

## **Ecological site F003XA307WA Mountain Slopes Forest Pacific silver fir**

Last updated: 1/29/2025  
Accessed: 05/10/2025

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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 North Cascades land resource unit is located in northwestern Washington primarily along the western slope of the Cascade Range. It bounded by the international boundary with Canada to the north and the Snoqualmie Pass area 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 Skagit River is the largest river to originate in the LRU and is governed by three hydroelectric dams. Other rivers that drain west include the Nooksack, Snohomish, and Skykomish. The Wenatchee River drains east toward the Columbia.

Lithology is the result of numerous accretions from tectonic subduction of the Pacific plate along the margin of the North American plate. The North Cascades are arranged in a west to east series of terranes which are combinations of metamorphized sedimentary or oceanic rock and intrusive volcanic plutons, punctuated by the minorly active Mount Baker and Glacier Peak volcanoes (Washington Geological Survey). Additionally, Pleistocene continental and alpine glaciation covered almost all of the area except the highest peaks in the range and deposited large amounts of glacial sediment. Alpine glaciers still remain active today in the highest elevations.

Soils are primarily Spodosols, Andisols, and Inceptisols.

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: ABAM/VAAL-MEFE

Ecological site concept

This ecological site is defined as being in the cryic soil temperature and udic soil moisture regime, at elevations spanning 3,000 to 5,300 feet on moderate to steep slopes (20 to 50 percent) on mountain slopes and glacial valley walls. The climate is influenced by the mountain environment (frost free days average 50 to 85 days, mean annual precipitation is 55 to 85 inches and the representative mean annual air temperature is 38 to 42 degrees Fahrenheit). The site is defined by moderate snowpack, a cooler growing season, and adequate precipitation. Soils are primarily Spodosols with some Andisols. A common feature with all representative soils is andic soil properties derived primarily from influence of volcanic ash. The soils have unique water holding capacities which provide plant-available moisture throughout the drier growing season. The parent material is volcanic ash over colluvium or till. These soils are also relatively high in organic matter due to the formation of metal-humus compounds typical for soils in this weathering regime and ash-influenced parent material. The reference community has Pacific silver fir in the overstory and in the regenerating layer, various seral tree species in multiple tree canopy layers and an understory that spans moist adapted species to drier site adapted species. Seral tree species include western hemlock, western redcedar, subalpine fir, Douglas-fir, western larch, western white pine, noblefir, lodgepole pine, Engelmann spruce and Alaska yellow cedar. Moist adapted understory species include rusty menziesia (*Menziesia ferruginea*), devilsclub (*Ophopanax horridus*), Cascade azalea (*Rhododendren albiflorum*), sweet after death (*Achlys triphylla*), Alaska blueberry (*Vaccinium alaskense*), threeleaf foamflower (*Tiarella trifoliata*) while dry site adapted vegetation include vine maple (*Acer circinatum*), roughfruit berry (*Rubus lasiococcus* ), thinleaf huckleberry (*Vaccinium membranaceum*). The fire return interval is generally rare (200 to 500 years) and typical fires are stand replacing, Pacific silver fir is a fire avoider, meaning it perishes in fire although the resident seedbank and windblown tree seedlings quickly re-establish. Shrubs resprout and pioneering herbaceous species establish on the site post-fire. Shrubs form a post-disturbance phase include vine maple, Douglas maple (*Acer glabrum* var. *douglasii*), Scouler willow (*Salix scouleriana*), Oregon boxleaf (*Paxistima myrsinites*), thinleaf huckleberry, Saskatoon serviceberry (*Amalancheir alnifolia*), Sitka alder (*Alnus viridis*) and snowbrush ceanothus (*Ceanothus velutinus*). Fires on the east side of the continental divide are more frequent due to drier continental climate factors. Fire is a rare, large patch disturbance while diseases and insects are frequent, small disturbances that serve to open the tree canopy in patches and include: Annosum and laminated root disease in subalpine fir, Engelmann spruce, Pacific silver fir, Grand fir, western hemlock, mountain hemlock; Indian paint fungus, mistletoe; severe outbreaks with mountain pine beetle (sere lodgepole pine), and the silver fir beetle.

