

Ecological site F003XA306WA East Mountain Slopes Forest subalpine 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 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 types: ABLA/RHAL2; ABLA/RHAL2-LUHI4; ABLA/VASC-LUHI4; ABLA/VACA.

Ecological site concept

This ecological site resides generally east of the Cascade crest and therefore has a more continental climate. Growing season is shortened by higher elevations with persistent snowpacks. The frost-free days span 60 to 90 days, the mean annual precipitation is 50 to 70 inches and the mean annual air temperature is 38 to 41 degrees Fahrenheit. This site occurs primarily on north-facing slopes and valley walls with elevations of 4,100 to 5,700 feet on slopes 25 to 55 percent. Soils are generally Spodosols or Inceptisols with andic soil properties in the upper part of the profiles. Andisols can also occur. Soil temperature regime is cryic and soil and the soil moisture regime is udic. Some soils may have restrictions within 20 inches of the surface. Parent material is generally volcanic ash over glacial till or colluvium. The reference phase is dominated by subalpine fir (*Abies lasiocarpa*) and Engelmann spruce (*Pinus engelmannii*), seral species include lodgepole pine (*Pinus contorta*) (until 100 years), warmer sites will have Douglas fir (*Pseudotsuga menziesii*), western white pine (*Pinus monticola*), western larch (*Larix occidentalis*) and higher elevations will have whitebark pine (*Pinus albicaulis*), western larch (*Larix lyallii*). The understory includes: Cascade azalea (*Rhododendron albiflorum*), grouse whortleberry (*Vaccinium scoparium*), sidebells wintergreen (*Orthilia secunda*), dwarf bilberry (*Vaccinium cespitosum*), whortleberry (*Vaccinium myrtillus*), pink mountainheath (*Phyllodoce empetrifomis*), Hitchcock’s smooth woodrush (*Luzula glabrata* var. *hitchcockii*), broadleaf arnica (*Arnica latifolia*), Northwestern sedge (*Carex concinnoides*), pinegrass (*Calamagrostis rubescens*) , western rattlesnake plantain (*Goodyera oblongifolia*), broadleaf lupine (*Lupinus latifolius*) , osmorhiza species, Oregon boxleaf (*Paxistima myrsinites*), thinleaf huckleberry (*Vaccinium membranaceum*), vine maple (*Acer circinatum*), Douglas maple (*Acer glabrum* var. *douglasii*), Cascade barberry (*Mahonia nervosa*), pipsissewa (*Chimaphila umbellata*), western teaberry (*Gaultheria ovatifolia*), *Lupinus* species, whitevined wintergreen (*Pyrola picta*). This site occurs in the high elevations of cold the subalpine fir zone. Alpine areas in the Cascades can be affected by numerous lightning strikes during the short 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 PICO 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, brown cubical rot, dwarf mistletoe.

Associated sites

R003XA304WA	Avalanche Sitka alder (<i>Alnus viridis</i>)
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Similar sites

F003XC306WA	High Glacial Valley Floors Forest subalpine fir
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Table 1. Dominant plant species

Tree	(1) <i>Abies lasiocarpa</i> (2) <i>Picea engelmannii</i>
Shrub	(1) <i>Rhododendron albiflorum</i> (2) <i>Vaccinium scoparium</i>
Herbaceous	(1) <i>Luzula glabrata</i> var. <i>hitchcockii</i> (2) <i>Vaccinium cespitosum</i>

Physiographic features

These reside on primarily north-facing mountain slopes and valley walls with elevations of 4,100 to 5,700 feet on slopes of 25 to 55 percent.

Table 2. Representative physiographic features

Landforms	(1) Mountains (2) Mountains > Mountain slope
Elevation	4,100–5,700 ft
Slope	25–55%
Aspect	W, E, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Elevation	3,000–7,000 ft
Slope	3–100%

Climatic features

Mean annual air temperature is 38 to 41 degrees Fahrenheit.

