

## Ecological site F003XB307WA High Mountain Slopes Forest Pacific silver fir

Last updated: 5/10/2024  
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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 Olympic Mountains land resource unit is composed of the mid to upper elevation areas on the Olympic Peninsula in northwest Washington. It occurs primarily on the eastern side of the peninsula above the warmer, lower Olympic foothills of MLRA 2.

Large amounts of rain and snow contribute to a very moist environment and a considerable stream and river network. Major rivers that have headwaters in the LRU include the Elwha, Wynoochee, and Skokomish Rivers.

Lithology is primarily oceanic sedimentary rock stacked in an accretionary wedge and coastal basalt that has been metamorphosed and vertically uplifted into a large horseshoe shape called the Crescent Formation (Washington Geological Survey). This chaotic collection of rock in many cases has been metamorphosed. These geologic materials were heavily modified by Pleistocene alpine glaciation. Contemporary glaciers which receive copious amounts of yearly snowfall continue to sculpt the dissected valleys with runoff.

Soils are primarily Spodosols, Inceptisols, and unique Andisols developed from non-volcanic materials.

The LRU has strong a rainshadow effect and areas on the northeastern side of the peninsula are considerably drier than near-Pacific western slopes. Vegetation is primarily dense forest. At lower elevations, western hemlock (*Tsuga heterophylla*) is the dominate tree species; western redcedar (*Thuja plicata*) is quite common in moist areas and Douglas-fir (*Pseudotsuga menziesii*) is common in drier areas. 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:

western hemlock/Alaska huckleberry/salal, Olympic  
western hemlock/Pacific rhododendron-salal, Olympic

## Ecological site concept

This ecological site is found predominantly on mountain slopes and valleys in the mountains, at elevations ranging from 2,700 to 3,600 feet on slopes of 45 to 80 percent. The climate is cool and moist (average frost-free days range from 125 to 150, average mean annual precipitation is 75 to 120 inches and mean annual air temperature is 40 to 42 Fahrenheit. The soils are in the cryic soil temperature regime and udic soil moisture regime. Soils are typically Haplocryands with medial-skeletal textures. Lithic contacts are common. Some soils have spodic materials or have an argillic horizon in more stable positions. Parent material is primarily colluvium derived from basalt or marine sedimentary rock. The reference community is a multi-layered tree canopy dominated by Pacific Silver fir (*Abies Amabilis*), with an understory dominated by Alaska blueberry (*Vaccinium alaskense*) and other moist adapted shrub and herbaceous species including red huckleberry (*Vaccinium parvifolium*), strawberryleaf raspberry (*Rubus pedatus*), bride's bonnet (*Clintonia uniflora*), oxalis species, twinflower (*Linnea borealis*), Cascade azalea (*Rhododendron albiflorum*), deer fern (*Blechnum spicant*), bunchberry dogwood (*Cornus canadensis*), and rusty menziesia (*Menziesii ferruginea*). Moisture across the site is dependent on aspect. Drier areas within this ecological site, have an understory with common beargrass (*Xerophyllum tenax*), Pacific rhododendron (*Rhododendron macrophyllum*), salal (*Gaultheria shallon*). Areas of higher moisture may have an addition of devilsclub (*Oplopanax horridus*), sweet after death (*Achlyus triphylla*), or threeleaf foamflower (*Tiarella trifoliata*) in the understory. Fire is the primary disturbance but occurs as rare, stand replacement events on a fire rotational interval of 500 years. Sites with a seasonal water table higher in the soil profile may have a fire interval of 1,000 years. Some drier sites may have fire more frequently on a rotation of 200 to 300 years. Post fire disturbance areas have a community of fireweed (*Chamerion angustifolia*), pearly everlasting (*Anaphalis margaritacea*), and other pioneering species that are quickly overtaken by resprouting resident shrub species. There are many seral tree species including Douglas fir (*Pseudotsuga menziesii*), western larch (*Larix occidentalis*), western white pine (*Pinus monticola*), Alaska cedar (*Callitropsis nootkansensis*), and mountain hemlock (*Tsuga mertensiana*). Pacific silver fir (*Abies amabilis*) eventually gains an advantage in the closed cool canopy within the interior of the forest and dominates the upper tree canopies. Insect damage and diseases such as Annosus, laminated or Armillaria root rot, heart and butt rot can occur on this site.

