

Ecoregions of Western Washington and Oregon

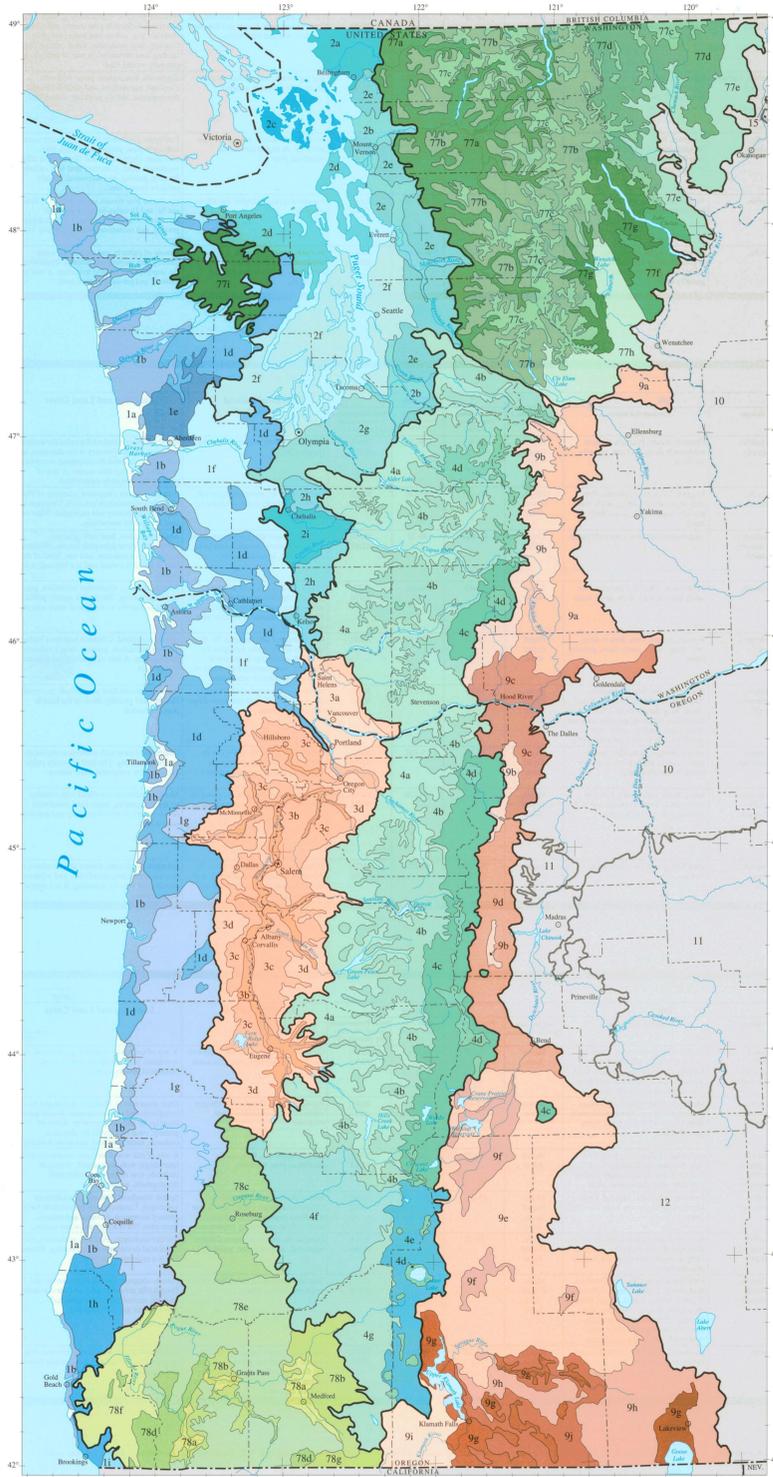
Ecoregions denote areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources; they are designed to serve as a spatial framework for the research, assessment, management, and monitoring of ecosystems and ecosystem components. Ecoregions are directly applicable to the immediate needs of state agencies, including the development of biological criteria and water quality standards, and the establishment of management goals for nonpoint-source pollution. They are also relevant to integrated ecosystem management, an ultimate goal of most federal and state resource management agencies.

