

ECOREGIONS

Oregon's State Wildlife Action Plan

3	Contents	
4	ECOREGIONS.....	5
5	BLUE MOUNTAINS.....	6
6	DESCRIPTION	6
7	CHARACTERISTICS	6
8	CONSERVATION ISSUES AND PRIORITIES.....	7
9	CLIMATE	8
10	LIMITING FACTORS AND RECOMMENDED APPROACHES.....	10
11	Limiting Factor: <i>Land Use Conversion and Urbanization</i>	10
12	Limiting Factor: <i>Altered Fire Regimes</i>	11
13	Limiting Factor: <i>Water</i>	12
14	Limiting Factor: <i>Invasive Species</i>	13
15	Limiting Factor: <i>Recreational Activity</i>	14
16	REFERENCES	15
17	COAST RANGE.....	16
18	DESCRIPTION	16
19	CHARACTERISTICS	16
20	CONSERVATION ISSUES AND PRIORITIES.....	18
21	CLIMATE	19
22	LIMITING FACTORS AND RECOMMENDED APPROACHES.....	21
23	Limiting Factor: <i>Land Use Conversion and Urbanization</i>	21
24	Limiting Factor: <i>Water</i>	22
25	Limiting Factor: <i>Habitat Fragmentation</i>	23
26	Limiting Factor: <i>Invasive Species</i>	23
27	Limiting Factor: <i>Recreational Activity</i>	25
28	Limiting Factor: <i>Oil Spills</i>	25
29	REFERENCES	26
30	COLUMBIA PLATEAU.....	27
31	DESCRIPTION	27
32	CHARACTERISTICS	27
33	CONSERVATION ISSUES AND PRIORITIES.....	29

34	CLIMATE	29
35	LIMITING FACTORS AND RECOMMENDED APPROACHES.....	31
36	Limiting Factor: <i>Water</i>	31
37	Limiting Factor: <i>Habitat Fragmentation</i>	32
38	Limiting Factor: <i>Invasive Species</i>	33
39	Limiting Factor: <i>Energy Development</i>	33
40	Limiting Factor: <i>Soil Erosion</i>	34
41	REFERENCES	34
42	EAST CASCADES.....	35
43	DESCRIPTION	35
44	CHARACTERISTICS	35
45	CONSERVATION ISSUES AND PRIORITIES.....	37
46	CLIMATE	37
47	LIMITING FACTORS AND RECOMMENDED APPROACHES.....	39
48	Limiting Factor: <i>Land Use Conversion and Urbanization</i>	39
49	Limiting Factor: <i>Altered Fire Regimes</i>	40
50	Limiting Factor: <i>Water</i>	41
51	Limiting Factor: <i>Habitat Fragmentation</i>	42
52	Limiting Factor: <i>Invasive Species</i>	43
53	Limiting Factor: <i>Energy Development</i>	43
54	Limiting Factor: <i>Recreational Activity</i>	44
55	REFERENCES	45
56	KLAMATH MOUNTAINS	46
57	DESCRIPTION	46
58	CHARACTERISTICS	47
59	CONSERVATION ISSUES AND PRIORITIES.....	48
60	CLIMATE	49
61	LIMITING FACTORS AND RECOMMENDED APPROACHES.....	51
62	Limiting Factor: <i>Land Use Conversion and Urbanization</i>	51
63	Limiting Factor: <i>Altered Fire Regimes</i>	52
64	Limiting Factor: <i>Water</i>	53
65	Limiting Factor: <i>Habitat Fragmentation</i>	54

66	Limiting Factor: <i>Invasive Species</i>	55
67	Limiting Factor: <i>Energy Development</i>	55
68	Limiting Factor: <i>Recreational Activity</i>	56
69	REFERENCES	57
70	NORTHERN BASIN AND RANGE.....	58
71	DESCRIPTION	58
72	CHARACTERISTICS	59
73	CONSERVATION ISSUES AND PRIORITIES.....	60
74	CLIMATE	61
75	LIMITING FACTORS AND RECOMMENDED APPROACHES.....	63
76	Limiting Factor: <i>Altered Fire Regimes</i>	63
77	Limiting Factor: <i>Water</i>	64
78	Limiting Factor: <i>Invasive Species</i>	65
79	Limiting Factor: <i>Energy Development</i>	66
80	Limiting Factor: <i>Recreational Activity</i>	67
81	REFERENCES	68
82	WEST CASCADES.....	69
83	DESCRIPTION	69
84	CHARACTERISTICS	70
85	CONSERVATION ISSUES AND PRIORITIES.....	71
86	CLIMATE	71
87	LIMITING FACTORS AND RECOMMENDED APPROACHES.....	73
88	Limiting Factor: <i>Altered Fire Regimes</i>	73
89	Limiting Factor: <i>Water</i>	74
90	Limiting Factor: <i>Habitat Fragmentation</i>	75
91	Limiting Factor: <i>Invasive Species</i>	75
92	Limiting Factor: <i>Recreational Activity</i>	76
93	REFERENCES	77
94	WILLAMETTE VALLEY	78
95	DESCRIPTION	78
96	CHARACTERISTICS	78
97	CONSERVATION ISSUES AND PRIORITIES.....	80

98	CLIMATE	80
99	LIMITING FACTORS AND RECOMMENDED APPROACHES.....	82
100	Limiting Factor: <i>Land Use Conversion and Urbanization</i>	82
101	Limiting Factor: <i>Altered Fire Regimes</i>	83
102	Limiting Factor: <i>Water</i>	84
103	Limiting Factor: <i>Habitat Fragmentation</i>	85
104	Limiting Factor: <i>Invasive Species</i>	85
105	Limiting Factor: <i>Altered Floodplain</i>	87
106	Limiting Factor: <i>Wildlife Hazards</i>	87
107	REFERENCES	88
108	NEARSHORE	89
109	DESCRIPTION	89
110	CHARACTERISTICS.....	91
111	Important Industries	96
112	Important Nature-based Recreational Areas	96
113	Elevation	96
114	Important Rivers, Estuaries and Bays.....	96
115	CONSERVATION ISSUES AND PRIORITIES	96
116	Climate Change Impacts.....	97
117	LIMITING FACTORS AND RECOMMENDED APPROACHES	98
118	Limiting Factor: Public Awareness	98
119	Limiting Factor: Habitat Alteration	98
120	Limiting Factor: Water Quality.....	99
121	Limiting Factor: Harvesting Aquatic Resources.....	100
122	Limiting Factor: Monitoring and Research Needs.....	101
123	NEARSHORE RECOMMENDATIONS	102
124	Category: Education and Outreach	103
125	Category: Research and Monitoring	105
126	Category: Management and Policy.....	110
127		
128		

ECOREGIONS

State Wildlife Action Plan Ecoregions provide information on each of Oregon's nine ecoregions, which are geographic areas of the state where ecosystems are generally similar, sharing things like natural communities, species, and climate. Information is provided on the characteristics, conservation issues and priorities, changing climate conditions, limiting factors, recommended approaches, **Species of Greatest Conservation Need**, and **Key Habitats** for each ecoregion.

For the inland portion of the state, the State Wildlife Action Plan uses the **Environmental Protection Agency's (EPA) Level III Ecoregions**, but combines the Snake River Plain with the Northern Basin and Range. The SWAP designates the Nearshore ecoregion from the outer boundary of Oregon's Territorial Sea at 3 nautical miles to the supratidal zone affected by wave spray and overwash at extreme high tides on our ocean shoreline, and up into the portions of estuaries where species depend on the saltwater that comes in from the ocean.



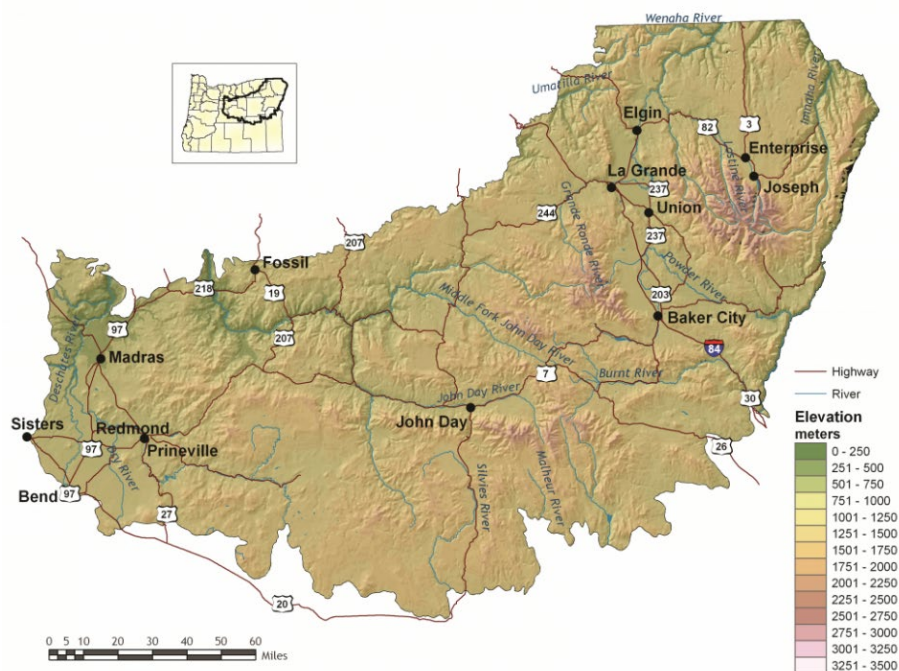
BLUE MOUNTAINS

DESCRIPTION

At 23,984 square miles, the Blue Mountains ecoregion is the largest ecoregion in Oregon. The Blue Mountains ecoregion is a diverse complex of mountain ranges, valleys, and plateaus that extends beyond Oregon into the states of Idaho and Washington. This ecoregion contains deep rock-walled canyons, glacially cut gorges, sagebrush steppe, juniper woodlands, mountain lakes, forests, and meadows. Broad alluvial-floored river valleys support ranches surrounded by irrigated hay meadows and agricultural fields. The climate varies because of elevational differences but, overall, the ecoregion has short, dry summers and long, cold winters. Because much of the precipitation falls as snow, snow melt gives life to the rivers and irrigated areas.

Wood products and cattle production dominate the economy of the ecoregion, but agriculture along river valleys supports a variety of crops. The ecoregion sustains some of the most robust ungulate populations in the state, numerous wildlife viewing opportunities, and attracts tourists year-round, offering scenic lakes and rivers, geologic features, and alpine areas. It includes the Prineville-Bend-Redmond metropolitan area, one of the fastest growing areas in the state, along with the cities of La Grande, Baker, Enterprise, and John Day.

CHARACTERISTICS



164 **Important Industries**

165 Agriculture, livestock (e.g., beef cattle, dairy cattle, sheep), forest products,
166 manufacturing, outdoor recreation (e.g., hunting, fishing, skiing, camping, wildlife viewing)

167 **Major Agricultural Products**

168 Wheat, alfalfa, grass seed, meadow hay, potatoes, onions, sugar beets, field corn

169 **Important Nature-based Recreational Areas**

170 John Day Fossil Beds National Monument, Hells Canyon National Recreational Area and
171 Hells Canyon Wilderness, Wallowa Lake, Crooked River National Grasslands. Umatilla
172 National Wildlife Refuge, John Day and Grande Ronde Rivers, Lake Billy Chinook, and
173 Smith Rock State Park. Black Canyon, Mill Creek, Eagle Cap, Strawberry Mountain, North
174 Fork John Day and Wenaha-Tucannon Wilderness Areas. Philip W. Schneider, Bridge
175 Creek, Ladd Marsh, Wenaha, Elkhorn, and Minam Wildlife Areas.

176 **Elevation**

177 1,000 feet (Snake River) – 9,838 feet (Sacajawea Peak)

178 **Important Rivers**

179 Deschutes, Crooked, Burnt, Grande Ronde, Imnaha, John Day, Malheur, Powder, Silvies,
180 Snake, Umatilla, Wallowa

181 **CONSERVATION ISSUES AND PRIORITIES**

182 While the Blue Mountains ecoregion contains some of the largest intact native grasslands
183 in the state and several large areas managed for conservation values, habitats have been
184 impacted by interrelated changes in ecological processes due to fire suppression,
185 selective harvest practices, and unsustainable grazing. These changes have increased
186 vulnerability of forests to insects, disease, and uncharacteristically severe wildfire.
187 Similarly, these changes have led to a rise in invasive species and increased vulnerability
188 to wildfire in sagebrush shrublands and steppe.

189 Habitat loss has been the most severe in lower elevation valley bottom habitats, such as
190 riparian areas, wetlands, and shrublands, where native vegetation has been converted to
191 agricultural uses. These low-elevation habitats are highly fragmented. Therefore,
192 maintaining connectivity and corridors for wildlife is especially important in these areas.

Increasing recreational pressure and invasive species can potentially impact all habitats in this ecoregion.

Key Conservation Issues of particular concern in the Blue Mountains ecoregion include **Climate Change**, **Disruption of Disturbance Regimes** (fire), **Land Use Changes**, **Water Quality and Quantity**, **Barriers to Animal Movement**, and **Invasive Species**. In addition to statewide issues, uncontrolled off-highway recreational vehicle use and unregulated horse herds are of increasing concern in this ecoregion.

CLIMATE

The Blue Mountains climate has both continental and Mediterranean influences, with warm, dry summers and cold winters. Mean annual temperature and precipitation vary widely depending upon elevation.

Warming is projected in all seasons across the Blue Mountains, with the largest increases projected in the summer. Summer average temperature is projected to increase by as much as 8°F for the 2040-2069 period, and as much as 12°F by the end of the century under a high emissions scenario (SSP585; Figure 1). Winters in the Blue Mountains are also projected to become warmer, and summers drier. Late summer total precipitation is projected to decrease by as much as 12% for the 2069-2099 period (Figure 2). Cool season precipitation projections show an increase in precipitation of 16%, with more of it falling as rain. Growing degree days are projected to more than double by the 2069-2099 period under the high emission scenario (SSP585). Frost days are projected to decrease from 210 per year to fewer than 150 per year, on average by the end of the century.

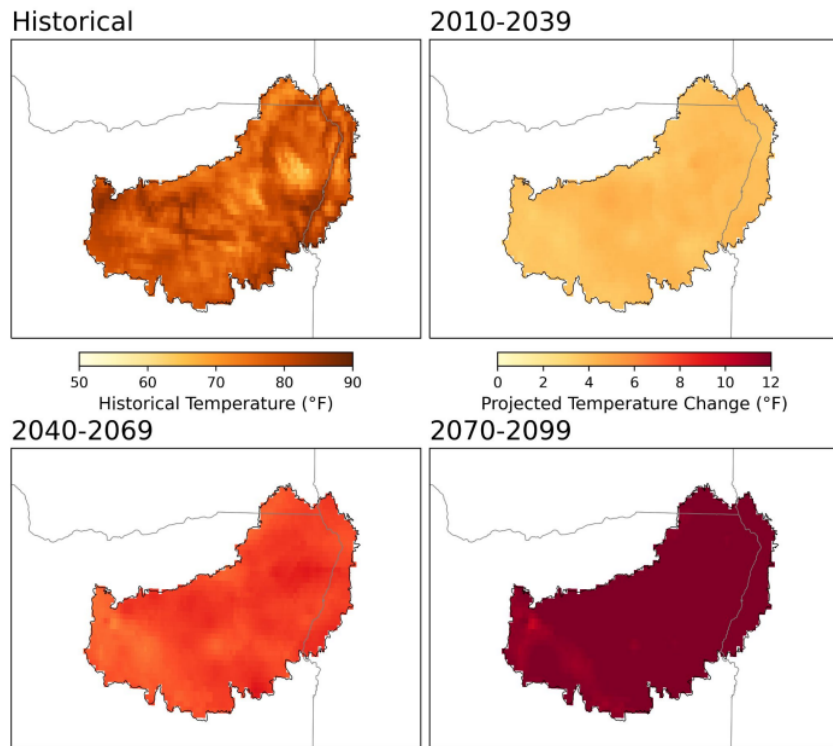


Figure 1. Model median historical (1950-2010) and future projections of summer maximum temperature change for three periods (2010-2039, 2040-2069, 2070-2099) under a high emission scenario (SSP585) for the Blue Mountains. Future projections show increasing temperatures over the century, with slightly less warming in the southwestern Blue Mountains (Raymond and Fusco, 2024).

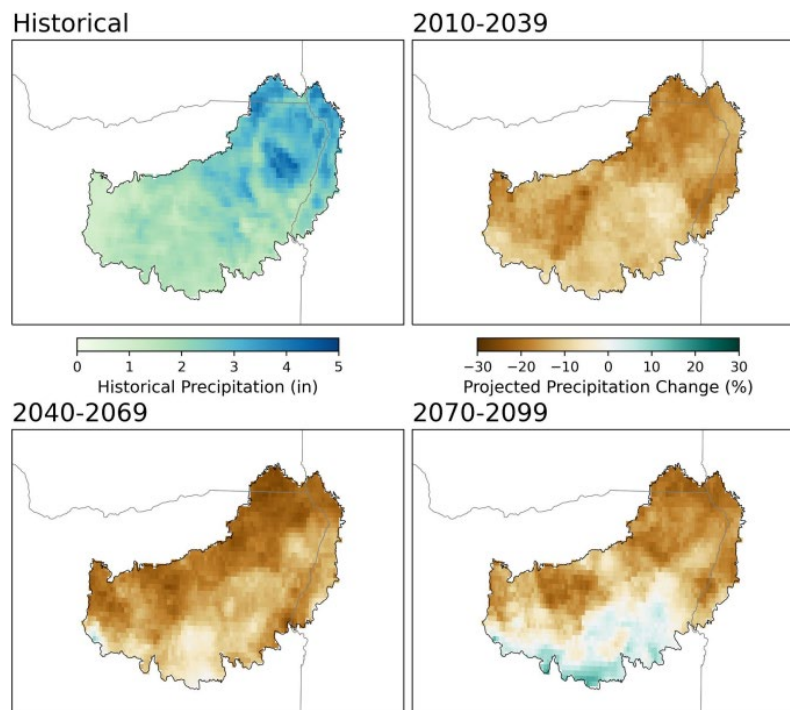


Figure 2. Model median historical (1950-2010) total late summer precipitation and projected percent change for three future periods (2010-2039, 2040-2069, 2070-2099) under a high emission scenario (SSP585) for the Blue Mountains. Future projections show decreasing late summer precipitation across the northern Blue Mountains throughout the century, and a slight increase for the southernmost Blue Mountains in the 2069-2099 time period. Confidence is low in projected changes in late summer precipitation after the 2010-2039 period due to variability among models (Raymond and Fusco, 2024).

LIMITING FACTORS AND RECOMMENDED APPROACHES

Limiting Factor: *Land Use Conversion and Urbanization*

CMP Direct Threats 1, 2.1, 2.3, 7.2

The western portion of the Blue Mountains ecoregion includes the Madras, Redmond, Prineville, and eastern Bend area, one of the fastest growing regions of the state. Rapid conversion to urban land uses threatens habitats and traditional land uses such as agriculture. Impacts to mule deer winter range are of particular concern. Northeast Oregon is increasingly popular with travelers, and habitat fragmentation due to rural development and recreation is a concern in some areas. While important economically, some agricultural uses contribute to habitat degradation for native fish and wildlife species. For

example, open grazing allotments in forests have significantly damaged understory and riparian habitat in several areas.

Although many acres in this ecoregion are managed for wildlife and recreational values, these areas are primarily limited to higher mountain forests and alpine areas, or steep canyonlands. Lower elevation vegetation types, such as valley bottom **grasslands**, **riparian** areas, **wetlands**, and **shrublands**, are mostly on private lands. Most remnant low-elevation native habitats occur as fragmented patches with poor connectivity.

Recommended Approach

Because important low-elevation habitats are primarily privately-owned, working with private landowners and local governments on voluntary cooperative approaches to improve habitat is the key to long-term conservation using tools such as financial incentives, regulatory assurance agreements, and conservation easements. Where feasible, maintain and restore habitats using a landscape approach to increase connectivity between habitat patches. Work with community leaders and agency partners to ensure ecologically and environmentally conscientious growth. Support and implement existing **land use regulations** to preserve farmland and rangeland, open spaces, recreation areas, and natural habitats. Coordinate with local SWCDs, watershed councils, NRCS, and NGOs to communicate the importance of managing fish and wildlife habitats on private lands.

Limiting Factor: *Altered Fire Regimes*

CMP Direct Threats 7.1, 11.3, 11.4

In ponderosa pine habitat types, fire suppression and past forest practices have resulted in young, dense mixed-species stands where open, park-like stands of ponderosa pine once dominated. Increasing encroachment by smaller Douglas-firs and true firs places the forest at greater risk of severe wildfire, disease, and damage by insects. The spread of native junipers and non-native annual grasses throughout the ecoregion has also significantly increased fuel loads. Wildfire risk is further exacerbated by warming climate conditions and changes to patterns of precipitation, resulting in more frequent, higher intensity megafires. Dense understories and insect-killed trees make it difficult to reintroduce natural fire regimes because hazardous fuel levels increase the risk of stand-replacing fires. Additionally, young forests are often lacking in mature trees and snags that serve as critical wildlife habitat for some species. Efforts to reduce fire danger and improve forest health may help to restore habitats but require careful planning to provide sufficient habitat features that are important to fish (e.g., large woody debris, riparian vegetation) and wildlife (e.g., snags, downed logs, hiding cover). Similarly, wildfire reforestation efforts

should be strategically planned to create stands with a diversity of tree age classes, understory vegetation, and natural forest openings.

Recommended Approach

Use an integrated approach to forest health issues that considers historical conditions, fish and wildlife conservation, **natural fire intervals**, and silvicultural techniques. Encourage forest management at a broad scale to address limiting factors. Implement fuel reduction projects to reduce the risk of forest-destroying wildfires, considering site-specific conditions and goals. Fuel reduction strategies need to address the habitat structures that are important to wildlife, such as snags and downed logs, and work to maintain them. Reintroduce fire where feasible; prioritize sites and applications where intervention is likely to be most successful. Use prescribed burns to enhance quality of forage and cover for a diversity of species. Where fire is not feasible, explore alternatives, such as thinning and masticating, that can help mimic natural disturbance. Maintain important wildlife habitat features, such as snags and logs, at a level to sustain wood-dependent species. Monitor forest health initiatives and use adaptive management techniques to ensure efforts are meeting habitat restoration and wildfire prevention objectives with minimal impacts on fish and wildlife. In the case of post-wildfire recovery, maintain high snag densities and replant with native tree, shrub, grass, and forb species. Manage reforestation after wildfire to create species and structural diversity, based on local management goals.

Limiting Factor: *Water*

CMP Direct Threats 7.2, 11.4

Water quantity is a limiting factor for fish and wildlife. Changing climate conditions are leading to rising temperatures and altered patterns of precipitation, which affect water availability across different times of year. High demands for water, including for use in irrigation, can drastically reduce water availability. In streams, seasonal low flows due to changing climate conditions and over-allocation of water for agricultural uses can limit habitat suitability and reproductive success for many fish and wildlife species. In areas where urbanization is increasing, particularly in central Oregon around Bend, Madras, and Redmond, the demand for water is contributing to a decrease in the supply of groundwater. Water quality can also limit species and habitats. Runoff from agricultural areas can contaminate waterways. Warming temperatures, combined with higher nutrient levels due to agricultural runoff, is increasing the prevalence of toxic cyanobacterial blooms.

Recommended Approach

Provide incentives and information about water usage and sharing during low flow conditions (e.g., late summer). 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 **EPA**. Work on implementing **Senate Bill 1010** (Oregon Department of Agriculture) and **DEQ Total Maximum Daily Load** water quality plans.

Limiting Factor: *Invasive Species*

CMP Direct Threat 8.1

Invasive plants and animals disrupt and degrade native communities, diminish populations of at-risk native species, and threaten the economic productivity of resource lands. Invasive plants, particularly noxious weeds, have been on the increase during the last 30 years. While not as disruptive, invasive animals have caused problems for native fish and wildlife species and have become a nuisance and impacted people economically. In this ecoregion, unregulated horse herds, including the Murderers Creek herd and Big Summit herd, are of particular concern, competing with native wildlife for vegetation and access to water, and trampling sensitive riparian habitats. In aquatic habitats, smallmouth bass, walleye, brook trout and American bullfrogs are problematic invasives. Several mussel species, including zebra, quagga, and golden mussels, pose significant threats to aquatic systems. Non-native annual grasses, including cheatgrass, ventenata, and Medusahead have rapidly expanded in perennial grass systems, displacing desirable forage for wildlife. Invasion of these species can also increase fuel loads by establishing in interspaces between sagebrush or other shrubs and perennial grasses, which were historically bare of vegetation.

Changing climate conditions and fire suppression have also led to the expansion of western juniper throughout the ecoregion. Western juniper is a native species, and **old growth juniper trees** in rocky outcrops offer benefits to native wildlife. However, the expansion of western juniper in the Blue Mountains has degraded some grassland, sagebrush, riparian, large-diameter juniper, and aspen habitats. Western juniper expansion may reduce water availability in many seasonal and some perennial streams. In riparian areas, junipers replace deciduous shrubs and trees that are more beneficial to riparian wildlife. In many of the grassland and sagebrush habitats, 20–30-year-old juniper trees form dense stands that are not suitable for many wildlife species that require the open sagebrush or grassland habitats that are now in decline. These dense stands also act as fuel for wildfire, contributing to large, high-intensity fires that destroy sagebrush habitat.

Recommended Approach

Promote dialogue between fish and wildlife managers, landowners, and land managers to develop management plans based on common priorities. Engage in outreach to educate the public on the negative impacts of invasive species and provide information on how to prevent invasions. Emphasize prevention, risk assessment, early detection, and quick control to prevent new **invasive species** from becoming fully established. Use multiple site-appropriate tools (e.g., mechanical, chemical, biological) to control the most damaging invasive species. Emphasize efforts to focus on key invasive species in high priority areas, particularly where **Key Habitats** and **Species of Greatest Conservation Need** occur. Cooperate with partners through habitat programs to reduce noxious weeds and other invasive species and to educate people about invasive species issues. Promote the use of native plants for restoration and revegetation. At some sites in sagebrush communities, 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.

Limiting Factor: *Recreational Activity*

CMP Direct Threats 1.3, 6.1

Activities like hiking, biking, hunting, fishing, camping, skiing, and off-road vehicle use can create sensory stressors for wildlife, with sound, light, and unusual smells that may deter species from moving through certain areas. Human recreation may contribute to destruction of sensitive vegetation, harassment of wildlife from off-leash pets, and contamination of areas with refuse. Dispersed recreation can cause new roads and trails to fragment the landscape and can cause the spread of invasive species from other locations. Many species will avoid areas near trails, campgrounds, and access roads when humans are present.

Recommended Approach

Plan new recreational trail systems carefully and with consideration for native wildlife and their habitats. Take advantage of abandoned or closed roads, rail lines, or previously impacted areas for conversion into trails. Work with land management agencies such as the USFS to designate areas as high value recreation and low habitat impact areas. Limit the use of motorized vehicles in sensitive areas, including off-road vehicles and electric bicycles. Institute road and/or area closures to protect species during sensitive times of year and decommission roads when possible. In high use areas, establish permitted entry systems to decrease recreational pressure. Engage in outreach to educate the public on the negative impacts of recreational activities and provide information on prevention.

REFERENCES

Raymond, C. L. and E. J. Fusco (Eds.). 2024. The State of Climate Adaptation Science for Ecosystems in the Northwest U.S. Prepared by the Climate Impacts Group for the Northwest Climate Adaptation Science Center.
<https://depts.washington.edu/nwclimateadaptation/socs/>

DRAFT

COAST RANGE

DESCRIPTION

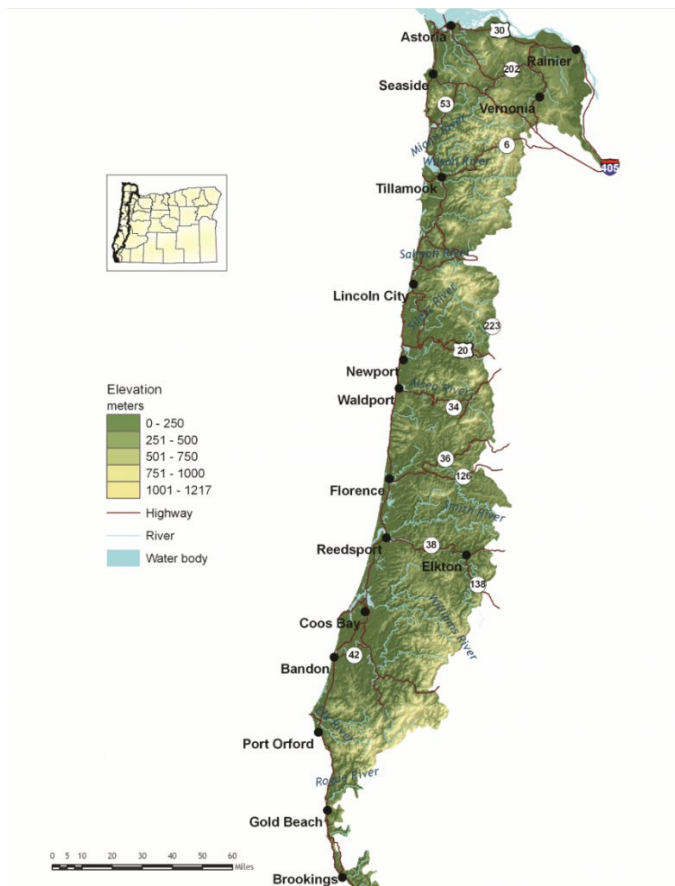
Oregon's Coast Range ecoregion is known for its dramatic scenery. It is also extremely ecologically diverse, with habitats ranging from open sandy dunes to lush forests and from beaches to headwater streams. Along the coastline, habitats directly influenced by the marine environment and include beaches, estuaries, and headlands. The Coast Range includes the highest density of streams found in the state, and deciduous riparian vegetation is distinct from surrounding coniferous forests. The Coast Range ecoregion includes the entire reach of the Oregon coastline, bordering the [Nearshore](#) ecoregion, and extends east through coastal forests to the border of the [Willamette Valley](#) and [Klamath Mountains](#) ecoregions.

The topography is highly variable, from coastal mountain ranges characterized by steep mountain slopes and sharp ridges to coastal lowlands. Elevation varies from sea level to Marys Peak, which is about 4,100 feet high; however, main ridge summits are approximately 1,400-2,500 feet.

The Coast Range's climate is influenced by its topography and cool, moist air from the ocean, making it the wettest and mildest in the state. These conditions are ideal for Oregon's highly productive temperate rainforests, which are important ecologically and for local economies. Most of the ecoregion is dominated by coniferous forests. Large forest fires are historically infrequent but are severe when they occur. For example, the Tillamook Burn, a series of wildfires that occurred from 1939-1951, burned approximately 350,000 acres. Warming temperatures and changes in timing and patterns of precipitation due to climate change may increase fire frequency and severity in this ecoregion.

