

# Ecological site F004AB403WA

## Coastal Upland Cool Forest

Last updated: 1/23/2025  
Accessed: 08/27/2026

---

### General information

**Provisional.** A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

### MLRA notes

Major Land Resource Area (MLRA): 004A–Sitka Spruce Belt

This resource area is along the coast of the Pacific Ocean. It is characterized by a marine climate and coastal fog belt. The parent material is primarily glacial, marine, or alluvial sediment and some scattered areas of Tertiary sedimentary rock and organic deposits. Glacial deposits are dominant in the northern part of the MLRA in Washington; marine and alluvial deposits and eolian sand are dominant along the southern part of the Washington coast and extending into Oregon. The mean annual precipitation ranges from 52 to 60 inches near the beaches to more than 190 inches in the inland areas of the MLRA. Andisols and Inceptisols are the dominant soil orders in the MLRA, but Spodosols, Entisols, and Histosols are also present. The soils are shallow to very deep and very poorly drained to somewhat excessively drained. They are on hilly marine terraces and drift plains; coastal uplands, hills, and foothills; flood plains; and coastal dunes, marshes, and estuaries. The soil temperature regimes of MLRA 4A are moderated by the proximity to the Pacific Ocean, which eases the differences between the mean summer and winter temperatures. The seasonal differences in temperature are more pronounced in adjacent MLRAs further inland. Included in MLRA 4A are soils in cooler areas at higher elevations or on northerly aspects that have an isofrigid temperature regime. The soil moisture regimes of MLRA 4A are typified by soils that do not have an extended dry period during normal years. Many of the soils further inland in MLRA 2 have a dry period in summer. Soils in low-lying areas and depressions of MLRA 4A are saturated in the rooting zone for extended periods due to a high water table or long or very long periods of flooding or ponding. MLRA 4A Soil Temperature Regimes Isomesic The mean annual soil temperature (measured at a depth of 20 inches) is 46 to 59 degrees F, and the difference between the mean winter and summer temperatures is less than 11 degrees. The seasonal soil temperatures and difference between the mean winter and summer temperatures are moderated by the proximity to the ocean and the effects of fog in summer. Isofrigid The mean annual soil temperature (measured at a depth of 20 inches) is 32 degrees F to less than 46 degrees, and the difference between the mean winter and mean summer temperatures is less than 11 degrees. The seasonal soil temperatures and difference between the mean winter and summer temperatures are moderated by the proximity to the ocean and the effects of fog in summer. The temperatures are cooler than in surrounding lowlands because of the higher elevation and differences in slope and aspect. MLRA 4A Soil Moisture Regimes Udic The soil rooting zone is not dry in any part for more than 90 cumulative days in normal years. Soil moisture does not limit plant growth because of the fog in summer. Aquic The soil is virtually free of dissolved oxygen due to saturation of the rooting zone. The soils are saturated for extended periods during the growing season and may be subject to long or very long periods of ponding and flooding. Refer to Keys to Soil Taxonomy for complete definitions of the soil temperature and moisture regimes.

### LRU notes

The Central Sitka Spruce Belt land resource unit (LRU B) of MLRA 4A is along the west coast of Washington and Oregon. The LRU extends from the Chehalis River in Washington to South Slough in Oregon, and it is bounded on the west by the Pacific Ocean. This area consists of sand dunes, flood plains, and marine terraces that extend a few miles east and are parallel to the Pacific Ocean, and it transitions to steeper and higher elevation ridges and mountainsides of the western slopes of the Coast Range in Oregon. Near the shore in coastal lowland areas, the parent material is dominantly eolian (wind-deposited) sand, alluvium, and marine sediment. Residuum, colluvium, and landslide deposits derived from sedimentary and basaltic sources are on the coastal foothills and mountains, and minor additions of recent alluvium are along the river valleys. Several major rivers carved steep, narrow valleys through the coastal mountains and foothills before entering broader coastal valleys. Subduction zones along the Pacific Coast may cause significant earthquakes and tsunamis, which would disrupt the ecological processes beyond what is described in this ecological site description.

### Classification relationships

National vegetation classification: G751 North Pacific Western Hemlock-Sitka Spruce-Western Red Cedar Seasonal Rainforest; A3608 Sitka Spruce-Salmonberry Mesic Forest Alliance Ecological Systems of Washington State community type: North Pacific Seasonal Sitka Spruce Forest Sitka spruce/swordfern; Sitka spruce/salmonberry-salal