Associated sites

|             |  |
|-------------|--|
| R003XA304WA | Avalanche Sitka alder ( <i>Alnus viridis</i> ) |
|-------------|--|

Similar sites

|             |  |
|-------------|--|
| F003XB307WA | High Mountain Slopes Forest Pacific silver fir |
|-------------|--|

Table 1. Dominant plant species

|            |  |
|------------|--|
| Tree       | (1) <i>Abies amabilis</i>  |
| Shrub      | (1) <i>Menziesia ferruginea</i><br>(2) <i>Vaccinium alaskaense</i> |
| Herbaceous | Not specified  |

Physiographic features

This ecological site resides at elevations typically 3,000 to 5,300 feet, on slopes are typically 30 to 50 percent, on mountain slopes and glacial valleys within the landscape of mountains.

**Table 2. Representative physiographic features**

|           |  |
|-----------|--|
| Landforms | (1) Mountains > Mountain slope<br>(2) Mountains > Glacial-valley floor |
| Elevation | 3,000–5,300 ft   |
| Slope     | 20–50%   |
| Aspect    | W, NW, N, S, SW  |

## Climatic features

The climate is moderate for the mountain environment. The mean annual air temperature is 38-42 Fahrenheit. The site is defined by moderate to very high snowpack, a moderate growing season, adequate precipitation.

**Table 3. Representative climatic features**

|  |            |
|--|------------|
| Frost-free period (characteristic range)   | 50-85 days |
| Freeze-free period (characteristic range)  |            |
| Precipitation total (characteristic range) | 60-85 in   |

## Influencing water features

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

## Soil features

Soils are primarily Spodosols with some Andisols. A common feature with all representative soils is andic soil properties derived primarily from influence of volcanic ash. The soils have unique water holding capacities which provide plant-available moisture throughout the drier growing season. The parent material is volcanic ash over colluvium, residuum or till. These soils are also relatively high in organic matter due to the formation of metal-humus compounds typical for soils in this weathering regime and ash-influenced parent material. Andic properties range 0 to 60 inches depth, but are typically 0-30 inches depth.

**Table 4. Representative soil features**

|   |  |
|---|--|
| Parent material                                       | (1) Colluvium<br>(2) Residuum<br>(3) Till                                |
| Surface texture                                       | (1) Ashy sandy loam<br>(2) Ashy fine sandy loam<br>(3) Medial sandy loam |
| Family particle size                                  | (1) Ashy over loamy-skeletal<br>(2) Medial over loamy-skeletal           |
| Drainage class  | Moderately well drained to well drained                                  |
| Permeability class                                    | Very slow to rapid   |
| Depth to restrictive layer                            | 20–60 in   |
| Soil depth  | 20–60 in   |
| Surface fragment cover <=3"                           | 0–30%  |
| Surface fragment cover >3"                            | 0–10%  |
| Available water capacity<br>(Depth not specified)     | 1.1–6.2 in   |
| Calcium carbonate equivalent<br>(Depth not specified) | 0%   |

|  |         |
|--|---------|
| Soil reaction (1:1 water)<br>(Depth not specified) | 5.1–7.3 |
|--|---------|

## Ecological dynamics

The fire return interval is generally rare (200 to 500 years) and fires are typically stand replacing, Pacific silver fir is a fire avoider, meaning it perishes in fire although the resident seedbank and windblown tree seedlings quickly re-establish. Shrubs resprout and pioneering herbaceous species establish on the site post fire. Shrubs form a post disturbance phase include vine maple, Douglas maple, Scouler willow, Oregon boxleaf, thinleaf huckleberry, Saskatoon serviceberry, Sitka alder and snowbrush ceanothus. Fires on the east side of the continental divide are more frequent due to drier continental climate factors. Fire is a rare, large patch disturbance while diseases and insects are frequent, small disturbances that serve to open the tree canopy in patches and include: Annosum and laminated root disease in subalpine fir, Engelmann spruce, Pacific silver fir, Grand fir, western hemlock, mountain hemlock; Indian paint fungus, mistletoe; severe outbreaks with mountain pine beetle (sere lodgepole pine), and the silver fir beetle.

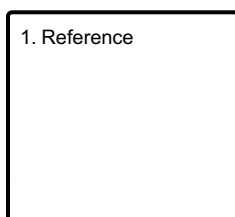
### FIRE REFERENCES:

Summary: Fire is a rare event and at stand replacement severity every 200-500 years.