Table 4. Representative climatic features

Frost-free period (characteristic range)	60-90 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	50-70 in

Influencing water features

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

Soil features

Soils are generally Spodosols or Inceptisols with andic soil properties in the upper part of the profiles. Andisols can also occur. Soil temperature regime is cryic and soil and the soil moisture regime is udic. Some soils may have restrictions within 20 inches of the surface. Parent material is volcanic ash over glacial till or colluvium and residuum from igneous, sedimentary, and metamorphic rock. Permeability is very low in dense glacial till, otherwise it is high to moderately high. Andic properties occur from 0 to 60 inches in depth.

Table 5. Representative soil features

Parent material	(1) Colluvium (2) Residuum (3) Till
Surface texture	(1) Ashy silt loam (2) Ashy sandy loam (3) Medial sandy loam
Family particle size	(1) Ashy-pumiceous (2) Medial over loamy-skeletal
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderately rapid to rapid
Depth to restrictive layer	8–60 in
Soil depth	8–60 in
Surface fragment cover <=3"	0–20%
Surface fragment cover >3"	0–25%

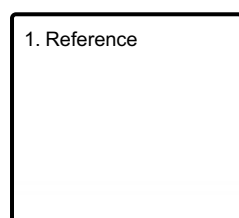
Available water capacity (Depth not specified)	1.7–7.7 in
Calcium carbonate equivalent (Depth not specified)	0%
Soil reaction (1:1 water) (Depth not specified)	4.5–7.3

Ecological dynamics

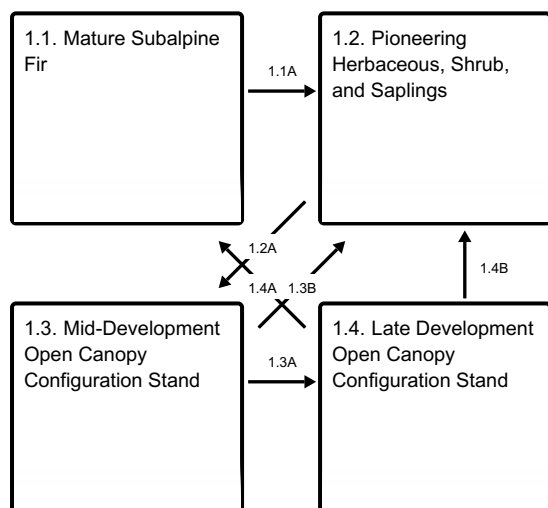
This covers the subalpine fir zone of cold, high elevation areas with persistent slow-melting snow that causes a short growing season. There are numerous lightning strikes in the area and the fire return interval ranges 100 to 300 years generally, with 50 percent of fires occurring as stand replacing events. Mixed severity fires occur as well. Fire Effects Information System classification for subalpine fir in the North Cascades states a fire return interval of 154 years. In the Wenatchee N.F., fire return intervals were viewed as less than 300 years, as evidenced by stand ages. LANDFIRE BPS 0810550 Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland, has 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 mountain pine beetles and 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, brown cubical rot, dwarf mistletoe.

State and transition model

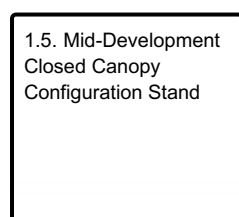
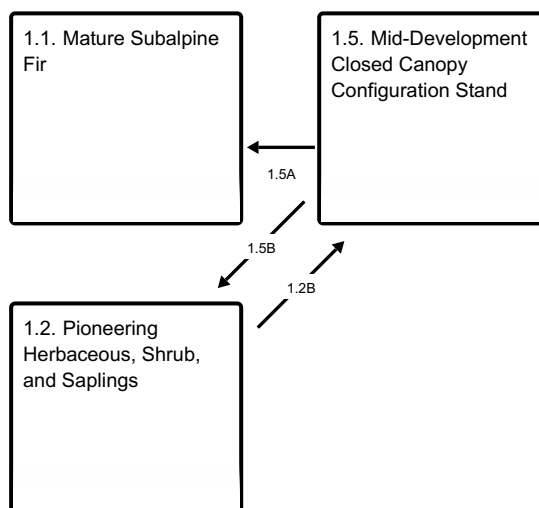
Ecosystem states



State 1 submodel, plant communities



Communities 1, 5 and 2 (additional pathways)



1.1A - Rare, stand-replacement fire that kills significant number of mature trees and top-kills shrubs and herbaceous plants.