Ecological site concept

This ecological site is on the western coastline of the Pacific Northwest, from southern Washington through central Oregon. It is on coastal hills, mountains, and headlands at an elevation of 30 to 1,800 feet. Slopes are 20 to 100 percent. The maritime climate is characterized by cool, moist summers and cool, wet winters. The mean annual precipitation is 70 to 130 inches. Coastal fog provides supplemental moisture in summer. Snowfall is rare, and it is not persistent when it occurs. The mean annual air temperatures is 48 to 52 degrees F. The mild temperatures and long growing season result in highly productive forestland. The soils that support this ecological site generally formed in colluvium and residuum derived dominantly from volcanic, basaltic, or metasedimentary rock. Areas of soils that are shallow to bedrock or are skeletal and have a high content of rock fragments and areas of rock outcroppings are on the steeper slopes. These areas can be significant locally. The soil parent material along the coast is exposed to a heightened weathering regime due to moderated temperatures and high precipitation. Enhanced weathering and organic matter from the dense vegetative cover have resulted in an accumulation of a particular suite of organic and metal oxide compounds, a process called andisolization. The level of andisolization varies within this ecological site, but Andisols and andic intergrades have been identified. A unique set of soil properties has developed as a result of andisolization, including an improved water-holding capacity, a high content of organic matter, and high phosphorous retention. This process is most typical in soils that formed in weathered volcanic ash, but a unique combination of climatic conditions and vegetation has resulted in these soil properties in coastal areas of the Pacific Northwest. This forest ecological site is supported by soils that have a wide range in physical properties. The soils are in the udic temperature regime and isomesic moisture regime. This climate is characterized by low potential evapotranspiration during the growing season; therefore, plants are not drought stressed. The soils have a high to low water-holding capacity, and the main soil properties that affect water-holding capacity are depth and texture. As a result of the unique abiotic conditions, this ecological site is considered one of the most productive forests in the world (Franklin, 1973). The most common overstory species are Sitka spruce (*Picea sitchensis*) and western hemlock (*Tsuga heterophylla*). Stands may also include Douglas-fir (*Pseudotsuga menziesii*) and western redcedar (*Thuja plicata*). Red alder (*Alnus rubra*) may be common in forest openings. Regeneration of red alder is limited by canopy cover, and it commonly is in gaps where sunlight is most available. Common understory species include salmonberry (*Rubus spectabilis*), evergreen huckleberry (*Vaccinium ovatum*), red huckleberry (*Vaccinium parvifolium*), salal (*Gaultheria shallon*), western swordfern (*Polystichum munitum*), and false lily of the valley (*Maianthemum dilatatum*). The most common natural disturbance on this ecological site is windthrow following large storms, which creates pockets of forest openings. Although wildfires are uncommon, the site is susceptible to catastrophic crown fires that are stand replacing (Taylor, 1990). The natural fire regime for Sitka spruce and western hemlock is 150 to 400 years (Griffith, 1992).

Table 1. Dominant plant species

|            |                                                                    |
|------------|--------------------------------------------------------------------|
| Tree       | (1) <i>Picea sitchensis</i><br>(2) <i>Tsuga heterophylla</i>       |
| Shrub      | (1) <i>Gaultheria shallon</i><br>(2) <i>Rubus spectabilis</i>      |
| Herbaceous | (1) <i>Polystichum munitum</i><br>(2) <i>Maianthemum dilatatum</i> |

Physiographic features

Table 2. Representative physiographic features

Climatic features

Influencing water features

Soil features

Ecological dynamics

State and transition model

Additional community tables

Table 3. Community 1.1 plant community composition

| Group | Common Name | Symbol | Scientific Name | Annual Production () | Foliar Cover (%) |
|-------|-------------|--------|-----------------|----------------------|------------------|
|-------|-------------|--------|-----------------|----------------------|------------------|

Table 4. Community 1.2 plant community composition

| Group | Common Name | Symbol | Scientific Name | Annual Production () | Foliar Cover (%) |
|-------|-------------|--------|-----------------|----------------------|------------------|
|-------|-------------|--------|-----------------|----------------------|------------------|

Table 5. Community 1.3 plant community composition

| Group | Common Name | Symbol | Scientific Name | Annual Production () | Foliar Cover (%) |
|-------|-------------|--------|-----------------|----------------------|------------------|
|-------|-------------|--------|-----------------|----------------------|------------------|

Table 6. Community 1.4 plant community composition

| Group | Common Name | Symbol | Scientific Name | Annual Production () | Foliar Cover (%) |
|-------|-------------|--------|-----------------|----------------------|------------------|
|-------|-------------|--------|-----------------|----------------------|------------------|

Table 7. Community 2.1 plant community composition

| Group | Common Name | Symbol | Scientific Name | Annual Production () | Foliar Cover (%) |
|-------|-------------|--------|-----------------|----------------------|------------------|
|-------|-------------|--------|-----------------|----------------------|------------------|

Table 8. Community 2.2 plant community composition

| Group | Common Name | Symbol | Scientific Name | Annual Production () | Foliar Cover (%) |
|-------|-------------|--------|-----------------|----------------------|------------------|
|-------|-------------|--------|-----------------|----------------------|------------------|