Some towns in Oregon's Coast Range ecoregion include Astoria, Bandon, Brookings, Cannon Beach, Elkton, Florence, Gold Beach, Lincoln City, Newport, Tillamook, Waldport, and Yachats. The largest urban area on the coast is in Coos Bay/North Bend, which serves as a hub for fishing, shellfish, forest products, and transportation. Forestry remains the primary industry in the interior portion of the ecoregion. The Oregon coast offers excellent recreational opportunities, and tourism is important to local communities. Commercial and recreational fishing and fish processing are significant components of the economy. The Coast Range is a popular destination for retirees, so retirement services are growing in importance to coastal communities.

CHARACTERISTICS



415

416 **Important Industries**

417 Forest products, agriculture, commercial fishing, fish processing, tourism and recreation,
418 and retirement services

419 **Major Agricultural Products**

420 Livestock forage, timber, beef and dairy cattle

421 **Important Nature-based Recreational Areas**

422 Coos Bay, Tillamook Bay, Oregon Dunes National Recreation Area, Siuslaw National
423 Forest, Clatsop and Tillamook State Forests, Elliot State Research Forest, Lower Rogue
424 River, South Slough National Estuarine Research Reserve, Cape Kiwanda, Jewell Meadows
425 Wildlife Area, Coquille Valley Wildlife Area

426 **Elevation**

427 From 0 to 4,100 feet

428 **Important Rivers**

429 Alsea, Chetco, Clatskanie, Coos, Coquille, Illinois, Lewis and Clark, Necanicum,
430 Nehalem, Nestucca, Rogue, Siletz, Siuslaw, Trask, Umpqua, Wilson, Yaquina, Youngs

431 **CONSERVATION ISSUES AND PRIORITIES**

432 Demand for property development is increasing due to growing numbers of people
433 recreating, relocating, and retiring along the Oregon coast. Development in many
434 communities is putting higher demands on surface water in streams, reducing flows during
435 critical time periods. Tidal and lowland habitats, which are important for rearing fish, are
436 also being significantly impacted by coastal development and agriculture. Growth of
437 communities along US Highway 101 creates barriers to wildlife movement between
438 coastal and inland habitats, and new roadways needed to accommodate growth impact
439 fish at stream crossings and increase mortality risks for wildlife. Tourism is greatly
440 increasing fish and wildlife exposure to human presence, particularly for shorebird and
441 waterfowl that use bays and mudflats near towns to feed and rest during migration.

442 Careful resource planning helps to balance these increasing demands with maintaining
443 coastal fish, wildlife, and habitats. Coordinated, broad-scale planning is especially
444 important given the diversity of the Coast Range ecoregion. Although many plans currently
445 exist, such as the Northwest Forest Plan, there is a continuing need to consider the unique
446 requirements of transitional zones such as estuaries, and to integrate marine and inland
447 conservation planning.

448 Much of the ecoregion is publicly owned and managed to balance recreation, tourism, and
449 conservation. However, ownership in the northern part of the ecoregion is particularly
450 fragmented. Restoration of watershed processes and functions (e.g., floodplain
451 connectivity), and restoration of habitat complexity (e.g., woody debris) to stream
452 and **riparian areas**, are major concerns throughout the entire Coast Range ecoregion.
453 Restoring flows to headwater streams maintains ecological connections important for
454 many species.

455 Changing climate conditions are impacting weather patterns, with warming temperatures
456 and altered timing and patterns of precipitation. Shifts in water availability throughout the
457 year may contribute to habitat loss for fish and amphibians, and warmer, drier summers
458 are expected to increase the risk of wildfire. Warming stream temperatures are limiting
459 summer rearing of some anadromous fish species. Altered hydrology, changes in storm
460 patterns, and warming temperatures may also impact stream flows and estuaries, which
461 serve as important habitat for many invertebrates, fish, and marine and terrestrial wildlife
462 species.

Key Conservation Issues of particular concern in the Coast Range ecoregion include **Land Use Changes**, **Climate Change**, and **Invasive Species**. In addition to the statewide issues, oil spills, loss of estuarine habitat, recreational use, and loss of habitat connectivity are of particular concern in coastal areas.

CLIMATE

The Coast Range terrain is varied, with steeply sloping dissected mountains, some hills, sand dunes, and beaches. The climate is maritime with warm, dry summers and mild, very wet winters. Mean annual temperature and precipitation vary considerably due to the large variation in latitudes and elevations.

Warming is projected in all seasons across the Coast Range ecoregion, with the largest increases projected for the summer. For a high emissions scenario (SSP585), summer average temperature is projected to increase by as much as 5°F for the 2040-2069 period and by as much as 8°F by the end of the century (Figure 1). Winters in the Coast Range are projected to be wetter, and summers are projected to be drier in the future. In late summer (July – September), total precipitation is projected to decrease by as much as 20% by the end of the century (Figure 2). For the cool season, the projections show an increase in precipitation of 9%. The confidence in changes in cool season precipitation is greater than in late summer precipitation. For a high emissions scenario (SSP585), growing degree days are projected to double by the end of the century. Frost days are projected to decrease from an average of 63 per year to about 15–30 per year, on average, for the 2070-2099 period.

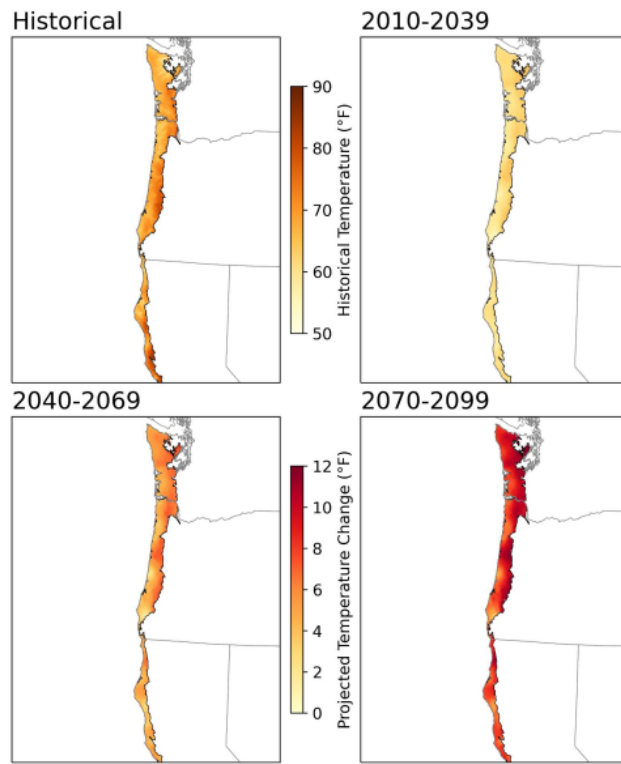


Figure 1. Model median historical (1950-2010) and future projections of summer maximum temperature change for three periods (2010-2039, 2040-2069, 2070-2099) under a high emission scenario (SSP585) for the Coast Range. Future projections show increasing temperatures through the century, with less warming in areas adjacent to the Pacific Ocean (Raymond and Fusco, 2024).

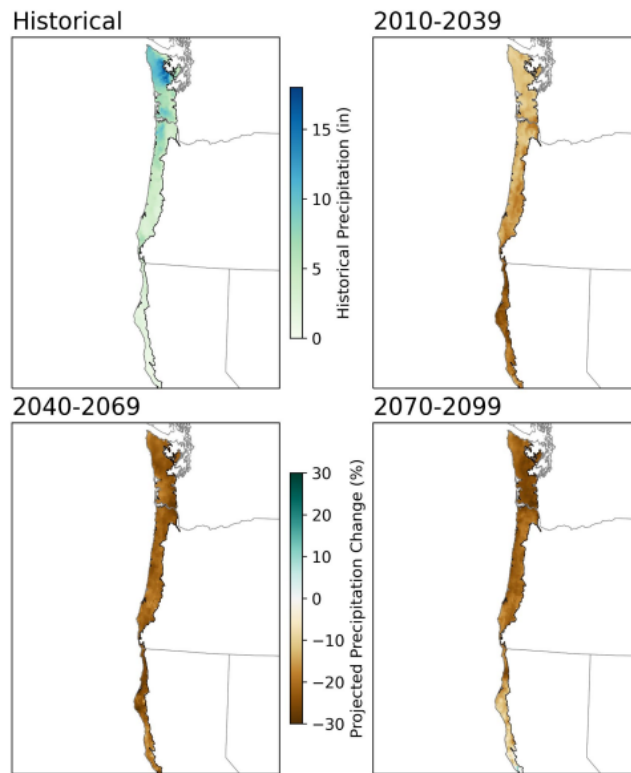


Figure 2. Model median historical (1950-2010) total late summer precipitation and projected percent change for three future periods (2010-2039, 2040-2069, 2070-2099) under a high emission scenario (SSP585) for the Coast Range. Future projections show decreasing late summer precipitation, with a greater decrease projected for the northern part of the ecoregion for the 2070-2099 period (Raymond and Fusco, 2024).

LIMITING FACTORS AND RECOMMENDED APPROACHES

Limiting Factor: *Land Use Conversion and Urbanization*

CMP Direct Threats 1, 2.1, 2.3, 7.2

Some areas of the Coast Range are developing rapidly, especially communities along the coastline, such as Cannon Beach, Lincoln City, and Newport. Steep slopes limit the amount of land available for development, and concentrate it in sensitive areas, particularly flatter lowlands and wetlands near rivers and estuaries. Residential development contributes to habitat loss and can contribute to loss of industry, such as agriculture and forestry. Draining of wetlands and marshes for agricultural use has also had significant impacts. Coastal rivers, wetlands, and estuaries were altered when side channels are diked, marshes drained, and channels deepened. These changes removed

508 necessary habitat complexity, degraded water quality, and reduced estuarine habitat for
509 fish and wildlife.

510 **Recommended Approach**

511 Work with community leaders and agency partners to encourage planned, efficient growth.
512 Support existing **land use regulations** to preserve farmland and forestland, open spaces,
513 recreation areas, wildlife refuges, and natural habitats. Provide outreach about the
514 benefits of wetland and tideland restoration. Support riparian buffers on all streams.
515 Where possible, remove dikes and tide gates to restore estuarine habitats. Where tide
516 gates need to be retained, replace older gates with new innovations, such as side-hinged
517 and aluminum gates that improve fish passage and hydrologic functions.

518 **Limiting Factor:** *Water*

519 CMP Direct Threats 7.2, 11.4

520 **Water quantity** is a limiting factor for fish and wildlife. Changing climate conditions are
521 leading to rising temperatures and altered patterns of precipitation, which affect water
522 availability across different times of year. Surface water is the primary source of drinking
523 water for nearly all municipal and community water providers along the coast. Some water
524 providers currently face water shortages, and future shortages are anticipated due to
525 decreasing supplies and increasing demand, especially during peak tourism season.

526 Water quality can also limit species and habitats. Runoff from agricultural and urban areas
527 can contaminate waterways. Landscape-scale application of herbicides in industrial
528 timber operations can also negatively impact water quality. Warming temperatures,
529 combined with higher nutrient levels due to agricultural runoff, are increasing the
530 prevalence of toxic algal blooms, leading to shellfish fishery closures and fish and wildlife
531 mortality. Timber harvest on steep slopes and agricultural grazing practices in moist soils
532 along the coast contribute to increased sedimentation in streams, wetlands, and
533 estuaries, causing changes in plant community composition, reducing habitat complexity,
534 and altering water circulation and nutrient flows.

535 **Recommended Approach**

536 Provide incentives and information about water usage and sharing during low flow
537 conditions (e.g., late summer). Increase awareness and manage timing of applications of
538 potential aquatic contaminants. Improve compliance with water quality standards and
539 pesticide use labels administered by the **DEQ** and **EPA**. Work on implementing **Senate Bill**
540 **1010** (Oregon Department of Agriculture) and **DEQ Total Maximum Daily Load** water
541 quality plans.

542 **Limiting Factor:** *Habitat Fragmentation*

543 CMP Direct Threats 1, 2.1, 2.3, 3.3, 8.1

544 Increasing traffic volumes, road density, recreational pressure, resource extraction, and
545 aging water control structures contribute to habitat loss and fragmentation and create
546 significant **barriers to animal movements**. In this ecoregion, US Highway 101 runs north
547 to south, limiting connectivity between coastal dunes and estuaries and other shoreline
548 habitats to inland wetlands, grasslands, and forests. At the northern end of the Coast
549 Range, US Highway 30 bisects the Columbia River floodplain marshes from upstream tidal
550 rivers. Commercial timber harvest significantly fragments forested habitats, reduces tree
551 species diversity, and limits forest structural complexity. Many water control structures,
552 such as culverts and tide gates, are older and have not been well-maintained. These aging
553 structures are often inundated with sediment and may be perched above water courses,
554 preventing use by wildlife and blocking movement of fish. Older tide gates alter hydrologic
555 functions, block fish passage, and reduce estuarine habitats.

556 **Recommended Approach**

557 Work with community leaders and agency partners to **protect wildlife movement**
558 **corridors** and to fund and implement site-appropriate habitat enhancement and
559 restoration efforts to facilitate wildlife movement. Promote the protection, restoration, and
560 maintenance of **Priority Wildlife Connectivity Areas**, following the guidelines outlined in
561 **Oregon's Wildlife Corridor Action Plan**. Work with the Oregon Department of
562 Transportation and county and city transportation departments to improve wildlife
563 passage across roadways and replace aging water control structures to improve
564 hydrologic function and permit fish passage. Prioritize timber harvest practices that retain
565 a diversity of tree and shrub species and habitat structural components, with variable
566 density thinning to help retain connections between forested areas.

567 Preserve existing farmland while restoring ecological functions that have been lost or
568 degraded, particularly in tidal lowlands. Provide incentives (e.g., financial assistance,
569 conservation easements) and information about the benefits of maintaining fish and
570 wildlife habitat. Broad-scale conservation strategies will need to focus on restoring and
571 maintaining more natural ecosystem processes and functions within areas that are
572 managed primarily for other values. This may include an emphasis on more "conservation-
573 friendly" management techniques for existing land uses, and restoration of some key
574 ecosystem components such as estuarine function.

575 **Limiting Factor:** *Invasive Species*

576 CMP Direct Threat 8.1, 8.2

Non-native plant and animal invasions disrupt native communities, diminish populations of at-risk native species, and threaten the economic productivity of resource lands and waters. Invasive plants have increased substantially during the past several decades. In this ecoregion, Himalayan blackberry is widespread, with significant local impacts to meadows, riparian areas, and grasslands. Other invaders include reed canary grass, purple loosestrife, and yellow flag iris. Along the coast, European beach grass, introduced to stabilize shifting sands along roads, and gorse, introduced as an ornamental “living fence”, have substantial negative impacts. European beach grass alters dune formation and has narrowed beaches, drastically reducing open, sandy habitats that are critical to native species. Gorse crowds out native plants and chokes streams, reducing fish and wildlife habitat, and is also highly flammable, significantly increasing fire risk.

Invasive animals have also caused significant issues in the Coast Range. Non-native smallmouth bass have been illegally introduced to several areas in the ecoregion, including the Coquille Basin and Eel Lake, negatively impacting a variety of native fish species. American bullfrogs are rapidly expanding, competing with native species for limited resources or preying on native species and/or their eggs or young. Nutria degrade water quality and destabilize stream banks, while competing with native species, such as American beaver and muskrat, for food. Barred owls, expanding westward from their native range in the eastern US, compete directly with the native, threatened Northern spotted owl for food and habitat. Barred owls may also hybridize with spotted owls.

Emerging threats from invasive invertebrates are also becoming a concern in this ecoregion. The non-native emerald ash borer defoliates tree species characteristic of riparian habitats, such as Oregon ash, putting riparian areas, and in-stream habitats that depend on shading from bankside trees, at risk.

Recommended Approach

Emphasize prevention, risk assessment, early detection, and quick control to prevent new **invasive species** from becoming fully established. Prioritize management and control efforts to focus on key invasive species in high priority areas, particularly where **Key Habitats** and **Species of Greatest Conservation Need** occur. Where needed, use multiple site-appropriate tools (e.g., mechanical, chemical, and biological) to control the most damaging invasive species. Work with partners to implement measures to prevent unintentional introduction of non-native species (e.g., implement existing ballast water treatment regulations). Provide information to the public about the ecological and economic damage that invasive species cause. Work with the **Oregon Invasive Species Council** and other partners to educate people about invasive species issues and to prevent introductions of potentially high-impact species. Provide technical and financial assistance to landowners interested in controlling invasive species on their properties. Promote the use of native species for restoration and revegetation.

615 **Limiting Factor:** *Recreational Activity*

616 CMP Direct Threats 1.3, 4.1, 5.1, 5.2, 5.4, 6.1

617 Increasing demands for recreational activity can disturb wildlife and degrade habitat.
618 Activities like hiking, biking, hunting, fishing, camping, jet boating, foraging, and UAV and
619 off-road vehicle use can create sensory stressors for wildlife, with sound, light, and
620 unusual smells that may disrupt behavior and deter species from moving through certain
621 areas. Recreation contributes positively to the Coast Range's economy and local
622 communities and is managed carefully in many areas. However, increasing numbers of
623 recreationists can impact sensitive areas, such as shorebird nesting areas, tidepool
624 habitats, and haul out sites for marine mammals. There are concerns with off-leash dogs
625 and uncontrolled off-highway vehicle use in some areas. Off-highway vehicle use and
626 target shooting are increasing on public forestlands, especially in areas near cities. In
627 many areas, off-highway vehicle and mountain bike use is not closely managed, leading to
628 habitat destruction as users create new networks of unsanctioned, unregulated trails.
629 Dispersed recreation can cause new roads and trails to fragment the landscape and can
630 cause the spread of invasive species from other locations. As more lands in the Klamath
631 Mountains, East and West Cascades, and Blue Mountain ecoregions are closed to the
632 public during fire seasons, public lands in the Coast Range are experiencing greater use.

633 **Recommended Approach**

634 Work with state and federal forest management agencies to plan recreational use and to
635 increase education and outreach for recreationists and associated businesses. Work with
636 land management agencies such as the USFS to designate areas as high value recreation
637 and low habitat impact areas. Institute road and/or area closures to protect species during
638 sensitive times of year and decommission roads when possible. Monitor to ensure that
639 OHV rules for use and public lands motor vehicle use maps are enforced by the managing
640 agencies. Improve public awareness of sensitive areas through signage and kiosks.

641 **Limiting Factor:** *Oil Spills*

642 CMP Direct Threats 4.1, 4.3, 9.2

643 Oil spills along the coast can have devastating effects on coastal habitats, fish, shellfish,
644 and wildlife. Tidal flux can spread oil or other hazardous materials around sensitive
645 habitats very quickly. Rapid response in the event of a spill is essential. Additionally, spills
646 of hazardous materials or oil from vehicles traveling on roads along the coast could
647 potentially impact nearby rivers, wetlands, estuaries, fish, and aquatic wildlife.

648 **Recommended Approach**

649 Ensure rapid response and preparedness for spills of hazardous substances. Oregon
650 Department of Environmental Quality's (DEQ) **Marine Oil Spill Prevention Program** and
651 the Pacific States/British Columbia **Oil Spill Task Force** work with multiple parties and
652 interested partners to address these concerns and quickly identify appropriate actions.

653 REFERENCES

654 Raymond, C. L. and E. J. Fusco (Eds.). 2024. The State of Climate Adaptation Science for
655 Ecosystems in the Northwest U.S. Prepared by the Climate Impacts Group for the
656 Northwest Climate Adaptation Science Center.
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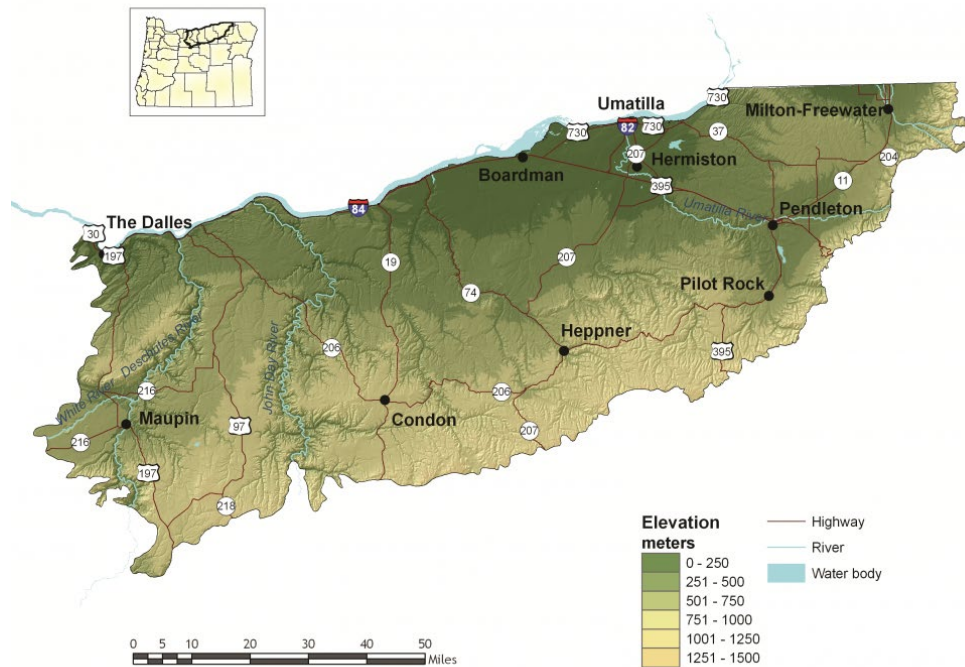
COLUMBIA PLATEAU

DESCRIPTION

The Columbia Plateau ecoregion is characterized by sagebrush steppe and grasslands with extensive areas of dryland farming and irrigated agriculture. Millions of years ago, the region was covered by lava flows up to 2 miles deep. The Oregon portion of the Columbia Plateau ecoregion extends from the eastern slopes of the Cascade Mountains to the border of the Blue Mountains ecoregion. The [Columbia River](#) delineates the northern border of the ecoregion in Oregon and has greatly influenced the surrounding area with cataclysmic floods and large deposits of wind-borne silt and sand. Over time, winds scoured the floodplain, depositing silt and sand across the landscape and creating ideal conditions for agriculture: rolling lands, deep soil, and plentiful flowing rivers. The ecoregion is made up entirely of lowlands, with an arid climate, cool winters, and hot summers.

The Columbia Plateau produces the vast majority of Oregon's grain, and grain production is the heart of the agricultural economy. The Columbia Plateau is second only to the Willamette Valley for agricultural production in Oregon. More than 80 percent of the ecoregion's population and employment is located in Umatilla County, which includes the cities of Pendleton and Hermiston. Other population centers include The Dalles, Condon, and Heppner. Most of the Umatilla Indian Reservation is found in the Columbia Plateau ecoregion.

CHARACTERISTICS



680

681 Important Industries

682 Agriculture, food processing, energy (solar and wind), livestock, retail and services,
683 construction, recreation

684 Major Agricultural Products

685 Grain, barley, potatoes, onions, fruit

686 Important Nature-based Recreational Areas

687 Cold Springs National Wildlife Refuge (NWR), Umatilla NWR, the canyons of the lower
688 Deschutes and John Day Rivers, Lower Deschutes Wildlife Area, Willow Creek Wildlife
689 Area, Irrigon Wildlife Area, Coyote Springs Wildlife Area, Power City Wildlife Area

690 Elevation

691 100 feet (The Dalles) to over 4,000 feet along the southern border

692 Important Rivers

693 Columbia, Deschutes, John Day, Umatilla, Walla Walla

CONSERVATION ISSUES AND PRIORITIES

Almost all the Columbia Plateau ecoregion is privately owned. Conservation opportunities on public lands are limited but should focus on maintaining connectivity among high quality habitat patches.

Water availability is a concern in this ecoregion, and demands for water include agricultural, industrial, and domestic use. Water quality in the Columbia Plateau ecoregion is affected by these demands, particularly in summer months when flows are reduced. Restoring flow to headwater streams is essential to maintain ecological connections. Maintaining aquifers is also critical.

Key Conservation Issues of particular concern in this ecoregion include **Water Quality and Quantity** and **Invasive Species**. In addition to the statewide issues, soil erosion, habitat fragmentation, and large-scale **energy development** are of conservation concern in this ecoregion.

CLIMATE

The Columbia Plateau ecoregion consists of irregular plains and hills. The climate is dry and desert-like with hot, dry summers and cold winters. Mean annual precipitation is low, especially in the western area of the ecoregion due to the rain-shadow effect of the Cascade Range. Most summer precipitation evaporates quickly, leaving little water for streams and reservoirs.

Warming is projected in all seasons across the region, with the largest increases project in summer. The average summer temperature is projected to increase by as much as 7°F for the 2040-2069 period, and as much as 12°F for the 2070-2099 period under a high emissions scenario (SSP585; Figure 1). Late summer precipitation is projected to decrease as much as 24% for a high emissions scenario (SSP585) in the 2070-2099 period (Figure 2). Cool season precipitation projections show an increase in precipitation of as much as 16% for the 2070-2099 period. Confidence is high in these projected precipitation changes. Growing degree days are projected to double by the 2070-2099 period under a high future scenario. Frost days are projected to decrease from 125 per year until there are fewer than 60, on average, under the high emissions scenario (SSP585).

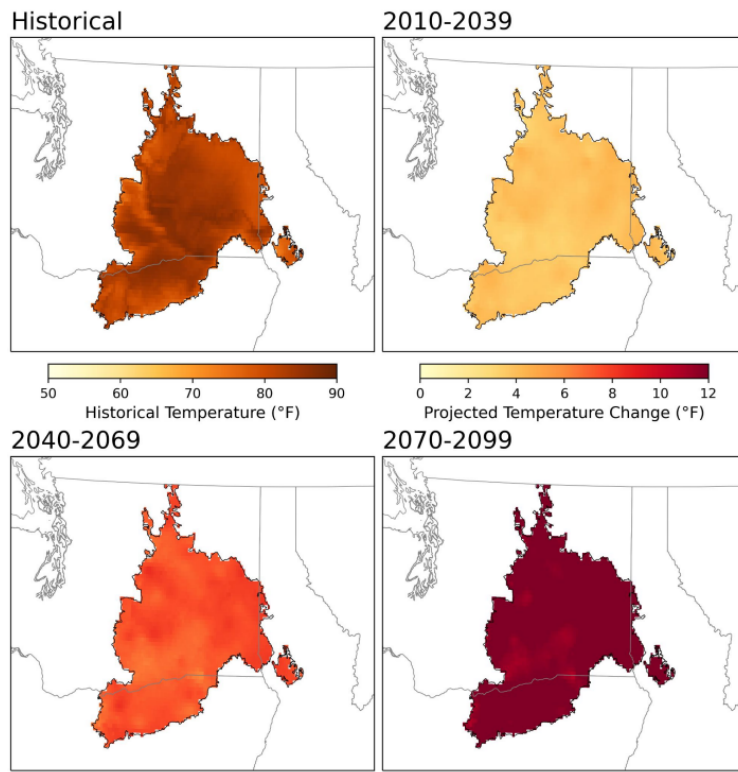


Figure 3. Model median historical (1950-2010) and future projections of summer maximum temperature change for three periods (2010-2039, 2040-2069, 2070-2099) under a high emission scenario (SSP585) for the Columbia Plateau. Future projections show increasing temperatures over the next century that is spatially uniform over the Columbia Plateau (Raymond and Fusco, 2024).

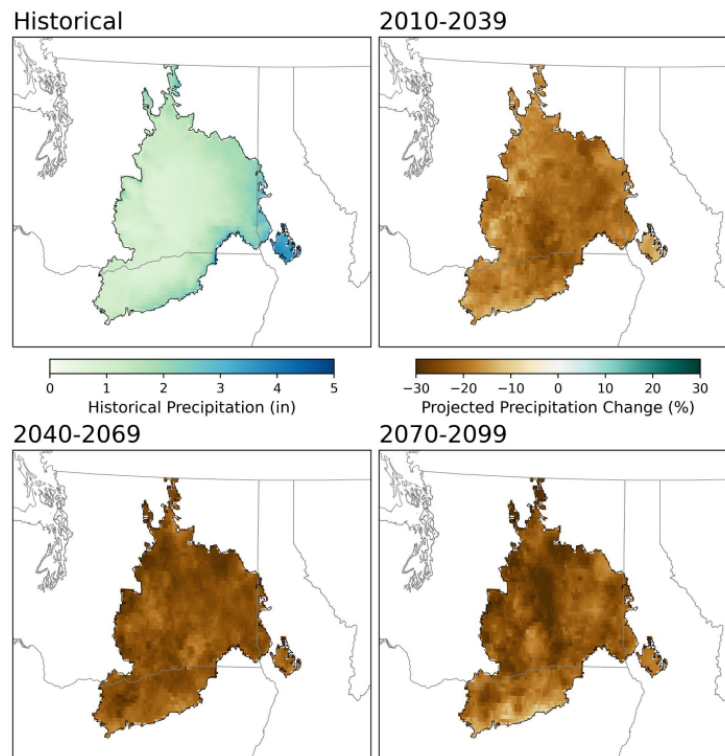


Figure 4. Model median historical (1950-2010) total late summer precipitation and projected percent change for three future periods (2010-2039, 2040-2069, 2070-2099) under a high emission scenario (SSP585) for the Columbia Plateau. Future projections show decreasing late summer precipitation across all of the Columbia Plateau ecoregion (Raymond and Fusco, 2024).

LIMITING FACTORS AND RECOMMENDED APPROACHES

Limiting Factor: *Water*

CMP Direct Threats 7.2, 9.3, 11.4

Water quantity is a limiting factor for fish and wildlife. Changing climate conditions are leading to rising temperatures and altered patterns of precipitation, which affects water availability across different times of year. In streams, seasonal low flows can limit habitat suitability and reproductive success for many fish and wildlife species. Reduced water availability for plants can affect the quality and availability of forage for many terrestrial species. In areas where urbanization is increasing, the demand for water is contributing to a decrease in the supply of groundwater. Many communities in the Columbia Plateau ecoregion are reliant on aquifers for water, and agricultural irrigation and private interests, such as aquifer use to cool computers in data centers, may threaten local water supplies.

748 There are seven critical groundwater areas in Oregon, five of which are within the Columbia
749 Plateau.

750 Water quality can also limit species and habitats. Runoff from agricultural areas can
751 contaminate waterways. Warming temperatures, combined with higher nutrient levels due
752 to agricultural runoff, are increasing the prevalence of harmful algal blooms in waterways
753 like the lower John Day and Deschutes Rivers. These harmful algal blooms can cause large-
754 scale fish die-off, sicken or kill wildlife, impact drinking water, and reduce habitat for fish
755 and wildlife by blocking sunlight and creating hypoxic zones, also known as dead zones.

