USDA Natural Resources
Conservation Service

Ecological site AX003X03F007
Glaciated Middle Cascades Cryic Udic Forest Group

Last updated: 1/28/2025
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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

The Cascade and Olympic Mountains (MLRA 3) include 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 more moist, 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 (LRU C) is located in western Oregon and Washington. It is bounded by Snoqualmie Pass on the north, the North Santiam River on the south, and Puget Trough and the lower Willamette Valley on the west. Major rivers draining this LRU include the Green, Puyallup, Nisqually, Cowlitz, Lewis, Sandy, and Clackamas.

Bedrock consists mainly of volcanic rocks. Topography is generally dissected and steep. Low-relief areas often contain ancient and contemporary landslides. Alpine glaciation was widespread at the beginning of the Holocene. U-shaped valleys and cirque basins containing scoured bedrock are common (Noller, et al. 2016).
Soil moisture regime is mainly udic or aquic. Soil temperature regime ranges from mesic to cryic. Soils in this LRU may have lower clay content compared with those to the south. Inceptisols, Andisols, and Spodosols are common soil orders.
Conifer forest is the dominant vegetation. The natural fire regime is infrequent in most areas. At low to mid elevations, Douglas-fir (Pseudotsuga menziesii) is a long-lived, early-seral tree; western hemlock (Tsuga heterophylla) is an associated shade-tolerant tree. Red alder (Alnus rubra) is a short-lived, early-seral tree. It is ephemeral on uplands but persists on wet or repeatedly-disturbed sites. At high elevations, Noble fir (Abies procera) is an early-seral tree; Pacific silver fir (*Abies amabilis*) or mountain hemlock (Tsuga mertensiana) are associated shade-tolerant trees. Sitka alder (Alnus viridis ssp. sinuata) and vine maple (Acer circinatum) form persistent shrub fields on sites subject to very deep snowpack or avalanches. Subalpine and alpine wetlands typically support shrubby or herbaceous vegetation.

Classification relationships

• LANDFIRE: BPS 0111740 North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest

Ecological site concept

This ecological site is found on steep mountain slopes. Climate is cold and moist. Soils are usually well drained and usually greater than 60 inches to a restrictive layer. Soil temperature regime is cryic, and soil moisture regime is udic. Soil parent material is usually volcanic ash and colluvium derived from andesite or basalt.

Associated sites

AX003X03C004	**Glaciated Middle Cascades Frigid Udic Forest Group** Lower on the landscape.

Similar sites

AX003X00F005	**Western Middle Cascades Low Cryic Udic Forest Group** Non-glaciated landforms.

Table 1. Dominant plant species

Tree	(1) *Abies amabilis*
Shrub	Not specified

Herbaceous	Not specified

Legacy ID

F003XC007OR

Physiographic features

This ecological site is found on mountain slopes at elevations of 3000 to 4530 feet. Slope gradient is usually 25 to 50 percent.

Table 2. Representative physiographic features

Elevation	3,000–4,530 ft
Slope	25–50%

Climatic features

Climate is cold and moist (frost-free days average 32 to 60, mean annual precipitation averages 77 to 111 inches, mean annual air temperature is 39 to 44 degrees Fahrenheit). Precipitation occurs mainly during fall, winter, and spring. Summers are dry. Snowpack accumulates during winter and persists through spring or early summer.

Influencing water features

None

Wetland description

None

Soil features

Soils are usually well drained but, when present, the top of the seasonal water table averages 24 to 36 inches below the soil surface. Soils are usually greater than 60 inches to a restrictive layer but, when present, root restrictions occur 32 to 47 inches below the soil surface. Soil temperature regime is cryic, and soil moisture regime is udic. Soil parent material is usually volcanic ash and colluvium derived from andesite or basalt. Soils usually classify as Andisols (Typic Haplocryands) or Inceptisols (Andic Cryochrepts).

Table 3. Representative soil features

Parent material	(1) Colluvium–andesite (2) Volcanic ash (3) Colluvium–basalt
Drainage class	Well drained

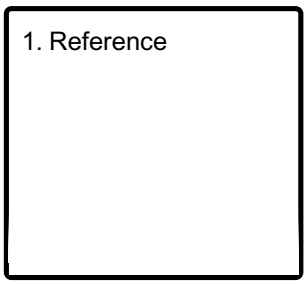
Ecological dynamics

This ecological site is found on mountain slopes, at elevations of 3000 to 4530 feet. Slope gradient is usually 21-47 percent. Climate is cold and moist (frost free days average 32-60, mean annual precipitation averages 77-111 inches, mean annual air temperature is 39-44 degrees Fahrenheit). Precipitation occurs mainly during fall, winter, and spring. Summers are dry. Snowpack accumulates during winter and persists through spring or early summer. Soils are usually well drained but, when present, the top of the seasonal water table averages 24-36 inches below the soil surface. Soils are usually greater than 60 inches to a restrictive layer but, when present, root restrictions occur 32-47 inches below the soil surface. Soil temperature regime is cryic, and soil moisture regime is udic. Soil parent material is usually volcanic ash and colluvium derived from andesite or basalt. Soils usually classify as Andisols (Typic Haplocryands) or Inceptisols (Andic Cryochrepts).

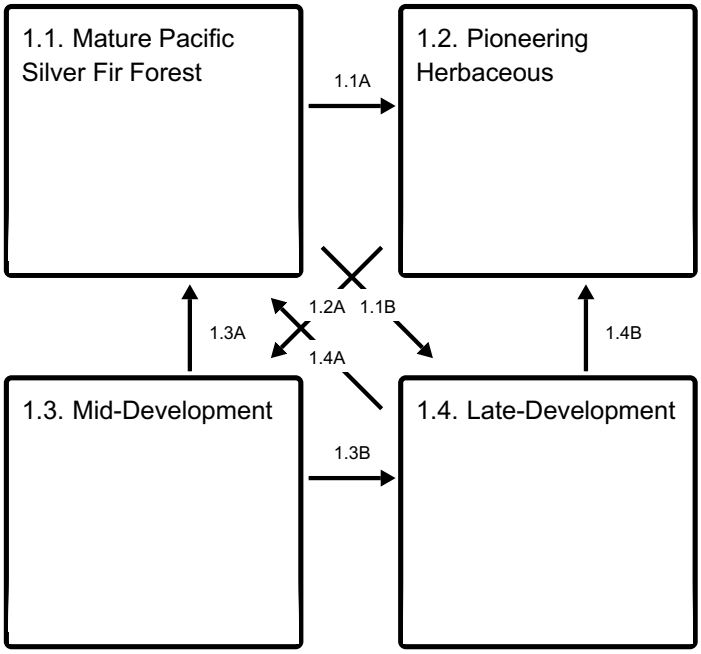
The reference plant community has an overstory of *Abies amabilis*, though seral trees include noble fir, Douglas fir, western redcedar, western hemlock, Sitka spruce and mountain hemlock. The understory includes salal, Pacific rhododendron, thinleaf huckleberry, common beargrass, mountain brome, vine maple, red alder, western swordfern, oval-leaf huckleberry, sweet-after death, red huckleberry, western fescue, Cascade barberry, common snowberry, broadleaf starflower. The fire return interval is generally rare (200-500 years) and is stand replacing, *Abies amabilis* perishes in fire but quickly restablishes under a canopy of seral trees. Shrubs resprout, and pioneering herbaceous species establish on the site post fire. Shrubs form a post-disturbance phase which may include vine maple, Douglas maple, Scouler willow, pachistima, thinleaf huckleberry, serviceberry, Sitka alder, and snowbrush ceanothus. Fires on the east side of the Cascade Crest are more frequent due to the continental climate factors. Fire is a rare, large-patch disturbance while diseases and insects create frequent, small-patch disturbances that open the tree canopy. Diseases include Annosum and laminated root disease, Indian paint fungus, and mistletoe. Insects include mountain pine beetle (in lodgepole pine) and silver fir beetle.

State and transition model

Ecosystem states



State 1 submodel, plant communities



State 1
Reference

Community 1.1
Mature Pacific Silver Fir Forest

This phase has an overstory dominated by Pacific Silver Fir although western hemlock can be co-dominant, with numerous lower tree canopies of seral species including western hemlock, western redcedar, Douglas fir, noble fir, Engelmann spruce, western white pine, an understory of tall shrubs, and cool, moist adapted herbaceous species. The trees are large (average diameter at breast height is 45 inches) and mature (the average age is over 150 years). The understory includes salal, Pacific rhododendron, thinleaf huckleberry, common beargrass, mountain brome, vine maple, red alder, western swordfern, oval-leaf huckleberry, sweet-after death, red huckleberry, western fescue, Cascade barberry, common snowberry, broadleaf starflower.

Community 1.2
Pioneering Herbaceous

Immediately post-fire, windblown tree seeds establish, shrub and herbaceous plants

resprout and pioneering herbaceous plants establish on mineral soil interspaces. This is a short duration community phase. Shrub Community. This plant community contains a high diversity of shrubs and herbaceous species including salal, Pacific rhododendron, thinleaf huckleberry, common beargrass, mountain brome, vine maple, red alder, western swordfern, oval-leaf huckleberry, sweet-after death, red huckleberry, western fescue, Cascade barberry, common snowberry, broadleaf starflower. Seedlings mature to saplings within twenty years.

Community 1.3
Mid-Development

This phase is dominated by a mix of Pacific Silver fir and seral tree species that are pole sized and are in either an open or closed canopy depending on the occurrence of mixed severity fire. If mixed severity fire occurs than a open canopy is created and maintained. The lower, secondary tree canopy layer is of Pacific Silver fir.

Community 1.4
Late-Development

This plant community is dominated by larger trees that is a mix of Pacific Silver fir and seral tree species in the overstory in either an open or closed canopy configuration depending on the occurrence of mixed severity fire. Fire would create and maintain an open canopy configuration. The lower tree canopy has Pacific Silver fir. Douglas fir can dominate this stand with mixed severity fire occurrence and adequate seedbank of Douglas fir.

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 1.1B
Community 1.1 to 1.4

Mixed severity fire returns the reference phase to the late development, open canopy phase which can allow Douglas fir a competitive advantage over Pacific Silver Fir.

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 1.4

Mixed severity fire can prefer Douglas fir, which can dominate community phase 1.4.

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

Stand replacement fire would return this forest to the pioneering herbaceous phase.

Additional community tables

Inventory data references

Fire references:

• USFS FEIS (Fire effects information service): FRI=200-500 yrs. Severe stand replacing fire.
• Wenatchee National Forest Plant Associations Guide: Fire Return Interval is 400 yrs.
• LANDFIRE: BPS 0111740 North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest

Other references

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).

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.

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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.

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

Kovalchik, Bernard L., and Rodrick R. Clausnitzer. "Classification and management of aquatic, riparian, and wetland sites on the national forests of eastern Washington: series description." Gen. Tech. Rep. PNW-GTR-593. Portland, OR: US Department of Agriculture, Forest Service, Pacific Northwest Research Station. 354 p. In cooperation with: Pacific Northwest Region, Colville, Okanogan, and Wenatchee National Forests 593 (2004).

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

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	10/05/2023
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:**

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:**