The approach used to compile this map is based on the premise that ecological regions can be identified through the analysis of the patterns and the composition of biotic and abiotic phenomena that reflect differences in ecosystem quality and integrity (Wiken, 1986; Omernik, 1987, 1995). These phenomena include geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology. The relative importance of each characteristic varies from one ecological region to another regardless of the hierarchical level. A Roman numeral hierarchical scheme has been adopted for different levels of ecological regions. Level I is the coarsest level, dividing North America into 15 ecological regions, with level II dividing the continent into 51 regions. At level III, the continental United States contains 98 ecoregions (United States Environmental Protection Agency [USEPA], 1996). Level IV is a further subdivision of level III ecoregions. Explanations of the methods used to define the USEPA's ecoregions are given in Omernik (1995), Griffith and others (1994), and Gallant and others (1989).

This level III and IV ecoregion map was compiled at a scale of 1:250,000; it depicts revisions and subdivisions of earlier level III ecoregions that were originally compiled at a smaller scale (USEPA, 1996; Omernik, 1987). This poster is the product of a collaborative effort primarily between the USEPA Region X, the USEPA National Health and Environmental Effects Research Laboratory (Corvallis, Oregon), the Oregon Natural Heritage Program, the United States Department of Agriculture - Forest Service (USFS), the United States Department of Agriculture - Natural Resources Conservation Service (NRCS) (formerly the Soil Conservation Service), the United States Department of the Interior - Geological Survey (USGS) - Earth Resources Observation Systems (EROS) Data Center, the Washington State Department of Natural Resources (Washington DNR), and the Washington State Department of Ecology.

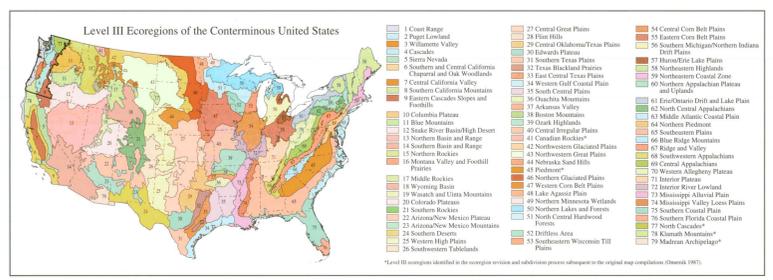
This project is associated with an interagency effort to develop a common framework of ecological regions. Reaching that objective requires recognition of the differences in the conceptual approaches and mapping methodologies that have been used to develop the most commonly used existing ecoregion-type frameworks, including those developed by the USFS (Bailey and others, 1994), the USEPA (Omernik, 1987, 1995), and the NRCS (United States Department of Agriculture - Soil Conservation Service, 1981). As each of these frameworks is further developed, the differences between them are becoming less. Regional collaborative projects such as this one in Washington and Oregon, where agreement can be reached among multiple resource management agencies, is a step in the direction of attaining commonality and consistency in ecoregion frameworks for the entire nation.

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- 1 Coast Range**
 - 1a Coastal Lowlands
 - 1b Coastal Uplands
 - 1c Low Olympics
 - 1d Volcanics
 - 1e Outwash
 - 1f Willapa Hills
 - 1g Mid-Coastal Sedimentary
 - 1h Southern Oregon Coastal Mountains
 - 1i Redwood Zone
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 - 2a Fraser Lowland
 - 2b Eastern Puget Rivierine Lowlands
 - 2c San Juan Islands
 - 2d Olympic Rainshadow
 - 2e Eastern Puget Uplands
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 - 2g Southern Puget Prairies
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- Legend:
 - - - Level III ecoregion
 - - - Level IV ecoregion
 - - - County boundary
 - - - State boundary
 - - - International boundary
- SCALE 1:1,350,000
 15 0 10 20 30 40 50 60 70 80 90 100 110 120
 Universal Transverse Mercator Projection, Zone 10

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WASHINGTON STATE DEPARTMENT OF Natural Resources

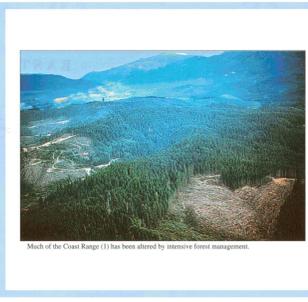
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RESOURCES DIVISION

