

Ecological site AX001X01X004

Mesic Aquic Forest

Last updated: 5/15/2025
Accessed: 09/27/2026

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): 001X–Northern Pacific Coast Range, Foothills, and Valleys

This area consists of a long and narrow range of mountains with associated foothills and valleys that parallels the Pacific Ocean. This area is entirely within the Pacific Border Province of the Pacific Mountain System in Oregon and Washington. MLRA 1 is bounded on the north by the highest elevations of the Olympic Mountains and the strait of Juan de Fuca, and by the Klamath Mountains on the south. The Washington portion of this MLRA is primarily composed of young Tertiary sedimentary rocks (siltstone and sandstone) mixed with some volcanic rocks of the same age. Glacial till and outwash deposits are also found in the northern half of this area in Washington. Much of this area is accreted terrane formed by tectonic processes. The average annual precipitation ranges from 60 to 200 inches (1,525 to 5,580 millimeters), increasing with elevation. Most of the precipitation in this area occurs during low-intensity, Pacific frontal storms and is evenly distributed throughout fall, winter, and spring. The dominant soil orders in this MLRA are Andisols, Inceptisols, and Ultisols. Soil depths broadly range from shallow to very deep. Soils are primarily well drained, however poorly drained soils may be found in depressional areas and on alluvial floodplains. Surface textures are typically medial and loamy or clayey. Soils in this area dominantly have a mesic or frigid temperature regime and a udic moisture regime. Soils with aquic moisture regimes and cryic temperature regimes also occur.

Ecological site concept

Mesic Aquic Forest sites occur primarily in microtopographical depressions on valley walls, terraces, and colluvial aprons. These sites receive run-on water from adjacent Mesic Udic Forest, Mesic Udic Moist Forest, Mesic Udic Dry Forest, Mesic Udic Alluvial Terrace Forest, and Mesic Udic Floodplain Forest sites. Additional run-on water causes these sites to occasionally or frequently pond. The somewhat poorly drained soils on this site support distinctive hydrophytic vegetation, such as devilsclub (*Oplopanax horridus*) and American skunkcabbage (*Lysichiton americanus*). Mesic Aquic Forest sites are characterized by an overstory of western hemlock (*Tsuga heterophylla*) and western redcedar (*Thuja plicata*), accompanied by an understory shrub community of salmonberry (*Rubus spectabilis*) and devilsclub. The herbaceous layer is primarily dominated by American skunkcabbage (*Lysichiton americanus*). Abundance of western redcedar (*Thuja plicata*) is generally much higher on this site than on any other adjacent site.

Associated sites

AX001X01X200	Temperate Wet Meadow Temperate Wet Meadows may be found in mosaic with Mesic Aquic Forest sites. Temperate Wet Meadows lack tree cover and are more frequently ponded.
--------------	---

Similar sites

AX001X01X108	Frigid Aquic Forest Frigid Aquic Forest sites are located at higher elevations and are distinguished by the presence of Pacific silver-fir (<i>Abies amabilis</i>).
--------------	--

AX004A01X404	Isomesic Aquic Forest Isomesic Aquic Forest sites are found at lower elevations in the Sitka Spruce Belt and are readily distinguished by the presence of Sitka spruce (<i>Picea sitchensis</i>).
---------------------	---

Table 1. Dominant plant species

Tree	(1) <i>Tsuga heterophylla</i> (2) <i>Thuja plicata</i>
Shrub	(1) <i>Rubus spectabilis</i> (2) <i>Oplopanax horridus</i>
Herbaceous	(1) <i>Lysichiton americanus</i> (2) <i>Carex</i>

Legacy ID

F001XA004WA

Physiographic features

This site primarily occurs on terraces, glacial valley walls, and colluvial aprons on mountains and valley trains. Mesic Aquic Forest sites are found in topographic depression positions and receive a significant amount of run-on water from upslope sites.

Table 2. Representative physiographic features

Landforms	(1) Mountains > Terrace (2) Mountains > Glacial-valley wall (3) Mountains > Colluvial apron (4) Mountains > Valley train
Flooding frequency	None
Ponding duration	Very brief (4 to 48 hours) to long (7 to 30 days)
Ponding frequency	None to frequent
Elevation	100 – 800 m
Slope	0 – 20 %
Water table depth	30 – 50 cm

Aspect	W, NW, N, NE, E, SE, S, SW
--------	----------------------------

Climatic features

This site occurs in a mesic temperature and udic moisture regime. Precipitation arrives mostly via low-intensity, Pacific frontal storms. Precipitation is unevenly distributed, with the lowest amounts on the leeward side of the Coast Range mountains. Precipitation falls largely as snow in higher elevations. Precipitation is evenly distributed throughout the fall, winter, and spring, while summers are dry. Air temperatures vary significantly along the elevation gradient.