756 **Recommended Approach**

757 Provide incentives and information about water usage and sharing during low flow
758 conditions (e.g., late summer). Increase awareness and manage timing of applications of
759 potential aquatic contaminants. Improve compliance with water quality standards and
760 pesticide use labels administered by the **DEQ** and **EPA**. Work on implementing **Senate Bill**
761 **1010** (Oregon Department of Agriculture) and **DEQ Total Maximum Daily Load** water
762 quality plans.

763 **Limiting Factor:** *Habitat Fragmentation*

764 CMP Direct Threats 2.1, 2.3, 3.3, 8.1

765 The impact of human activity in the Columbia Plateau is high. The majority of the prairie
766 and shrub-steppe habitat has been converted for agricultural uses. The remaining **Key**
767 **Habitats** for at-risk native plant and animal species are limited and largely confined to
768 small and often isolated fragments, such as roadsides and sloughs. These remaining
769 parcels have the potential to be converted to agriculture, and there are few opportunities
770 for large-scale protection or restoration of native landscapes. Existing land use and land
771 ownership patterns present challenges to large-scale ecosystem restoration.

772 **Recommended Approach**

773 Provide incentives (e.g., financial assistance, conservation easements) and information
774 about the benefits of maintaining bird and other wildlife habitat. Broad-scale conservation
775 strategies will need to focus on restoring and maintaining more natural ecosystem
776 processes and functions within a landscape that is managed primarily for other values.
777 This may include an emphasis on more “conservation-friendly” management techniques
778 for existing land uses, and restoration of some key ecosystem components such
779 as **riparian** function. “Fine filter” conservation strategies that focus on needs of individual
780 **Species of Greatest Conservation Need** and key sites are particularly important in this
781 ecoregion.

Because approximately 84 percent of the Columbia Plateau ecoregion is privately-owned, voluntary cooperative approaches are the key to long-term conservation using tools such as financial incentives, regulatory assurance agreements, and conservation easements. Where appropriate, plan development carefully to maintain existing native habitats. Identifying important habitat areas and directing mitigation from ongoing energy development may be another protection strategy. Promote the protection, restoration, and maintenance of **Priority Wildlife Connectivity Areas**, following the guidelines outlined in **Oregon's Wildlife Corridor Action Plan**.

Limiting Factor: *Invasive Species*

CMP Direct Threat 8.1

Invasive plant and animal species disrupt native communities, diminish populations of at-risk native species, and threaten the economic productivity of resource lands including farmland and rangeland. Differences in county policies and funding availability regarding invasive species have resulted in some inconsistencies in approach. Non-native annual grasses, such as cheatgrass and Medusahead, have rapidly expanded in perennial grass systems in the Columbia Plateau, displacing desirable forage for wildlife and livestock. Invasion of cheatgrass has also increased fuel loads substantially, leading to catastrophic fire events. Invasive species such as yellow star thistle, Russian thistle, and Russian olive are also of concern, growing rapidly to crowd out native species.

Recommended Approach

Emphasize prevention, risk assessment, early detection, and quick control to prevent new **invasive species** from becoming fully established. Use multiple site-appropriate tools (e.g., mechanical, chemical and biological) to control the most damaging invasive species. Focus on key invasive species in high priority areas, particularly where **Key Habitats** and **Species of Greatest Conservation Need** occur. Ensure cooperation and collaboration between counties, landowners, land managers, and other entities with invasive species policies and interests. Promote the use of native species for restoration and revegetation.

Limiting Factor: *Energy Development*

CMP Direct Threat 3.3

Climate change and global economies are increasing pressure for renewable energy development, including wind, solar, and geothermal energy. Energy projects offer environmental benefits but also have impacts on fish, wildlife, and their habitats. Wind energy potential is especially high in the Columbia Plateau. The area is increasingly

816 challenged with the need to balance the state’s interest in clean energy development with
817 local natural resource conservation needs.

818 **Recommended Approach**

819 Plan energy projects carefully, using the best available information and consultation with
820 biologists. See the Key Conservation Issue on **Land Use Changes**, the **Oregon**
821 **Department of Fish and Wildlife Solar Siting Guidance** and the **Oregon Columbia**
822 **Plateau Ecoregion Wind Energy Siting and Permitting Guidelines**. Focus potential
823 mitigation efforts from energy siting into areas of greatest habitat integrity in the region.
824 Avoid siting new facilities within critical movement and migration areas, including **Priority**
825 **Wildlife Connectivity Areas**.

826 **Limiting Factor: Soil Erosion**

827 CMP Direct Threats 2.1, 9.3, 9.5

828 Soil loss through erosion and decreases in soil quality jeopardize the productivity of native
829 habitats and agricultural lands. Agricultural use, particularly tilled production without the
830 use of cover crops, is prevalent in the Columbia Plateau ecoregion. This region also sees
831 characteristically high, sustained winds, contributing to soil loss. Sandy soils along the
832 Columbia River are particularly susceptible to erosion from high winds. Soil erosion
833 decreases water infiltration, which is essential for productive habitats and groundwater
834 recharge, and can also increase sediment loading in streams, as well as air-borne
835 pollutants.

836 **Recommended Approach**

837 Use incentives to promote no-till farming and agricultural practices that do not allow land
838 to lay bare for long periods of time. Support no-till practices that use crop rotation and
839 cover crops. Encourage participation and support for programs such as the Natural
840 Resources Conservation Service’s **Conservation Reserve Program**, which promote
841 practices that can offset or minimize soil erosion and degradation.

842 **REFERENCES**

843 Raymond, C. L. and E. J. Fusco (Eds.). 2024. The State of Climate Adaptation Science for
844 Ecosystems in the Northwest U.S. Prepared by the Climate Impacts Group for the
845 Northwest Climate Adaptation Science Center.
846 <https://depts.washington.edu/nwclimateadaptation/socs/>

847

848 EAST CASCADES

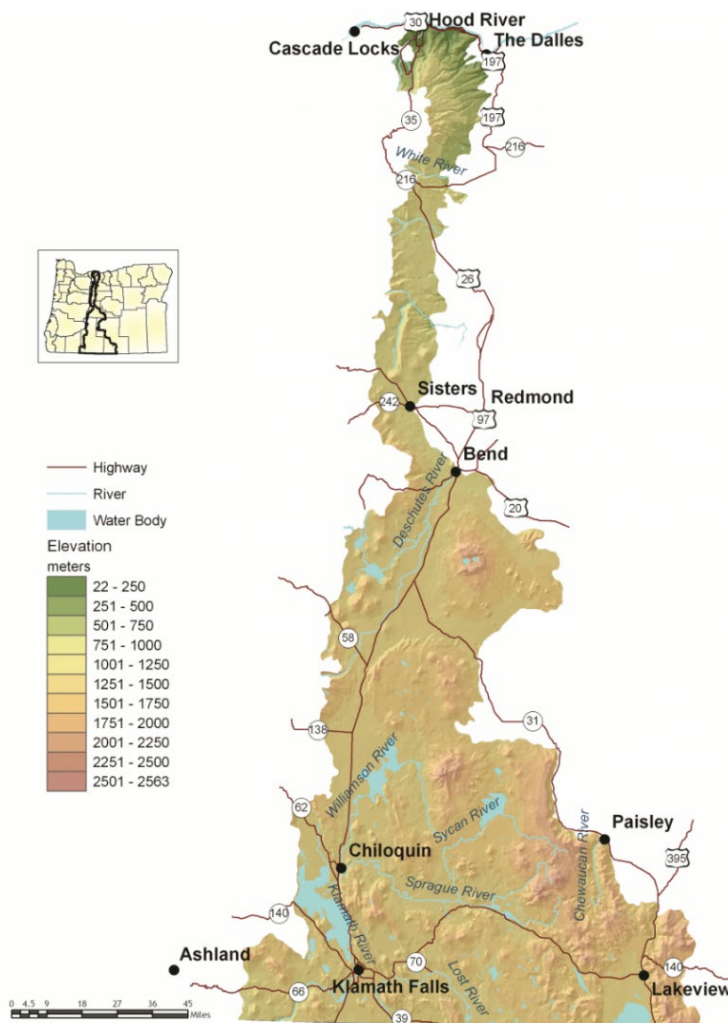
849 DESCRIPTION

850 The East Cascades ecoregion extends from just east of the Cascade Mountains' summit to
851 the warmer, drier high desert to the east. Stretching the full north-to-south length of the
852 state, the East Cascades is narrow at the Columbia River but becomes wider toward the
853 south. This ecoregion varies dramatically from its cool, moist border with the West
854 Cascades ecoregion to its dry eastern border with the Northern Basin and Range
855 ecoregion. The climate is generally dry, with wide variations in temperature. The East
856 Cascades ecoregion includes several peaks and ridges in the 6,000-7,000-foot range, but
857 overall, the slopes on the east side of the Cascade Mountains are less steep than the West
858 Cascades ecoregion. The East Cascades' volcanic history is evident through numerous
859 buttes, lava flows, craters, and lava caves, and in the extensive deep ash deposits created
860 by the explosion of historical Mt. Mazama during the creation of Crater Lake.

861 The terrain ranges from forested uplands to marshes and agricultural fields at lower
862 elevations. The northern two-thirds of the East Cascades ecoregion is drained by the
863 Deschutes River, ultimately flowing into the Columbia River. Most of the southern portion
864 of the East Cascades ecoregion is drained by the Klamath River, with a small portion
865 draining into Goose Lake, a closed basin. In general, the East Cascades are drier than the
866 West Cascades, with fewer rivers flowing over the mountain slopes. However, the East
867 Cascades ecoregion is characterized by many lakes, reservoirs, and marshes, providing
868 exceptional habitat for species closely associated with water, including waterbirds,
869 amphibians, fish, aquatic plants, and aquatic invertebrates.

870 When compared to Oregon's other ecoregions, the East Cascades has the second-highest
871 average income (the Willamette Valley ecoregion supports the highest per-capita income).
872 Much of this income is related to tourism and recreation, but forestry and agriculture also
873 provide important roles. Towns include Bend, Klamath Falls, Lakeview, and Hood River;
874 many communities in this ecoregion are experiencing rapid population growth. Most of the
875 Warm Springs Reservation is found in the East Cascades ecoregion.

876 CHARACTERISTICS



877

878 Important Industries

879 Recreation (tourism and hospitality), forest products, agriculture

880 Major Agricultural Products

881 Fruit (Hood River Valley), carrot seed (Jefferson County), wood, onions, potatoes,
882 strawberries, barley (Klamath Basin), alfalfa, and cattle (Lake County)

883 Important Nature-based Recreational Areas

884 Klamath Basin National Wildlife Refuge Complex, Goose Lake, Newberry Crater National
885 Monument, high Cascade lakes along Century Drive, Pine Mountain, Warner Mountains,
886 Gearhart and Badger Creek Wilderness Areas, Metolius and Deschutes sub-basins, White
887 River Wildlife Area

888 Elevation

889 70 feet (in the Columbia River Gorge area) to over 8,000 feet (peaks in the southeastern
890 portion of the ecoregion)

891 Important Rivers

892 Deschutes, Hood, Klamath, Metolius, Link, Williamson, Sycan, and Sprague

893 CONSERVATION ISSUES AND PRIORITIES

894 The habitats of the East Cascades ecoregion are varied, from sagebrush flats to alpine
895 fields. The conservation issues are similarly diverse, as well as complex. Timber harvest
896 practices, grazing, and fire suppression have altered the distribution and structure of much
897 of the ecoregion's historical ponderosa pine forests and oak woodlands and have
898 degraded many of the riparian and wetland habitats. Rapidly expanding urban and rural
899 residential development is another major emerging conservation issue, resulting in
900 development within riparian zones, the loss of ungulate winter range, and water diversions
901 to support development. Along with this development, traffic volumes on US Highway 20
902 and US Highway 97 continue to increase, creating a major barrier to wildlife movement.
903 Lastly, a high percentage of historic wetlands have been converted to agricultural and
904 other uses in the Klamath Basin, and water continues to be a complex and challenging
905 issue in the area.

906 Key Conservation Issues of particular concern in the East Cascades ecoregion
907 include Invasive Species, Disruption of Disturbance Regimes, Water Quality and
908 Quantity, and Land Use Changes. In addition to the statewide issues, habitat
909 fragmentation and increasing recreational use are of concern in this ecoregion.

910 CLIMATE

911 The East Cascades terrain includes sloping mountains and high plateaus. The climate is
912 more continental with greater temperature extremes than a maritime climate and less
913 precipitation. Summers are warm and dry; winters are cold. The frost-free period is
914 typically short, especially on the high peaks, and the mean annual precipitation varies
915 considerably with elevation. With increased temperatures, the frost-free period in the East
916 Cascades will lengthen.

917 Warming is projected in all seasons across the East Cascades, with the greatest increases
918 projected for the summer. The average summer temperature is projected to increase by as
919 much as 7°F for the 2040-2069 period, and as much as 12°F for the 2070-2099 period

under a high emissions scenario (SSP585; Figure 1). Late summer total precipitation is projected to decrease in the north and increase in the south of the ecoregion, however, confidence is low in the projected changes in summer precipitation after 2039. (Figure 2). Projections of cool season precipitation show an increase of as much as 9% under a high emissions scenario (SSP585) for the 2070-2099 period. Under a high (SSP585) scenario, growing degree days are projected to double by the 2070-2099 period and frost days are projected to decrease from over 200 per year to 120 per year, on average, by the end of the century.

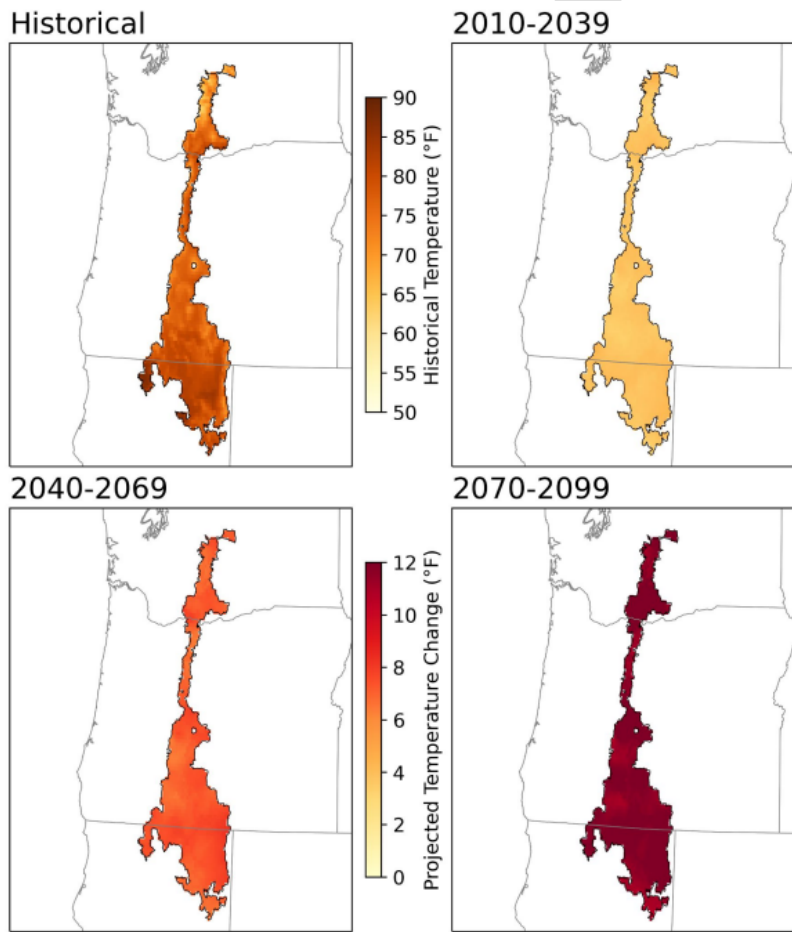


Figure 1. Model median historical (1950-2010) and future projections of summer maximum temperature change for three periods (2010-2039, 2040-2069, 2070-2099) under a high emission scenario (SSP585) for the East Cascades. Future projections show increasing temperatures over the next century, with slightly less warming in the western section of the region with higher elevation (Raymond and Fusco, 2024).

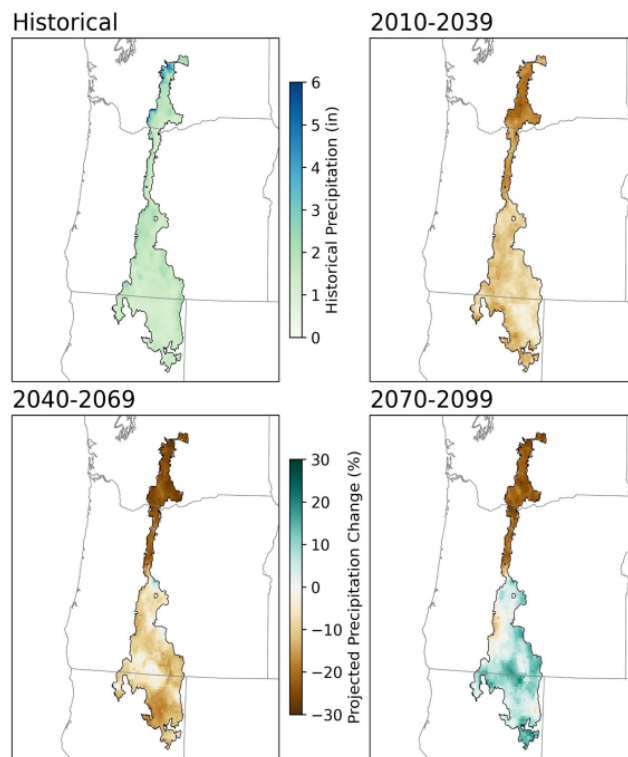


Figure 2. Model median historical (1950-2010) total late summer precipitation and projected percent change for three future periods (2010-2039, 2040-2069, 2070-2099) under a high emission scenario (SSP585) for the East Cascades. Future projections show decreasing late summer precipitation across the north through the century and an increase for the south for the end of the century. Confidence is low in projected changes in late summer precipitation after the 2010-2039 period (Raymond and Fusco, 2024).

LIMITING FACTORS AND RECOMMENDED APPROACHES

Limiting Factor: *Land Use Conversion and Urbanization*

CMP Direct Threats 1, 2.1, 2.3, 7.2

The East Cascades ecoregion includes some of the fastest growing areas of the state (e.g., Bend, Klamath Falls). Rapid urban and rural residential development contributes to habitat loss, and can threaten traditional land uses, such as agriculture and forestry. Urban and rural residential development can also fragment habitat into small patches, isolating wildlife populations. Residential development is increasing in sensitive habitats, such as wetlands, **riparian** areas, and close to **cliffs and rims** where raptors nest. Some agricultural uses contribute to habitat degradation for native wildlife species. For example,

951 open grazing allotments in forests have significantly damaged understory and riparian
952 habitat in many areas.

953 **Recommended Approach**

954 Cooperative approaches with both large and small private landowners are critical. Work
955 with community leaders and agency partners to encourage **planned, efficient growth**.
956 Support existing land use regulations to preserve forestland, farmland, rangeland, open
957 spaces, recreation areas, wildlife refuges, and natural habitats. Work with community
958 leaders and agency partners to **protect wildlife movement corridors** and to fund and
959 implement site-appropriate habitat enhancement and restoration efforts to facilitate
960 wildlife movement. Encourage condensing development and utilize pre-existing
961 disturbance footprints for new developments when possible. Work with counties to update
962 Wildlife Inventories.

963 **Limiting Factor:** *Altered Fire Regimes*

964 CMP Direct Threats 7.1, 11.3, 11.4

965 Past forest practices and fire suppression have resulted in young, dense mixed-species
966 stands where open, park-like stands of ponderosa pine once dominated. These mixed
967 conifer forests are at increased risk of forest-destroying crown fires, disease, and damage
968 by insects. Shading from encroaching trees and fire suppression has reduced the vigor of
969 shrubs, particularly bitterbrush, an important forage plant for many wildlife species. Forest
970 crowding and reduced fire resiliency is also a significant issue in oak habitat, as large
971 legacy oaks have become surrounded by dense stands of younger trees.

972 Wildfire risk is further exacerbated by warming climate conditions and changes to patterns
973 of precipitation, and more frequent, higher intensity megafires are becoming more
974 common. Additionally, past forest practices have contributed to forests that are lacking in
975 mature trees and snags that serve as critical wildlife habitat for some species. Efforts to
976 reduce fire danger and improve forest health may help to restore habitats but require
977 careful planning to provide sufficient habitat features that are important to wildlife (e.g.,
978 snags, downed logs, hiding cover).

979 Increasing residential and resort development in forested habitats makes prescribed fire
980 difficult in some areas and increases risk of high-cost wildfires. Although many urban
981 interface “fireproofing” measures can be implemented with minimal effects to wildlife
982 habitat, some poorly planned efforts have unintentionally and unnecessarily harmed
983 habitat.

984 **Recommended Approach**

Use an integrated approach to forest health issues that considers historical conditions, wildlife conservation, **natural fire intervals**, and silvicultural techniques. Evaluate individual stands to determine site-appropriate actions, such as monitoring in healthy stands or thinning, mowing, and prescribed fire in at-risk stands. Where appropriate, thin smaller trees in the understory and develop markets for small-diameter trees.

Implement fuels reduction projects to reduce the risk of forest-destroying wildfires, considering site-specific conditions and goals. Fuels reduction strategies need to consider the habitat structures that are required by wildlife, such as snags and downed logs, and try to maintain them at a level to sustain wood-dependent species. Design frequency and scale of prescribed fire to meet the habitat needs of a diversity of species. 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 wildfire while maintaining habitat quality. Highlight successful, environmentally sensitive fuels management programs. In the case of post-wildfire recovery, maintain high snag densities and replant with native tree, shrub, grass, and forb species. Manage reforestation after wildfire to create species and structural diversity, based on local management goals.

Limiting Factor: *Water*

CMP Direct Threats 7.2, 11.4

Water quantity is a limiting factor for fish and wildlife, and water availability is a significant issue in this ecoregion. Changing climate conditions are leading to rising temperatures and altered patterns of precipitation, which affect water availability across different times of year, and drought conditions are occurring more frequently. In high elevation areas, loss of snowpack due to warming climate conditions is affecting habitat for many species along the Cascade crest and is leading to reduced stream flow rates and peak flow rates that are occurring earlier in the year. In streams, seasonal low flows can limit habitat suitability and reproductive success for many fish and wildlife species. In areas where urbanization is increasing, particularly around Bend and Klamath Falls, the demand for water, along with regular droughts, has led to a decrease in the supply of groundwater. Dwindling groundwater supplies further contribute to wetland loss and altered timing in the availability of water in seasonal wetlands, impacting habitat for many fish and wildlife species.

Water quality can also limit species and habitats. Runoff from agricultural areas can contaminate waterways. Warming temperatures, combined with higher nutrient levels due to agricultural runoff, are increasing the prevalence of toxic cyanobacterial blooms.

1021 **Recommended Approach**

1022 Provide incentives and information about water usage and sharing during low flow
1023 conditions (e.g., late summer). Increase awareness and manage timing of applications of
1024 potential aquatic contaminants. Improve compliance with water quality standards and
1025 pesticide use labels administered by the [DEQ](#) and [EPA](#). Work on implementing [Senate Bill](#)
1026 [1010](#) (Oregon Department of Agriculture) and [DEQ Total Maximum Daily Load](#) water
1027 quality plans. Work with NRCS and other partners to support water-smart practices, like
1028 conversion from flood to piped irrigation, on working lands.

1029 **Limiting Factor:** *Habitat Fragmentation*

1030 CMP Direct Threats 1, 2.1, 2.3, 3.3, 8.1

1031 Increasing traffic volumes, road density, and recreational pressure associated with
1032 development is contributing to habitat loss and fragmentation and creates [barriers to](#)
1033 [animal movements](#), especially in National Forest and Wilderness Areas near urban
1034 centers and along US Highway 20 and US Highway 97. In non-forested areas, habitats for
1035 at-risk native plants and some animal species are largely confined to small and often
1036 isolated fragments, such as roadsides and sloughs. These remaining parcels have
1037 potential to be converted to agriculture or developed for solar energy production, and there
1038 are few opportunities for large-scale protection or restoration of native landscapes.
1039 Existing land use and land ownership patterns in many areas, particularly the Klamath
1040 Basin, present challenges to large-scale ecosystem restoration. In-stream barriers to
1041 movement, such as dams and undersized or poorly maintained culverts and bridges, may
1042 limit passage of fish and aquatic wildlife.

1043 **Recommended Approach**

1044 Work with community leaders and agency partners to [protect wildlife movement](#)
1045 [corridors](#) and to fund and implement site-appropriate habitat enhancement and
1046 restoration efforts to facilitate wildlife movement. Promote the protection, restoration, and
1047 maintenance of [Priority Wildlife Connectivity Areas](#), following the guidelines outlined in
1048 [Oregon's Wildlife Corridor Action Plan](#).

1049 Remove barriers to movement wherever possible. Ensure that waterways remain passable
1050 for fish at culverts and bridges. Inventory fencing locations and conditions. Remove
1051 fencing that is no longer needed or in poor condition; modify needed fencing to be [wildlife](#)
1052 [friendly](#). Work with the Oregon Department of Transportation and county and city
1053 transportation departments to improve wildlife passage across roadways. In forested
1054 habitats, maintain vegetation to provide screening along open roads, prioritize roads for

1055 closure based on transportation needs and wildlife goals, and/or manage road use during
1056 critical periods.

1057 Provide incentives (e.g., financial assistance, conservation easements) and information
1058 about the benefits of maintaining bird and other wildlife habitat. Broad-scale conservation
1059 strategies will need to focus on restoring and maintaining more natural ecosystem
1060 processes and functions within areas that are managed primarily for other values. This
1061 may include an emphasis on more “conservation-friendly” management techniques for
1062 existing land uses, and restoration of some key ecosystem components such
1063 as **riparian** function.

1064 **Limiting Factor:** *Invasive Species*

1065 CMP Direct Threat 8.1, 8.2

1066 Non-native plant and animal invasions disrupt native communities, diminish populations
1067 of at-risk native species, and threaten the economic productivity of resource lands. Non-
1068 native annual grasses, particularly cheatgrass, have infiltrated perennial grass systems in
1069 the eastern portion of the East Cascades ecoregion, displacing desirable forage for wildlife
1070 and livestock. Non-native fish and wildlife species are also causing detrimental impacts. In
1071 the East Cascades, the Pokegama horse herd has increased substantially, well above
1072 Appropriate Management Levels and outside of the established Herd Management Area.
1073 Unregulated horse herds have significant negative impacts, competing with native wildlife
1074 for vegetation and access to water, increasing soil erosion, and trampling sensitive
1075 habitats. American bullfrogs are rapidly expanding, competing with native species for
1076 limited resources or preying on native species and/or their eggs or young. Non-native fish,
1077 introduced to many high elevation lakes, have similar impacts, particularly for native
1078 amphibians.

1079 **Recommended Approach**

1080 Emphasize prevention, risk assessment, early detection, and quick control to prevent
1081 new **invasive species** from becoming fully established. Use multiple site-appropriate
1082 tools (e.g., mechanical, chemical, and biological) to control the most damaging invasive
1083 species. Prioritize efforts to focus on key invasive species in high priority areas, particularly
1084 where **Key Habitats** and **Species of Greatest Conservation Need** occur. Promote the use
1085 of native species for restoration and revegetation.

1086 **Limiting Factor:** *Energy Development*

1087 CMP Direct Threat 3.3

1088 Climate change and global economies are increasing pressure for renewable energy
1089 development, including solar energy. Solar energy potential is especially high in the East
1090 Cascades. Solar energy projects offer environmental benefits but also have significant
1091 impacts on wildlife and their habitat. Many solar energy facilities have large footprints.
1092 Federal requirements for facilities to be fully fenced make any remaining habitat within a
1093 solar field inaccessible to most terrestrial wildlife species, which results in lost habitat and
1094 may disrupt critical movement and migration pathways. Solar facilities are also a collision
1095 risk for birds, as reflection of sunlight off the panels may cause solar fields to resemble
1096 large water bodies. In addition to solar, hydropower production is also prevalent, and
1097 geothermal production is increasing. The area is increasingly challenged with the need to
1098 balance the state's interest in clean energy development with local natural resource
1099 conservation needs.

1100 **Recommended Approach**

1101 Plan energy projects utilizing all available resources, including the **ODFW Solar Siting**
1102 **Guidelines**. Work with prospective energy developers to incorporate interior project
1103 designs to offer potential habitat services for pollinator and avian species, where
1104 appropriate. See the Key Conservation Issue on **Land Use Changes**. Consider the broader
1105 landscape context when planning new facilities, including habitat connectivity, cumulative
1106 impacts, fish and wildlife species presence, and mapped or modeled suitable habitat.
1107 Ensure new facilities minimize negative impacts to fish and wildlife. For example, establish
1108 fish ladders or bypass channels to reduce fish passage barriers at dams, and use wildlife-
1109 permeable fencing or allow egress to permit passage for medium-sized animals through
1110 solar fields.

1111 **Limiting Factor:** *Recreational Activity*

1112 CMP Direct Threats 1.3, 4.1, 5.1, 5.2, 5.4, 6.1

1113 Increasing demands for year-round recreational activity, including new mountain bike
1114 trails, ski lifts, and skill parks, can disturb wildlife. Activities like hiking, biking, hunting,
1115 fishing, camping, skiing, and off-road vehicle use can create sensory stressors for wildlife,
1116 with sound, light, and unusual smells that may deter species from moving through certain
1117 areas. Recreational pressure is increasingly significant in the East Cascades along the
1118 Cascade crest as urban communities grow. Recreationists are drawn to this region due to
1119 access to many trail systems across several National Forests and Wilderness Areas.

1120 Recreational pressure can lead to an increase in wildlife stress response and behavioral
1121 changes that ultimately impact reproductive rates and population abundance. Human
1122 recreation may contribute to destruction of sensitive vegetation, harassment of wildlife

1123 from off-leash pets, spread of invasive species, and contamination of areas with refuse.
1124 Many species will avoid areas near trails, campgrounds, and access roads when humans
1125 are present. New winter tire and headlamp technologies are allowing mountain bicyclists
1126 access to important wildlife areas that were previously inaccessible due to snow. Trail
1127 riding can now occur day or night throughout the year, which can disturb wildlife during
1128 critical life stages. Rock climbing too close to cliff-nesting birds such as Golden Eagles can
1129 result in nest abandonment. Expanded road and trail systems developed to help
1130 accommodate higher numbers of visitors are increasing habitat fragmentation and risks of
1131 behavioral impacts to wildlife.