USGS science for a changing world

U.S. FOREST SERVICE



1. Coast Range

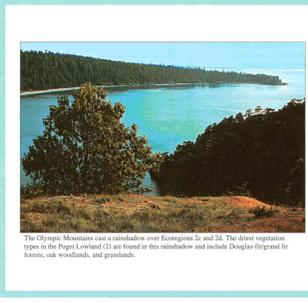
Highly productive, rain-drenched coniferous forests cover the low mountains of the Coast Range. Sitka spruce forests originally dominated the fog-shrouded coast, while a mosaic of western red cedar, western hemlock, and searal Douglas-fir blanketed inland areas. Today Douglas-fir plantations are prevalent on the intensively logged and managed landscape.

1a The Coastal Lowlands ecoregion encompasses estuarine marshes, freshwater lakes, black-water streams, marine terraces, and sand dunes. Elevations range from sea level to 300 feet. Channelization and diking have converted many of its wetlands into dry pastures; associated stream quality degradation has occurred.

1b The Coastal Uplands ecoregion extends to an elevation of about 500 feet. The climate of Ecoregion 1b is marine-influenced with an extended winter rainy season, enough fog during the summer dry season to reduce moisture stress, and a lack of seasonal temperature extremes. The ecoregion roughly corresponds with the historic distribution of Sitka spruce. The extent of the original forest has been greatly reduced by logging.

1c The Low Olympics ecoregion contains foothills and mountains and rises to an elevation of approximately 4000 feet. Copious precipitation (up to 200 inches/year) supports a lush, epiphyte-rich rainforest of western hemlock, western red cedar, and Douglas-fir. Much of the region is in the third rotation of logging. However, a portion of the region lies within the Olympic National Park and contains ancient forests.

1d The Volcanics ecoregion varies in elevation from 1000 to 4000 feet and is disjoint. Columnar and pillow basalts outcrop often. Its mountains may have been offshore seamounts eroded by continental sediments about 200 million years ago. The basaltic substrate preserves relatively stable summer stream flows that still support spring chinook salmon and summer steelhead. Its forests are intensively managed.



2. Puget Lowland

This broad rolling lowland is characterized by a mild maritime climate and flanks the intricately cut coastline of Puget Sound. It occupies a continental glacial trough and has many islands, peninsulas, and bays. Coniferous forest originally grew on the ecoregion's ground moraines, outwash plains, floodplains, and terraces. The distribution of forest species is affected by the rainshadow from the Olympic Mountains.

2a The Fraser Lowland ecoregion is composed of glacial drift plains, terraces, and some floodplains. Undulating terrain, a mild, wet climate, and productive pastureland are characteristic. This ecoregion has the highest dairy farm concentration in Washington.

2b The Eastern Puget Rivierine Lowlands ecoregion is composed of floodplains and terraces. Western red cedar forest, western hemlock forest, and both riverine and wetland habitat were common before the 19th century. Subsequently, many of the wetlands were drained. Pastures, cropland, forests, and urban centers now dominate the landscape.

2c The glacial-scoured San Juan Islands ecoregion is underlain by sedimentary rock. Well-drained, shallow soils are typical. It is in the rainshadow of the Olympic Mountains. The forest vegetation types in the Puget Lowland (2) grow here and include Douglas-fir/grand fir forests, oak woodlands, and grasslands.

2d The Olympic Rainshadow ecoregion receives, on the average, only 10 to 40 inches of precipitation each year depending on location. Streams on the till plains have low discharge, and their drainage pattern is often dendritic or internal. Its loamy soils tend to retain moisture better than the soils of the San Juan Islands (2c) and support pastureland, cropland, and woodland.

2e The Eastern Puget Uplands ecoregion is made up of rolling moraines and foothills and is a zone of transition. Both Puget Lowland and Cascadian vegetation associations occur with the latter most common.

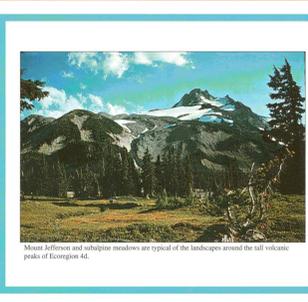


3. Willamette Valley

Rolling prairies, deciduous/coniferous forests, and extensive wetlands characterized the pre-settlement landscape of this broad, lowland valley. Ecoregion 3 is distinguished from the adjacent Coast Range (1) and Cascades (4) by low precipitation, less relief, and a different mosaic of vegetation. Landforms consist of terraces and floodplains, interlaced and surrounded by rolling hills. Productive soils and a temperate climate make it one of the most important agricultural areas in Oregon.

