- Reintroduce natural fire regimes into forested habitats and reduce wildfire risk while maintaining late successional habitats.
- Reintroduce fire into fire-dependent landscapes, such as native grasslands, chaparral, oak savannas, and ponderosa pine habitats. Develop fire prescriptions to address the constraints of surrounding land uses, smoke management, safety, and other considerations.
- Address wildfire in areas with mid-term fire (30-70 year) fire return intervals, such as shrub-steppe and old-growth forest habitats, where it can be especially damaging to the wildlife habitat, and prescribed fire may not always be possible.
- Maintain fire-dependent habitats in the absence of natural fire regimes, especially where prescribed fire is not practical.

Oak Woodlands and Savanna

- Enhance cavity development in oak trees (e.g., fungal inoculations, limbing).
- Determine effectiveness of snag creation from competing conifers to provide cavity-nesting habitat for oak-associated birds, such as the **Western Bluebird**, **Acorn Woodpecker**, and **White-breasted Nuthatch**.
- Encourage large, open-structure Oregon white oak tree growth.
- Evaluate effects of management practices on natural oak regeneration.

Aspen Woodlands

- Determine the effects of altered subsoil water levels on aspen.
- Utilize prescribed fire techniques that can be applied in aspen habitats to control junipers while stimulating aspen shoots.

Ponderosa Pine Woodlands

- Determine desired patch size and connectivity across landscapes.
- Determine gap dynamics (e.g., how forest openings are created, maintained, change over the landscape, and are used by or affect wildlife).
- For high-elevation ponderosa pine habitats that have converted to mixed-conifer habitats, determine if restoration is possible and desirable. If so, investigate restoration methods.

AQUATIC HABITATS

- Determine specific requirements for large woody debris levels in streams.
- Identify factors that impact channel stability and channel conditions.
- Understand and assess effects of changes in channel geometry.
- Assess historical temperature and water quality regimes.
- Improve methods to understand impacts of upland management on aquatic habitats.
- To ensure effective management of non-point source pollutants, such as fertilizers and pesticides:
    - Understand the chemical breakdown of pollutants in wetlands and other temporary aquatic habitats.
    - Investigate potential impacts of pesticides or herbicides on ecological communities, considering trophic dynamics.
    - Compile management suggestions for reducing the impact of non-point source pollution.
    - Develop non-toxic alternatives to pesticides and fertilizers, where feasible.

MULTIPLE-OBJECTIVE RESOURCE LANDS

- Develop decision-making tools to help land owners and land managers assess and compare the short-term and long-term risks to wildlife and habitat of forest management practices that reduce the risk of uncharacteristic fire.

- Determine the impacts of intensive vegetation management (through herbicides and fertilizers) on native wildlife and ecological communities.
- Increase efforts to understand and evaluate the benefits of managed farm and rangeland (for example, soil and ecological processes; ability to adapt to change).
- Investigate grazing regimes that are compatible with grassland conservation goals.
- Investigate impacts of range management regimes on big sagebrush habitats, understanding what habitat components are important to wildlife and how grazing or other activities affect these habitats.
- Evaluate management actions on range and other land to determine best practices.
- Evaluate efficiency with which runoff and irrigation water is used, and evaluate the degree to which farm and range land resist erosion and runoff.
- Determine relationships between groundwater withdrawals and surface water volume.
- Develop quantitative measures of environmental condition and performance for managed landscapes, including managed forests, agricultural lands, rangelands, and urban areas.
- Increase understanding about the ecological effects of urbanization, and ways to minimize negative consequences for species and habitats within and beyond the urbanized footprint.
- Improve our understanding of climate change and how:
    - it may impact our ability to maintain native habitat.
    - to increase resiliency of habitats.
    - we can best allow for movement and migration of wildlife.