Table 3 Representative climatic features

Frost-free period (characteristic range)	180-240 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	1,750-2,740 mm

Influencing water features

Mesic Aquic Forest sites occasionally pond and have high water tables throughout the growing season. Plants must be adapted to anaerobic growing conditions.

Soil features

The soils that support this ecological site occur in the mesic soil temperature regime. Happylake and Butlercreek soils occur in the aquic soil moisture regime, and Mountappleton soils occur in the udic soil moisture regime with an oxyaquic subclass. Happylake soils are formed from mixed geology alluvium and are found on depressions on alluvial terraces in river valleys. Butlercreek and Mountappleton soils are formed from colluvium from metasedimentary rock and found on depressions or seeps on colluvial aprons and glacial valley walls. Saturated hydraulic conductivity is high or very high throughout. They are all somewhat poorly drained and very deep and have a seasonally high water table within 10 and 20 inches of the surface at some point during the growing season (March through October). These soils have greater than 35 percent rock fragments and textures range from silt loam to sandy loam in the control section. Excessive soil moisture from flooding and ponding in this high precipitation climate is a limiting factor to plant growth. Thin organic horizons are present on most soils, protecting the soil from wind and water erosion. Although representative of this site, these soils may exist across multiple ecological sites because of naturally variable slope, texture, rock fragments, and pH. An on-site soil pit and the most current ecological site key are necessary to classify a site.

Table 4. Representative soil features

Parent material	(1) Alluvium (2) Colluvium – metasedimentary rock
Surface texture	(1) Gravelly loam (2) Silt loam
Drainage class	Somewhat poorly drained
Soil depth	150 cm

Surface fragment cover <=3"	0 – 10 %
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	8.13 – 22.1 cm
Soil reaction (1:1 water) (0-25.4cm)	4.5 – 5.5
Subsurface fragment volume <=3" (0-50.8cm)	20 – 50 %
Subsurface fragment volume >3" (0-50.8cm)	0 – 40 %

Ecological dynamics

Plant community dynamics on this site are primarily driven by a high water table which persists at or near the surface for much of the growing season. This site may also experience occasional ponding. Hydrophytic understory species dominate on this site. Conifers may not tolerate saturated soil conditions and are often limited to growing on higher elevation microsites or on nurse logs. Trees on this site are especially vulnerable to windthrow due to their shallow rooting depth. The high water table restricts the number and depth of sinker roots. Fallen trees create small canopy openings that allow sunlight to penetrate to the forest floor, promoting understory species productivity. High intensity coastal storms may generate stand replacing windthrow events. Fire occurs very infrequently on this site, on average once every 100 to 1,000 years (FEIS, 2012). High soil moisture and poor fuel conditions hinder fire. When wildfire does occur, it is likely to be during prolonged periods of drought and to be stand-replacing.

State and transition model

Additional community tables

Table 5. Community 1.1 plant community composition

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

Table 6. Community 1.2 plant community composition

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

Table 7. Community 1.3 plant community composition

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

Other references

Breemen, Nico van. "How Sphagnum Bogs down Other Plants." Trends in Ecology & Evolution 10, no. 7 (July 1, 1995): 270–75. 90007-1.

Dwire, K. and Kauffman, J. 2003. Fire and Riparian Ecosystems in Landscapes in the Western United States. Forest Ecology and Management, Vol. 178 pg. 61-74.