3a The Portland/Vancouver Basin ecoregion is composed of undulating terraces and floodplains with numerous wetlands, oxbow lakes, and ponds. Historically, prairie and oak woodland grew on better drained sites while wetlands, Oregon hazel, and Douglas-fir occurred elsewhere in the fault block basin. Today, Ecoregion 3a is dominated by urban and suburban development, pastures, and nurseries. Weather here is often affected by cold or warm easterly winds that blow through the Columbia River Gorge.

3b In the Willamette River and Tributaries Gallery Forest ecoregion, meandering, low-gradient channels and oxbow lakes are incised into floodplains. Deciduous riparian forests that once grew on its fertile, alluvial soils have been largely replaced by agriculture and rural residential, suburban, and urban development.



4. Cascades

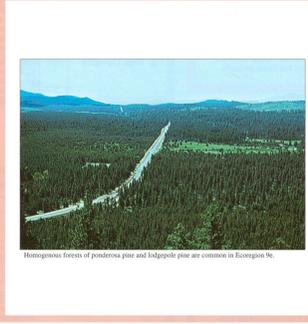
This mountainous ecoregion underlain by Cenozoic volcanics has been affected by alpine glaciations. It is characterized by steep ridges and river valleys in the west, a high plateau in the east, and both active and dormant volcanoes. Elevations range upwards to 14,410 feet. Its moist, temperate climate supports an extensive and highly productive coniferous forest. Subalpine meadows occur at high elevations.

4a The Western Cascades Lowlands and Valleys ecoregion is characterized by a network of steep ridges and narrow valleys. Elevations are generally less than 3200 feet and are the lowest in Ecoregion 4. The wet, mild climate promotes lush forests that are dominated by Douglas-fir and western hemlock. It is one of the most important timber producing areas in the Northwest.

4b The Western Cascades Montane Highlands ecoregion is composed of steep, glaciated mountains that have been dissected by high-gradient streams. It has lower temperatures than Ecoregion 4a and is characterized by a deep annual snow pack. Soils are of the frigid and cryic temperature regimes and support forests dominated by Pacific silver fir, western hemlock, mountain hemlock, Douglas-fir, and noble fir.

4c The Cascade Crest Montane Forest ecoregion consists of an undulating plateau punctuated by volcanic buttes and cones that reach a maximum elevation of about 6500 feet. Its Pliocene and Pleistocene volcanics were glaciated leaving numerous lakes in their wake. The ecoregion is extensively forested with mountain hemlock and Pacific silver fir.

4d The Cascades Subalpine/Alpine ecoregion is an area of high, glaciated, volcanic peaks that rise above subalpine meadows. Elevations range from 5000 to 12000 feet. Active glaciation occurs on the highest volcanics and decreases from north to south. The winters are very cold and the growing season is extremely short.



9. Eastern Cascades Slopes and Foothills

Ecoregion 9 is in the rainshadow of the Cascade Mountains. Its climate exhibits greater temperature extremes and less precipitation than ecoregions to the west. Open forests of ponderosa pine and some lodgepole pine distinguish this region from the higher ecoregions to the west where hemlock and fir forests are common, and the lower, dryer ecoregions to the east where shrubs and grasslands are predominant. The vegetation is adapted to the prevailing dry, continental climate and is highly susceptible to wildfire. Volcanic cones and buttes are common in much of the region.

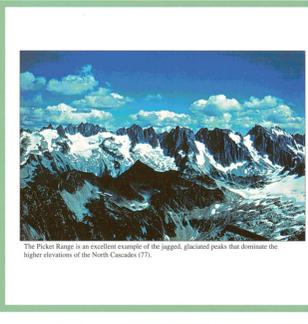
9a The unglaciated Yakima Plateau and Slopes ecoregion is characterized by plateaus, buttes, and canyons, a dry continental climate, and open woodlands dominated by ponderosa pine. Fire is an integral part of its ecosystem.

