

## **Ecological site F003XC307WA**

### **High Mountain Slopes Forest Pacific silver fir**

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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: ABAM/MEFE-VAAL.

Ecological site concept

This ecological site is defined as being in the cryic soil temperature and udic soil moisture regime, at elevations spanning 3,300 to 5,500 feet on moderate to steep slopes (30 to 60 percent) on mountain slopes. The climate is influenced by the mountain environment and is cool and moist (frost free days average 50 to 85 days, mean annual precipitation is 60 to 90 inches and the mean annual air temperature is 38 to 42 degrees Fahrenheit). The site is defined by moderate snowpack, a cooler growing season, and adequate precipitation. The soils are Andisols (Typic or Ultic Vitricryands) with ashy-skeletal soil textures or Spodosols (Andic Haplocryods) with loamy-skeletal soil textures. Parent material is volcanic ash over colluvium from igneous or metamorphic rock. Lithic contacts within the profile are common, although some soils are greater than 60 inches to bedrock. The reference community has Pacific silver fir (*Abies amabilis*) 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 (*Tsuga heterophylla*), western redcedar (*Thuja plicata*), subalpine fir (*Abies lasiocarpa*), Douglas-fir (*Pseudotsuga menziesii*), western larch (*Larix occidentalis*), western white pine (*Pinus monticola*), noble fir (*Abies procera*), lodgepole pine (*Pinus contorta*), Engelmann spruce (*Pinus engelmannii*) and Alaska cedar (*Callitropsis nootkanensis*). Moist adapted understory species include rusty menziesia (*Menziesia ferruginea*), devilsclub (*Oplopanax horridus*), sweet after death (*Achlys triphylla*), Alaska blueberry (*Vaccinium alaskense*), threeleaf foamflower (*Tiarella trifoliata*) while dry site adapted vegetation includes vine maple (*Acer circinatum*) and common beargrass (*Xerophyllum tenax*). Colder sites have Cascade azalea (*Rhododendron albiflorum*) and thinleaf huckleberry (*Vaccinium membranaceum*). The fire return interval is generally rare (200 to 500 years) and typical fires are stand replacing, Pacific silver fir (*Abies amabilis*) 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 included in the post disturbance phase are vine maple, Douglas maple (*Acer glabrum* var. *douglasii*), Scouler willow (*Salix scouleriana*), Oregon boxleaf (*Paxistima myrsinites*), thinleaf huckleberry, Saskatoon serviceberry (*Amelanchier alnifolia*), Sitka alder (*Alnus viridis*) and snowbrush ceanothus (*Ceanothus velutinus*). Fires on the east side of the Cascade Crest are more frequent due to the drier continental climate factors. Fire is a rare, large patch disturbance while diseases and insect impacts are frequent, small disturbances that serve to open the tree canopy in patches and include, Annosum and laminated root disease, Indian paint fungus, mistletoe, severe outbreaks of mountain pine beetle (in *Pinus contorta*), and silver fir beetle.

Associated sites

F003XC306WA	High Glacial Valley Floors Forest subalpine fir
F003XC309WA	Mountain Slopes Parkland and Forest whitebark pine

Similar sites

F003XA307WA	Mountain Slopes Forest Pacific silver fir
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> (2) <i>Vaccinium alaskaense</i>
Herbaceous	(1) <i>Achlys triphylla</i> (2) <i>Tiarella trifoliata</i> var. <i>unifoliata</i>

## Physiographic features

This ecological site resides on mountain slopes in the mountains at elevations spanning 3,300 to 5,500 feet on slopes of 30 to 60 percent.

**Table 2. Representative physiographic features**

Landforms	(1) Mountains > Mountain slope
Flooding duration	Brief (2 to 7 days)
Flooding frequency	Occasional to none
Ponding frequency	None
Elevation	3,300–5,500 ft
Slope	30–60%
Aspect	W, NW, N, S, SW

## Climatic features

The climate is cool and moist. The mean annual air temperature is 38-42 Fahrenheit.