## Associated sites

|             |                                                  |
|-------------|--------------------------------------------------|
| F003XB308WA | High Cirque Walls Forest mountain hemlock        |
| F003XB305WA | Low Mountain Slopes Moist Forest western hemlock |

## Similar sites

|             |                                           |
|-------------|-------------------------------------------|
| F003XA307WA | Mountain Slopes Forest Pacific silver fir |
|-------------|-------------------------------------------|

Table 1. Dominant plant species

|            |                                                                         |
|------------|-------------------------------------------------------------------------|
| Tree       | (1) <i>Abies amabilis</i>                                               |
| Shrub      | (1) <i>Vaccinium alaskaense</i><br>(2) <i>Rhododendron macrophyllum</i> |
| Herbaceous | (1) <i>Gaultheria shallon</i>                                           |

## Physiographic features

This ecological site is found predominantly on mountain slopes and valleys in the mountains, at elevations ranging 2,700 to 3,600 feet on 45 to 80 percent slopes.

**Table 2. Representative physiographic features**

|                    |                                              |
|--------------------|----------------------------------------------|
| Landforms          | (1) Mountains > Mountain slope<br>(2) Valley |
| Flooding frequency | None                                         |
| Ponding frequency  | None                                         |
| Elevation          | 823–1,097 m                                  |
| Slope              | 45–80%                                       |
| Aspect             | W, NW, N, NE, E, SE, S, SW                   |

## Climatic features

The climate is cool and moist. The mean annual air temperature is 40 to 42 degrees Fahrenheit.

**Table 3. Representative climatic features**

|                                            |                |
|--------------------------------------------|----------------|
| Frost-free period (characteristic range)   | 125-150 days   |
| Freeze-free period (characteristic range)  |                |
| Precipitation total (characteristic range) | 1,905-3,048 mm |

## Influencing water features

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

## Soil features

The soils are in the cryic soil temperature regime and udic soil moisture regime. Soils are typically Haplocryands with medial-skeletal textures. Lithic contacts are common. Some soils have spodic materials or have an argillic horizon in more stable positions.

**Table 4. Representative soil features**

|                                                    |                                              |
|----------------------------------------------------|----------------------------------------------|
| Parent material                                    | (1) Colluvium–basalt<br>(2) Sedimentary rock |
| Surface texture                                    | (1) Medial sandy loam<br>(2) Medial loam     |
| Family particle size                               | (1) Medial-skeletal                          |
| Drainage class                                     | Somewhat poorly drained to well drained      |
| Permeability class                                 | Moderately rapid to rapid                    |
| Depth to restrictive layer                         | 10–152 cm                                    |
| Soil depth                                         | 10–152 cm                                    |
| Surface fragment cover <=3"                        | 0–50%                                        |
| Surface fragment cover >3"                         | 0–30%                                        |
| Available water capacity<br>(Depth not specified)  | 0.76–14.73 cm                                |
| Soil reaction (1:1 water)<br>(Depth not specified) | 3.5–6.5                                      |

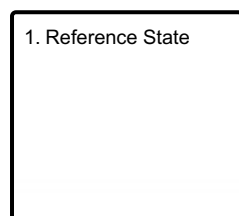
## Ecological dynamics

This ecological site is found predominantly on mountain slopes and valleys at elevations ranging 2,700 to 3,600 feet