9b The Grand Fir Mixed Forest ecoregion is mostly outside the limit of maritime climatic influence. It is characterized by high, glaciated plateaus and mountains, frigid soils, and a snow-dominated, continental climate. The vegetation is a mix of grand fir, Douglas-fir, and ponderosa pine.

9c The Oak/Conifer Eastern Cascades Columbia Foothills ecoregion is more diverse than any other within the Eastern Cascades Slopes and Foothills (9). Soil, climate, and landforms are all highly variable and contribute to a mosaic of vegetation types that includes grasslands, oak woodlands, Douglas-fir/ponderosa pine forests, and western hemlock/Douglas-fir forests. Maritime weather systems sometime enter Ecoregion 9c via the Columbia River Gorge and moderate its otherwise continental climate.

9d The Ponderosa Pine/Bitterbrush Woodland ecoregion has a terrain dominated by undulating volcanic plateaus and canyons. Frigid soils are often derived from ash and support nearly homogeneous stands of ponderosa pine. Bitterbrush grows at lower elevations. Stands of lodgepole pines are largely absent in contrast to the Pumice Plateau Forest (9e) to the south.

9e The Pumice Plateau Forest ecoregion is a high volcanic plateau that is thickly covered by Mt. Mazama ash and pumice. Its residual soils are somewhat excessively drained. Spring-fed creeks, marshes, and a few lakes occur. Forests of ponderosa pine are common on slopes; cold depressions and flats are dominated by lodgepole pine. Winters are consistently cold and precipitation falls mainly as snow. Summers tend to be mild.



77. North Cascades

The terrain of Ecoregion 77 is composed of high, rugged mountains. It contains the greatest concentration of active alpine glaciers in the conterminous United States and has a variety of climatic zones. A dry continental climate occurs in the east and mid, maritime, rainforest conditions are found in the west. It is underlain by sedimentary and metamorphic rock in contrast to the adjoining Cascades (4) which are composed of volcanics.

77a The North Cascades Lowland Forests ecoregion is composed of low mountains, broad glaciated valleys, and glacial-fed rivers that receive, on average, 60 to 90 inches of precipitation per year. Extensive, productive rainforests have developed under the mild maritime climate and are dominated by western hemlock, Douglas-fir, and western red cedar. Pastures occur in the valleys.

77b The landscape of the North Cascades Highland Forests ecoregion consists of steep, glaciated ridges, high-gradient streams, and tarns. Colder climatic conditions, deeper snow pack, and Pacific silver fir/mountain hemlock forests distinguish it from Ecoregion 77a.

77c The North Cascades Subalpine/Alpine ecoregion is characterized by high mountain peaks, bare rock, glaciers, many tarns, plentiful precipitation, and sediment-laden glacial meltwater streams. Subalpine meadows occur around the taller peaks; their flora and fauna is adapted to the prevailing subarctic climate.

77d The Pasayten/Sawtooth Highlands has colder winter temperatures than elsewhere in Ecoregion 77 and has experienced both continental and alpine glaciation. Its landscape of high ridges, plateaus, and trough valleys is dominated by subalpine fir. In addition, lodgepole pine grows in the northeast. Douglas-fir is found at lower elevations, and many wetlands occur. Mean precipitation is from 25 to 65 inches per year and varies according to elevation and slope; it is less than that received by Ecoregions 77a, b, c, and i which occur to the west.

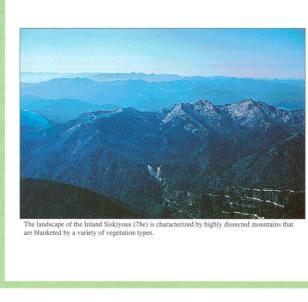
77e The glacially affected Okanogan Pine/Fir Forest ecoregion has rounded mountains and broad, U-shaped valleys. Elevations are lower and slope angles are gentler than further west in the jagged, mountainous areas of the North Cascades (77). Precipitation ranges from 10 to 35 inches per year, falling mostly as snow. It is lower than elsewhere in Ecoregion 77 and droughty conditions prevail. Precipitation and temperature both vary according to elevation, microtopography, and slope aspect and affect the distribution of vegetation. Ponderosa pine grows in lower, drier areas and Douglas-fir is found at higher elevations. Bluebunch wheatgrass is common in the understory of the south and Idaho fescue grows in the north.

