

# Ecological site F003XC306WA

## High Glacial Valley Floors Forest

### subalpine fir

Last updated: 1/29/2025  
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#### 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): 003X—Olympic and Cascade Mountains

This area includes the west slope and parts of the east slope of the Cascades Mountains in Washington and Oregon. The Olympic Mountains in Washington State are also included. These mountains are part of a volcanic arc located at a convergent plate boundary. Volcanic rocks predominate but metamorphic and sedimentary rocks occur in the North Cascades and Olympic Mountains. Topography is generally dissected and steep, but some areas consist of constructional volcanic platforms and isolated stratovolcanoes. Elevation is usually 500 to 6000 feet but reaches to 14,410 ft at the summit of Mount Rainier. Many areas hosted alpine glaciers or ice sheets during the Pleistocene, and a few remain today. Climate becomes cooler and moister with increasing elevation and latitude. Low elevations experience a long growing season and mild temperatures. High elevations can accumulate snowpack lasting into summer and frost may occur in any month. Average annual precipitation ranges from 60 to 180 inches in most areas. Most precipitation falls during the fall, winter, and spring during low-intensity frontal storms. Summers are relatively dry. Average annual temperature is 27 to 50 degrees F. The frost-free period is 10 to 180 days.

#### LRU notes

The Glaciated Western Cascades land resource unit is located in southwestern Washington primarily along the western slope of the Cascade Range. It is bounded by the Snoqualmie Pass area to the north and the Columbia River to the south. To the west is the Puget Sound Trough (MLRA 2) and to the east is the drier eastern slope of the Cascade Range (MLRA 6). The major rivers originating in the LRU are the Puyallup and Nisqually Rivers which drain to Puget Sound and the Cowlitz and Lewis Rivers which drain west to the Columbia. Some of the lithology in the LRU is the result of numerous accretions from tectonic subduction of the Pacific plate along the margin of the North American plate creating combinations of metamorphized sedimentary or oceanic rock and intrusive volcanic plutons. The Cascades in this area have a long history of volcanic activity starting about 55 million years ago. Eruptions have created a complex sequence of low-silica and silica-rich depositions that have been eroded and buried repeatedly (Washington Geological Survey). Mount Rainier, Mount Adams, and Mount Saint Helens are volcanoes and the most notable peaks; Mount Saint Helens continues to vent after the 1980 eruption. Alpine glaciers still remain active at the highest elevations. The area was not influenced by continental glaciation, however Pleistocene alpine glaciation modified much of the dissected terrain and contributed glacial sediment to the complex combination of lithologies and volcanism. Soils are mainly Spodosols and Andisols. Vegetation is primarily dense forest with some parkland in subalpine and alpine areas. Douglas-fir (*Pseudotsuga menziesii*) and western hemlock (*Tsuga heterophylla*) are the dominate tree species found at lower elevations; western redcedar (*Thuja plicata*) is quite common. Pacific silver fir (*Abies amabilis*) and mountain hemlock (*Tsuga mertensiana*) are the primary tree species in the higher elevations; subalpine fir (*Abies lasiocarpa*) and Alaska cedar (*Callitropsis nootkatensis*) can be widespread as well.

#### Classification relationships

USFS Plant Association: ABLA/PAMY.

#### Ecological site concept

This ecological site resides in mountainous areas on glacial valley floors or valley walls and mountain slopes at elevations ranging 3,000 to 5,500 feet on slopes of 5 to 30 percent. The climate is cold and relatively dry (average frost-free days range from 35 to 80, the mean annual precipitation is 55 to 100 inches and the mean annual air temperature is 38 to 42 degrees Fahrenheit. The soils are primarily Andisols. Parent material is volcanic ash over glacial till. The soils develop andic soil properties from the weathering of volcanic ash and exhibit unique water holding capacities. The soil temperature regime is cryic and the soil moisture regime is udic. The reference phase is dominated by subalpine fir and Englemann spruce (*Picea engelmannii*). Seral species include lodgepole pine (*Pinus contorta*); after 100

years, lodgepole pine begins to die. Warmer sites will have Douglas-fir, western white pine (*Pinus monticola*), and western larch (*Larix occidentalis*); higher elevations will have whitebark pine (*Pinus albicaulis*), and subalpine larch (*Larix lyallii*). The understory species include deerfoot vanilla leaf (*Achlys triphylla*), pipsissewa (*Chimaphila umbellata*), dwarf Oregon-grape (*Mahonia nervosa*), fool's huckleberry (*Menziesia ferruginea*), Oregon boxleaf (*Paxistima myrsinites*), pyrola species, Pacific yew (*Taxus brevifolia*), and various *Vaccinium* species. This site occurs in the subalpine fir zone of cold, high elevation areas with persistent slow-melting snow that causes a short growing season. Alpine areas in the Cascades can be affected by numerous lightning strikes during the growing season; fire return interval ranges 100- 300 years generally, with stand replacing events occurring 50 percent of the time; mixed severity events occur as well. Insects and disease can cause small endemic patch disturbances or larger epidemic events. Insects such as mountain pine beetles and bark beetles effect lodgepole pine seral stands, causing small or large patches of dead trees. Diseases that affect can be Armillaria and Annosum root disease, Laminated and Tomentosus root rot, Indian paint fungus (*Echinodontium tinctorium*), brown cubical rot (*Phaeolus schweinitzii*), or dwarf mistletoe (*Arceuthobium* spp.).

Associated sites

|             |                                                    |
|-------------|----------------------------------------------------|
| F003XC307WA | High Mountain Slopes Forest Pacific silver fir     |
| F003XC309WA | Mountain Slopes Parkland and Forest whitebark pine |

Similar sites

|             |                                           |
|-------------|-------------------------------------------|
| F003XA306WA | East Mountain Slopes Forest subalpine fir |
|-------------|-------------------------------------------|

Table 1. Dominant plant species

|            |                                                                |
|------------|----------------------------------------------------------------|
| Tree       | (1) <i>Abies lasiocarpa</i><br>(2) <i>Picea engelmannii</i>    |
| Shrub      | (1) <i>Paxistima myrsinites</i><br>(2) <i>Mahonia nervosa</i>  |
| Herbaceous | (1) <i>Achlys triphylla</i><br>(2) <i>Chimaphila umbellata</i> |

Physiographic features

This ecological site resides in mountainous areas on glacial valley floors or valley walls and mountain slopes at elevations ranging 3000 to 5500 feet on slopes of 5 to 30 percent.

Table 2. Representative physiographic features

|           |                                                                                                               |
|-----------|---------------------------------------------------------------------------------------------------------------|
| Landforms | (1) Mountains > Glacial-valley floor<br>(2) Mountains > Glacial-valley wall<br>(3) Mountains > Mountain slope |
| Elevation | 910 – 1,680 m                                                                                                 |
| Slope     | 10 – 30 %                                                                                                     |

|        |              |
|--------|--------------|
| Aspect | W, NW, S, SW |
|--------|--------------|

### Climatic features

The climate is cold and relatively dry. The mean annual air temperature is 38 to 42 degrees Fahrenheit.

Table 3 Representative climatic features

|                                            |                |
|--------------------------------------------|----------------|
| Frost-free period (characteristic range)   | 40-80 days     |
| Freeze-free period (characteristic range)  |                |
| Precipitation total (characteristic range) | 1,400-2,540 mm |

### Influencing water features

This site is not influenced by water from a wetland or stream.

### Soil features

The soils are primarily Andisols formed from volcanic ash mixed with glacial till parent material in the cryic soil temperature and udic soil moisture regimes. Andic properties occur from 0 to 60 inches in depth in the soil pedon.

Table 4. Representative soil features

|                             |                              |
|-----------------------------|------------------------------|
| Parent material             | (1) Volcanic ash<br>(2) Till |
| Surface texture             | (1) Ashy sandy loam          |
| Family particle size        | (1) Ashy-skeletal            |
| Drainage class              | Well drained                 |
| Permeability class          | Rapid                        |
| Depth to restrictive layer  | 150 cm                       |
| Soil depth                  | 150 cm                       |
| Surface fragment cover <=3" | 10 – 30 %                    |
| Surface fragment cover >3"  | 0 – 10 %                     |

|                                                       |                 |
|-------------------------------------------------------|-----------------|
| Available water capacity<br>(Depth not specified)     | 7.62 – 10.16 cm |
| Calcium carbonate equivalent<br>(Depth not specified) | Not specified   |
| Soil reaction (1:1 water)<br>(Depth not specified)    | 5.1 – 6.5       |

## Ecological dynamics

This site occurs in the subalpine fir zone of cold, high elevation areas with persistent slow-melting snow that causes a short growing season. There can be numerous lightning strikes in the area; and the fire return interval generally ranges 100 - 300 years, with about half of the fires occurring as stand replacing events; mixed severity fires occur as well. The USFS Fire Effects Information System classification for subalpine fir in the North Cascades states a fire return interval of 154 years. Seral stands with lodgepole pine have a fire return interval of 109 years. In the Wenatchee National Forest., fire return intervals occur less than 300 years, as evidenced by stand ages. LANDFIRE BPS 0810550 Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland, has a fire return interval ranging from 99 to 125 years, though for subalpine mixed conifer forests as 250 years of stand replacing and mixed severity fires. Insects and disease can cause small endemic patch disturbances or larger epidemic events. Insects such as the mountain pine beetle (*Dendroctonus ponderosae*) and other bark beetles effect lodgepole pine seral stands, causing small or large patches of dead trees. Diseases the effect the site include *Armillaria* and *Annosum* root disease, Laminated and *Tomentosus* root rot, Indian paint fungus (*Echinodontium tinctorium*), brown cubical rot (*Phaeolus schweinitzii*), or dwarf mistletoe (*Arceuthobium* spp.).

## 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 (%) |
|-------|-------------|--------|-----------------|----------------------|------------------|
|-------|-------------|--------|-----------------|----------------------|------------------|

Table 8. Community 1.4 plant community composition

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

Table 9. Community 1.5 plant community composition

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

## Other references

Scientific Literature:

WENATCHEE N.F.

Lillybridge, Terry R., et al. "Field guide for forested plant associations of the Wenatchee National Forest." Gen. Tech. Rep. PNW-GTR-359. Portland, OR: US Department of Agriculture, Forest Service, Pacific Northwest Research Station. 335 p. In cooperation with: Pacific Northwest Region, Wenatchee National Forest 359 (1995).

OLYMPIC N.F.

Henderson, Jan A., et al. "Forested plant associations of the Olympic National Forest." (1989).

GIFFORD PINCHOT N.F.

Brockway, Dale G. Plant association and management guide for the Pacific silver fir zone: Gifford Pinchot National Forest. US

Department of Agriculture, Forest Service, Pacific Northwest Region, 1983.

Topik, Christopher, Nancy M. Halverson, and Dale G. Brockway. Plant association and management guide for the western hemlock zone: Gifford Pinchot National Forest. US Department of Agriculture, Forest Service, Pacific Northwest Region, 1986.

Topik, Christopher. Plant association and management guide for the grand fir zone: Gifford Pinchot National Forest. Vol. 6. No. 88. US Department of Agriculture, Forest Service, Pacific Northwest Region, 1989.

Diaz, Nancy M. "Plant association and management guide for the mountain hemlock zone: Gifford Pinchot and Mt. Hood National Forests." (1997).

MT. BAKER-SNOQUALMIE N.F.

Henderson, Jan A. Field guide to the forested plant associations of the Mt. Baker-Snoqualmie National Forest. Vol. 28. No. 91. USDA, Forest Service, Pacific Northwest Region, 1992.

FIRE

Landfire, USFS FEIS.

LANDFIRE, 2007, Biophysical Settings Model Descriptions, LANDFIRE 1.1.0, U.S. Department of the Interior, USDA Forest service, Accessed 20 April 2020 at <https://www.landfire.gov/bps-models.php>

Rocchio, F. J., and R. C. Crawford. "Draft field guide to Washington's ecological systems." Washington Natural Heritage Program, Washington Department of Natural Resources. Olympia, WA (2008).

Franklin, J., & Dyrness, C. Natural vegetation of Oregon and Washington. : Portland, Or., Pacific Northwest Forest and Range Experiment Station, Forest Service, U.S. Dept. of Agriculture.

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## Approval

Kirt Walstad, 1/29/2025

## 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                                        | 05/09/2024        |
| Approved by                                 |                   |
| Approval date                               |                   |
| Composition (Indicators 10 and 12) based on | Annual Production |

## Indicators

1. Number and extent of rills:

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2. Presence of water flow patterns:

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3. Number and height of erosional pedestals or terracettes:

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

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5. Number of gullies and erosion associated with gullies:

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

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

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

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

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

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

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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:

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

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

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

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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:

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17. Perennial plant reproductive capability:

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