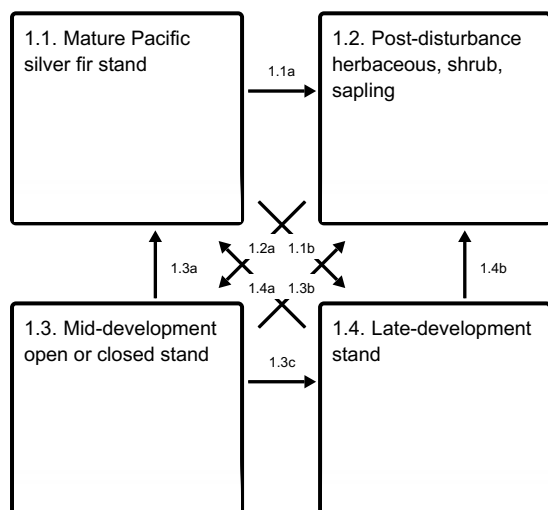
on slopes of 45 to 80 percent. The climate is cool and moist; the average frost free days range from 125 to 150, average mean annual precipitation is 75 to 120 inches and mean annual air temperature is 40-42 degrees Fahrenheit. The soils are in the cryic soil temperature regime and udic soil moisture regime. Soils are typically Haplocryands with medial-skeletal textures. Lithic contacts are common. Some soils have spodic materials or have an argillic horizon in more stable positions. The reference community is a multi-layered tree canopy dominated by Pacific silver fir, with an understory dominated by Alaska blueberry and other moist adapted shrub and herbaceous species. Fire is the dominant disturbance and occurs as rare, stand replacement events that occurs typically on a rotational interval of 500 years in the Olympic N.F. Pacific silver fir in general has a fire return interval of 500 years (USFS FEIS, Pacific silver fir). Areas that have a seasonal water table with more moisture adapted understory species may have fire on an interval of 1,000 years; drier areas within this ecological site may have fire more frequently at every 200 to 300 years. LANDFIRE: BPS 0111740 North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest states that mixed severity fires occur in 300 year intervals (100 to 400 year range), stand replacement severity fires occur in 330 year intervals (100 to 800 year range) and all severity type fires occur in 157 intervals. In wetter areas included in this ecological site, the fire regimes is LANDFIRE BPS: PNW mountain hemlock which has fire rotational intervals of 400 to 5000 years with stand replacement severity fires occurring 33 to 100% of occurrences, mixed severity fire as 0-67% of occurrences and no low severity fires.

## State and transition model

### Ecosystem states



### State 1 submodel, plant communities



## State 1 Reference State

### Community 1.1 Mature Pacific silver fir stand

The reference community has an overstory dominated by Pacific silver fir with numerous lower tree canopies of seral species that may include: western hemlock, western redcedar, mountain hemlock (less than ten percent of canopy cover) and Douglas fir. The trees are large (average diameter at breast height is 45 inches) and mature (the average age is over 150 years old). The understory generally has high cover of Alaska blueberry along with tall shrubs and cool, moist adapted herbaceous species including: red huckleberry, thimbleberry, bride's bonnet, common beargrass, oneleaf foamflower, redwood sorrel, rusty menziesia, deer fern, Cascade azalea, bunchberry dogwood.

### Dominant plant species

- Pacific silver fir (*Abies amabilis*), tree
- western hemlock (*Tsuga heterophylla*), tree
- western redcedar (*Thuja plicata*), tree
- mountain hemlock (*Tsuga mertensiana*), tree
- Douglas-fir (*Pseudotsuga menziesii*), tree
- Alaska blueberry (*Vaccinium alaskaense*), shrub
- red huckleberry (*Vaccinium parvifolium*), shrub
- thimbleberry (*Rubus parviflorus*), shrub
- Cascade azalea (*Rhododendron albiflorum*), shrub
- rusty menziesia (*Menziesia ferruginea*), shrub
- bunchberry dogwood (*Cornus canadensis*), shrub
- bride's bonnet (*Clintonia uniflora*), other herbaceous
- deer fern (*Blechnum spicant*), other herbaceous
- common beargrass (*Xerophyllum tenax*), other herbaceous
- oneleaf foamflower (*Tiarella trifoliata* var. *unifoliata*), other herbaceous

## Community 1.2

### Post-disturbance herbaceous, shrub, sapling

This is the post disturbance, pioneering herbaceous community that generally has common fireweed (*Chamerion angustifolia*) and pearly everlasting (*Anaphalis margaritacea*) that give way to a shrub community after approximately two years. There are remnant mature trees throughout. The perennial shrub community has species such as Alaska huckleberry, red huckleberry, thimbleberry and rusty menziesia. Seedlings can establish immediately post-fire from resident seeds and windblown seeds of Pacific silver fir, western redcedar and less mountain hemlock and Douglas fir. Trees in this phase grow to pole-size within forty years.