77f The steep, glaciated Chelan Tephra Hills ecoregion is dominated by deep deposits of coarse, volcanic debris which contribute to the character of this dry, east-side region. Elevations range from 1200 to 5700 feet. Ponderosa pine grows in lower areas, Douglas-fir occurs in the mid-elevations, and subalpine fir is found above 5000 feet in elevation.

77g The glaciated Wenatchee/Chelan Highlands ecoregion is characterized by mountains and ridges, tarns, U-shaped valleys, and dissected high-gradient streams. Leeward climatic conditions prevail. Douglas-fir, grand fir, and subalpine fir are common; lodgepole pine and Engelmann spruce also occur. Average precipitation ranges from only 15 to about 40 inches per year.

77h The Chiwaukum Hills and Lowlands are composed of feldspar-rich sandstone and are trough valleys neighboring ecoregions which are underlain by metamorphic and igneous rock. Its low mountains, hills, and canyons can be highly erodible and unstable. Streams have high sediment yields and run in V-shaped valleys; their network forms a trellis pattern.

77i The High Olympics ecoregion contains steep, glaciated mountains that reach an elevation of 8000 feet. Its vegetation is rock outcrops, tarns, persistent snow pack, alpine glaciers, and high-gradient, glacial-fed streams. It is characterized by subalpine mountain hemlock and Pacific silver fir forests as well as alpine meadows. Subalpine fir occurs on the very soils of northeastern rainshadow areas.



78. Klamath Mountains

The ecoregion is physically and biologically diverse. Highly dissected, folded mountains, foothills, terraces, and floodplains occur and are underlain by igneous, sedimentary, and some metamorphic rock. The mild, subhumid climate of Ecoregion 78 is characterized by a lengthy summer drought. It supports a variety of mix of northern Californian and Pacific Northwest conifers.

78a The Rogue/Ilinois Valleys ecoregion consists of floodplains and terraces that have a local relief of 100 to 600 feet. It is characterized by hot, dry summers and a native vegetation of Oregon white oak, madrone, California black oak, ponderosa pine, and grasslands. Today, a mix of orchards, cropland, pastureland, oak woodland, pine woodland, and rural residential development occurs. Vegetation and land use are more similar to those of northern California's inland valleys than to those of the Willamette Valley (3).

78b The Siskiyou Foothills are affected by a Mediterranean climate that is similar to Ecoregion 78a. The drier areas occur east of Medford and is dominated by oak woodlands, ponderosa pine, and Douglas-fir. The wetter foothills adjacent to the Illinois Valley support Douglas-fir, madrone, and incense cedar.

78c The Umpqua Interior Foothills ecoregion is an intermingling of narrow valleys, terraces, and foothills. It contrasts with the terrain of the more mountainous Inland Siskiyou (78a). A mix of oak woodlands, Douglas-fir, ponderosa pine, and madrone intermingles with pastureland, vineyards, orchards, and row crops. The vegetation and land use are similar to those of Ecoregions 77a, b, and c. Summers are hot and dry, although the climate is transitional to both the Willamette and Rogue valleys; it is most similar to the Rogue Valley.

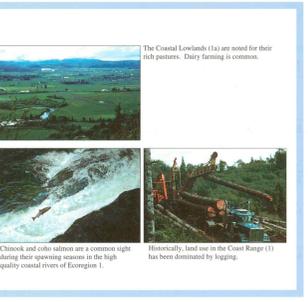
1e The Outwash ecoregion is a gently sloping fan of glacial outwash material that is dominated by industrial timber plantations. It lies outside the zone of marine influence and has lower stream flows than most other parts of the Coast Range (1).

1f The Willapa Hills ecoregion has erodible silt and clay soils. Drainage density is lower than in other parts of the Coast Range (1) that are also underlain by sedimentary rock. Industrial timberland has almost completely replaced the historic forests of the ecoregion.

1g The Mid-Coastal Sedimentary ecoregion is commonly underlain by massive beds of siltstone and sandstone. Its dissected, forested mountains are more rugged than in Ecoregion 1f and are prone to mass movement when the vegetal cover is removed. Stream gradients and fluvial erosion rates can be high.