1132 **Recommended Approach**

1133 Ensure that large patches of unfragmented habitat remain free from recreational pressure.
1134 Plan new recreational trail systems carefully and with consideration for native wildlife and
1135 their habitats. For example, limit night riding to certain areas to minimize disturbance to
1136 wildlife, avoiding areas more sensitive to damage such as wetlands. Take advantage of
1137 abandoned or closed roads, rail lines, or previously impacted areas for conversion into
1138 trails. Identify user-created roads and trails and decommission or enforce closures of
1139 these areas. Work with land management agencies such as the USFS to designate areas as
1140 high value recreation and low habitat impact areas. Institute road, area, and/or seasonal
1141 closures to protect species during sensitive times of year and decommission roads when
1142 possible. In high use areas, establish permitted entry systems to decrease recreational
1143 pressure. Research recreation impacts, including growing use of vehicles such as electric
1144 bicycles, and incorporate findings into recreation planning and habitat conservation.
1145 Engage in outreach and education to increase public awareness of recreation impacts to
1146 fish and wildlife species; develop messaging to communicate the need for “responsible
1147 recreation”.

1148 **REFERENCES**

1149 Raymond, C. L. and E. J. Fusco (Eds.). 2024. The State of Climate Adaptation Science for
1150 Ecosystems in the Northwest U.S. Prepared by the Climate Impacts Group for the
1151 Northwest Climate Adaptation Science Center.
1152 <https://depts.washington.edu/nwclimateadaptation/socs/>
1153

1154 KLAMATH MOUNTAINS

1155 DESCRIPTION

1156 The Klamath Mountains ecoregion covers much of southwestern Oregon, including the
1157 Klamath Mountains, Siskiyou Mountains, the interior valleys and foothills between these
1158 and the Cascade Range, and the Rogue and Umpqua river valleys. Several popular and
1159 scenic rivers run through the ecoregion, including the Umpqua, Rogue, Illinois, and
1160 Applegate rivers. Historically, this ecoregion is known for some of the best anadromous
1161 fish habitat in Oregon. While the Klamath Mountains ecoregion has an abundance of rivers
1162 and streams, lakes and ponds are relatively rare and found almost exclusively in montane
1163 environments.

1164 Within the ecoregion, there are wide ranges in elevation, topography, geology, and climate.
1165 The elevation ranges from about 60 to more than 7,500 feet, from steep mountains and
1166 canyons to gentle foothills and flat valley bottoms. This variation, along with the varied
1167 marine influence, supports a climate that ranges from the lush, rainy western portion of
1168 the ecoregion to the dry, warmer interior valleys and cold, snowy mountains.

1169 Plate tectonics have played a major role in creating the complex mosaic of landforms and
1170 rock types in this ecoregion. The geology of the Klamath Mountains can be better described
1171 as a patchwork rather than the layer-cake geology of most of the rest of the state. In the
1172 Klamath Mountains, serpentine mineral bedrock has weathered to a soil rich in heavy
1173 metals, including chromium, nickel, and gold, and in other parts, mineral deposits have
1174 crystallized in fractures. In fact, mining was the first major resource use of the ecoregion
1175 following Euro-American settlement, and Jacksonville was Oregon's most classic "gold
1176 rush" town.

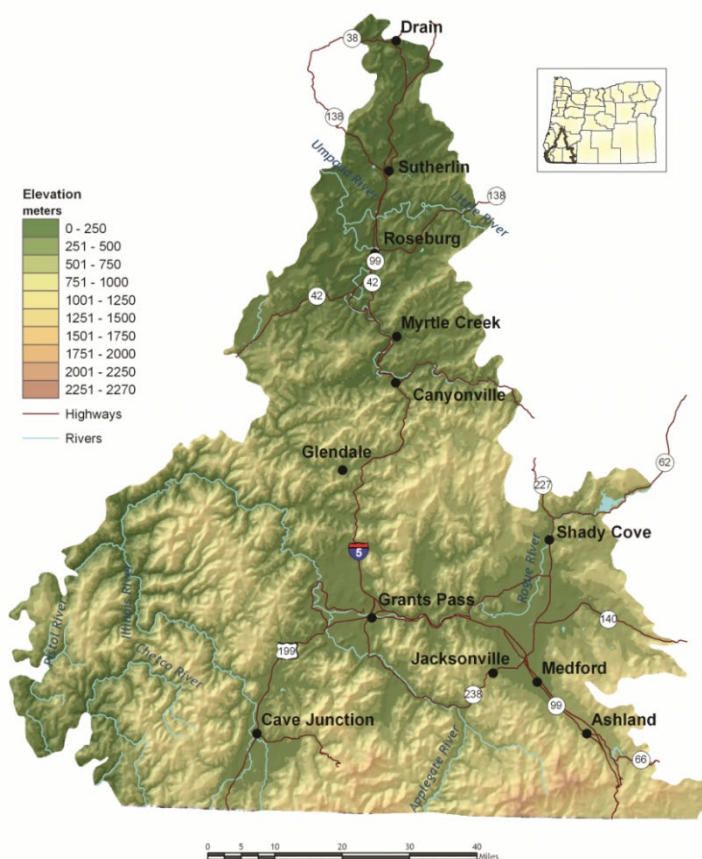
1177 Because of its unique geology, geography, and extreme climatic variation, the Klamath
1178 Mountains ecoregion boasts high species diversity, including many species found only
1179 locally. In fact, the Klamath-Siskiyou region was included in the World Wildlife Fund's
1180 assessment of the 200 most important locations for species diversity worldwide. The
1181 region is particularly rich in plant species, including many pockets of endemic
1182 communities and some of the most diverse plant communities in the world. For example,
1183 there are more kinds of cone-bearing trees found in the Klamath Mountains ecoregion than
1184 anywhere else in North America. In all, of the 4,000 native plants in Oregon, more than half
1185 are found in the Klamath Mountains ecoregion. This biodiversity hotspot is species-rich for
1186 reptiles and amphibians, too, with 38 different native species calling the region home. The
1187 ecoregion also boasts many unique invertebrates, although many of these are not well
1188 studied. The complexity of topographies and microclimates have allowed the Klamath
1189 Mountains to act as a refuge from climate changes in the past, promoting species diversity,

1190 but land use changes and rapidly warming temperatures now threaten many of the region's
1191 endemic species.

1192 In June 2000, President Clinton established the Cascade-Siskiyou National Monument,
1193 which encompasses 86,774 acres of forest and grassland. This National Monument is the
1194 first U.S. National Monument set aside solely for the preservation of biodiversity. The
1195 United States Congress then expanded the protected area by designating the adjacent
1196 Soda Mountain Wilderness in 2009, which encompasses 24,100 acres. These protected
1197 lands are managed by the Bureau of Land Management (BLM).

1198 While panning for gold first drew European settlers to the Klamath Mountains ecoregion,
1199 today's communities have a wide range of industries and economies, including
1200 agriculture, timber production, healthcare, manufacturing, and tourism. Many retirement
1201 communities are rapidly growing in the Ashland and Grants Pass areas.

1202 CHARACTERISTICS



1203

1204 **Important Industries**

1205 Forest products, service, tourism, trade, healthcare, new electronics, transportation
1206 equipment

1207 **Major Agricultural Products**

1208 Fruit (including wine grapes), vegetables, livestock, dairy farms, nursery products, timber,
1209 cannabis

1210 **Important Nature-based Recreational Areas**

1211 Cascade-Siskiyou National Monument, Oregon Caves National Monument, Rogue-Siskiyou
1212 National Forest, Applegate Lake, Emigrant Lake, Howard Prairie Lake, Lost Creek Lake,
1213 Red Buttes and Kalmiopsis Wilderness Areas, Table Rock, North Bank Habitat Management
1214 Area, Denman Wildlife Area

1215 **Elevation**

1216 600 feet to 7,500 feet (Mt. Ashland)

1217 **Important Rivers**

1218 Applegate, Rogue, Chetco, Coquille, Umpqua, South Umpqua, North Umpqua, Illinois

1219 **CONSERVATION ISSUES AND PRIORITIES**

1220 While the Klamath Mountains ecoregion is unique, it embodies many of the conservation
1221 issues facing other parts of Oregon. For example, increasing population growth and
1222 development in rural residential and urban communities strain resources, particularly in
1223 the southern and eastern portions of the ecoregion. The demand for further development is
1224 concentrated along the important transportation corridors, particularly Interstate 5, where
1225 most of the region's population lives. Development is not only a direct threat to the
1226 conservation of biodiversity on sites but also to the long-term ecological management of
1227 these sites.

1228 Linear infrastructure, such as roadways, needed to accommodate growth impact fish at
1229 stream crossings and increase mortality risks for wildlife. Decades of poor practices have
1230 led to significant fish passage issues, with many culverts and other structures undersized,
1231 inundated, or poorly maintained. Population growth also affects water availability, with
1232 increased demands for agricultural, industrial, and domestic water use. Stress on water
1233 systems is particularly high in summer months when flows are reduced.

The **Northwest Forest Plan** covers many of the forests found in the western part of the ecoregion. Overall, these habitats are challenged by decades of fire suppression, a need to reduce excessive fuel loads that have accumulated in the dry interior, and by checkerboard ownership patterns that can make resource planning particularly challenging. Grasslands in the Klamath Mountains ecoregion are home to many endemic and at-risk plant communities but are also impacted by invasive grasses and by conversion to development. Despite ongoing threats, habitat protection efforts, as well as local collaborative conservation via watershed councils and other groups, have been successful at improving water quality and riparian conditions in the ecoregion.

Key Conservation Issues of particular concern in the Klamath Mountains ecoregion include **Land Use Changes**, **Disruption of Disturbance Regimes**, and **Invasive Species**. In addition to the statewide issues, loss of habitat connectivity and water availability are of concern in this ecoregion. Many unique plant and soil features are found in this ecoregion, including granitic sediments in many streambeds. These features are highly sensitive to local disturbances.

CLIMATE

The Klamath Mountain region includes mountainous terrain and steep slopes, foothills, terraces, and floodplains. The climate is mild and Mediterranean with warm summers that typically have a long dry period and mild winters. Mean annual precipitation varies greatly between the low dry areas to the wetter high mountains. Mean annual temperature and number of frost-free days vary considerably with elevation.

Warming is projected in all seasons across the Klamath Mountains ecoregion, with the largest increases projected in the summer. Summers are projected to be warmer and drier, which is expected to lead to longer drought periods. Summer average temperature is projected to increase by as much as 6°F for the 2040-2069 period, and as much as 10°F for the 2070-2099 period under a high emissions scenario (SSP585; Figure 1). Late summer total precipitation is projected to decrease as much as 15%, and cool season precipitation projections show an increase of 7% (2070-2099) period. Precipitation projections, however, show low confidence in their results due to high model variability (Figure 2). Growing degree days are projected to double for the 2070-2099 period under a high emissions scenario (SSP585). Frost days are projected to decrease from 138 per year on average until there are between 30-80 per year, on average, for the 2070-2099 period under a high (SSP585) scenario.

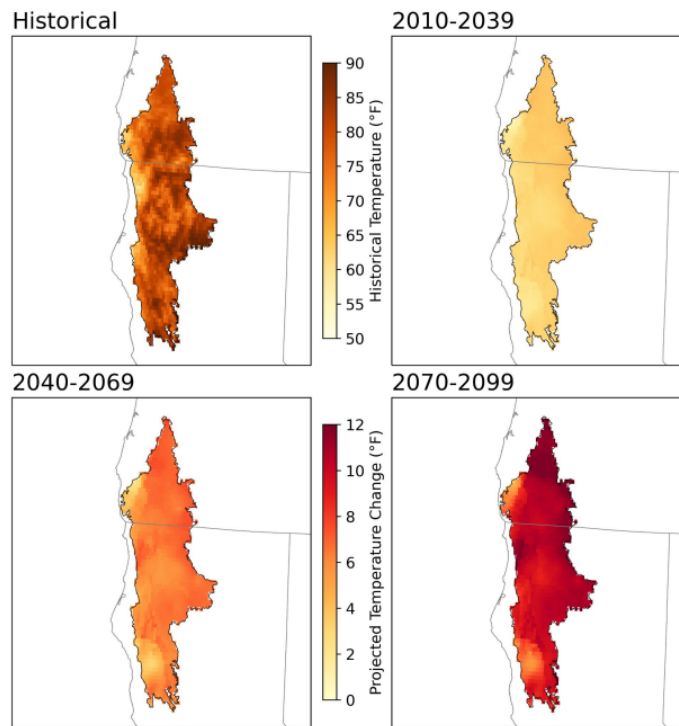


Figure 5 Model median historical (1950-2010) and future projections of summer maximum temperature change for three periods (2010-2039, 2040-2069, 2070-2099) under a high emission scenario (SSP585) for the Klamath Mountains. Future projections show increasing temperatures through the century, with slightly less warming in areas of the ecoregion that are closer to the coast (Raymond and Fusco, 2024).

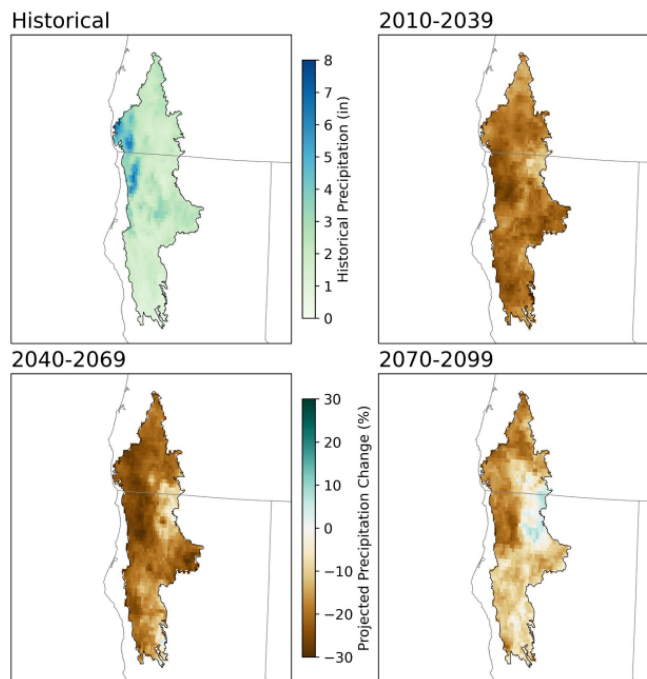


Figure 6 Model median historical (1950-2010) total late summer precipitation and projected percent change for three future periods (2010-2039, 2040-2069, 2070-2099) under a high emission scenario (SSP585) for the Klamath Mountains. Future projections show decreasing late summer precipitation across the western Klamath Mountains ecoregion through the century and a slight increase for the eastern Klamath Mountains in the 2070-2099 time period (Raymond and Fusco, 2024).

LIMITING FACTORS AND RECOMMENDED APPROACHES

Limiting Factor: *Land Use Conversion and Urbanization*

CMP Direct Threats 1, 2.1, 2.3, 7.2

Many communities in the Klamath Mountains ecoregion are expanding, particularly Central Point and Roseburg. Rapid urbanization can strain the ability of sensitive habitats, such as valleys, wetlands, and aquatic habitats, to continue to provide valued ecological functions and services. Development increases the potential for conflict between people and wildlife. For example, increasing road traffic increases the potential for collisions with migrating species, creating hazards for both motorists and wildlife. Development in this area threatens the region's unique geomorphic features and the diversity of plant and animal life they support.

1293 Conversion of habitat for cannabis cultivation is also increasing in the Klamath Mountains.
1294 Cannabis cultivation can have disproportionately large impacts on the area under
1295 production. Cultivators often use substantial quantities of pesticides, including
1296 insecticides and rodenticides, to discourage wildlife from foraging on plants. In addition to
1297 killing pests, insecticides are toxic to native insect pollinators and other beneficial
1298 arthropods and decomposers. Anticoagulant rodenticides often result in poisoning or
1299 secondary poisoning of numerous non-target species. Additionally, cannabis is a water-
1300 intensive crop, and cultivation occurs during the dry season in the Klamath Mountains
1301 when water availability is already significantly decreased. Cultivation often requires
1302 stream diversions, which can alter habitat for fish and wildlife, change flow regimes,
1303 interfere with fish passage, and increase water temperatures.

1304 **Recommended Approach**

1305 Cooperative approaches with private landowners are the key to long-term
1306 conservation. Essential tools include financial incentives, conservation easements, and
1307 informational resources. Work with community leaders and agency partners to ensure
1308 planned, efficient growth. Support and implement existing **land use regulations** to
1309 preserve farm and range land, open spaces, recreation areas, and natural habitats for
1310 wildlife. Support strategic land acquisition/protection, emphasizing species and habitats
1311 underrepresented in current protected sites. Ensure that local wildlife services are
1312 sufficiently maintained to help residents manage wildlife damage issues. Apply **best**
1313 **management practices** for cannabis cultivation to limit negative impacts to fish and
1314 wildlife and their habitats.

1315 **Limiting Factor:** *Altered Fire Regimes*

1316 CMP Direct Threats 7.1, 8.2, 11.3, 11.4

1317 Historically, the Klamath Mountains ecoregion was dominated by fire-adapted vegetation
1318 and experienced widely variable fire regimes, ranging from areas with relatively short fire
1319 return intervals to areas with greater than 50-year return intervals. Fire suppression and
1320 certain silvicultural practices have damaged forest health, resulting in undesirable
1321 changes in vegetation and increased intensity of wildfires as a result of increased fuel
1322 loads. Wildfire risk is further exacerbated by warming climate conditions and changes to
1323 patterns of precipitation, and more frequent, higher intensity megafires are becoming
1324 more common. Elevated levels of tree mortality due to drought, disease, and insects like fir
1325 borer, engraver, and mountain pine beetles have further increased fire risk in this
1326 ecoregion.

1327 The cumulative impacts of these forest changes have drastically increased threats to
1328 biodiversity, not only from damage due to more frequent, higher-intensity wildfires, but

1329 also as a result of the loss of the frequent, mixed-severity fires needed to maintain
1330 structural diversity and a range of different species of vegetation in some forest types.
1331 Efforts to reduce fire danger can help to restore fish and wildlife habitat, but they require
1332 careful planning. Reintroducing fire can be challenging in the Klamath Mountains because
1333 of high volatility of fuels, “checkerboard” land ownership patterns, and scattered rural
1334 residential developments.

1335 **Recommended Approach**

1336 Use an integrated approach to fuels management and forest health issues that considers
1337 historical conditions, wildlife conservation, **natural fire intervals**, and silvicultural
1338 techniques. Encourage forest management at a broad scale to address limiting factors.
1339 Reintroduce fire where feasible. Prioritize sites and applications. Increase resources to
1340 help private landowners implement hazard reduction techniques. Maintain important
1341 wildlife habitat features, such as snags and logs, to sustain wood-dependent species. In
1342 areas where prescribed fire is undesirable or difficult to implement, use mechanical
1343 treatment methods (e.g., chipping, cutting for firewood) that minimize soil disturbance.
1344 Monitor these efforts and use adaptive management techniques to ensure efforts are
1345 meeting habitat restoration and wildfire prevention objectives with minimal impacts on
1346 wildlife. Identify sub-basins with unique granitic sediment features that are especially at
1347 risk.

1348 **Limiting Factor: *Water***

1349 CMP Direct Threats 7.2, 11.4

1350 **Water quantity** is a limiting factor for fish and wildlife. In streams, seasonal low flows can
1351 limit habitat suitability and reproductive success for many fish and wildlife species. The
1352 Klamath Mountains ecoregion is highly susceptible to drought, with hot, dry summer
1353 climates. Changing climate regimes, such as predicted increased average summer
1354 temperatures and changes to patterns in precipitation, add to the likelihood and severity of
1355 drought conditions. Human activities, in the form of stream channelization, diversion
1356 systems, and irrigation operations, can also impact water availability, in addition to
1357 impacting in-stream and riparian habitat for fish and wildlife.

1358 Water quality can also limit species and habitats. Runoff from agricultural areas can
1359 contaminate waterways. Warming temperatures, combined with higher nutrient levels due
1360 to agricultural runoff, are increasing the prevalence of toxic cyanobacterial blooms.
1361 Contaminants left from mining activities are also a concern for water quality. Seepage and
1362 leaching of contaminated sediments and groundwater can lead to the introduction of
1363 acidic mine drainage and other toxicants into waterways.

1364 **Recommended Approach**

1365 Provide incentives and information about water usage and sharing during low flow
1366 conditions (e.g., late summer). Increase awareness and manage timing of applications of
1367 potential aquatic contaminants. Improve compliance with water quality standards and
1368 pesticide use labels administered by the **DEQ** and **EPA**. Work on implementing **Senate Bill**
1369 **1010** (Oregon Department of Agriculture) and **DEQ Total Maximum Daily Load** water
1370 quality plans. Follow guidelines outlined in regional species management plans, including
1371 the **Rogue-South Coast Multi-Species Conservation and Management Plan**.

1372 **Limiting Factor:** *Habitat Fragmentation*

1373 CMP Direct Threats 1, 2.1, 2.3, 3.3, 8.1

1374 The Klamath Mountains ecoregion is naturally diverse and heterogeneous. Some habitat
1375 types have been particularly disrupted by fragmentation and **loss of connectivity**,
1376 including late-successional forests and valley bottom habitats. However, existing
1377 development, growth pressures, high land costs, disconnected land ownerships, and the
1378 fragmented nature of remaining native habitats all present barriers to large-scale
1379 ecosystem restoration.

1380 Roadways are also a significant contributor to habitat fragmentation in this ecoregion.
1381 Interstate 5 bisects the ecoregion, running north to south. The number of lanes, traffic
1382 speeds, and volume of freight and motorist traffic make the interstate a near complete
1383 barrier to species movement, preventing species dispersal, range expansion, or migration.
1384 Undersized, inundated, and/or poorly maintained culverts and bridges also limit or prevent
1385 passage of fish and other aquatic species. Other roadways also impede wildlife
1386 connectivity and can block fish passage, particularly near urban areas. Densities of vehicle
1387 collisions with ungulates around the cities of Roseburg, Grants Pass, and Medford are
1388 some of the highest in the state.

1389 **Recommended Approach**

1390 Broad-scale conservation strategies will need to focus on restoring and maintaining more
1391 natural ecosystem processes and functions within a landscape that is managed primarily
1392 for other values. This may include an emphasis on conservation-oriented management
1393 techniques for existing land uses and restoration of some key ecosystem components,
1394 such as **river-floodplain connections** and **riparian** function.

1395 Work with community leaders and agency partners to **protect wildlife movement**
1396 **corridors** and to fund and implement site-appropriate habitat enhancement and
1397 restoration efforts to facilitate wildlife movement. Promote the protection, restoration, and

1398 maintenance of **Priority Wildlife Connectivity Areas**, following the guidelines outlined in
1399 **Oregon's Wildlife Corridor Action Plan**. Work with the Oregon Department of
1400 Transportation and county and city transportation departments to improve wildlife
1401 passage across roadways. Follow **fish passage guidelines** to prioritize and implement
1402 strategic removal of barriers to fish passage.

1403 **Limiting Factor: *Invasive Species***

1404 CMP Direct Threats 8.1, 8.2

1405 Invasive plants are of particular concern in the Klamath Mountains ecoregion. Invasive
1406 plants disrupt native communities, diminish populations of at-risk native species, and
1407 threaten the economic productivity of resource lands. Scotch broom, cheatgrass,
1408 Medusahead, and Himalayan blackberry are all prevalent and continue to spread. Non-
1409 native fish and wildlife species are also causing detrimental impacts. Feral horse
1410 populations have increased within the Cascade-Siskiyou National Monument, expanding
1411 beyond the Pokegama Herd Management Area. Unregulated horse herds have significant
1412 negative impacts, competing with native wildlife for vegetation and access to water,
1413 increasing soil erosion, and trampling sensitive habitats. American bullfrogs are rapidly
1414 expanding, competing with native species for limited resources or preying on native
1415 species and/or their eggs or young. Other problematic species include red-eared sliders,
1416 carp, signal crayfish, and mosquitofish.

1417 **Recommended Approach**

1418 Emphasize prevention, risk assessment, early detection, and quick control to prevent
1419 new **invasive species** from becoming fully established. Use multiple site-appropriate
1420 tools (e.g., mechanical, chemical, and biological) to control the most damaging invasive
1421 species. Prioritize efforts to focus on key invasive species in high priority areas, particularly
1422 where **Key Habitats** and **Species of Greatest Conservation Need** occur. Cooperate with
1423 partners through habitat programs and county weed boards to address invasive species
1424 problems. Promote the use of native species for restoration and revegetation.

1425 **Limiting Factor: *Energy Development***

1426 CMP Direct Threat 3.3

1427 Climate change and global economies are increasing pressure for renewable energy
1428 development. Hydroelectric facilities currently cause the greatest impacts to fish and
1429 wildlife in the Klamath Mountains ecoregion. Hydroelectric energy production alters stream
1430 flow rates and timing in ways that are often at odds with fish and wildlife life cycles,
1431 breeding requirements, and other resource needs. Some facilities in the ecoregion have

1432 inadequate fish passage structures due to regulatory changes over the course of their
1433 permitted timeline. Wind and solar energy production are also increasing, with particular
1434 demand for new solar developments.

1435 **Recommended Approach**

1436 Plan energy projects carefully, using best available information and early consultation with
1437 biologists. See the Key Conservation Issue on **Land Use Changes**. Remove dams that are
1438 aging, inefficient, or obsolete, and use techniques like fish ladders, management strategies
1439 to reduce reservoir sedimentation, and seasonally appropriate flow release to help mitigate
1440 the negative environmental impacts of dams. Consider the broader landscape context
1441 when planning new facilities, including habitat connectivity, cumulative impacts, fish and
1442 wildlife species presence, and mapped or modeled suitable habitat. Use wildlife-
1443 permeable fencing or allow egress to permit passage for medium-sized animals through
1444 solar fields.

1445 **Limiting Factor:** *Recreational Activity*

1446 CMP Direct Threats 1.3, 4.1, 5.1, 5.2, 5.4, 6.1

1447 Increasing demands for year-round recreational activity can disturb wildlife. Activities like
1448 hiking, biking, hunting, fishing, jet boating, mushroom foraging, and off-road vehicle use
1449 can create sensory stressors for wildlife, with sound, light, and unusual smells that may
1450 deter species from moving through certain areas. Human recreation may contribute to
1451 destruction of sensitive vegetation, harassment of wildlife from off-leash pets, spread of
1452 invasive species, and contamination of areas with refuse. Many species will avoid areas
1453 near trails, waterways, campgrounds, and access roads when humans are present.

1454 In the Klamath Mountains, extensive off-road vehicle use, both legal and illegal, increase
1455 stress for wildlife, and contributes to habitat fragmentation, disease transmission, and
1456 spread of invasive vegetation. Particular areas of concern for off-road vehicle impacts
1457 include the Applegate Valley, Shady Cove, and Illinois Valley.

1458 Activities on waterways can also have detrimental impacts to fish and wildlife.
1459 Paddleboarding, increasing in popularity throughout the region, can affect birds and
1460 aquatic wildlife, with increased access to non-motorized waterways. Paddleboard use can
1461 also increase the risk of disease transmission without proper cleaning. Jet boat use is also
1462 popular in this ecoregion, with a number of commercial jet boat tours provided on the
1463 Rogue River. The timing, frequency, and extent of jet boat use in river habitats may create
1464 conflicts for anadromous and other fish, as well as wildlife.

1465 **Recommended Approach**

1466 Plan new recreational trail systems carefully and with consideration for native wildlife and
1467 their habitats. For example, limit timing and use of certain areas to minimize disturbance
1468 to wildlife, avoiding areas more sensitive to damage such as wetlands. Take advantage of
1469 abandoned or closed roads, rail lines, or previously impacted areas for conversion into
1470 trails. Work with land management agencies such as the USFS to designate areas as high
1471 value recreation and low habitat impact areas. Institute road and/or area closures to
1472 protect species during sensitive times of year and decommission roads when possible.
1473 Enforce laws surrounding illegal off-road vehicle use and consider seasonal closures
1474 during sensitive times of the year. Consider limiting access of both motorized and non-
1475 motorized watercraft to sensitive stream reaches. In high use recreational areas, establish
1476 permitted entry systems to decrease recreational pressure.

1477 **REFERENCES**

1478 Raymond, C. L. and E. J. Fusco (Eds.). 2024. The State of Climate Adaptation Science for
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1482

NORTHERN BASIN AND RANGE

DESCRIPTION

The Northern Basin and Range ecoregion covers the southeastern portion of the state, from Burns south to the Nevada border and from Fort Rock Valley east to Idaho. The name describes the landscape, with numerous flat basins separated by isolated mountain ranges. Several important mountains are fault blocks, with gradual slopes on one side and steep basalt **ridges and cliffs** on the other side. The Owyhee Uplands consist of a broad plateau cut by deep river canyons. Elevations range from 2,070 feet near the Snake River to more than 9,700 feet on the Steens Mountain.

In the rain shadow of the Cascade Mountains, the Northern Basin and Range is Oregon's driest ecoregion, marked by extreme ranges of daily and seasonal temperatures. Much of the ecoregion receives less than 15 inches of precipitation per year, although mountain peaks may receive 30-40 inches per year. The extreme southeastern corner of the state has desert-like conditions, with annual precipitation of only 8-12 inches. Despite regional aridity, natural springs and spring-fed wetlands are scattered around the landscape. Runoff from precipitation and mountain snowpack often flows into low, flat playas where it forms seasonal shallow lakes and marshes. Most of these basins contained large, deep lakes during the late Pleistocene, between 40,000 and 10,000 years ago. As these lakes, which don't drain to the ocean, dried through evaporation, they left salt and mineral deposits that formed **alkali flats**, extremely important stopover sites for migratory shorebirds as a rich source of invertebrate prey.

Sagebrush communities dominate the landscape. Due to the limited availability of water, sagebrush is usually widely spaced and associated with an understory of forbs and perennial bunchgrasses, such as bluebunch wheatgrass and Idaho fescue. The isolated mountain ranges have few forests or woodlands, with rare white fir stands in Steens Mountain and Hart Mountain. However, aspen and **mountain mahogany** are more widespread and can be found in the Trout Creeks, Steens Mountain, Pueblo Mountains, Oregon Canyon Mountain, and Mahogany Mountains, and juniper woodlands comprise a significant portion of the northern end of the ecoregion. In the southern portion of the ecoregion, there are vast areas of desert shrubland, called salt-desert scrub, dominated by spiny, salt-tolerant shrubs. Throughout the ecoregion, soils are typically rocky and thin, low in organic matter, and high in minerals.

The Northern Basin and Range ecoregion is sparsely inhabited, but the local communities have vibrant cultural traditions. The largest community is Ontario, with more than 11,000 people. Other communities include Nyssa, Vale, Burns, and Lakeview, with 1,930 to 3,250 people each. Land ownership is mostly federal and primarily administered by the BLM.

Livestock and agriculture are the foundations of the regional economy. Food processing is important in Malheur County. Recreation is a seasonal component of local economies, particularly in Harney County. Hunting contributes to local economies, as does wildlife viewing, white-water rafting, and camping. Historically, lumber processing and harvesting from the nearby Blue Mountains was the basis of some local communities, particularly for Burns. However, these industries have declined with lower harvests from neighboring federal forests.

CHARACTERISTICS



Important Industries

Livestock, forest products, agriculture, food processing, recreation

Major Agricultural Products

Alfalfa, wheat, hay, corn, oats, onions, sugar beets, potatoes

Important Nature-based Recreational Areas

1533 Summer Lake Wildlife Area, Malheur Lake National Wildlife Refuge, Hart Mountain
1534 National Antelope Refuge, Steens Cooperative Management and Protection Area

1535 **Elevation**

1536 2,070 feet (Snake River) to 9,733 feet (Steens Mountain)

1537 **Important Rivers**

1538 Chewaucan, Donner und Blitzen, Malheur, Owyhee, Silvies

1539 **CONSERVATION ISSUES AND PRIORITIES**

1540 Uncontrolled livestock grazing in the decades before the enactment of the Taylor Grazing
1541 Act of 1934 caused serious long-term ecological damage throughout the ecoregion.
1542 Rangeland conditions have substantially improved since then in most areas, and grazing is
1543 now managed more sustainably in many parts of the ecoregion. However, some areas are
1544 still impacted by poor grazing practices. In addition, sensitive areas, such as riparian
1545 habitats and arid areas of **sagebrush** and **salt desert**, have been slow to recover.

1546 Some areas are still recovering from intensive management in the past, damaged by
1547 misguided efforts to rehabilitate overgrazed, degraded rangelands and improve livestock
1548 grazing by planting crested wheatgrass, a non-native pasture grass. For example, in 1962
1549 the BLM began a massive effort, the Vale Rehabilitation Project, to remove native
1550 sagebrush and establish crested wheatgrass. Over the course of 10 years, the Vale
1551 Rehabilitation Project seeded 250,000 acres to crested wheatgrass and used plowing,
1552 chaining, and herbicides, reducing sagebrush on as much as 506,000 acres. Modern day
1553 restoration efforts focus on returning these areas to healthy, native sagebrush habitat.

1554 Invasive species and altered fire regimes are the greatest terrestrial conservation issues in
1555 this ecoregion. Overgrazing and fire suppression, followed by invasion of non-native annual
1556 grasses such as cheatgrass, have greatly altered natural fire cycles in many sagebrush
1557 steppe habitats. Landscapes formerly comprised of mosaics dominated by bunchgrasses
1558 and forbs are now heavily and disproportionately dominated by shrubs (mostly sagebrush)
1559 and exotic grasses and forbs. As a result of altered fire regimes, encroachment of juniper
1560 has displaced grasses and sagebrush, especially in the northern portions of the ecoregion.
1561 However, old-growth juniper naturally occurs in some areas, especially in rock outcrops
1562 where grasses and sagebrush are uncommon and where fire is less of a factor. These **old-**
1563 **growth juniper** are extremely beneficial to wildlife.

1564 Greater Sage-Grouse are considered excellent indicators of sagebrush habitat quality.
1565 Current efforts to improve conditions for the Greater Sage-Grouse include comprehensive
1566 range-wide assessments and conservation planning.

1567 Throughout the Northern Basin and Range ecoregion, water quality is impacted by high
1568 temperatures, and in some areas, by bacteria, pollutants, and aquatic weeds. Water is
1569 limited in the ecoregion, fully allocated in storage and other uses. Aquatic habitats are
1570 affected by altered channel and flow conditions, obstructions, and poor riparian condition.
1571 Efforts to assess the quality of aquatic habitats are ongoing, and priorities include
1572 assessment of the impact of federal dams on water quantity and obtaining an
1573 understanding of natural temperature and water quality dynamics in the ecoregion.
1574 Under climate change, drought conditions may become more frequent, resulting in
1575 reduced water availability for wetlands in important wildlife areas like Summer Lake, Lake
1576 Abert, and Malheur Lake.

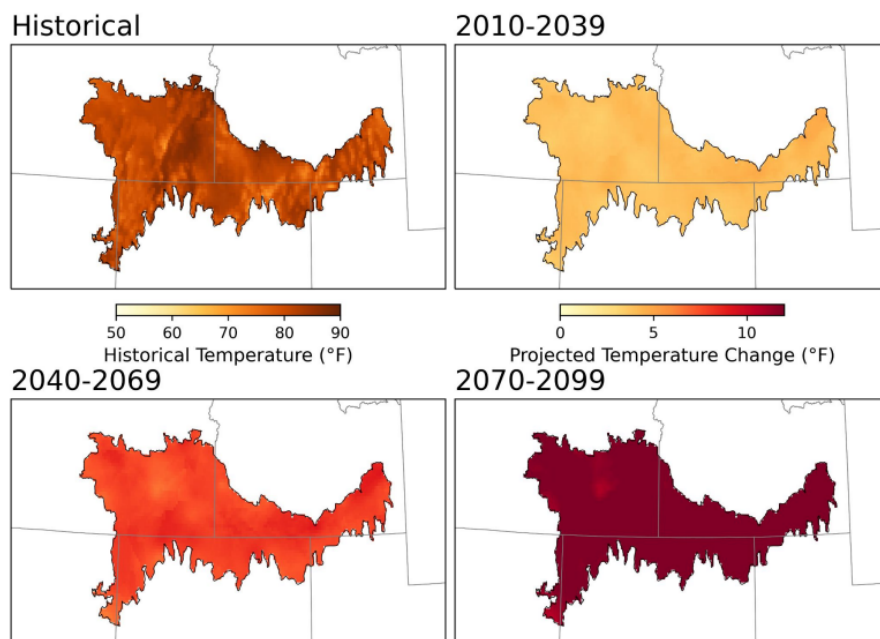
1577 Key Conservation Issues in the Northern Basin and Range ecoregion include Invasive
1578 Species, Water Quality and Quantity, and Disruption of Disturbance Regimes. In
1579 addition to the statewide issues, increasing demand for energy development, ongoing
1580 recovery from historical overgrazing, unregulated horse herds, uncontrolled use of off-
1581 highway vehicles, and increasing recreational demand are issues in this ecoregion.

1582 CLIMATE

1583 The Northern Basin and Range terrain consists of tablelands, basins, plains, some
1584 mountains, and valleys. The climate is arid with both steppe and desert climates, hot
1585 summers, and cold winters. Mean annual precipitation varies from minimal in the low
1586 areas to considerable in the higher mountainous areas. Increasing temperatures will lead
1587 to hotter summers, warmer winters, and more precipitation falling as rain in the winter in
1588 the higher elevation areas.

1589 Warming is projected in all seasons across the ecoregion, with the largest increases
1590 projected in summer. Summer average temperature is projected to increase by as much as
1591 8°F for the 2040-2069 period and as much as 12°F for the 2070-2099 period under the high
1592 emissions scenario (SSP585; Figure 1). Increasing temperatures will lead to hotter
1593 summers, warmer winters, and more precipitation falling as rain in the winter in the higher
1594 elevation areas. Late summer total precipitation is projected to change depending on time-
1595 period and scenario. Cool season precipitation projections show an increase in
1596 precipitation of as much as 19% for the 2070-2099 period (Figure 2). Confidence is low,
1597 however, in the late summer projections due to the large model range. Growing degree days
1598 are projected to double by the 2070-2099 period for the Northern Basin and Range under a
1599 high emissions scenario (SSP585). Frost days are projected to decrease from 200 until
1600 there are fewer than 150 per year, on average, under the high emissions scenario (SSP585).

1601



1602

1603 **Figure 7.** Model median historical (1950-2010) and future projections of summer maximum
1604 temperature change for three periods (2010-2039, 2040-2069, 2070-2099) under a high
1605 emission scenario (SSP585) for the Northern Basin and Range. Future projections show
1606 increasing temperatures through the century for the entire Northern Basin and Range
1607 ecoregion (Raymond and Fusco, 2024).

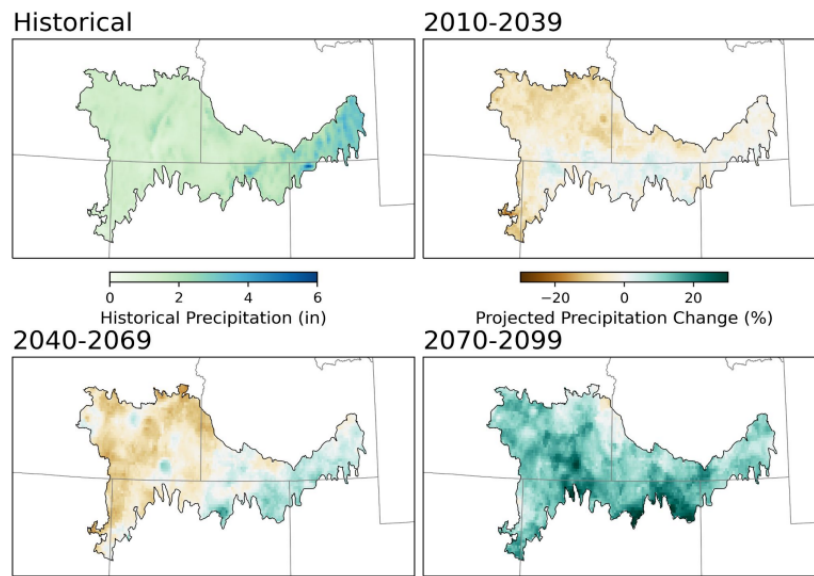


Figure 8. Model median historical (1950-2010) total late summer precipitation and projected percent change for three future periods (2010-2039, 2040-2069, 2070-2099) under a high emission scenario (SSP585) for the Northern Basin and Range. Future projections show varied changes in late summer precipitation across the Northern Basin and Range ecoregion through the next century. For the 2070-2099 period, projections show an increase in precipitation for the southern are of the Northern Basin and Range ecoregion (Raymond and Fusco, 2024).

LIMITING FACTORS AND RECOMMENDED APPROACHES

Limiting Factor: *Altered Fire Regimes*

CMP Direct Threats 7.1, 8.1, 8.2, 11.3, 11.4

Most **sagebrush-dominated** areas were once a mosaic of successional stages, from recently burned areas dominated by grasses and forbs to old, sagebrush-dominated stands that had not burned for 80 to 300 years. However, fire suppression and intensive grazing practices have reduced this mosaic and resulted in large areas dominated by invasive annual grasses, particularly cheatgrass, or older big sagebrush with a dense understory of invasive annual plants.

Changing climate conditions, including warming temperatures and more frequent and severe droughts, are contributing to increased frequency of fires, resulting in landscapes that are susceptible to the spread of western juniper and cheatgrass. Areas dominated by cheatgrass or other invasive annual grasses are more susceptible to fire ignition and reburning. Juniper invasion and encroachment of other woody vegetation provides fuel for

1630 wildfires, leading to higher intensity burns. Large fire events often destroy sagebrush,
1631 which are very slow to recover, leaving behind habitat that is no longer suitable for
1632 sagebrush-obligate species such as greater sage-grouse and pygmy rabbit. Big sagebrush
1633 communities with non-native invasive annuals in the understory will not recover from fire
1634 without significant intervention.

1635 **Recommended Approach**

1636 Under current vegetation management conditions, fire is damaging to sagebrush stands.
1637 Reintroduction of natural fire regimes may be difficult, and risks loss of sagebrush habitat.
1638 In many areas prescribed fire may be impractical. Use mechanical treatment methods that
1639 minimize soil disturbance to help remove encroaching juniper and annual invasive grasses
1640 that contribute to more frequent, higher-intensity fires. Chemical or biological
1641 management techniques can also be explored. Use of herbicides in sagebrush habitats
1642 that are moderately impacted by invasive annual grasses may help preserve sagebrush
1643 and increase fire resiliency. Engage in research on the efficacy and impacts of new
1644 herbicides to control nonnative vegetation.

1645 If determined to be ecologically beneficial with limited risk of sagebrush loss, reintroduce
1646 natural fire regimes using site-appropriate prescriptions that account for the historical fire
1647 regime, as well as area size and vegetation characteristics that affect resiliency and
1648 resistance to disturbance. Use prescribed fire to create a mosaic of successional stages
1649 and avoid larger prescribed fires.

1650 **Limiting Factor:** *Water*

1651 CMP Direct Threats 7.2, 11.4

1652 **Water quantity** is a limiting factor for fish and wildlife. Changing climate conditions are
1653 leading to rising temperatures and altered patterns of precipitation, which affect water
1654 availability across different times of year. In streams, seasonal low flows can limit habitat
1655 suitability and reproductive success for many fish and wildlife species. Although many
1656 communities in this ecoregion are small, increases in the demand for water for crop
1657 irrigation and livestock production, coupled with increasing drought conditions, mean the
1658 supply of groundwater is decreasing. Already an arid ecoregion, increases in drought
1659 conditions have also resulted in the loss of some marshes and alkali lakes—areas that are
1660 critical for wildlife, particularly migrating birds. Water quality can also limit species and
1661 habitats. Warming waters provide conditions for increased bacterial growth which can
1662 impact fish and wildlife, as well as drinking water supplies.

1663 **Recommended Approach**

1664 Provide incentives and information about water usage and sharing during low flow
1665 conditions (e.g., late summer). Increase awareness and manage timing of applications of
1666 potential aquatic contaminants. Improve compliance with water quality standards and
1667 pesticide use labels administered by the [DEQ](#) and [EPA](#). Work on implementing [Senate Bill](#)
1668 [1010](#) (Oregon Department of Agriculture) and [DEQ Total Maximum Daily Load](#) water
1669 quality plans.

1670 **Limiting Factor:** *Invasive Species*

1671 CMP Direct Threat 8.1, 8.2

1672 Non-native annual grasses, particularly cheatgrass and medusahead, have rapidly
1673 expanded in the Northern Basin and Range, displacing desirable forage for wildlife and
1674 livestock. These invasive plants disrupt native communities, diminish populations of at-
1675 risk native species, and threaten the economic productivity of resource lands. The spread
1676 of invasives like cheatgrass and medusahead can also increase the frequency, intensity,
1677 and spread of fires, replacing sagebrush and native bunchgrasses, which are adapted to
1678 infrequent, patchy fires.

1679 While not nearly as extensive as invasive plants, non-native animals have also impacted
1680 native fish and wildlife populations. For example, invasive carp in [Malheur Lake](#) have
1681 damaged one of the most important waterfowl production areas in Oregon, altering
1682 ecological dynamics through predation and altering water quality by disturbing sediments.
1683 Brown bullhead have also spread throughout the ecoregion, competing with native species
1684 for limited resources or preying on native species and/or their eggs or young. Unregulated
1685 horse herds are a concern in many areas, competing with native wildlife for vegetation and
1686 access to limited water sources, spreading invasive plant seeds via their manure, and
1687 trampling sensitive habitats.

1688 Changing climate conditions and fire suppression have also led to the expansion of
1689 western juniper throughout the ecoregion. Western juniper is a native species, and **old**
1690 **growth juniper trees** in rocky outcrops offer benefits to native wildlife. However, the
1691 expansion of western juniper in the Northern Basin and Range has degraded some
1692 grassland, sagebrush, riparian, large-diameter juniper, and aspen habitats. Western
1693 juniper expansion may reduce water availability in many seasonal and some perennial
1694 streams. In riparian areas, junipers replace deciduous shrubs and trees that are more
1695 beneficial to riparian wildlife. In many of the grassland and sagebrush habitats, 20–30-
1696 year-old juniper trees form dense stands that are not suitable for many wildlife species
1697 that require the open sagebrush or grassland habitats that are now in decline. These dense
1698 stands also act as fuel for wildfire, contributing to large, high-intensity fires that destroy
1699 sagebrush habitat.

1700 **Recommended Approach**

1701 Controlling western juniper in newly invaded areas benefits wildlife and other habitat
1702 values. Early control of newly invaded young trees before woodlands become established
1703 is often the most successful approach. Develop markets for small juniper trees as a
1704 special forest product to reduce restoration costs. Maintain large-diameter juniper trees in
1705 the native rocky outcrops and ridges, which are important nesting habitat for
1706 passerines and raptors. In some areas, fire can be used to control young juniper. Carefully
1707 evaluate sites to determine if **prescribed fire** is appropriate, considering the landscape
1708 context, vegetation types, and risk of sagebrush loss.

1709 Emphasize prevention, risk assessment, early detection, and quick control to prevent
1710 new **invasive species** from becoming fully established. Use multiple site-appropriate
1711 tools (e.g., mechanical, chemical, and biological) to control the most damaging invasive
1712 species. Prioritize efforts to focus on key invasive species in high priority areas, particularly
1713 where **Key Habitats** and **Species of Greatest Conservation Need** occur. Cooperate with
1714 partners through habitat programs and county weed boards to address invasive species
1715 problems. Carefully manage wildfires in cheatgrass-dominated areas. Promote the use of
1716 native “local” stock for restoration and revegetation where native species have the
1717 greatest potential to successfully establish. In some cases, use “assisted succession”
1718 strategies, applying low seed rates of non-invasive non-native plants in conjunction with
1719 native plant seeds as an intermediate step in rehabilitating disturbances in sagebrush
1720 communities.

1721 Promote dialogue between wildlife managers, landowners, and land managers to develop
1722 horse management plans based on common priorities. Promote outreach to explain the
1723 issue to the public and the impacts of unregulated herds on wildlife and habitat.

1724 **Limiting Factor:** *Energy Development*

1725 CMP Direct Threat 3.3

1726 Climate change and global economies are increasing pressure for renewable energy
1727 development, including solar energy. Solar energy projects offer environmental benefits
1728 but also have significant impacts on wildlife and their habitat. Many solar energy facilities
1729 have large footprints. Federal requirements for facilities to be fully fenced make any
1730 remaining habitat within a solar field inaccessible to most terrestrial wildlife species,
1731 which results in lost habitat and may disrupt critical movement and migration pathways.
1732 Solar facilities are also a collision risk for birds, as reflection of sunlight off the panels may
1733 cause solar fields to resemble large water bodies. The area is increasingly challenged with
1734 the need to balance the state’s interest in clean energy development with local natural
1735 resource conservation needs. The Northern Basin and Range ecoregion offers excellent

1736 renewable energy resources, but the ecoregion is particularly sensitive to local **impacts on**
1737 **sagebrush** and other habitats.

1738 **Recommended Approach**

1739 Plan energy projects carefully, using the best available information and early consultation
1740 with biologists. Use available tools and resources found in the **Land Use**
1741 **Changes** and **Climate Change** KCIs and ODFW **Compass**. Consider the broader
1742 landscape context when planning new development, including habitat connectivity,
1743 cumulative impacts, fish and wildlife species presence, and mapped or modeled suitable
1744 habitat. Use wildlife-permeable fencing or allow egress to permit passage for medium-
1745 sized animals through solar fields.

1746 **Limiting Factor:** *Recreational Activity*

1747 CMP Direct Threats 1.3, 4.1, 6.1

1748 Use of off-highway vehicles (OHVs) is particularly prevalent in the Northern Basin and
1749 Range. When limited and controlled, OHV use can be compatible with wildlife
1750 conservation. Illegal use, however, is prevalent, and highly detrimental. In general, OHV
1751 use can damage soils, impact sensitive riparian, aquatic, and upland habitats, spread
1752 invasive plant seeds, affect wildlife behavior and distribution, and increase the risk of
1753 wildfires. Although OHV use is limited to designated roads in some sensitive landscapes,
1754 there is little to no enforcement due to lack of funds and law enforcement personnel.

1755 In addition to OHV use, other recreational use, such as camping, soaking in hot springs,
1756 rock climbing, and parasailing, is increasing. Demands at some sites, such as the Alvord
1757 Desert, are high, damaging sensitive desert playa habitat. Although recreational use is still
1758 light in comparison to other ecoregions, social media is driving increased use of several
1759 other areas in the ecoregion. This increased recreational pressure could intensify impacts
1760 to wildlife, increasing disturbance in areas previously little-used by people.

1761 **Recommended Approach**

1762 Work cooperatively with land managers and OHV groups to direct use to maintained trails
1763 in low-impact areas and improve enforcement of existing rules. Support educational
1764 efforts to promote low-impact recreational use such as the **Tread Lightly! Program**.
1765 Monitor the impacts of OHV use on priority areas. Support efforts to effectively manage
1766 OHV use on public lands, particularly in highly sensitive habitats, and restore damaged
1767 areas.

1768 Proactively consider potential impacts to wildlife and habitats when developing or
1769 promoting recreational opportunities to encourage compatible uses. Monitor recreational
1770 patterns and trends. Institute road and/or area closures to protect species during sensitive
1771 times of year and decommission roads when possible. In high use areas, establish
1772 permitted entry systems to decrease recreational pressure.

1773 **Limiting Factor:** *Ongoing Recovery from Historical Overgrazing*

1774 CMP Direct Threats 2.3, 7.3, 8.1

1775 Prior to limitations that were initiated on public lands in the mid-1930s, livestock grazing
1776 had a profound influence on landscapes throughout the Northern Basin and Range
1777 ecoregion. Many areas experienced serious ecological damage. Conditions on rangelands
1778 in general have improved substantially over the past half-century as a result of
1779 improvements in livestock management, and most ecosystems are recovering. However,
1780 some habitats have been slow to recover, such as some **riparian** areas
1781 and **sagebrush** communities, especially where cheatgrass and other invasive annual
1782 grasses have invaded.

1783 **Recommended Approach**

1784 Continue to proactively manage livestock grazing and restore degraded habitats. Minimize
1785 grazing during restoration of highly sensitive areas, such as wetlands and riparian areas.

1786 REFERENCES

1787 Raymond, C. L. and E. J. Fusco (Eds.). 2024. The State of Climate Adaptation Science for
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1791

WEST CASCADES

DESCRIPTION

The West Cascades ecoregion extends from just east of the Cascade Mountains' summit to the foothills of the Willamette, Umpqua, and Rogue Valleys, and spans nearly the entire length of the state of Oregon, from the [Columbia River](#) to within five miles of the California border. The topography and soils of the West Cascades ecoregion have been shaped dramatically by its volcanic past. Geologically, the West Cascades ecoregion has two geologically distinct areas: the younger volcanic crest (approximately 8 million years old) and the "old Cascades" to the west of the crest (at least 30 million years old). The volcanic crest includes the highest peaks in Oregon: Mt. Hood, Mt. Jefferson, and North, Middle, and South Sisters, all more than 10,000 feet. The "old Cascades" are characterized by long, steep ridges and wide, glaciated valleys.

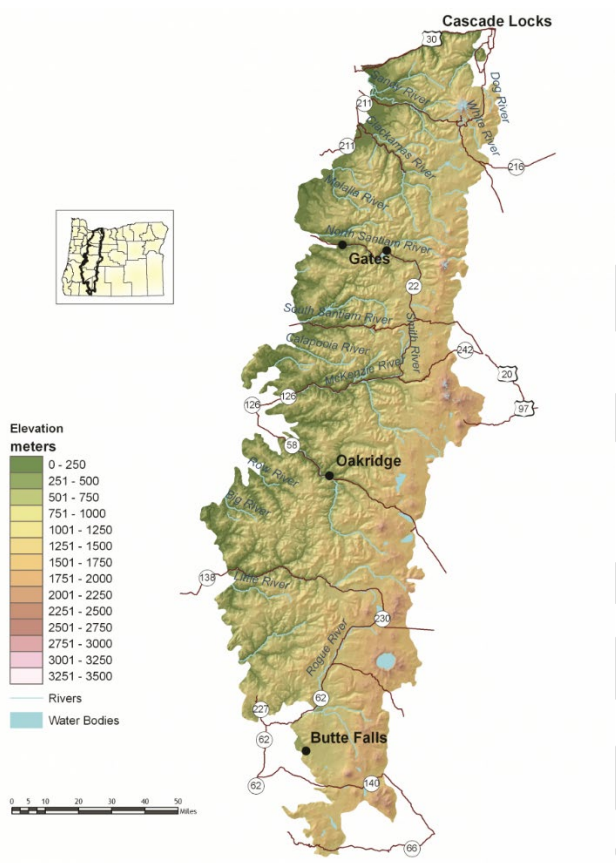
This ecoregion is almost entirely forested by conifers, although the dominant tree species vary by elevation, site characteristics, and stand history. Douglas-fir is the most common tree below 4,000 feet, often with western hemlock as a co-dominant species. At higher elevations, dominant tree species include Pacific silver fir, mountain hemlock, or subalpine fir. Other common conifers include western redcedar, grand fir, and noble fir. Above approximately 7,000 feet, the conditions are too severe for tree growth, and [alpine parklands](#) and dwarf shrubs predominate, including some wetlands and barren expanses of rock and ice. In the southern areas, [ponderosa pine](#), sugar pine, and incense cedar often are found with Douglas-fir at the lower elevations.

The climate and resulting fire regimes vary with latitude and elevation. The northern portion of the ecoregion is typified by less frequent but more severe fires, whereas the southern portion is typically drier with moderately frequent, mixed-severity, lightning-caused fires. Across the entire region, fire return intervals and severity are increasing due to changing climate. At lower elevations, winter conditions are often mild with high rainfall. In contrast, above 4,000 feet, winters are typified by lower temperatures and much of the precipitation occurs as snowfall.

The West Cascades ecoregion is sparsely populated, mostly in towns including Cascade Locks, Butte Falls, Detroit, Gates, Idanha, McKenzie Bridge, Blue River, Oakridge, Westfir, and part of Sandy and Sweet Home (the remainder of which lie in the Willamette Valley ecoregion). Local economies were once entirely dependent on timber harvest but have been greatly affected as market conditions (long-term and broad-scale changes in the forest products marketplace) and shifts in public forest management priorities have shaped Oregon's timber industry. Many towns are increasingly promoting recreational

1827 opportunities, including hiking, camping, fishing, hunting, birding, mountain biking, and
1828 skiing.

1829 CHARACTERISTICS



1830
1831 **Important Industries**
1832 Forest products, recreation (hiking, biking, wildlife viewing, hunting, fishing, snow sports)

1833 **Major Agricultural Products**

1834 Fruits, mint, cattle

1835 **Important Nature-based Recreational Areas**

1836 Mt. Hood, Willamette, Umpqua, and Rogue River-Siskiyou National Forests, Waldo Lake,
1837 Odell Lake, Detroit and Hills Creek Reservoirs, Crater Lake National Park, Three Sisters,
1838 Sky Lakes, and Mount Jefferson Wilderness Areas, Willamette Hatchery

1839 **Elevation**

1840 98 feet (along the western border of the ecoregion) to 11,240 feet (Cascade peaks)

1841 **Important Rivers**

1842 Clackamas (Oak Grove Fork), McKenzie, Rogue, Umpqua, Breitenbush, Middle Santiam,
1843 North and Middle Fork of the Willamette

1844 **CONSERVATION ISSUES AND PRIORITIES**

1845 As with Oregon's other forested ecoregions, habitats have been impacted by interrelated
1846 changes in ecological processes due to fire suppression, selective harvest practices, and
1847 unsustainable grazing. These changes have increased vulnerability of forests to insects,
1848 disease, and uncharacteristically severe wildfire. In addition, changing climate conditions
1849 are also putting this ecoregion at risk, with increased drought prevalence and warming
1850 temperatures affecting water availability and contributing to more frequent and severe
1851 wildfires. Recreational pressure is also a growing concern, with a variety of impacts
1852 resulting from activities like mountain biking, skiing, and off-road vehicle use and
1853 associated demands for new trails and facilities.

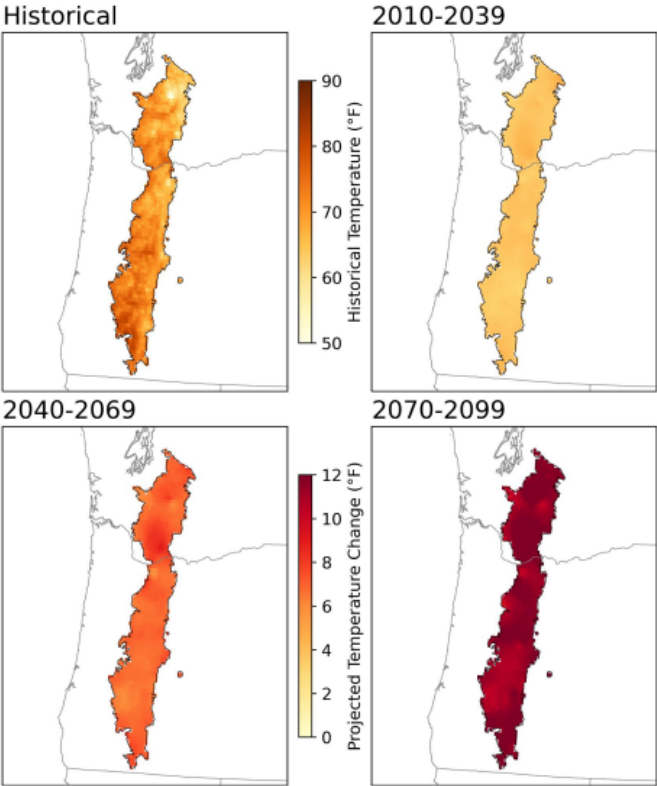
1854 **Key Conservation Issues** of particular concern in the West Cascades ecoregion
1855 include **Disruption of Disturbance Regimes**, Water Quality and Quantity, **Invasive**
1856 **Species**, and **Barriers to Animal Movement**.

1857 **CLIMATE**

1858 The West Cascades ecoregion is characterized by steep ridges and river valleys to the west
1859 and a high plateau to the east. The region has a mild to severe mid-latitude climate with
1860 dry, warm summers and mild or cool, very wet winters. The climate varies by latitude and
1861 elevation, especially near the volcanoes within this ecoregion.

1862 Warming is projected in all seasons across the Cascades ecoregion, with the largest
1863 increases projected for summer. Summer average temperature is projected to increase by
1864 as much as 7°F for the 2040-2069 period and as much as 11°F for the 2070-2099 period
1865 (Figure 1). Less precipitation will fall as snow in Cascades in the future, leading to even
1866 wetter winters and drier summers. Late summer precipitation is projected to decrease by
1867 as much as 19% by the 2070-2099 period, and cool season precipitation is projected to
1868 increase by 6% (Figure 2). Less precipitation will fall as snow in Cascades in the future,
1869 leading to even wetter winters and drier summers. Confidence in cool season projections,
1870 however, is low after 2010-2039. Growing degree days are projected to more than double

1871 by the 2070-2099 period for this ecoregion under a high emissions scenario (SSP585). Frost
1872 days are projected to decrease from 171 per year until there are fewer than 100 per year,
1873 on average, under the high emissions scenario (SSP585).



1874
1875 **Figure 1.** Model median historical (1950-2010) and future projections of summer
1876 maximum temperature change for three periods (2010-2039, 2040-2069, 2070-2099) under
1877 a high emission scenario (SSP585) for the West Cascades. Future projections show
1878 increasing temperatures, with slightly less warming in the southwest (Raymond and Fusco,
1879 2024).