#### Dominant plant species

- Pacific silver fir (*Abies amabilis*), tree
- western redcedar (*Thuja plicata*), tree
- mountain hemlock (*Tsuga mertensiana*), tree
- Douglas-fir (*Pseudotsuga menziesii*), tree
- Alaska blueberry (*Vaccinium alaskaense*), shrub
- red huckleberry (*Vaccinium parvifolium*), shrub
- strawberryleaf raspberry (*Rubus pedatus*), shrub
- rusty menziesia (*Menziesia ferruginea*), shrub
- fireweed (*Chamerion angustifolium*), other herbaceous
- western pearly everlasting (*Anaphalis margaritacea*), other herbaceous

## Community 1.3

### Mid-development open or closed stand

This is a mid-development stand of pole sized trees of Pacific silver fir and seral tree species, western hemlock and less mountain hemlock and Douglas fir, that has either a closed canopy or an open canopy due to small patch disturbance such as mixed severity fire, windthrow, disease or insect damage. The lower canopy is predominantly Pacific silver fir. Trees average eighty years old and are pole-sized (less than twenty inches at diameter breast height).

#### Dominant plant species

- western hemlock (*Tsuga heterophylla*), tree
- Pacific silver fir (*Abies amabilis*), tree

## Community 1.4

### Late-development stand

This is a late development stand of large than pole sized trees (average diameter at breast height is more than twenty inches) of Pacific silver fir and seral tree species, particularly Douglas fir (in the event of a mixed severity

fire), western hemlock and less mountain hemlock, with a mixed understory of shrubs and herbaceous plant species. Pacific silver fir is in the upper and dominates the lower canopy, with a closed canopy configuration or open canopy depending on the occurrence of mixed severity fire, insect, disease damage or windthrow. In the event of mixed severity fire and a seedbank of Douglas fir, Douglas fir may dominate this phase. The understory has Alaska huckleberry, rusty menziesia, Cascade azalea, bride's bonnet, twinflower, bunchberry dogwood, thimbleberry.

### **Dominant plant species**

- rusty menziesia (*Menziesia ferruginea*), shrub
- Alaska blueberry (*Vaccinium alaskaense*), shrub
- strawberryleaf raspberry (*Rubus pedatus*), shrub
- bunchberry dogwood (*Cornus canadensis*), shrub
- bride's bonnet (*Clintonia uniflora*), other herbaceous
- twinflower (*Linnaea borealis*), other herbaceous

### **Pathway 1.1a**

#### **Community 1.1 to 1.2**

Rare, stand-replacement fire that kills significant number of mature trees and top-kills shrubs and herbaceous plants. The disturbance causes a return to the pioneering, herbaceous community with resprouting shrubs.

### **Pathway 1.1b**

#### **Community 1.1 to 1.4**

Mixed severity fire creates patches of post-fire disturbance within the stand that can allow Douglas fir a competitive advantage over Pacific Silver Fir, resulting in community phase 1.4.

### **Pathway 1.2a**

#### **Community 1.2 to 1.3**

Saplings of seral tree species and Pacific Silver fir mature to pole-sized trees in either a closed canopy, if mixed severity fire does not occur or an open canopy if it does.

### **Pathway 1.3a**

#### **Community 1.3 to 1.1**

With time, the mid development community will grow into the mature reference phase.

### **Pathway 1.3b**

#### **Community 1.3 to 1.2**

Rare, stand-replacement fire that kills significant number of mature trees and top-kills shrubs and herbaceous plants. The disturbance causes a return to the pioneering, herbaceous community with resprouting shrubs.

### **Pathway 1.3c**

#### **Community 1.3 to 1.4**

With time, the mid development community will grow into the mature reference phase.

### **Pathway 1.4a**

#### **Community 1.4 to 1.1**

With time, Pacific Silver fir in the lower tree canopy will dominate the overstory and transition the community phase to the reference phase.

### **Pathway 1.4b**

## Community 1.4 to 1.2

Rare, stand-replacement fire that kills significant number of mature trees and top-kills shrubs and herbaceous plants. The disturbance causes a return to the pioneering, herbaceous community with resprouting shrubs.

## Additional community tables

### 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.

### Contributors

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### Approval

Kirt Walstad, 5/10/2024

### 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                                 | Kirt Walstad      |
| 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:

---

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:**
-