1h The Southern Oregon Coastal Mountains is a mountains ecoregion with an ocean-modified climate. It is a transitional area between the Siskiyou Mountains and the Coast Range and is underlain by Jurassic sandstone, metamorphosed sediments, granite, and serpentine. Overall, the geology of Ecoregion 1h is complex, like that of the Siskiyou Mountains, but its mountains are lower and are not as dissected. The distributions of northern and southern vegetation blend together here and species diversity is high.

1i The Redwood Zone is the northernmost tip of an ecoregion that extends to San Francisco Bay. Remnants of unlogged redwood forest survive east of Brookings. The redwood forest, when it functioned as an intact ecosystem, moderated its own microclimate by entrainment of coastal fog and by shading.



2a The Fraser Lowland ecoregion is composed of glacial drift plains, terraces, and some floodplains. Undulating terrain, a mild, wet climate, and productive pastureland are characteristic. This ecoregion has the highest dairy farm concentration in Washington.

2b The Eastern Puget Rivierine Lowlands ecoregion is composed of floodplains and terraces. Western red cedar forest, western hemlock forest, and both riverine and wetland habitat were common before the 19th century. Subsequently, many of the wetlands were drained. Pastures, cropland, forests, and urban centers now dominate the landscape.

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2d The Olympic Rainshadow ecoregion receives, on the average, only 10 to 40 inches of precipitation each year depending on location. Streams on the till plains have low discharge, and their drainage pattern is often dendritic or internal. Its loamy soils tend to retain moisture better than the soils of the San Juan Islands (2c) and support pastureland, cropland, and woodland.

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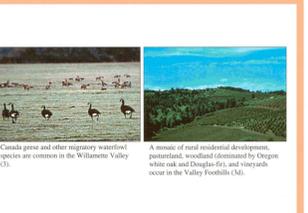


3a The Portland/Vancouver Basin ecoregion is composed of undulating terraces and floodplains with numerous wetlands, oxbow lakes, and ponds. Historically, prairie and oak woodland grew on better drained sites while wetlands, Oregon hazel, and Douglas-fir occurred elsewhere in the fault block basin. Today, Ecoregion 3a is dominated by urban and suburban development, pastures, and nurseries. Weather here is often affected by cold or warm easterly winds that blow through the Columbia River Gorge.

3b In the Willamette River and Tributaries Gallery Forest ecoregion, meandering, low-gradient channels and oxbow lakes are incised into floodplains. Deciduous riparian forests that once grew on its fertile, alluvial soils have been largely replaced by agriculture and rural residential, suburban, and urban development.

3c The undulating Prairie Terraces ecoregion is dissected by low-gradient, meandering streams and rivers. Its fluvial terraces once supported prairie and oak woodlands which were maintained by burning; Oregon ash and Douglas-fir occurred in wetter areas. Today, grass seed and grain crops are commonly grown.

3d The Valley Foothills ecoregion is a transitional zone between the Willamette Valley (3), the Cascades (4), and the Coast Range (1). It has less rainfall than adjacent, more mountainous ecoregions and, consequently, its potential natural vegetation is distinct. Oregon white oak and Douglas-fir were originally dominant, but today, rural residential development, woodland, pastureland, vineyards, tree farms, and orchards are common.



4a The Western Cascades Lowlands and Valleys ecoregion is characterized by a network of steep ridges and narrow valleys. Elevations are generally less than 3200 feet and are the lowest in Ecoregion 4. The wet, mild climate promotes lush forests that are dominated by Douglas-fir and western hemlock. It is one of the most important timber producing areas in the Northwest.

4b The Western Cascades Montane Highlands ecoregion is composed of steep, glaciated mountains that have been dissected by high-gradient streams. It has lower temperatures than Ecoregion 4a and is characterized by a deep annual snow pack. Soils are of the frigid and cryic temperature regimes and support forests dominated by Pacific silver fir, western hemlock, mountain hemlock, Douglas-fir, and noble fir.

4c The Cascade Crest Montane Forest ecoregion consists of an undulating plateau punctuated by volcanic buttes and cones that reach a maximum elevation of about 6500 feet. Its Pliocene and Pleistocene volcanics were glaciated leaving numerous lakes in their wake. The ecoregion is extensively forested with mountain hemlock and Pacific silver fir.