**Table 3. Representative climatic features**

Frost-free period (characteristic range)	50-85 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	60-90 in

## Influencing water features

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

## Soil features

This ecological site is defined as being in the cryic soil temperature and udic soil moisture regime. The soils are Andisols (Typic or Ultic Vitricryands) with ashy-skeletal soil textures or Spodosols (Andic Haplocryods) with loamy-skeletal soil textures. Parent material is volcanic ash over colluvium from igneous or metamorphic rock. Lithic contacts within the profile are common, although some soils are greater than 60 inches to bedrock. Andic soil properties can occur at 0 to 60 inches, but typically 0 to 30 inches depth in the soil pedon.

**Table 4. Representative soil features**

Parent material	(1) Colluvium–igneous rock (2) Volcanic ash (3) Colluvium–metamorphic rock
Surface texture	(1) Ashy sandy loam (2) Ashy loamy sand
Family particle size	(1) Ashy-skeletal (2) Ashy-skeletal over loamy-skeletal
Drainage class	Somewhat poorly drained to well drained
Permeability class	Moderately rapid to rapid
Depth to restrictive layer	20–60 in
Soil depth	20–60 in
Surface fragment cover <=3"	0–26%

Surface fragment cover >3"	0–19%
Available water capacity (Depth not specified)	1–6.9 in
Calcium carbonate equivalent (Depth not specified)	0%
Soil reaction (1:1 water) (Depth not specified)	4.5–7.3

## Ecological dynamics

The fire return interval is generally rare (200 to 500 years) and is 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 and include vine maple, Douglas maple, Scouler willow, pachistima, big huckleberry, serviceberry, Sitka alder and snowbrush ceanothus. Fires on the east side of the continental divide are more frequent due to the 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 of mountain pine beetle (in lodgepole pine), and silver fir beetle.

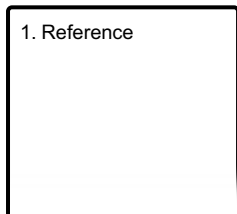
### FIRE

Summary: Fire is rare, stand replacement severity 200-500 fire return interval

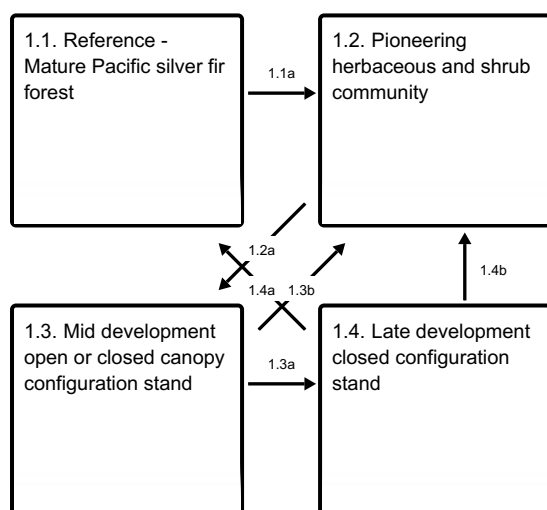
- FEIS: FRI=200-500 yrs. Severe stand replacing fire.
- Wenatchee National Forest: Fire Return Interval=400 yrs.
- LANDFIRE: BPS 0111740 North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest

## State and transition model

### Ecosystem states



### State 1 submodel, plant communities



## State 1

### Reference

### Community 1.1

### Reference - Mature Pacific silver fir forest

A multi-canopy forest that is dominated by Pacific silver fir in the overstory and regenerating layers with lower cover of 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 predominantly rusty menziesia, but also oval-leaf blueberry, devilsclub, Cascade azalea, sweet after death, Alaska blueberry, threeleaf foamflower while dry site adapted vegetation include vine maple, roughfruit berry, thinleaf huckleberry, and common beargrass . This site is very stable.

## **Community 1.2**

### **Pioneering herbaceous and shrub community**

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 (Pacific silver fir, Engelmann spruce, western white pine, western hemlock, western redcedar, Douglas fir, Alaska cedar, noble fir) 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 (Pacific silver fir, western white pine, Engelmann spruce, noble fir, 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 (Pacific silver fir, western white pine, noble fir, Engelmann spruce, 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**

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:

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### **Contributors**

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## Approval

Kirt Walstad, 9/09/2023

## 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	05/08/2024
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):**

- 
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:

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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):**
- 

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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