- 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.
- 1.2B** - With time, the tree seedlings and small saplings go to the mid development community grow into the closed canopy configuration.
- 1.3B** - Rare, stand-replacement fire that kills significant number of mature trees and top-kills shrubs and herbaceous plants.
- 1.3A** - With time, the pole sized trees develop to large mature trees in the late development phase.
- 1.4A** - With time, the large mature trees develop into the closed configuration of the reference phase without the occurrence of mixed severity fire.
- 1.4B** - Rare, stand-replacement fire that kills significant number of mature trees and top-kills shrubs and herbaceous plants.
- 1.5A** - With time, the large mature trees develop into the closed configuration of the reference phase without the occurrence of mixed severity fire.
- 1.5B** - Rare, stand-replacement fire that kills significant number of mature trees and top-kills shrubs and herbaceous plants.

State 1 Reference

Community 1.1 Mature Subalpine Fir

The overstory, mid canopy and regeneration layers are dominated by subalpine fir though Engelmann spruce, may have high canopy cover. Trees are large (average diameter at breast height ranges 20 to 30 inches) and older (at least 150 to 200 years old). The understory is generally dominated by shrub species, with warmer sites having Oregon boxleaf, pinegrass and colder sites with dwarf bilberry, grouse whortleberry and the highest elevation areas with Hitchcock's smooth woodrush, yellow mountainheath, Cascade azalea.

Community 1.2 Pioneering Herbaceous, Shrub, and Saplings

The post disturbance phase is initially dominated by pioneering herbaceous species and resprouting shrubs and resident and windblown tree seedlings including Subalpine fir, Engelmann spruce and lodgepole pine. This pioneering phase lasts approximately three years. After that time, a shrub dominated phase develops until shaded by tree saplings. Shrub species can include Cascade azalea, dwarf bilberry, grouse whortleberry, whortleberry, and at higher elevations pink mountainheath can occur. This entire phase lasts approximately twenty years.

Community 1.3 Mid-Development Open Canopy Configuration Stand

A mid development phase of pole sized seral tree species dominates in an open canopy configuration due to windthrow, disease and insect damage. Tree species include: Subalpine fir, Engelmann spruce and lodgepole pine that is pole-sized (less than 20 inches at diameter at breast height) and young (20-100 years old). The open canopy is due to tree death from the mountain pine beetle. The understory is varied, but has Cascade azalea and dwarf bilberry.

Community 1.4 Late Development Open Canopy Configuration Stand

An open canopy of large trees with a mix of subalpine fir and seral tree species that are 100 to 200 years old, with an understory of moist adapted shrubs and herbaceous species. This is a late development phase of pole to large sized tree species in an open canopy configuration due to windthrow, disease and insect damage. Tree species include Subalpine fir and Engelmann spruce, and lodgepole pine is senescing. The understory is varied, but has Cascade azalea and dwarf bilberry.

Community 1.5 Mid-Development Closed Canopy Configuration Stand

A closed canopy of mid development pole sized trees in the competitive exclusion phase results from the growth of saplings and that will eventually develop single to few tree deaths that eventually develop into the reference community. Trees are 20 to 100 years old. Subalpine fir, Engelmann spruce and lodgepole pine comprise the canopy and is pole-sized (less than 20 inches at diameter at breast height) and young (20-100 years old). The understory is varied, but has Cascade azalea and dwarf bilberry.

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.

Pathway 1.2B

Community 1.2 to 1.5

1.2B: With time, the tree seedlings and small saplings go to the mid development community grow into the closed canopy 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

1.3A: 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

1.4a: 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.

Pathway 1.5A

Community 1.5 to 1.1

1.5A: With time, the large mature trees develop into the closed configuration of the reference phase without the occurrence of mixed severity fire.

Pathway 1.5B

Community 1.5 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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Henderson, Jan A., et al. "Forested plant associations of the Olympic National Forest." (1989).

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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.

Contributors

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Approval

Kirt Walstad, 1/28/2025

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:

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:**