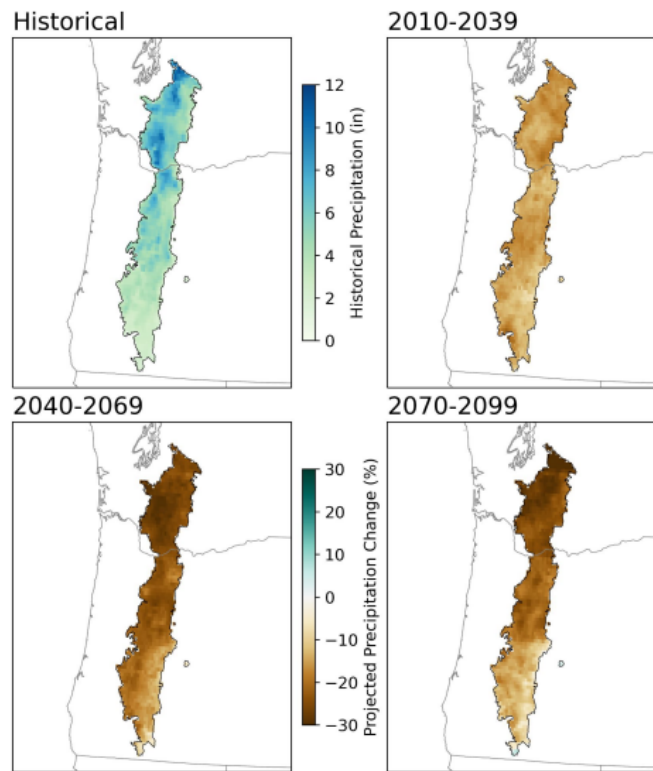


Figure 2. Model median historical (1950-2010) total late summer precipitation and projected percent change for three future periods (2010-2039, 2040-2069, 2070-2099) under a high emission scenario (SSP585) for the West Cascades. Future projections for a high (SSP585) scenario show decreasing late summer precipitation across the region with a greater decrease in the north (Raymond and Fusco, 2024).

LIMITING FACTORS AND RECOMMENDED APPROACHES

Limiting Factor: *Altered Fire Regimes*

CMP Direct Threats 7.1, 11.3, 11.4

Many forests in the West Cascades ecoregion are at risk of losing one or more ecosystem components to wildfire. Fire suppression and certain forest practices have resulted in young, dense, mixed-species stands of trees that are at increased risk of forest-destroying crown fires, disease, and damage by insects. Under changing climate conditions these risks are expected to increase, with warming temperatures and more frequent drought contributing to shorter fire return intervals and more severe fires. Efforts to reduce risks of uncharacteristically severe fires can help to restore habitat but require careful planning to provide sufficient habitat features that are important to wildlife (e.g., snags, downed logs, hiding cover).

1898 **Recommended Approach**

1899 Use an integrated approach to **wildfire issues** that considers historical conditions, wildlife
1900 conservation, natural fire intervals, and silvicultural techniques. Consider the broader
1901 landscape context, including habitat connectivity, cumulative impacts, fish and wildlife
1902 species presence, and mapped or modeled suitable habitat when engaging in forest
1903 management and wildfire risk mitigation activities. Reintroduce fire where feasible;
1904 prioritize sites and applications. Maintain important wildlife habitat features, such as
1905 snags and logs, to sustain wildlife species that are dependent on dead wood. Maintain
1906 early-, mid-, and late-seral habitats to support a diversity of species. Monitor these efforts
1907 and use adaptive management techniques to ensure efforts are meeting habitat
1908 restoration and wildfire prevention objectives with minimal impacts on wildlife. Work with
1909 homeowners and resort operators to reduce vulnerability of properties to wildfire while
1910 maintaining habitat quality. Highlight successful, environmentally sensitive fuel
1911 management programs. In the case of post-wildfire recovery, maintain high snag densities
1912 and replant with site-adapted native tree, shrub, grass, and forb species. Promote
1913 revegetation with native species that are expected to be climate resilient. Prevent
1914 colonization of invasive vegetation, such as scotch broom. Manage reforestation after
1915 wildfire to create species and structural diversity, based on local management goals.

1916 **Limiting Factor:** *Water*

1917 CMP Direct Threats 7.2, 114

1918 **Water quantity** is a limiting factor for fish, wildlife, and livestock. Changing climate
1919 conditions are leading to rising temperatures and altered patterns of precipitation, which
1920 affect water availability across different times of year, and drought conditions are
1921 occurring more frequently. In high elevation areas, loss of snowpack due to warming
1922 climate conditions is affecting habitat for many species along the Cascade crest and is
1923 leading to reduced stream flow rates and peak flow rates that are occurring earlier in the
1924 year. In streams, seasonal low flows can limit habitat suitability and survival and
1925 reproduction for many fish and wildlife species.

1926 Water quality can also limit species and habitats. Runoff from agricultural areas and
1927 herbicides applied to forest lands can contaminate waterways. Warming temperatures,
1928 combined with higher nutrient levels due to agricultural runoff, are increasing the
1929 prevalence of toxic cyanobacterial blooms.

1930 **Recommended Approach**

1931 Provide incentives and information about water usage and sharing during low flow
1932 conditions (e.g., late summer). Increase awareness and manage timing of applications of

1933 potential aquatic contaminants. Improve compliance with water quality standards and
1934 pesticide use labels administered by the **DEQ** and **EPA**. Work on implementing **Senate Bill**
1935 **1010** (Oregon Department of Agriculture) and **DEQ Total Maximum Daily Load** water
1936 quality plans.

1937 **Limiting Factor:** *Habitat Fragmentation*

1938 CMP Direct Threats 1, 2.1, 2.3, 3.3, 8.1

1939 Increasing traffic volumes, road density, recreational pressure, and urban and rural
1940 development are contributing to habitat loss and fragmentation, and create significant
1941 **barriers to animal movements**. Hydropower systems, including high-head flood control
1942 and hydropower dams, also have significant impacts to species movement in this
1943 ecoregion. Levees, hydropower canals, and hardened stream banks reduce available
1944 habitat for fish and aquatic species and can entrap and kill wildlife. Altered hydrology from
1945 these systems, including impacts to temperatures and timing of water availability, can
1946 affect fish passage.

1947 **Recommended Approach**

1948 Work with community leaders and agency partners to encourage **planned, efficient**
1949 **growth**. Support existing land use regulations to preserve forestland, farmland, rangeland,
1950 open spaces, recreation areas, wildlife refuges, and natural habitats. Work with
1951 community leaders and agency partners to **protect wildlife movement corridors** and to
1952 fund and implement site-appropriate habitat enhancement and restoration efforts to
1953 facilitate wildlife movement. Continue working with **Oregon Watershed Enhancement**
1954 **Board**, Oregon Department of Transportation, Oregon Department of Forestry, USFS, BLM,
1955 counties, local municipalities, irrigation districts, and other partners to inventory,
1956 prioritize, and provide fish passage at artificial obstructions, leveraging current work done
1957 by **ODFW's Fish Passage Task Force** to expand implementation of fish passage priorities.
1958 Minimize entrapment risk in hydropower canals by providing crossing structures and
1959 escape devices at regular intervals. Provide incentives (e.g., financial assistance,
1960 conservation easements) and information about the benefits of maintaining wildlife
1961 habitat. Broad-scale conservation strategies will need to focus on restoring and
1962 maintaining more natural ecosystem processes and functions within areas that are
1963 managed primarily for other values. This may include an emphasis on more "conservation-
1964 friendly" management techniques for existing land uses, and restoration of some key
1965 ecosystem components such as **riparian** function.

1966 **Limiting Factor:** *Invasive Species*

1967 CMP Direct Threat 8.1

1968 Invasive plants and animals disrupt and degrade native communities, diminish populations
 1969 of at-risk native species, and threaten the economic productivity of resource lands.
 1970 Invasive plants, particularly noxious weeds, have increased substantially. In many cases,
 1971 the spread of invasives is facilitated by wildfire, as many invasive species can quickly
 1972 colonize disturbed areas. In this ecoregion, Scotch broom is of particular concern. Scotch
 1973 broom spreads aggressively to form monocultures, displacing native, beneficial plants and
 1974 forage grasses, with seeds that can remain viable for decades, making it very difficult to
 1975 eradicate. Himalayan blackberry is also widespread, with significant local impacts to
 1976 meadows, riparian areas, and grasslands.

1977 While not as disruptive as invasive vegetation, invasive animals have caused problems for
 1978 native wildlife species in this ecoregion. A variety of sport fish, introduced to many high
 1979 elevation lakes, compete with native amphibians for limited resources and prey on native
 1980 species and/or their eggs or young. Barred Owl, expanding westward from their native
 1981 range in the eastern US, compete directly with the native, threatened Northern Spotted
 1982 Owl for food and habitat.

1983 **Recommended Approach**

1984 Emphasize prevention, risk assessment, early detection, and quick control to prevent
 1985 new **invasive species** from becoming fully established. Prioritize efforts to focus on key
 1986 invasive species in high priority areas, particularly where **Key Habitats** and **Species of**
 1987 **Greatest Conservation Need** occur. Where needed, use multiple site-appropriate tools
 1988 (e.g., mechanical, chemical, and biological) to control the most damaging invasive
 1989 species. During post-fire recovery efforts, use techniques that prevent establishment of or
 1990 quickly eradicate invasive vegetation. Ensure native species are used during restoration
 1991 and revegetation efforts and promote native species that are expected to be climate
 1992 resilient.

1993 **Limiting Factor:** *Recreational Activity*

1994 CMP Direct Threats 1.3, 4.1, 5.1, 5.2, 5.4, 6.1

1995 Increasing demands for year-round recreational activity can disturb wildlife. Population
 1996 growth has contributed to increased pressure on natural areas from recreationists,
 1997 including those engaging in hiking, biking, camping, fishing, hunting, foraging, rafting,
 1998 backcountry skiing, boating, paddleboarding, and off-road vehicle use. Expanded road and
 1999 trail systems developed to help accommodate higher numbers of visitors are increasing
 2000 habitat fragmentation and risks of behavioral impacts to wildlife. Recreational pressure
 2001 can lead to an increase in wildlife stress response and behavioral changes that ultimately
 2002 impact reproductive rates and population abundance. Human recreation can contribute to
 2003 destruction of sensitive vegetation, harassment of wildlife from off-leash pets, spread of

2004 invasive species, and contamination of areas with refuse. Many species will avoid areas
2005 near trails, campgrounds, and access roads when humans are present.

2006 **Recommended Approach**

2007 Plan new recreational trail systems carefully and with consideration for native wildlife and
2008 their habitats. For example, limit use and access to certain areas to minimize disturbance
2009 to wildlife, avoiding areas more sensitive to damage such as wetlands. Take advantage of
2010 abandoned or closed roads, rail lines, or previously impacted areas for conversion into
2011 trails. Work with land management agencies such as the USFS to designate areas as high
2012 value recreation and low habitat impact areas. Institute road and/or area closures to
2013 protect species during sensitive times of year and decommission roads when possible. In
2014 high use areas, establish permitted entry systems to decrease recreational pressure.
2015 Engage in outreach and education to increase public awareness of recreation impacts to
2016 fish and wildlife species; develop messaging to communicate the need for “responsible
2017 recreation”.

2018 **REFERENCES**

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2020 Ecosystems in the Northwest U.S. Prepared by the Climate Impacts Group for the
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2022 <https://depts.washington.edu/nwclimateadaptation/socs/>

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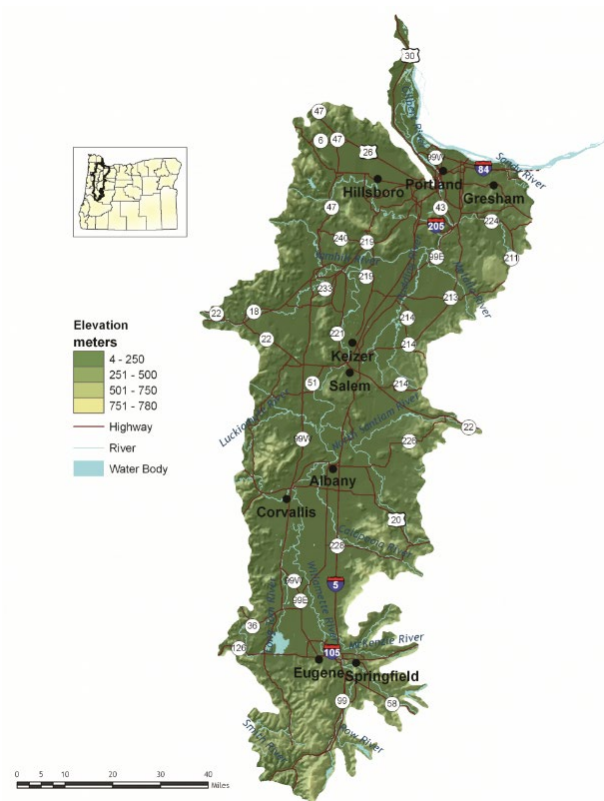
2024 WILLAMETTE VALLEY

2025 DESCRIPTION

2026 Bounded on the west by the Coast Range and on the east by the Cascade Range, this
2027 ecoregion encompasses 5,308 square miles and includes the Willamette Valley and
2028 adjacent foothills. Twenty to 40 miles wide and 120 miles long, the Willamette Valley is an
2029 elongated, level alluvial plain with scattered groups of low basalt hills. Elevations on the
2030 valley floor are about 400 feet at the southern end near Eugene, dropping gently to near
2031 sea-level in Portland. The climate is characterized by mild, wet winters and warm, dry
2032 summers. Fertile soil and abundant rainfall make the valley the most important
2033 agricultural region in the state.

2034 Societally, the Willamette Valley is a land of contrasts. Bustling urban areas are nestled
2035 within rural farmlands. A wide diversity of industries contribute to the vibrant economy. It
2036 includes more than half of the state's agricultural-producing counties, and the vast
2037 majority of the largest private sector employers (e.g., manufacturing, technology, forest
2038 products, agriculture, and services). Interstate 5 runs the length of the ecoregion,
2039 contributing to the transportation system and flow of goods while connecting
2040 communities. The Willamette Valley is the most urban ecoregion in the state, containing
2041 8 of the 10 largest cities in Oregon. It is also the fastest-growing ecoregion. Pressure on
2042 valley ecosystems from population growth, land use conversion, recreation, and pollution
2043 is likely to increase as population centers expand.

2044 CHARACTERISTICS



2045

2046 Important Industries

2047 Agriculture, manufacturing, technology, forest products, construction, retail, services,
2048 government, academia, health care, tourism

2049 Major Agricultural Products

2050 Nursery and greenhouse plants, grass seed, wine grapes, Christmas trees, poultry, dairy,
2051 vegetables, small fruits and berries, nuts, grains, hops, cannabis

2052 Important Nature-based Recreational Areas

2053 Smith and Bybee Wetlands Natural Area, Henry Hagg Lake, Fall Creek Lake, Milo McIver
2054 State Park, Willamette River Greenway and Water Trail, Willamette Valley National Wildlife
2055 Refuge Complex, Fern Ridge Reservoir, McDonald and Dunn Research Forests, Rivers to
2056 Ridges parks network, Howard Buford Recreation Area, Tualatin and William L. Finley
2057 National Wildlife Refuges, Sauvie Island Wildlife Area, E. E. Wilson Wildlife Area

2058 Elevation

2059 4 feet (Columbia River) to over 2,000 feet in the south

2060 Important Rivers

2061 Willamette, McKenzie, Santiam, Sandy, Molalla, Clackamas, Tualatin, Yamhill, Calapooia,
2062 Marys, Muddy, Pudding, Luckiamute, Long Tom

2063 CONSERVATION ISSUES AND PRIORITIES

2064 The Willamette Valley is a steadily growing and densely populated ecoregion, containing
2065 the state's three largest metropolitan areas, Portland, Eugene, and Salem. Since the
2066 1850s, much of the ecoregion has been altered by development (agricultural and urban),
2067 particularly affecting oak woodland, oak savanna, grassland, riverine, and wetland
2068 habitats. The Willamette River has been disconnected from its floodplain, and much of the
2069 historical habitat has been fragmented. About 96 percent of the Willamette Valley
2070 ecoregion is privately-owned, presenting challenges to conservation efforts. Conservation
2071 strategies that focus on the needs of individual at-risk species and key sites are
2072 particularly critical in this ecoregion.

2073 Historical accounts indicate that prior to European settlement, much of the Willamette
2074 Valley was covered by native grasses, forbs, and oak savanna. The Kalapuya people
2075 regularly set fires to improve hunting and travel. The fires helped to maintain the Valley's
2076 mosaic of grasslands, oak savannas, wet prairies, and other open habitats. The cessation
2077 of fire management by indigenous peoples and subsequent fire suppression efforts have
2078 led to denser vegetation and encroachment of trees like Douglas-fir, impacting the health
2079 of oak woodlands and reducing the size of grasslands and prairies.

2080 **Key Conservation Issues** of particular concern in the Willamette Valley ecoregion
2081 include **Land Use Changes**, **Disruption of Disturbance Regimes** (both fire and floodplain
2082 function), **Challenges and Opportunities for Private Landowners to Engage in**
2083 **Conservation**, and **Invasive Species**. In addition to the statewide factors, specific
2084 hazards to wildlife in **urban areas** and habitat fragmentation are of conservation concern
2085 here.

2086 CLIMATE

2087 The Willamette Valley is mostly a low elevation valley with terraces and floodplains
2088 encompassed by rolling hills. The climate is Mediterranean, with mild, wet winters and
2089 warm, dry summers. Mean annual precipitation varies by elevation, with more occurring in
2090 the mountainous foothills. Many tributaries join the Willamette River, entering this
2091 ecoregion from the Cascades to the east and Coast Range to the west.

Warming is projected in all seasons across the region, with the largest increases projected for summer. Summer average temperature is projected to increase as much as 6°F for the 2040-2069 period, and as much as 10°F for the 2070-2099 period for a high emissions scenario (SSP585). Warming temperatures will lead to wetter winters and drier summers. Late summer precipitation is projected to decrease as much as 20% by the end of the century. Projections of cool season precipitation show an increase of 6% for the same period under a high emissions scenario (SSP585), although there is less confidence in predicted changes in cool season precipitation. Under a high emissions scenario (SSP585), growing degree days are projected to double for the 2070-2099 period, while frost days are projected to decrease from 50 per year on average to fewer than 20 per year on average.

The modeled median temperature change from 25 CMIP6 projections for the Willamette Valley shows warming over the century, with slightly less warming in the southern Willamette Valley (Figure 1). Congruently, future projections show decreasing late summer precipitation across the Willamette Valley ecoregion, with the greatest decrease in the 2040-2069 period under a high (SSP585) scenario (Figure 2). Models generally agree on late summer precipitation projections, so confidence in these projections is high.

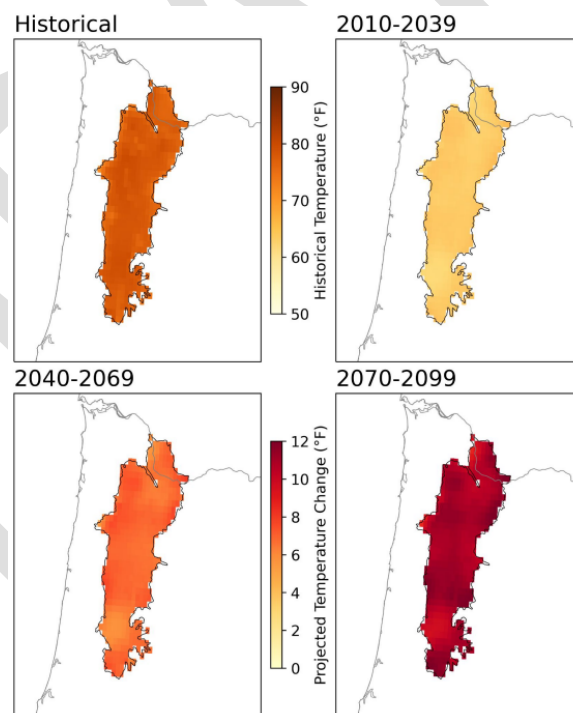


Figure 1. Model median historical (1950-2010) and future projections of summer maximum temperature change for three future periods (2010-2039, 2040-2069, 2070-2099) under a high emission scenario (SSP585) for the Willamette Valley (Raymond and Fusco, 2024).

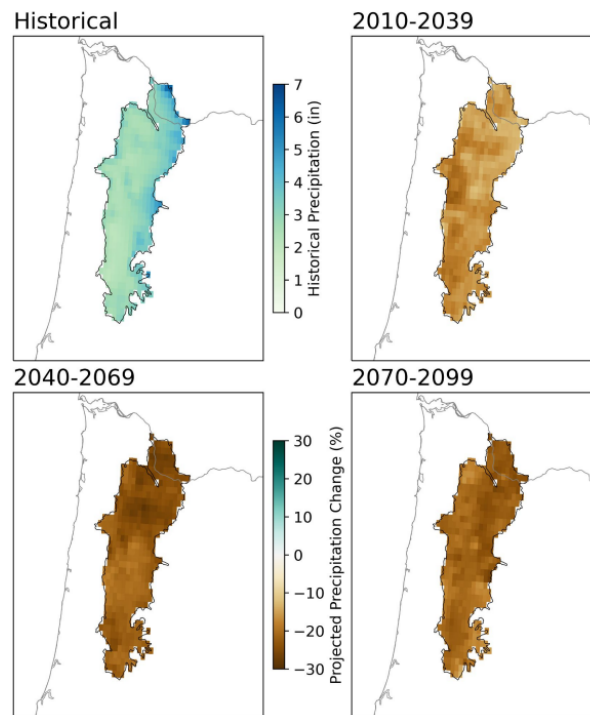


Figure 2. Model median historical (1950-2010) total late summer precipitation and projected percent change for three future periods (2010-2039, 2040-2069, 2070-2099) under a high emission scenario (SSP585) for the Willamette Valley (Raymond and Fusco, 2024).

LIMITING FACTORS AND RECOMMENDED APPROACHES

Limiting Factor: *Land Use Conversion and Urbanization*

CMP Direct Threats 1, 2.1, 2.3, 7.2

Of all the ecoregions in Oregon, the Willamette Valley has been most impacted by development and conversion of native habitats to other uses. The fragmented nature of remaining habitat patches in the Willamette Valley creates barriers to movement and dispersal for many species, particularly amphibians, reptiles, invertebrates, and small mammals. Continued fragmentation of remnant habitats, including grasslands and oak woodlands, has resulted in small and disjunct populations that are at an increased risk of genetic isolation and extirpation.

In addition to rural and urban residential and commercial development, conversion of habitat for vineyards is also increasing. Application of fungicides and insecticides applied to protect wine grapes and other crops, including grasses and hazelnuts, may impact the

2132 health, survival, and reproduction of pollinators, birds, and fish. The extensive
2133 development of the Willamette Valley ecoregion also means the potential for conflict
2134 between people and wildlife is high. For example, agricultural production may cause
2135 conflicts with wildlife that are attracted to feed on plants, nuts, or ripened fruit. Lack of
2136 suitable habitat may cause bats and birds to nest or roost in houses and other human
2137 structures. High road densities and road traffic volumes increase the potential for
2138 collisions with wildlife, with hundreds of thousands of animals lost each year to roadkill.

2139 **Recommended Approach**

2140 Landscape Scale: Because so much of the Willamette Valley ecoregion is privately-owned,
2141 voluntary cooperative approaches are the key to long-term conservation using tools such
2142 as **financial incentives**, Candidate Conservation Agreements with Assurances, and
2143 conservation easements. Careful **land use planning** is also essential. Work with agency
2144 partners to support and implement existing land use regulations to preserve farmland,
2145 open spaces, recreation areas, and natural habitats. Monitor changes in land uses across
2146 the landscape and in land use plans and policies.

2147 Within **Urban Areas**: Parks and natural areas, wildlife corridors, and green infrastructure
2148 can contribute to conservation, connect people to the natural environment, and enhance
2149 the quality of life in communities. Mitigate the impacts of development to the greatest
2150 extent possible. Many **Priority Wildlife Connectivity Areas** exist throughout the
2151 Willamette Valley that can help maintain important movement corridors for wildlife.
2152 Promote programs such as the **Backyard Habitat Certification Program** to increase
2153 wildlife habitat and connectivity within urban spaces. Support and promote innovative
2154 campaigns and programs to reduce wildlife hazards. Work with municipalities to develop
2155 policies, such as wildlife-friendly building guidelines, wildlife-friendly lighting strategies,
2156 and integration of fish and wildlife crossings into transportation plans to reduce hazards.
2157 Engage in community outreach and education efforts to promote habitat protection and
2158 coexistence with wildlife.

2159 **Limiting Factor:** *Altered Fire Regimes*

2160 CMP Direct Threats 7.1, 11.3, 11.4

2161 Past forest practices and fire suppression have resulted in young, dense, conifer-
2162 dominated forests where open-structured habitats like **grasslands**, **oak savannas**,
2163 and **wet prairies** once dominated. Maintenance of these **Key Habitats** is dependent, in
2164 part, on periodic burning. Forest crowding is a particularly significant issue in oak habitat,
2165 as large legacy oaks have become surrounded by dense stands of younger trees. The
2166 dense conifer stands that have replaced open-structured habitats are at increased risk of
2167 high-intensity fires, disease, and damage by insects. Wildfire risk is further exacerbated by

2168 warming climate conditions and changes to patterns of precipitation, and more frequent,
2169 moderate to severe wildfires are becoming more common, particularly along the
2170 urban/rural interface surrounding many Willamette Valley communities. Reintroduction of
2171 fire poses significant management problems in many areas of the ecoregion. These
2172 problems include conflicts with surrounding land use, smoke management, air quality,
2173 and safety.

2174 **Recommended Approach**

2175 Use multiple tools, including mowing and controlled grazing, to maintain open-structured
2176 habitats. Ensure that tools are site-appropriate and implemented to minimize impacts to
2177 native species. **Reintroduce fire** at locations where conflicts, such as smoke and safety
2178 concerns, can be minimized. Work with communities to ensure that air quality and other
2179 local concerns are addressed. Support the formation of Prescribed Burn Associations and
2180 other community partnerships to promote and implement controlled burns.

2181 **Limiting Factor: Water**

2182 CMP Direct Threats 7.2, 11.4

2183 **Water quantity** is a limiting factor for fish and wildlife. Changing climate conditions are
2184 leading to rising temperatures and altered patterns of precipitation, which affects water
2185 availability across different times of year. In streams, seasonal low flows can limit habitat
2186 suitability and reproductive success for many fish and wildlife species. In much of the
2187 Willamette Valley, the demand for water for supporting population growth and agricultural
2188 production is putting increasing pressure on the supply of groundwater.

2189 Water quality can also limit species and habitats. Runoff from agricultural areas can
2190 contaminate waterways. Warming temperatures, combined with higher nutrient levels due
2191 to agricultural runoff, is increasing the prevalence of toxic cyanobacterial blooms,
2192 sometimes called “harmful algal blooms” or “HABs”, leading to fish and wildlife mortality
2193 and safety issues for people and pets. Stormwater runoff from urban areas and from
2194 historic industrial activities, such as the Portland Harbor Superfund site, has introduced a
2195 variety of pollutants into wetland and aquatic habitats.

2196 **Recommended Approach**

2197 Provide incentives and information about water usage and sharing during low flow
2198 conditions (e.g., late summer). Increase awareness and manage timing of applications of
2199 potential aquatic contaminants. Improve compliance with water quality standards and
2200 pesticide use labels administered by the **DEQ** and **EPA**. Work on implementing **Senate Bill**

2201 **1010** (Oregon Department of Agriculture) and **DEQ Total Maximum Daily Load** water
2202 quality plans.

2203 **Limiting Factor:** *Habitat Fragmentation*

2204 CMP Direct Threats 1, 2.1, 2.3, 3.3, 8.1

2205 Habitats for at-risk native plant and animal species are largely confined to small and often
2206 isolated fragments, such as roadsides and sloughs. Habitat fragmentation also
2207 limits **species' ability to move** across the landscape to fulfill life history needs.

2208 Opportunities for large-scale protection or restoration of native landscapes are limited.
2209 Barriers to large-scale ecosystem restoration include existing development, growth
2210 pressures, high land costs, and fragmented land ownerships. Remnant habitat patches in
2211 the otherwise highly developed Willamette Valley ecoregion are critical to protect,
2212 maintain, and restore. Even small patches of intact habitat can serve as important
2213 steppingstones for wildlife movement and migration.

2214 Roadways are also a significant contributor to habitat fragmentation in this ecoregion.
2215 Interstate 5 bisects the ecoregion, running north to south. The number of lanes, traffic
2216 speeds, and volume of freight and motorist traffic make the interstate a near complete
2217 barrier to species movement, preventing species dispersal, range expansion, or migration.
2218 The Willamette Valley ecoregion has the highest road density of any ecoregion in the state,
2219 significantly impeding wildlife connectivity in urban areas.

2220 **Recommended Approach**

2221 Broad-scale conservation strategies will need to focus on restoring and maintaining more
2222 natural ecosystem processes and functions within a landscape that is managed primarily
2223 for other values. This may include an emphasis on more “conservation-friendly”
2224 management techniques for existing land uses and restoration of some key ecosystem
2225 components, such as river-floodplain connections and **wetland** and **riparian habitats**.
2226 “Fine-filter” conservation strategies that focus on needs of individual **Species of Greatest**
2227 **Conservation Need** and **key sites** are particularly critical in this ecoregion. Manage for the
2228 full lifecycle of the species to maintain access to breeding, migration, and nonbreeding
2229 habitats. Plan for and promote habitat connectivity. Many **Priority Wildlife Connectivity**
2230 **Areas** exist throughout the Willamette Valley that can help maintain important movement
2231 corridors for wildlife. Integration of fish and wildlife crossings into transportation plans will
2232 help to reduce hazards.

2233 **Limiting Factor:** *Invasive Species*

2234 CMP Direct Threat 8.1, 8.2

2235 Invasive species disrupt native plant and animal communities and impact populations of
2236 at-risk native species. Hundreds of non-native and invasive plants have been introduced in
2237 this ecoregion for use as livestock forage, erosion control, and ornamental purposes.
2238 Plants such as reed canary grass and water primrose form dense monocultures, displacing
2239 native plants in wetland and riparian areas, choking waterways, and reducing foraging and
2240 breeding areas for wildlife. Himalayan blackberry is also widespread in this ecoregion, with
2241 significant local impacts to meadows, riparian areas, and grasslands. European hawthorn,
2242 black locust, and English ivy, among many others, are also highly invasive, outcompeting
2243 and engulfing native trees and shrubs.

2244 Invasive animals have also caused significant issues in the Willamette Valley. American
2245 bullfrogs are rapidly expanding, competing with native species for limited resources or
2246 preying on native species and/or their eggs or young. Nutria degrade water quality and
2247 destabilize stream banks, while competing with native species, such as American beaver
2248 and muskrat, for food. Virginia opossum, Eastern fox squirrel, and Eastern gray squirrels
2249 prey on native birds and compete with native species, such as Western gray squirrels, for
2250 food and nest sites. Common snapping turtles prey on native fish and wildlife species, and
2251 red-eared sliders compete directly with Northwestern pond turtles and Western painted
2252 turtles. Several mussel species, including zebra, quagga, and golden mussels, pose
2253 significant threats to aquatic systems. A variety of non-native fish have been introduced to
2254 waterways in the ecoregion, such as Gambusia, bass, and sunfish, which compete with
2255 native fish for food and prey directly on native fish, amphibians, and/or their eggs or young.

2256 Emerging threats from invasive invertebrates are also becoming a concern in the
2257 Willamette Valley. Japanese beetles can infest and defoliate native hardwood trees like
2258 oaks and maples. The non-native emerald ash borer defoliates tree species characteristic
2259 of riparian habitats, such as Oregon ash, putting riparian areas, and in-stream habitats that
2260 depend on shading from bankside trees, at risk. Mediterranean oak borer targets native oak
2261 species, including Oregon white oak and California black oak, which have already
2262 experienced significant declines in the ecoregion due to habitat loss and development.

2263 **Recommended Approach**

2264 Emphasize prevention, risk assessment, early detection, and quick control to prevent
2265 new **invasive species** from becoming fully established. Use multiple site-appropriate
2266 tools (e.g., mechanical, chemical, biological) to control the most damaging non-native
2267 species. Prioritize efforts that focus on key invasive species in high priority areas,
2268 particularly where **Key Habitats** and **Species of Greatest Conservation Need** occur.
2269 Work with the **Oregon Invasive Species Council** and other partners to educate people
2270 about invasive species issues and to prevent introductions of potentially high-impact
2271 species, such as the zebra mussel. Provide technical and financial assistance to

2272 landowners interested in controlling invasive species on their properties. Promote the use
2273 of native species for restoration and revegetation.

2274 **Limiting Factor:** *Altered Floodplain*

2275 CMP Direct Threat 7.2

2276 The floodplain dynamics of Willamette Valley rivers have been significantly altered.
2277 Historically, multiple braided channels dispersed floodwaters, deposited fertile soil,
2278 moderated water flow and temperatures, and provided a variety of slow-water habitats,
2279 such as sloughs and oxbow lakes. Since Euro-American settlement, however, many of the
2280 valley's major rivers, including the Willamette, Santiam, and McKenzie Rivers, have largely
2281 been confined to a single channel and disconnected from their floodplains. Addition of
2282 dikes and levees, bank hardening, and channelization to facilitate agricultural irrigation
2283 have all had significant impacts to riparian habitats in the ecoregion. Hydroelectric
2284 projects located on the major rivers and their tributaries, while reducing downstream flood
2285 risk, have altered hydrology significantly, restricting fish passage and acting as barriers to
2286 movement of aquatic wildlife.

2287 **Recommended Approach**

2288 Cooperative efforts are needed to restore floodplain function and critical off-channel
2289 habitats. Using green infrastructure and careful planning for development outside of
2290 floodplains can help **maintain floodplain function**. Removing infrastructure such as
2291 revetments that channelize rivers can help restore natural stream flows.

2292 **Limiting Factor:** *Wildlife Hazards*

2293 CMP Direct Threats 1.1, 1.2

2294 **Urban landscapes** can present a variety of hazards for wildlife. High densities of buildings
2295 increase risk of bird collisions with windows. Collisions with vehicles and powerlines and
2296 entanglements in fencing are also significant hazards for wildlife in urban areas. Outdoor
2297 cats, even well-fed, indoor/outdoor cats, prey on a variety of wildlife species, with
2298 significant local impacts to populations of birds, small mammals, and reptiles. Similarly,
2299 off-leash dogs in natural areas can disturb, injure, or kill wildlife. Noise and light pollution,
2300 as well as other disturbances from human presence and activity, can alter wildlife
2301 behavior. Food provided to wildlife, either intentionally with devices like bird feeders or
2302 unintentionally by leaving garbage unsecured or by leaving pet food outdoors, can increase
2303 disease transfer and can cause human-wildlife conflicts. Illegal encampments can
2304 degrade or destroy sensitive fish and wildlife habitats, particularly riparian areas, due to
2305 loss of vegetation, felling of snags for use as firewood, and unmanaged human refuse and

2306 waste. Additional hazards include exposure to pesticides, rodenticides, and other
2307 contaminants, harassment, and poaching. These hazards can significantly impact wildlife
2308 and undermine habitat conservation efforts.

2309 **Recommended Approach**

2310 Support and promote innovative campaigns and programs to reduce wildlife hazards. Work
2311 with municipalities to develop policies, such as wildlife-friendly building guidelines,
2312 wildlife-friendly lighting strategies, feeding ordinances, and integration of wildlife crossings
2313 into transportation plans to reduce hazards. Support research into better understanding
2314 of **urban wildlife hazards** and the management strategies to reduce those hazards.
2315 Communities can work with local park districts and conservation organizations to support
2316 habitat enhancement projects and reduce the need for herbicide use in parks.
2317 Communities, local governments, and non-profit organizations can promote **bird-friendly**
2318 **building design** and outreach efforts about the **impacts of cats on wildlife**. Support
2319 policies that address housing access to alleviate the pressure for illegal camping on public
2320 lands.

2321 **REFERENCES**

2322 Raymond, C. L. and E. J. Fusco (Eds.). 2024. The State of Climate Adaptation Science for
2323 Ecosystems in the Northwest U.S. Prepared by the Climate Impacts Group for the
2324 Northwest Climate Adaptation Science Center.
2325 <https://depts.washington.edu/nwclimateadaptation/socs/>

2326

2327 NEARSHORE

2328 DESCRIPTION

2329 Oregon's Nearshore ecoregion offers opportunities for boating, surfing, wildlife viewing,
2330 fishing, crabbing, clamming, and recreational pursuits. It supports commercial fish
2331 harvests and shipping that includes export of many products and commodities like wood
2332 produced in Oregon as well as imports of products from around the world. The Nearshore
2333 provides ecosystem services that benefit all Oregonians.

2334 The nearshore environment includes a variety of habitats ranging from submerged high-
2335 relief rocky reefs to broad expanses of intertidal mudflats in estuaries. These habitats are
2336 described in more detail in the **Nearshore** and **Estuaries** Key Habitats. A vast array of fish,
2337 invertebrates, marine mammals, birds, algae, plants, and micro-organisms make their
2338 homes here. These habitats and species are integral parts of Oregon's complex nearshore
2339 ecosystem, and are interconnected through food webs, nutrient cycling, habitat usage, and
2340 ocean currents. They are also influenced by a multitude of other biological, physical,
2341 chemical, geological, and human use factors.

2342 The Nearshore ecoregion encompasses the area from the outer boundary of Oregon's
2343 Territorial Sea at 3 nautical miles to the supratidal zone affected by wave spray and
2344 overwash at extreme high tides on the ocean shoreline, and up into the portions of
2345 estuaries where species depend on the saltwater that comes in from the ocean. The
2346 Nearshore ecoregion is bordered by the **Coast Range Ecoregion** on the ocean shores and
2347 intersects it in Oregon's estuaries where the influence of the terrestrial watersheds are
2348 strongest (Figure 1). Humans are an important part of the ecology of the Nearshore
2349 ecoregion and coastal communities are an integral part of that ecology (see **Appendix –**
2350 **Coastal Communities**).

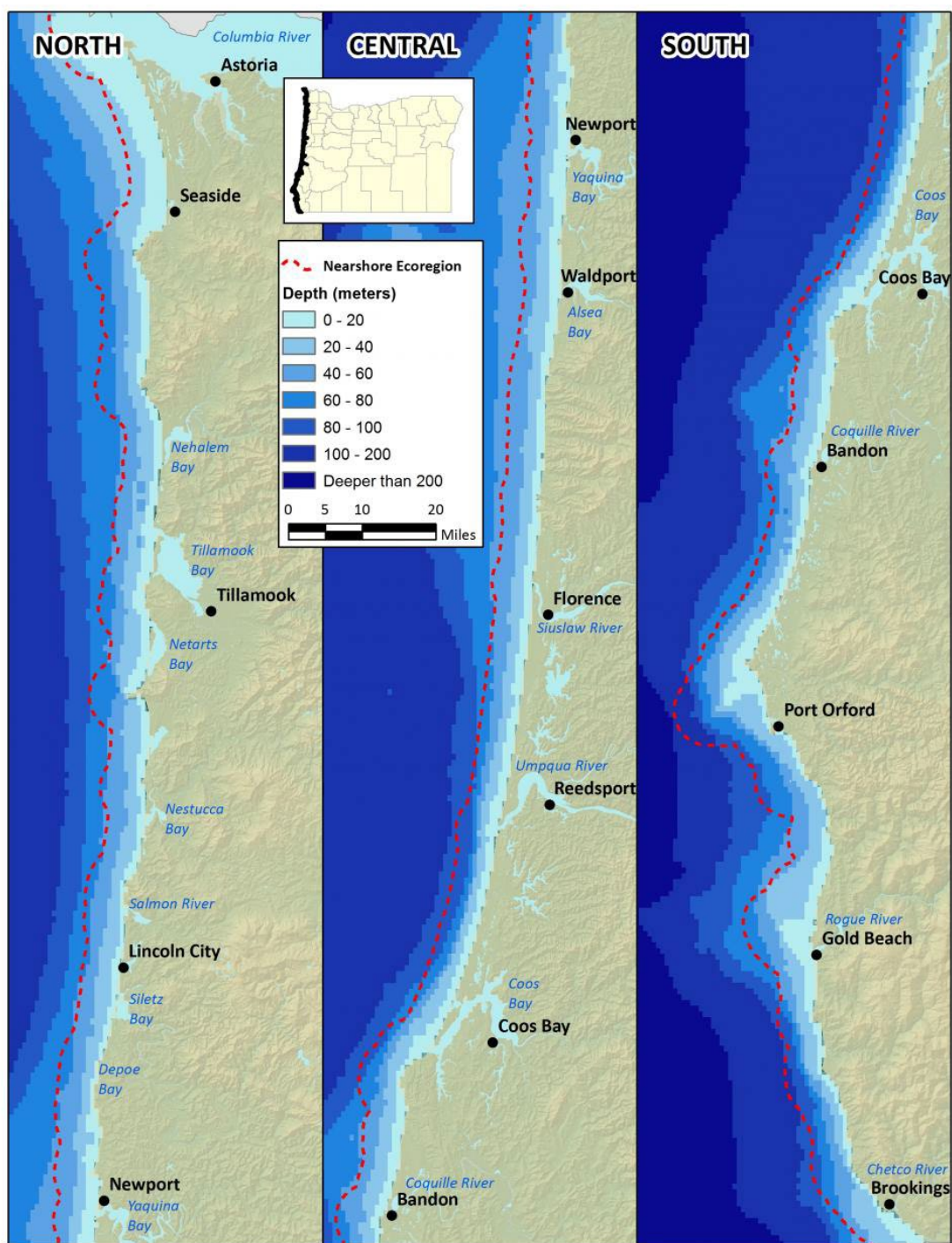


Figure 1. Oregon's Nearshore is defined as the area from the outer boundary of the territorial sea to the shoreline affected by extreme high tides and up into the estuaries where species depend on saltwater from the ocean.

2355 CHARACTERISTICS

2356 The distinct suite of oceanographic features and physical forcing agents that help define
2357 the Nearshore ecoregion include the northern portion of the California Current System and
2358 the annual seasonal upwelling/downwelling cycle that are responsible for its high
2359 productivity (Figures 2 and 3). The eastern boundary current called the California Current
2360 System is a part of the North Pacific gyre that moves cold water from the North Pacific
2361 toward the equator. It has a southward flowing current over Oregon's shelf and slope and a
2362 northward flowing undercurrent over the slope in spring and summer. In winter, the current
2363 over the shelf consists primarily of the northward flowing Davidson current (Figure 2).

2364 During spring and summer, winds blowing from a northerly direction drive an upwelling
2365 system that brings cold, nutrient-rich, and oxygen-poor waters from depth up onto the
2366 continental shelf (Figure 3a). The upwelling process is highly variable on many time scales
2367 and is generally stronger and more persistent on the south Oregon coast and more
2368 intermittent on the central and northern Oregon coast. In addition to nutrients derived from
2369 upwelling, river discharge from the Columbia River provides a major source of nutrients to
2370 the Oregon continental shelf, especially along the north coast. The upwelling and river-
2371 plume nutrients fuel high phytoplankton productivity which drives an extremely productive
2372 marine ecosystem off Oregon. In the fall and winter months winds blowing from a
2373 southerly direction cause seasonal downwelling that bring well oxygenated water from the
2374 surface downward in the water column (Figure 3b). Surface water temperatures provide a
2375 good indication of these seasonal wind forcing differences that bring the cold, nutrient-rich
2376 waters to the surface in the summer (Figure 4a) and the warmer waters from offshore to the
2377 coast in the winter Figure 4b). Superimposed on these large-scale processes are smaller
2378 scale eddies, gyres, fronts, and other oceanographic phenomena, which together serve to
2379 create a complex spatially and temporally dynamic ecosystem.

2380 In 2012 the Coastal and Marine Ecological Classification Standard (CMECS) was adopted
2381 in the United States (Federal Geographic Data Committee 2012) as a means to provide a
2382 common framework for describing habitat, using a simple, standardized classification
2383 scheme and common terminology. The goal of using CMECS is to both enhance scientific
2384 understanding and to advance ecosystem-based and place-based resource management
2385 through better communication. Components of the CMECS classification framework have
2386 been incorporated into the SWAP – in particular, the CMECS approach to evaluating and
2387 describing **Nearshore Key Habitats**. For more information on the CMECS Framework see
2388 **Appendix - Marine Habitat Classification**.

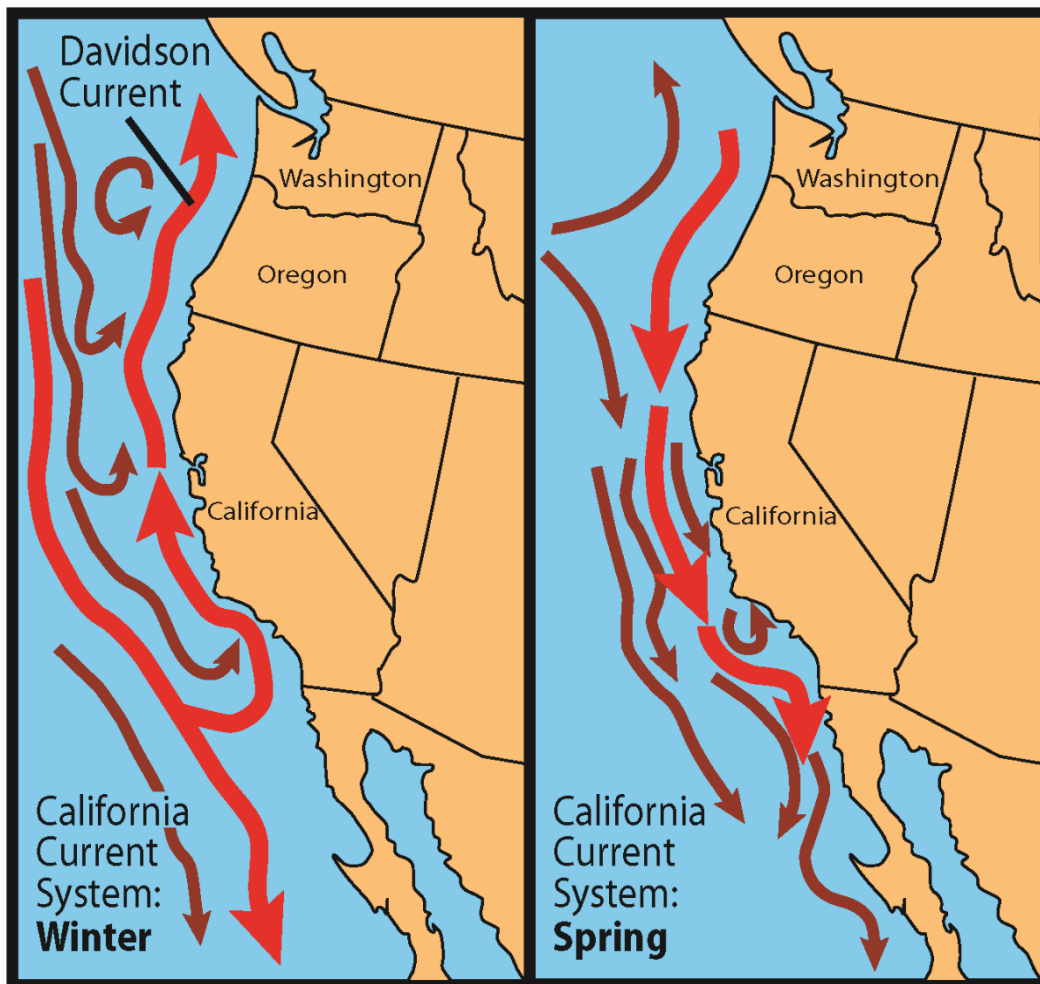


Figure 2. The California Current System typically varies seasonally. (Source P. T. Strub).

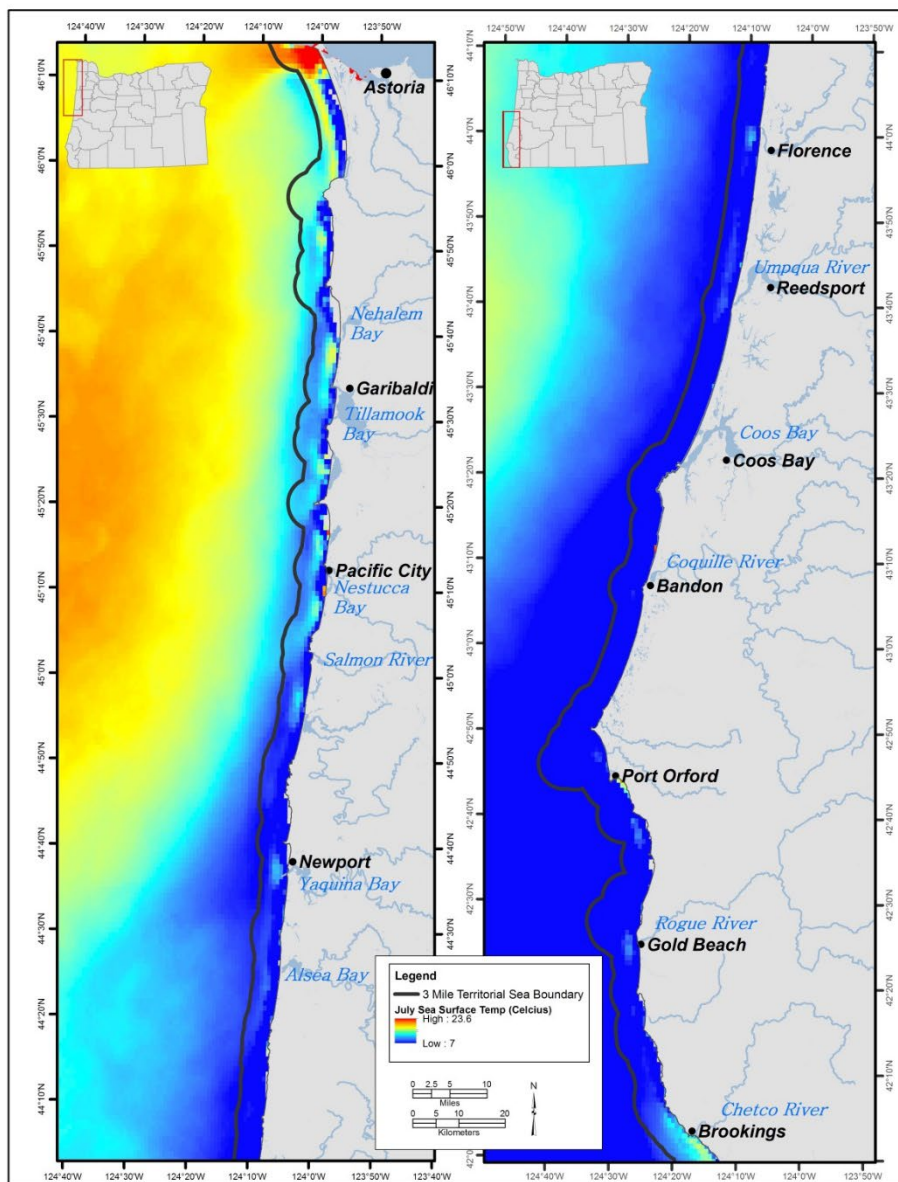
The diagram illustrates the relationship between wind, surface currents, and upwelling. At the top, a red arrow labeled "Northerly Winds" points towards the right, blowing over the ocean surface. Below the wind, a large blue arrow labeled "Surface Water" points to the right, indicating the direction of the surface current. On the right side, a green coastline with hills is shown. A blue arrow labeled "Upwelling" points upwards from the bottom of the ocean towards the surface, indicating the movement of deep water. In the bottom left, a large grey whale is shown swimming. In the center, a group of smaller fish are swimming. Two circular insets on the right show "PHYTOPLANKTON" (green, plant-like organisms) and "ZOOPLANKTON" (various small animals like copepods and krill). The ocean floor is depicted as a yellowish-brown seabed.

A 3D diagram illustrating ocean circulation. A red arrow labeled "Southerly Winds" points towards the surface. A large blue arrow labeled "Surface Water" points from the left towards the right. A large blue arrow labeled "Downwelling" points from the surface towards the bottom. The diagram shows a cross-section of the ocean with a green seabed and a yellow bottom layer. A large blue arrow labeled "Surface Water" points from the left towards the right. A large blue arrow labeled "Downwelling" points from the surface towards the bottom. The diagram shows a cross-section of the ocean with a green seabed and a yellow bottom layer. On the right, there are two circular insets: one labeled "PHYTOPLANKTON" showing various plant-like organisms, and another labeled "ZOOPLANKTON" showing various animal-like organisms.



asonal cycle

2394



2395

2396 **Figure 4a.** Average sea surface temperature for July (1997 - 2003). Note colder water
 2397 nearshore. (Source: Juan-Jorda Masters Thesis/College of Oceanic and Atmospheric
 2398 Sciences/ Oregon State University/2006).

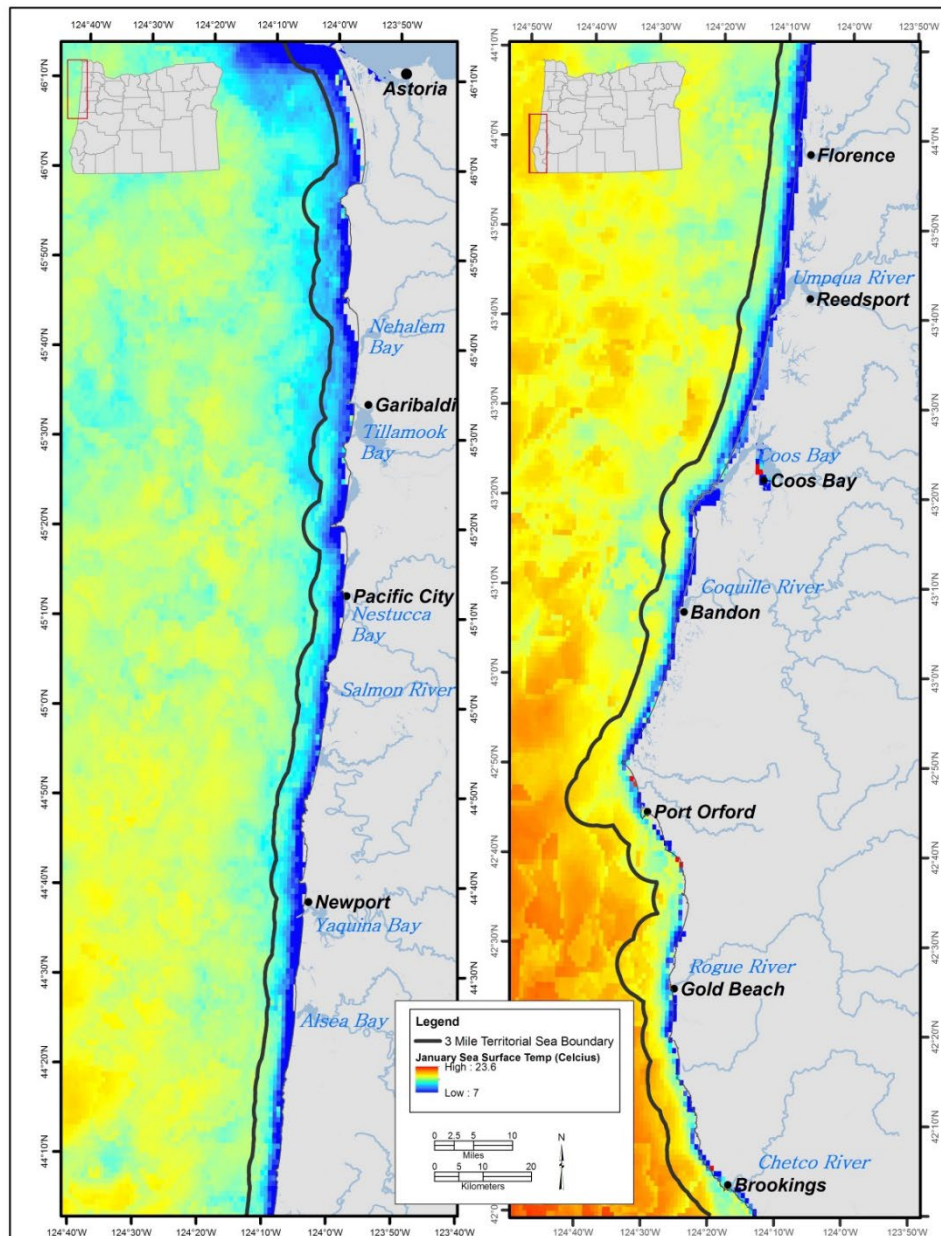


Figure 4b. Average sea surface temperature for January (1997 - 2003). Note warmer water nearshore. Source: Juan-Jorda Masters Thesis/College of Oceanic and Atmospheric Sciences/ Oregon State University/2006).

2402 **Important Industries**

2403 Commercial fishing, fish processing, tourism and recreation (including recreational fishing,
2404 shellfish harvest, and wildlife viewing), mariculture, and shipping.

2405 **Important Nature-based Recreational Areas**

2406 All open water, surf zone, subtidal rocky reefs, sandy beaches, rocky intertidal areas, and
2407 estuaries. Ecola Point Marine Conservation Area, Chapman Point Marine Garden, Haystack
2408 Rock Marine Gardens Cape Falcon Marine Reserve and West Marine Protected Area, Cape
2409 lookout Marine Conservation Area, Tillamook Bay, Netarts Bay, Cape Kiwanda Marine
2410 Garden, Fogarty Creek Marine Conservation Area, Boiler Bay Marine Research Area,
2411 Cascade Head Marine Reserve and its North, South and West Marine Protected Areas,
2412 Pirate Cove Marine Research Area, Whale Cove Marine Conservation Area, Otter Rock
2413 Marine Garden, Otter Rock Marine Reserve, Yaquina Head Marine Garden, Yaquina Bay,
2414 Yachats Marine Garden, Cape Perpetua Marine Garden, Neptune Marine Research Area,
2415 Cape Perpetua Marine Reserve and Marine Protected Areas, Coos Bay, Gregory Point
2416 Marine Research Area, Cape Arago Marine Research Area, Cape Blanco Marine Research
2417 Area, Redfish Rocks Marine Reserve and Protected Areas, Coquille Point Marine Garden,
2418 Harris Beach Marine Garden, Brookings Marine Research Area

2419 **Elevation**

2420 From approximately 10 feet above to 636 feet below sea level

2421 **Important Rivers, Estuaries and Bays**

2422 Alsea Bay, Chetco River, Columbia River, Coos Bay, Coquille River, Depoe Bay, Elks River,
2423 Necanicum River, Nehalem Bay, Nestucca Bay, Netarts Bay, Pistol River, Rogue River,
2424 Salmon River, Sand Lake, Siletz Bay, Siuslaw River, Sixes River, Tillamook Bay, Umpqua
2425 River, Winchuck River, Yaquina Bay

2426 **CONSERVATION ISSUES AND PRIORITIES**

2427 Oregon's ecosystem-based management approach recognizes the role human populations
2428 play as a part of ecological systems. As human activities in and around the Nearshore
2429 ecoregion increase, human impacts on the fish, wildlife, and their habitats may also
2430 increase. Of Oregon's thirty-three coastal cities, twelve are active ports supporting vessel
2431 traffic to and from ocean waters, and all are an integral part of coastal ecology. Coastal

2432 development, tourism, recreation, sport and commercial fishing, dredging, rainwater
2433 runoff, wastewater disposal, aquaculture, and energy development are just a few
2434 nearshore uses that benefit human communities. However, along with the benefits, there
2435 are potentially adverse effects on nearshore resources.

2436 To balance human use benefits with conservation concerns, conservation actions are
2437 recommended. These actions address nearshore issues that need immediate or timely
2438 attention, are feasible to implement given appropriate funding, and have received some
2439 level of public support. There are three general categories of action: 1) education and
2440 outreach, 2) research and monitoring, and 3) management and policy. The conservation of
2441 marine resources is the responsibility of all users, to ensure the long-term productivity of
2442 marine ecosystems. Education and Outreach provide information about the Nearshore to
2443 the public which helps shape both Research and Monitoring efforts and Policy and
2444 Management of the species habitats in Oregon's Nearshore ecoregion.

2445 Key Conservation Issues (KCIs) of particular concern in the Nearshore ecoregion include
2446 **Climate Change, Pollution, Land Use Changes, and Invasive Species.**

2447 **Climate Change Impacts**

2448 The earth's oceans have absorbed roughly 90% of the heat caused by human emitted
2449 greenhouse gases that are warming our planet. The oceans have also actually slowed the
2450 warming of the planet by absorbing roughly 30% of the carbon dioxide, but this has
2451 dramatically changed ocean chemistry making the ocean more acidic. The land is also
2452 heating up. But the air temperatures over the land adjacent to the ocean will increase faster
2453 than ocean temperatures so the difference between temperatures of the nearshore ocean
2454 and the adjacent land mass is projected to increase causing both an increase in the
2455 northerly winds that drive upwelling and for those northerly winds to occur for more of the
2456 annual seasonal cycle. These changes have impacted and will continue to impact Oregon's
2457 nearshore waters in multiple ways. Impacts include increasing ocean acidification,
2458 increasing hypoxia, increasing stratification of ocean waters, increasing frequency and
2459 intensity of marine heat waves, changes to the seasonal cycle of upwelling and
2460 downwelling, increases in the size of waves and the intensity of storms, changes in coastal
2461 erosion and accretion, changes in freshwater input from rainfall and subsequent runoff,
2462 and increases in ocean temperatures. These impacts affect the species that live in
2463 Oregon's nearshore waters and their habitats.

2464 LIMITING FACTORS AND RECOMMENDED APPROACHES

2465 **Limiting Factor: Public Awareness**

2466 Numerous marine species and habitats occur below the water's surface and go unseen by
2467 most members of the public. Many people will never have to opportunity to go out on the
2468 ocean or even visit the coastline. Without firsthand experience, the effects that humans
2469 have on the Nearshore ecosystem through Pollution, Climate Changes, Invasive Species
2470 and other Key Conservation Issues facing Nearshore species and their Nearshore Habitats
2471 are poorly understood. Education and outreach efforts are needed to increase public
2472 awareness about nearshore marine species and habitats, as well as the issues affecting
2473 them.

2474 **Recommended Approach**

2475 Improve education and outreach efforts to disseminate information on species
2476 identification and distribution, management regulations, and release techniques designed
2477 to reduce discard mortality. Develop curriculum materials and provide information to
2478 schools for use in classrooms about the effects humans are having on the Nearshore
2479 ecoregion, the Nearshore species that live there, and conservation actions. Continue to
2480 improve the appearance, visibility, and effectiveness of the ODFW Marine Resources
2481 Program website. Employ emerging technologies, blogs, and social media sites. Use local
2482 newspapers and literature to share research and conservation actions with adults and
2483 children. Display conservation and educational materials at hotels, charter offices, angling
2484 shops, real estate offices, malls, parks, marinas, boat ramps, beach access points, and
2485 other public areas. Encourage development of local and port groups to facilitate
2486 information and knowledge exchange between agencies and local constituents. Design
2487 and convene workshops tailored to educate the public on specific topics (e.g., fish, algae,
2488 shellfish, non-native species identification workshops).

2489 **Limiting Factor: Habitat Alteration**

2490 CMP Direct Threats 1, 2.4, 3.3, 6.1, 6.2, 7.3, 8.1, 8.4, 9, 10.2, 11

2491 Disturbance to, or loss of, habitat important to nearshore species and **Nearshore Habitats**
2492 can occur from both direct and indirect sources. Disturbances to vulnerable intertidal
2493 habitats are often subtle and can be a consequence of human activities that cause light or
2494 noise pollution or result in trampling of intertidal habitats, animals, or plants. Intertidal and
2495 submerged habitats are impacted by changes to sediment transport due to altered

2496 hydrology, coastal development, shoreline armoring, beach grooming, global climate
2497 change, and many other factors. Non-native species introductions may alter physical
2498 properties and habitat-forming biological communities (e.g., crowding out native
2499 organisms that function as substrate for other organisms). Certain bottom fishing methods
2500 may reduce structural diversity of the sea floor and change benthic communities.
2501 Development of renewable energy facilities such as wind and wave energy and their
2502 anchors and cables may alter habitats in a variety of ways such as altering winds and
2503 currents. Dredging, dredge and fill activities, shellfish mariculture, building dikes and
2504 levees, and installation and removal of tide gates are all examples of habitat alteration.
2505 Habitat in **Estuaries** has been transformed and altered by the introduction of the non-
2506 native species of Japanese eelgrass.

2507 **Recommended Approach**

2508 Continue to monitor species and habitats to document impacts that may be subtle or may
2509 accumulate over time, and to determine areas where disturbance is causing, or could
2510 cause, negative impacts to species or habitat. Collaborate with academic and
2511 management entities in the study of non-native species, survey intertidal and subtidal
2512 habitats for presence, set a baseline of habitat use, and monitor communities for potential
2513 spread. Investigate alternative methods (e.g., fishing techniques, shoreline erosion control,
2514 development practices) that reduce or remedy negative impacts on habitats. Inform the
2515 public about the use of non-disturbing methods appropriate for viewing marine wildlife.
2516 Provide new or improved interpretive signage, media inserts, feature articles and booklets
2517 about intertidal habitats, fisheries information, and other nearshore ocean resources.
2518 Examine alternative methods for cultivation of shellfish. Work with cities, counties, tribes,
2519 industries and management agencies in the Coast Range ecoregion on developmental
2520 planning efforts to ensure they consider their effects on Nearshore Habitats such as
2521 rainwater runoff, sedimentation, coastal squeeze, etc.

2522 **Limiting Factor: Water Quality**

2523 CMP Direct Threats 1, 9, 11.2, 11.3, 11.4

2524 Water quality degradation caused by human activities or natural causes may impact
2525 nearshore species and habitats. Water quality within the nearshore ocean is affected by
2526 coastal and inland development, either from increased runoff of contaminated water or
2527 increased water temperature resulting from altered hydrology or depth (e.g., dredging,
2528 filling). Boating activity in nearshore waters or adjacent estuaries may lead to
2529 accumulation of oil in surface waters from poorly maintained or failing equipment.

2530 Pollution due to other toxic chemicals from both point sources and non-point sources can
2531 degrade water quality. Contamination by fecal indicator bacteria degrades water quality.
2532 Water quality may be further degraded if conditions support significant blooms of harmful
2533 algae, which can lead to highly concentrated marine biotoxins. Ocean acidification and
2534 hypoxia both degrade water quality in the nearshore. Runoff from pavement, agricultural
2535 lands, and forests can all degrade water quality.

2536 **Recommended Approach**

2537 Coordinate with the multiple state and federal agencies involved in water quality issues to
2538 update and improve signage at marinas and public beaches to inform boaters and beach
2539 users about water quality issues and methods for reporting problems. Develop incentive
2540 programs to encourage boaters to use environmentally friendly gear or equipment. Prevent
2541 contamination and enforce laws regarding pollution and water quality issues. Monitor for
2542 harmful algal blooms to diagnose potential indications of domoic acid or paralytic shellfish
2543 poisoning. Work with the Department of Environment Quality (DEQ) in their monitoring
2544 efforts to continue and expand their assessments of water quality in the marine
2545 environment and their annual integrated reports which now include ocean acidification
2546 and hypoxia. Work with cities, counties, Oregon Department of Transportation (ODOT), and
2547 coastal industries to address rainwater runoff and sedimentation. Additional activities are
2548 needed to map and monitor the spatial distribution and extent of native eelgrass in both the
2549 intertidal and subtidal zones of Oregon estuaries.

2550 **Limiting Factor: Harvesting Aquatic Resources**

2551 CMP Direct Threats 5.4, 9.4

2552 Accurate accounting of abundance and harvest impacts is an important component of
2553 sustainable resource management. However, abundance estimates, and complete life
2554 history information needed to model abundance remains unknown for many nearshore
2555 species. Yet many nearshore species are targeted by fisheries. Populations of nearshore
2556 species may be impacted and limited by commercial or recreational overharvest at local or
2557 at broader scales, as well as through bycatch and discard of non-targeted species.
2558 Entanglement of whales and sea turtles is one form of bycatch, defined as incidentally
2559 affected species that are not retained, that people often do not think about. These
2560 interactions can cause death as well as non-lethal effects that can limit populations of
2561 these species.

2562 **Recommended Approach**

2563 Provide opportunities for protecting and enhancing nearshore fisheries stocks. Develop
2564 and implement fish release methods designed to minimize discard mortality. Increase the
2565 ODFW representation at sportsmen shows, festivals, and other venues, encourage fishers
2566 to avoid vulnerable species, and make information about proper discard techniques widely
2567 available. Develop monitoring, conservation, resource analyses, and harvest management
2568 plans for commercially and recreationally harvested shellfish. Evaluate immediate and
2569 long-term conservation and harvest management needs for Oregon's recreational and
2570 commercial nearshore fisheries. Develop stock assessment and/or stock status indicator
2571 strategies for priority nearshore groundfish and shellfish species, designed to
2572 accommodate the unique circumstances and habitats of Nearshore species with the
2573 greatest management need. Develop fishery-independent survey methodologies and
2574 gather baseline information for all key nearshore species. Review the SGCN list to identify
2575 priority species in need of conservation plans under Oregon's Native Fish Conservation
2576 Policy. Collaborate with sport and commercial fishermen, university researchers, and
2577 others to gather imperative information for exploited nearshore stocks. Sponsor
2578 socioeconomic analysis of coastal communities to determine the relationship between
2579 stock status and direct (e.g., fishing) or indirect (e.g., tourism) impacts from various
2580 industries.

2581 **Limiting Factor: Monitoring and Research Needs**

2582 Monitoring species and habitat changes will help evaluate resource status and trends over
2583 the long-term. Although some monitoring is done at present, more is needed to examine
2584 changes and trends within Oregon's nearshore ecosystem. More data are needed to
2585 understand local and regional ecological changes due to predator-prey population
2586 dynamics, the introduction of non-native species, algae blooms, climate change, ocean
2587 acidification and hypoxia effects and other changes. Many aspects of Oregon's **Nearshore**
2588 **Habitats** and nearshore species are poorly understood. For many marine species,
2589 substantial data gaps exist with regards to population abundance and trends, population
2590 structure, life history parameters, responses to environmental changes, and species-
2591 habitat associations. Similarly, while significant strides have been made toward describing
2592 and mapping **Nearshore Habitats**, gaps remain for parts of the nearshore area. In addition,
2593 researchers are still accumulating data to describe the physical properties and biological
2594 component of certain habitat types, and to provide long-term information on the physical
2595 response of nearshore systems to climate change. More information is needed to assess
2596 and understand the complexity of the nearshore ecosystem and the effects of human
2597 interactions.

2598 **Recommended Approach**

2599 Encourage and assist in monitoring the population dynamics and habitat usage of rocky
2600 reef-associated species. Research the movement, behavior, and predator-prey
2601 relationships of adult and juvenile stages of nearshore species. Identify and evaluate
2602 conflicts between marine mammals and fisheries. Inventory and monitor non-native
2603 species. Public users should inspect boats, clothing, and equipment for non-native
2604 species before and after use of natural areas or waterbodies and should report sightings to
2605 support ongoing monitoring of species distribution. Assess and gather baseline
2606 information on levels of human use and disturbances to intertidal habitats, animals, and
2607 plants. Review coastal development plans and regulations to identify opportunities to
2608 address areas with consequent negative impacts to nearshore resources. Improve and
2609 expand the capabilities of research and monitoring programs to meet the requirements of
2610 the Native Fish Conservation Policy and other nearshore resource management programs.
2611 Investigate the effects of environmental changes on nearshore species and **Nearshore**
2612 **Habitats**. Continue to study, evaluate, and monitor harmful algal blooms to provide an
2613 early warning system for blooms. Continue to develop non-lethal habitat surveys of
2614 nearshore species and collaborate with interested stakeholders to increase survey
2615 coverage.

2616 NEARSHORE RECOMMENDATIONS

2617 The following set of recommendations, intended to facilitate voluntary, collaborative
2618 actions to improve understanding and stewardship of Oregon's nearshore resources, is the
2619 core of the information provided for the Nearshore ecoregion. These recommendations
2620 reflect the input received from the ODFW's staff, outside experts who served as technical
2621 advisors and reviewers, and members of the public. Twelve recommendations are outlined
2622 below, categorized into three main themes: Education and Outreach, Research and
2623 Monitoring, and Management and Policy. These are all important and not listed in a
2624 prioritized manner. Each recommendation was chosen because it addresses priority
2625 nearshore issues in need of immediate or timely attention, is feasible, has received public
2626 support, and is beyond the capability of any single institution to achieve. The
2627 recommendations rely on partners to differing degrees and are intended to help guide
2628 collaboration rather than act as an action plan for the ODFW alone.

2629 The description of each recommendation includes:

2630 **Recommendation:** A brief statement of the recommended action.

2631 **Rationale:** Conservation and/or management need(s) addressed by this recommended
2632 action, and strategies to achieve results. Recommendations are based on

2633 the known and/or potential factors affecting nearshore resources and
2634 resource sensitivity, as identified by public input, scientific information,
2635 technical advisors, and the ODFW staff.

2636 **Potential Partners:** Who should—or could—be involved? A general list (not necessarily
2637 comprehensive) of potential partners for collaboration on
2638 implementation.

2639 **Category: Education and Outreach**

2640 A well-informed public helps drive policy and management decisions that support a healthy
2641 ecosystem and the many benefits it offers. The following recommendations are designed to
2642 enhance public awareness of nearshore species and habitats, and foster public
2643 engagement in nearshore conservation issues.

2644 *(1) General Public, Constituent and Advisory Group Engagement*

2645 Recommendation: Develop and expand creative avenues to engage a diverse array of
2646 constituents, including the broader general public, on nearshore resource
2647 issues. Explore technologies that support alternative methods of
2648 communication and participation, in addition to continuing to support
2649 traditional paths such as issue-specific advisory groups.

2650 Rationale: Input from informed and engaged partners is essential to successfully
2651 developing and implementing research, management/policy, and
2652 outreach on all natural resource issues. The exchange of information
2653 between ODFW and constituents improves understanding and support
2654 on both sides, and aligns management with public priorities. Advisory
2655 committees can provide focused, in-depth engagement in selected
2656 aspects of nearshore management and research. In addition, there is a
2657 growing need to augment traditional methods of public input to reach an
2658 increasingly dispersed and diverse population of constituents interested
2659 in nearshore issues. ODFW has begun using new options for engaging the
2660 public and exchanging information, e.g., opportunities for online
2661 participation in public meetings and online surveys, and these have
2662 shown promise as effective tools for enhancing traditional methods.

2663 Potential Partners: ODFW, existing advisory bodies, the general public, sport and
2664 commercial fishing interests, non-governmental organizations, tribes,

2665 Oregon Sea Grant, and various other communities of interested parties
2666 with a broad and diverse representation.

2667 *(2) Nearshore Resources Outreach Information, Access and Awareness*

2668 Recommendation: Broaden outreach materials and information available electronically,
2669 to deepen public appreciation of Oregon's nearshore environment.
2670 Increase the quantity, quality, and timeliness of information available on
2671 ODFW's website on nearshore fisheries, regulations, conservation and
2672 ecosystem management.

2673 Rationale: Oregon's nearshore is one of the richest ecological systems in the world,
2674 home to thousands of species in a multitude of habitat types. While there
2675 is much to learn about this incredible ecoregion, there is a wealth of
2676 existing information that could be used more effectively to fuel public
2677 interest in natural resource issues, and stewardship of those resources.
2678 Populating educational exhibits, websites, social media, and other media
2679 outlets with information about Oregon's nearshore will deepen
2680 Oregonian's connection to the outdoors and to wildlife. Photographs,
2681 videos, and stories, provided through a variety of sources and outlets will
2682 engage the public in the short-term, and build partnership and
2683 stewardship in the long-term.

2684 Potential Partners: State and federal natural resource agencies, universities, Oregon Sea
2685 Grant, public aquaria and museums, non-governmental organizations,
2686 tribes, news outlets, and others.

2687 *(3) Communications Partnerships*

2688 Recommendation: Develop and expand existing partnerships for communication,
2689 education, and outreach on nearshore topics and issues. Work with
2690 partners to develop new mechanisms for information development and
2691 dissemination and through partnerships reach new audiences.

2692 Rationale: Conservation and management actions are better trusted and publicly
2693 supported when they are developed with stakeholders who understand
2694 nearshore issues. Partnering with groups that have a rich history of
2695 developing science-based education and outreach programs effectively
2696 and efficiently amplifies the quality and scope of nearshore resources

2697 communication, and builds relationships and capacity outside of ODFW
2698 on nearshore resource issues. Through these partnerships, Oregon's
2699 understanding of nearshore issues – and clarity on what members of the
2700 public can do to contribute to a healthy nearshore ecosystem – would
2701 facilitate a renewed spirit of engagement and commitment to nearshore
2702 resource stewardship.

2703 Potential Partners: State and federal natural resource agencies, universities, Oregon Sea
2704 Grant, public aquaria and museums, non-governmental organizations,
2705 tribes, and others.

2706 **Category: Research and Monitoring**

2707 Expanded research and monitoring activities are required to generate data and information
2708 to meet the needs of resource managers. This is especially true in the nearshore area
2709 where human activity is intense and information on many species and their habitats is
2710 sparse. The **Nearshore Research and Monitoring** Appendix lists some key data elements
2711 and examples of projects that would help support resource management. The following
2712 recommendations address research and monitoring program priorities for collaborative,
2713 multi-institutional issues. The broad objectives in this category are far beyond the
2714 capability of any one institution to fully achieve and therefore require partnerships to
2715 realize meaningful results.

2716 *(4) Ecosystem Response to Climate Change*

2717 Recommendation: Develop and implement research and monitoring efforts to
2718 understand, track, and work toward predicting effects of climate change
2719 and increased carbon dioxide on Oregon's nearshore species and
2720 ecosystems. Focus research on species and ecosystems most at risk,
2721 and foster collaboration between scientists and managers to optimize
2722 research outcomes for use in management and conservation.

2723 Rationale: Oregon's ocean is already experiencing effects of climate change and
2724 increased carbon dioxide, including ocean acidification, hypoxia, other
2725 changes in water chemistry, warming ocean temperature, and changes in
2726 upwelling and other characteristics of the nearshore ocean and
2727 estuaries. These changes will continue to grow and intensify in the future.
2728 Oregon's upwelling ecosystem is experiencing many of these changes
2729 sooner and in greater magnitude than other parts of the nation,

2730 increasing the urgency for collecting the needed information and
2731 formulating the necessary management response. This is a global
2732 problem that requires rigorous scientific information to solve, and
2733 partnership between scientists inside and outside of agencies to both
2734 understand the phenomena and try to mitigate its effects. Desired
2735 outcomes are to increase ecosystem and community resilience and
2736 sustainability of Oregon's nearshore resource.

2737 Potential Partners: State and federal natural resource agencies, universities, local
2738 governments, non-governmental organizations, shellfish and fishing
2739 interests, tribes and others.

2740 *(5) Ecosystem Characterization – Species and Habitats*

2741 Recommendation: Continue and expand research and monitoring efforts on nearshore
2742 species and habitats. Gather scientific information on the abundance
2743 and distribution of species and habitats, the interactions among species
2744 and between species and their physical environment, and changes in
2745 those resources and interactions over time. The SGCN species
2746 information and **Nearshore Research and Monitoring** needs provide
2747 guidance for setting research and monitoring priorities.

2748 Rationale: Management of nearshore resources is most effective when based on a
2749 sound scientific understanding of the nearshore ecosystem. While there
2750 has been a great deal of research on Oregon's nearshore ocean and
2751 natural resources, there remain significant data gaps that, once filled, will
2752 reduce uncertainty in resource management. ODFW gathers information
2753 on nearshore fish, invertebrates, marine mammals and habitats. In
2754 addition, ODFW monitors changes in marine reserves and nearby
2755 comparison areas, providing a unique opportunity to examine changes
2756 that occur to nearshore species in areas that are closed to fishing
2757 compared with similar areas where fishing occurs. These ODFW
2758 programs, along with numerous efforts undertaken by universities,
2759 resource agencies, and other partners need to be continued and
2760 expanding to produce information necessary to meet resource
2761 management challenges.

2762 Potential Partners: State and federal natural resource agencies, universities, non-
2763 governmental organizations, fishing interests, tribes, and the general
2764 public.

2765 *(6) Fishery Independent Surveys*

2766 Recommendation: Develop methods for surveying fishery species in the nearshore
2767 environment with the goal of collecting fish and shellfish abundance data
2768 useful in assessing the status of harvested fish and shellfish stocks. Once
2769 methods are developed, conduct periodic fishery-independent surveys in
2770 the nearshore environment to produce data useful in stock assessments
2771 and develop long-term datasets that can indicate trends in abundance
2772 over time.

2773 Rationale: The status of fishery stocks needs to be assessed periodically to ensure
2774 that fishery managers set appropriate catch limits and to provide
2775 sustainable harvest into the future. Stock assessments are often based
2776 on a combination of data collected from fishery landings and fishery-
2777 independent surveys of fish populations. Fishery-independent data are
2778 crucial to fine-tune and ground truth stock assessment models, helping
2779 to ensure assessment results most accurately reflect real-world fish
2780 abundance. These more accurate results allow managers and fishermen
2781 to have more certainty with management decisions and reduce the risk of
2782 deviating from conservation targets.

2783 There are currently no fishery-independent surveys for most fish species
2784 targeted by nearshore fisheries. Many of these species are caught on
2785 nearshore rocky reefs, an environment that presents challenges to
2786 conventional fish survey methodology (e.g., trawl surveys). Methods need
2787 to be developed for conducting fish surveys in nearshore rocky reef areas
2788 that will produce consistent and reliable results useful in assessing
2789 stocks. Surveys then need to be conducted on a periodic basis and
2790 continued over a long time period to be most useful in supporting stock
2791 assessments. The initial focus should be on nearshore rocky reef fish
2792 species, including black, blue, deacon, China, copper, quillback, and
2793 other rockfish species, as well as kelp greenling and cabezon.

2794 Potential Partners: Fishery managers, stock assessment scientists, commercial and
2795 sport fishing interests, tribes, non-governmental organizations and
2796 university scientists.

2797 *(7) Nearshore Species Stock Assessments*

2798 Recommendation: Improve stock assessments and/or stock status indicators for priority
2799 data-limited nearshore fish and shellfish species to improve confidence
2800 in population estimates and management strategies. Develop and
2801 improve data collection programs needed to support nearshore species
2802 stock assessments including developing fishery-independent surveys
2803 (see Recommendation 6), and evaluating and improving existing fishery
2804 monitoring programs that record fishery catch/landings, estimate fishery
2805 effort, and collect biological data on landed catch.

2806 Rationale: There is limited information about nearshore fish and shellfish
2807 populations available for use in population assessments. Data and
2808 monitoring have not been adequate to confidently assess stock status on
2809 many nearshore species, and there is currently no mechanism for
2810 indicating a population decline for many species. Developing stock
2811 assessment and/or indicator strategies, along with collecting the data
2812 necessary to implement the strategies, is essential to maintain
2813 confidence in management decisions and ensure sustainable harvest.

2814 Potential Partners: ODFW, NOAA stock assessment scientists, other state and federal
2815 fishery resource agencies, tribes, university scientists, and the fishing
2816 industry.

2817 *(8) Human Dimensions Research and Monitoring*

2818 Recommendation: Conduct and support studies of social and economic patterns and
2819 trends as they relate to nearshore resources, human use of the
2820 resources, and effects of resource management actions on individuals,
2821 user groups, or communities. Potential topics include coastal community
2822 demographic trends, economic and social contributions of industries
2823 that depend on nearshore resources directly (e.g., fishing) or indirectly
2824 (e.g., tourism), and the impacts of regulatory and other management
2825 changes, including those that address climate change effects on coastal

2826 communities. In some cases, new methods will need to be developed to
2827 study these topics and develop data useful for resource management.

2828 Rationale: Human dimensions information is central to understanding the context of
2829 natural resource issues and how people, coastal communities,
2830 economies, and nearshore resources are interrelated and might be
2831 affected by various management actions and policy choices. The social
2832 and economic benefits and consequences of resource management and
2833 policy actions including spatial planning need to be an integral part of the
2834 process. Gaining a better understanding how to engage diverse
2835 communities and cultures to effectively participate in shaping policy is
2836 becoming increasingly important. There is a complex mix of conservation,
2837 sustainable harvest, land use practices, and social wellbeing that go into
2838 such decisions. One of many examples include how to best address such
2839 things as the effects of climate change impacts in a timely proactive
2840 manner. Another example is ODFW's marine reserves program ongoing
2841 human dimensions work about Oregon's coastal communities evaluating
2842 marine reserves as a management tool that increases our general
2843 understanding Oregon's coastal communities and user groups.

2844 Potential Partners: State and federal natural resource agencies, university scientists,
2845 non-governmental organizations, the fishing industry, tribes, and the
2846 general public.

2847 *(9) Marine Mammal-Human Interactions*

2848 Recommendation: Continue and expand efforts to gather necessary information to
2849 manage resource conflicts between marine mammals and people in
2850 Oregon's nearshore ocean, estuaries, and rivers. Information needed
2851 includes ongoing monitoring of population abundance, research on
2852 feeding habits and foraging behavior, research on predation impacts to
2853 fish populations, evaluation of conflicts with fisheries and methods to
2854 reduce them, and research on how to mitigate negative effects of human
2855 activities on marine mammals.

2856 Rationale: Many marine mammal species in the Pacific Northwest, under the
2857 protection of the federal Marine Mammal Protection Act of 1972, have
2858 enjoyed a marked recovery of their populations. In some cases, the
2859 substantial increase in the number of pinnipeds along the coast and in

2860 the lower Columbia River has resulted in widespread negative impacts to
2861 fish species of conservation concern such as ESA-listed salmon and
2862 steelhead, white sturgeon and Pacific lamprey, as well as conflicts with
2863 sport and commercial fisheries. As an example, the eastern stock of
2864 Steller sea lions has experienced a successful recovery and was delisted
2865 under the Endangered Species Act. Similarly, some populations of
2866 cetaceans like gray whales and humpback whales have increased. While
2867 these are conservation success stories, the increase has resulted in
2868 increased resource conflicts throughout their range. To address conflicts
2869 created by increasing marine mammal populations, it is essential to
2870 monitor these populations, examine food habits, foraging behavior, and
2871 predation effects on fish populations, and evaluate conflicts with
2872 fisheries and other human activities and how best to mitigate them.

2873 Potential Partners: ODFW, National Oceanic and Atmospheric Administration, the
2874 Washington Department of Fish and Wildlife, U.S. Army Corps of
2875 Engineers, sport and commercial fishing interests, tribes, port districts,
2876 and other state and local government entities.

2877 **Category: Management and Policy**

2878 Good governance for natural resources is built from a transparent management framework,
2879 trust from stakeholders, and sound science. Resource sustainability and resilience to a
2880 changing environment is improved with good management, good policy, and good
2881 governance. The recommendations in this category address priority nearshore issues and
2882 species using a variety of non-regulatory tools.

2883 *(10) Management Response to Climate Change*

2884 Recommendation: Promote use of climate change information in management decision-
2885 making and policy development in statewide, regional and global arenas.
2886 Build climate resilience and climate change adaptation into decision-
2887 making to maximize the long-term benefits of today's public investment
2888 in natural resource management.

2889 Rationale: Our understanding of climate change continues to broaden and deepen,
2890 as we discover the multitude of climate change symptoms and explore
2891 predictions of future impacts. Symptoms include those that have been in
2892 the public awareness for decades (e.g. warming temperatures) as well as

2893 newly identified phenomenon such as ocean acidification, which was
2894 first recognized in 2003. Many (or arguably most) natural resource
2895 management tools do not explicitly incorporate climate change
2896 information; at best, management tools include methods for addressing
2897 scientific uncertainty (e.g. harvest quota estimates), which may indirectly
2898 account for some degree of climate change uncertainty, but not all of it.
2899 Decisions made today on natural resource issues – made in a vacuum
2900 relative to climate change adaptation information – likely will not stand
2901 the test of time. Poor decisions today, assuming a static environment, will
2902 likely lead to destabilization of businesses, and economies that rely on
2903 resource availability for harvest, tourism or other purposes.

2904 Potential Partners: State and federal natural resource agencies, university scientists,
2905 non-governmental organizations, tribes, and the fishing industry.

2906 *(11) Marine Fishery Management Plans*

2907 Recommendation: Build the information/datasets and stakeholder support for state
2908 marine fishery management plans for appropriate nearshore SGCN and
2909 Watch List species (see **Appendix - Nearshore Species**).

2910 Rationale: Transparent documentation of management strategies can lead to
2911 increased public engagement in management (particularly increased
2912 public input) and improved information for decision-making processes.
2913 Both lead to greater public confidence that Oregon's natural resources
2914 are healthy and well-managed. To facilitate transparency and improve
2915 information in decision-making, ODFW has developed the Marine Fishery
2916 Management Plan Framework (2015) – an approach to developing Fishery
2917 Management Plans (FMPs) for nearshore and other marine species,
2918 developed under the umbrella of the Native Fish Conservation Policy. The
2919 goal of the Framework is to create a common understanding of what can
2920 and/or should be part of state FMPs, and lay out a publicly transparent
2921 road map for how to develop marine FMPs. The real heart of the
2922 Framework is in the building of individual FMPs, each of which will be
2923 adopted by the Fish and Wildlife Commission. Building each individual
2924 FMP will be time-consuming and labor-intensive, both for agency staff
2925 and for the public, whose input will be necessary for the FMPs to be
2926 rigorous and effective.

2927 Potential Partners: State and federal natural resource agencies, sport and commercial
2928 fishing interests, non-governmental organizations, university scientists,
2929 tribes, and the general public.

2930 *(12) Marine Planning*

2931 Recommendation: Participate in marine planning processes to ensure Oregon's interests
2932 in marine natural resource conservation and use are fully represented in
2933 marine policy. Develop marine natural resource spatial information and
2934 incorporate it into marine planning processes to ensure they use the best
2935 available science to formulate plans concerning Oregon's marine
2936 resources and uses (see **Land Use Planning** KCI). There are many
2937 processes underway that are specifically focused on the marine
2938 environment, both within the state and outside of state boundaries that
2939 may affect Oregon's nearshore waters, species and habitats.

2940 Rationale: Growing demand for ocean resources and competing use of ocean space
2941 has increased the need to move beyond single-sector management and
2942 plan for ocean uses more holistically. Marine planning processes require
2943 comprehensive spatial information on location, abundance and
2944 distribution of marine resources and resource uses. Spatial data that
2945 meet these needs have not been developed for many marine resources
2946 and require collaborative efforts and funding to ensure full development.
2947 Marine planning efforts engage multiple users, governments, and
2948 management agencies to ensure continued sustainability of ocean
2949 resources, while providing for a diverse array of uses and public priorities.
2950 Alongside many collaborators and partners, ODFW participated in the
2951 state's development and modifications of the Territorial Sea Plan, which
2952 outlines state policy on its Territorial Sea including spatial planning that
2953 may affect marine life and their habitats. Several marine planning
2954 processes affecting Oregon are currently underway at the federal level.
2955 While these are in federal waters, they still affect Oregon's nearshore
2956 marine resources and Oregon's ocean users. ODFW will continue to play
2957 a key role in providing natural resource information to support these
2958 processes, as well as ensuring Oregon's nearshore resources and ocean
2959 user groups are represented in policy decisions. ODFW will also play an
2960 ongoing role in plan implementation and keeping marine resource data
2961 sets current, and relevant, as new information becomes available.

2962 Potential Partners: State and federal natural resource agencies, sport and commercial
2963 fishing interests, local, state, regional, and federal governments,
2964 community groups, non-governmental organizations, tribes, and the
2965 general public.

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