Table 9. Community 2.3 plant community composition

| Group | Common Name | Symbol | Scientific Name | Annual Production () | Foliar Cover (%) |
|-------|-------------|--------|-----------------|----------------------|------------------|
|-------|-------------|--------|-----------------|----------------------|------------------|

## Other references

- Baily, A., and C. Poulton. 1967. Plant communities and environmental interrelationships in a portion of the Tillamook Burn, northwestern Oregon. *Ecology* 55(1): 1-13.
- Christy, J., J. Kagan., and A. Wiedemann. 1998. Plant associations of the Oregon Dunes National Recreation Area. U.S. Department of Agriculture, Forest Service, Pacific Northwest Region Technical Paper R6-NR-ECOL-TP-09-98.
- Fonda, R.W. 1974. Forest succession in relation to river terrace development in Olympic National Park, Washington. *Ecology* 55(5): 927-942.
- Franklin, J.F., and C.T. Dyrness. 1973. Natural vegetation of Oregon and Washington. Oregon State University Press, Corvallis, OR.
- Goheen, E.M. and E.A. Willhite. 2006. Field guide to common diseases and insect pests of Oregon and Washington conifers. U.S. Department of Agriculture, Forest Service, Pacific Northwest Region, Series R6-NR-FID-PR-01-06.
- Griffith, R.S. 1992. *Picea sitchensis*. In Fire Effects Information System. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory.
- Hemstrom, M., and S. Logan. 1986. Plant association and management guide: Siuslaw National Forest. U.S. Department of Agriculture, Forest Service, Pacific Northwest Region Technical Paper R6-Ecol 220-1986a.
- Henderson, J., D. Peter, R. Leshner, and D. Shaw. 1989. Forested plant associations of the Olympic National Forest. U.S. Department of Agriculture, Forest Service, Pacific Northwest Region Technical Paper R6 ECOL 001-88.
- Naiman, R., S. Bechtold, T. Beechie, J. Latterell, and R. Van Pelt. 2009. A process-based view of floodplain forest patterns in coastal river valleys of the Pacific Northwest. *Ecosystems*. Volume 13, pages 1-31.
- Packee, E.C. 1990. *Tsuga heterophylla*. In *Silvics of North America*. U.S. Department of Agriculture, Forest Service, Northeastern Area.
- Peterson, E.B., N.M. Peterson, G.F. Weetman, and P.J. Martin. 1997. Ecology and management of Sitka spruce: Emphasizing its natural range in British Columbia. University of British Columbia Press, Vancouver, British Columbia.
- Pojar, J., and A. MacKinnon. 1994. Plants of the Pacific Northwest coast. Lone Pine Publishing, Vancouver, British Columbia.
- PRISM Climate Group. Oregon State University. <http://prism.oregonstate.edu>. Accessed February 2015.
- Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436.
- Soil Survey Staff. 2014. Keys to soil taxonomy. 12th edition. U.S. Department of Agriculture, Natural Resources Conservation Service.
- Taylor, A. 1990. Disturbance and persistence of Sitka spruce (*Picea sitchensis*) in coastal forests of the Pacific Northwest, North America. *Journal of Biogeography*. Volume 17, number 1, pages 47-58.
- United States National Vegetation Classification. 2016. United States national vegetation classification database, V2.0. Federal Geographic Data Committee, Vegetation Subcommittee, Washington, D.C. Accessed November 28, 2016.
- Villarin, L., D. Chapin, and J. Jones. 2009. Riparian forest structure and succession in second-growth stands of the central Cascade Mountains, Washington, USA. *Forest Ecology and Management*. Volume 257, pages 1375-1385.
- Washington Department of Natural Resources, Natural Heritage Program. 2015. Ecological systems of Washington State. A guide to identification.

## Approval

## Rangeland health reference sheet

**Interpreting Indicators of Rangeland Health** is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

|                                             |                   |
|---------------------------------------------|-------------------|
| Author(s)/participant(s)                    |                   |
| Contact for lead author                     |                   |
| Date                                        | 05/07/2024        |
| Approved by                                 |                   |
| Approval date                               |                   |
| Composition (Indicators 10 and 12) based on | Annual Production |

## Indicators

**1. Number and extent of rills:**

---

**2. Presence of water flow patterns:**

---

**3. Number and height of erosional pedestals or terracettes:**

---

**4. Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

---

**5. Number of gullies and erosion associated with gullies:**

---

**6. Extent of wind scoured, blowouts and/or depositional areas:**

---

**7. Amount of litter movement (describe size and distance expected to travel):**

---

8. Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):

---

9. Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):

---

10. Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:

---

11. Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):

---

12. Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):

Dominant:

Sub-dominant:

Other:

Additional:

---

13. Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):

---

14. Average percent litter cover (%) and depth ( in):

---

15. Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):

---

16. Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:

---

17. Perennial plant reproductive capability:

---