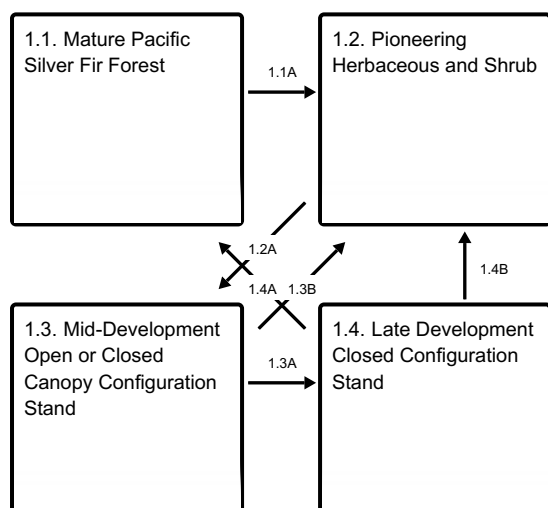
- USFS FEIS WEBSITE: FRI (fire return interval)=200-500 yrs. Severe stand replacing fire.
- WENA (Wenatchee N.F. Plant Associations reference): FRI=400 yrs.
- LANDFIRE: BPS 0111740 North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest

## State and transition model

### Ecosystem states



### State 1 submodel, plant communities



## State 1 Reference

### Community 1.1 Mature Pacific Silver Fir Forest

A multicanopy forest that is dominated by Pacific silver fir in the overstory and regenerating layers with seral trees (western hemlock, western redcedar, Douglas fir, Alaska cedar). These trees are large (the average diameter at

breast height is 45 inches) and older, mature trees (at least 150 years old on average). The understory varies from moist sites with moist adapted understory species include rusty menziesia, devilsclub, Cascade azalea, sweet after death, Alaska blueberry, threeleaf foamflower while dry site adapted vegetation include vine maple , roughfruit berry, thinleaf huckleberry. This site is very stable.

## **Community 1.2**

### **Pioneering Herbaceous and Shrub**

A post fire community that is initially of pioneering herbaceous species that is quickly (after approximately two years) dominated by a shrub community of resprouting and windblown seeds that quickly establish. Shrubs that dominate after about a decade post-fire. Shrub species can include: vine maple, thinleaf huckleberry, Saskatoon serviceberry, Sitka alder, and snowbush ceanothus. Tree seedlings (western hemlock, western redcedar, Douglas fir, Alaska cedar) from resident seedbank and windblown seeds from off-site establish and grow to saplings. This entire phase lasts approximately forty years.

## **Community 1.3**

### **Mid-Development Open or Closed Canopy Configuration Stand**

Community Phase 1.3: An open or closed canopy configuration with seral trees (western hemlock, western redcedar, Douglas fir, Alaska cedar) in the upper canopy and Pacific silver fir in the lower canopy layer with seral tree species in the upper canopy. The open canopy is due to mixed fire severity, though disease, insects and windthrow may also occur and cause small patch disturbance. Trees are pole-sized (average diameter at breast height is twenty inches) and young (average tree age is eighty years old).

## **Community 1.4**

### **Late Development Closed Configuration Stand**

A closed canopy configuration with seral tree species (western hemlock, western redcedar, Douglas fir, Alaska cedar) in the upper and lower canopies and Pacific silver fir in the lower canopy.

## **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. This disturbance causes a return to the pioneering, herbaceous community with resprouting shrubs.

## **Pathway 1.2A**

### **Community 1.2 to 1.3**

1.2a:With time, the tree seedlings and small saplings go to the mid development community and due to the occurrence of mixed severity fire the canopy is in an open configuration. With time, the tree seedlings and small saplings go to the mid development community and due to the occurrence of mixed severity fire the canopy is in an open configuration.

## **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. This disturbance causes a return to the pioneering, herbaceous community with resprouting shrubs.

## **Pathway 1.3A**

### **Community 1.3 to 1.4**

With time, the pole sized trees develop to large mature trees in the late development phase.

## **Pathway 1.4A**

## **Community 1.4 to 1.1**

With time, the large mature trees develop into the closed configuration of the reference phase without the occurrence of mixed severity fire.

## **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. This 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).  
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## **Contributors**

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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                                 | 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):**
- 

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):**
- 

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:**
-