4d The Cascades Subalpine/Alpine ecoregion is an area of high, glaciated, volcanic peaks that rise above subalpine meadows. Elevations range from 5000 to 12000 feet. Active glaciation occurs on the highest volcanics and decreases from north to south. The winters are very cold and the growing season is extremely short.



9a The unglaciated Yakima Plateau and Slopes ecoregion includes Sycan Marsh, Klamath Marsh, and La Pine Basin. All three areas function as cold air catch-basins during the winter and have lower minimum temperatures than Ecoregion 9e. Its marshes and forested wetlands are commonly 4500 to 5000 feet in elevation and are important habitat for migratory waterfowl. The La Pine Basin is underlain by thick lacustrine deposits that exhibit high ground water levels during the spring snow melt.

9b The Klamath/Goose Lake Warm Wet Basins ecoregion is drier than elsewhere in Ecoregion 9, yet it contains floodplains, terraces, and a pluvial lake basin. Its tule, sedge, and cattail wetlands have largely been drained for agriculture. Sagebrush and bunchgrass occur in upland areas.

9c The terrain of the Fremont Pine/Fir Forest ecoregion is composed of mountains and high plateaus. Its continental climate and diverse terrain support a range of vegetation types. Ponderosa pine woodlands are common at lower elevations while white fir is more prevalent in higher areas.

9d The Southern Cascades Slope ecoregion is a transitional zone between the Cascades (4) and the drier Eastern Cascades Slopes and Foothills (9). Forests of ponderosa pine blanket the mountainous landscape; white fir, Shasta red fir, and Douglas-fir grow at higher elevations. Much of Ecoregion 9d typically receives more precipitation than Ecoregions 9a, c, d, e, f, g, and j.

9e The terrain of the Klamath Juniper/Ponderosa Pine Woodland ecoregion consists of undulating hills, escarpments, and plateaus. Mean annual precipitation ranges from 12 to 20 inches per year. Reservoirs dot the landscape and are important to lowland irrigation. The natural vegetation was mostly juniper in the south and a mix of ponderosa pine and juniper in the north; today, a mosaic of pastures and woodland occurs.



77a The North Cascades Lowland Forests ecoregion is composed of low mountains, broad glaciated valleys, and glacial-fed rivers that receive, on average, 60 to 90 inches of precipitation per year. Extensive, productive rainforests have developed under the mild maritime climate and are dominated by western hemlock, Douglas-fir, and western red cedar. Pastures occur in the valleys.

77b The landscape of the North Cascades Highland Forests ecoregion consists of steep, glaciated ridges, high-gradient streams, and tarns. Colder climatic conditions, deeper snow pack, and Pacific silver fir/mountain hemlock forests distinguish it from Ecoregion 77a.

77c The North Cascades Subalpine/Alpine ecoregion is characterized by high mountain peaks, bare rock, glaciers, many tarns, plentiful precipitation, and sediment-laden glacial meltwater streams. Subalpine meadows occur around the taller peaks; their flora and fauna is adapted to the prevailing subarctic climate.

77d The Pasayten/Sawtooth Highlands has colder winter temperatures than elsewhere in Ecoregion 77 and has experienced both continental and alpine glaciation. Its landscape of high ridges, plateaus, and trough valleys is dominated by subalpine fir. In addition, lodgepole pine grows in the northeast. Douglas-fir is found at lower elevations, and many wetlands occur. Mean precipitation is from 25 to 65 inches per year and varies according to elevation and slope; it is less than that received by Ecoregions 77a, b, c, and i which occur to the west.

77e The glacially affected Okanogan Pine/Fir Forest ecoregion has rounded mountains and broad, U-shaped valleys. Elevations are lower and slope angles are gentler than further west in the jagged, mountainous areas of the North Cascades (77). Precipitation ranges from 10 to 35 inches per year, falling mostly as snow. It is lower than elsewhere in Ecoregion 77 and droughty conditions prevail. Precipitation and temperature both vary according to elevation, microtopography, and slope aspect and affect the distribution of vegetation. Ponderosa pine grows in lower, drier areas and Douglas-fir is found at higher elevations. Bluebunch wheatgrass is common in the understory of the south and Idaho fescue grows in the north.

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