Franklin, Jerry F.; Cromack, Kermit, Jr.; Denison, William; [and others]. 1981. Ecological characteristics of old-growth Douglas-fir forests. Gen. Tech. Rep. PNW-118. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range

- Gavin, D., Brubaker, L. (2015). The Modern Landscape of the Olympic Peninsula. In: Late Pleistocene and Holocene Environmental Change on the Olympic Peninsula, Washington. Ecological Studies, vol 222. Springer, Cham. https://doi.org/10.1007/978-3-319-11014-1_1
- Geertsema, Marten & Pojar, James. (2007). Influence of landslides on biophysical diversity — A perspective from British Columbia. *Geomorphology*. 89. 55-69. [10.1016/j.geomorph.2006.07.019](https://doi.org/10.1016/j.geomorph.2006.07.019).
- Goheen, E.M. and Willhite, E.A. 2006. Field Guide to Common Diseases and Inspect Pests of Oregon and Washington Conifers. Portland, Oregon: USDA Forest Service, Pacific Northwest Region R6-NR-FID-PR-01-06.
- Hanley, D.P and D.M. Baumgartner. 2002. Forest Ecology in Washington. Washington State University Extension Publishing. Technical Report EB 1943.
- Hanson, E.J., D.L. Azuma and B.A. Hiserote. 2002. Site Index Equations and Mean Annual Increment Equations for Pacific Northwest Research Station Forest Inventory and Analysis Inventories, 1985-2001. USDA Forest Service Pacific Northwest Research Station, Research Note PNW-RN-533.
- Hemstrom, M., Franklin, J. 1982. Fire and Other Disturbances of the Forests in Mount Rainier National Park. *Quaternary Research*, Vol 18 pp 32-61.
- James K. Agee and Mark H. Huff. 1987. Fuel succession in a western hemlock/Douglas-fir forest. *Canadian Journal of Forest Research*. 17(7): 697-704. <https://doi.org/10.1139/x87-112>
- Nielsen, E. M., R. L. Brunner, C. Copass and L. K. Wise, 2021. Olympic National Park map class descriptions. National Park Service, Fort Collins.
- Pojar J., and MacKinnon. 1994. Plants of the Pacific Northwest Coast. Lone Pine, Vancouver, British Columbia. 528 pages.
- PRISM Climate Group, Oregon State University, <http://prism.oregonstate.edu>, visited October 2023.
- Reed Wendel, Darlene Zabowski "Fire History within the Lower Elwha River Watershed, Olympic National Park, Washington," *Northwest Science*, 84(1), 88-97, (1 January 2010)
- Rocheftort, R.M. and Peterson, D.L. 1996. Temporal and Spatial Distribution of Trees in Subalpine Meadows of Mount Rainier National Park. *Arctic and Alpine Research*, Vol. 28, No. 1 pp 52-59.
- Seastedt, T.R., Adams, G.A. 2001. Effects of Mobile Tree Islands on Alpine Tundra Soils. *Ecology*, Vol 82 pp 8-17.
- Smith, K., G. Kuhn, and L. Townsend. 2008. Culmination of Mean Annual Increment for Indicator Tree Species in the State of Washington. USDA-NRCS Technical Note Forestry-9.
- United States Department of Agriculture, Forest Service, 2015. Silvics Manual Vol 1. http://na.fs.fed.us/spfo/pubs/silvics_manual/Volume_1/vol1_Table_of_contents.htm, visited December 2015.
- United States Department of Agriculture, Natural Resources Conservation Service, and United States Department of the Interior, National Park Service. 2014. Ecological Site Descriptions for North Cascades National Park Complex, Washington.
- United States Department of Agriculture, Natural Resources Conservation Service, and United States Department of the Interior, National Park Service. Ecological Site Descriptions for Mount Rainier National Park, Washington.
- Van Pelt, R. 2007. Identifying Mature and Old Forests in Western Washington. Washington State Department of Natural Resources, Olympia, WA. 104 p
- Washington Department of Natural Resources, Natural Heritage Program. 2015. Ecological Systems of Washington State. A Guide to Identification.
- Wood, David, and Moral, Roger del. "Mechanisms of Early Primary Succession in Subalpine Habitats on Mount St. Helens." *Ecology* 68, no. 4 (1987).
- Zhao, Yunpeng, Chengzhu Liu, Simin Wang, Yiyun Wang, Xiaoqing Liu, Wanqing Luo, and Xiaojuan Feng. "'Triple Locks' on Soil Organic Carbon Exerted by Sphagnum Acid in Wetlands." *Geochimica et Cosmochimica Acta* 315 (December 2021): 24–37. <https://doi.org/10.1016/j.gca.2021.09.028>.

Contributors

Alec Haulotte
Erin Kreutz
Abigail Field
Max Ross
Erik Dahlke

Approval

Grant Petersen, 5/15/2025

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	09/27/2026
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:
