

Ecological site AX003X03C004 Glaciated Middle Cascades Frigid Udic Forest Group

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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 Fahrenheit. 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

Not classified at this time.

Ecological site concept

This ecological site occurs on mountain slopes, at elevations of 1745 to 3000 feet. Slope gradient is usually 20 to 50 percent. Climate is cool and moist (frost-free days average 44 to 104, mean annual precipitation averages 71 to 93 inches, mean annual air temperature is 41 to 45 degrees Fahrenheit). Precipitation occurs mainly during fall, winter, and spring. Summers are dry. Snowpack accumulates during winter, but melts in early spring. Soils are usually well drained and very deep. Soil temperature regime is frigid, and soil moisture regime is udic. Soils usually classify as Inceptisols.

Associated sites

AX003X03B003	Glaciated Middle Cascades Mesic Udic Forest Group Lower on the landscape.
AX003X03F007	Glaciated Middle Cascades Cryic Udic Forest Group Higher on the landscape.

Similar sites

AX003X00D004	Western Middle Cascades Frigid Udic Forest Group More broken topography in LRU E.
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Table 1. Dominant plant species

Tree	(1) <i>Thuja plicata</i> (2) <i>Tsuga heterophylla</i>
Shrub	Not specified
Herbaceous	Not specified

Legacy ID

F003XC004OR

Physiographic features

This ecological site occurs on mountain slopes, at elevations of 1700 to 3000 feet. Slope gradient is usually 22 to 50 percent.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope
Elevation	1,700–3,000 ft
Slope	20–50%

Climatic features

Climate is cool and moist (frost-free days average 44 to 104, mean annual precipitation averages 71 to 93 inches, mean annual air temperature is 41 to 45 degrees Fahrenheit). Precipitation occurs mainly during fall, winter, and spring. Summers are dry. Snowpack accumulates during winter, but melts in early spring.

Influencing water features

None

Wetland description

None

Soil features

Soils are usually well drained and very deep. Soil temperature regime is frigid, and soil moisture regime is udic. Soils usually classify as Inceptisols.

Table 3. Representative soil features

Drainage class	Well drained
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Ecological dynamics

The reference community has an overstory of THPL and TSHE with seral tree species in seral phases including PSME and ALRU2. The understory has ACCI, GASH, MANE2, POMU, PSME, PTAQP2, RUUR, TSHE, VAPA, ALRU2, OXOR, POMU, VAPA. After ten years dominating the understory, *Acer circinatum* can be replaced with other longer living shrub species.

Fire is the main disturbance factor. It has a return interval of 100-200 years, and is stand replacing in severity. For *Tsuga heterophylla* forests in the Pacific Northwest, the fire return interval is 150-400 years. LANDFIRE states that all types of fires for *Tsuga heterophylla* stands have a return interval typically of 400 years but spans 300-800 years for stand replacing fires. Common small-patch disturbances include diseases such as laminated root rots (*Armillaria*, *Annosum*), brown cubical rot, and dwarf mistletoe. Insect damage also occurs.

Ecological Dynamics Narrative:

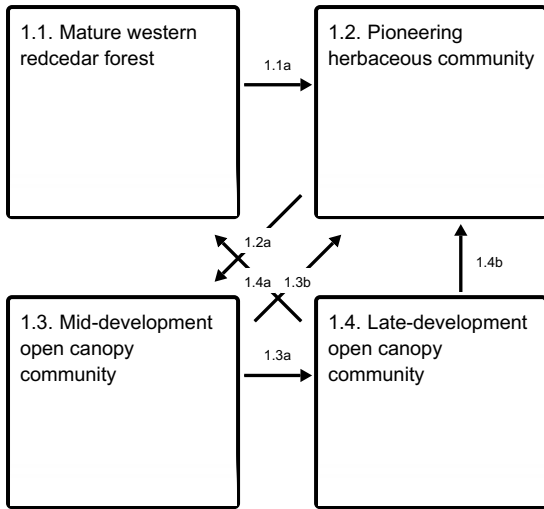
Fire is a rare, stand-replacing event in this ecological site. Generally, the fire return interval is believed to be 100-200 years in Wenatchee NF, based on stand ages and 150-400 years for TSHE in the Pacific Northwest as a whole. LANDFIRE BPS Models state that stand replacement fires occur in 400 year intervals (300-800 year range) for TSHE forests in WA and OR. Fire is a large-patch disturbance while diseases such as laminated root rots (*Armillaria*, *Annosum*), brown cubical rot, and dwarf mistletoe are small-patch disturbances that open the forest canopy.

State and transition model

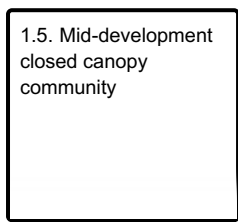
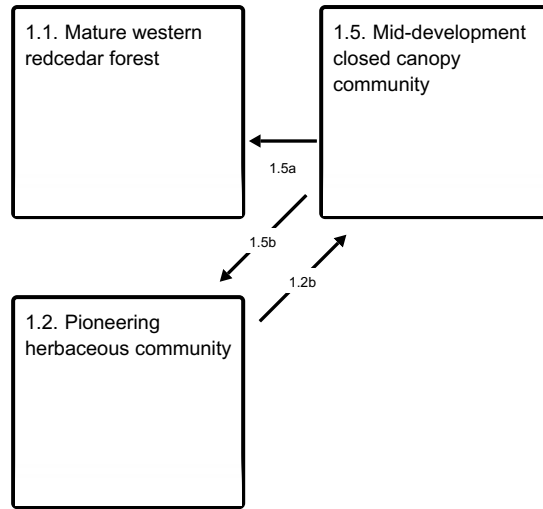
Ecosystem states

1. Reference State

State 1 submodel, plant communities



Communities 1, 5 and 2 (additional pathways)



State 1 Reference State

Community 1.1 Mature western redcedar forest

This phase has an overstory dominated Western hemlock, with Western cedar and Douglas fir, with a lower tree canopy of these species; an understory of tall shrubs, and cool, moist adapted herbaceous species. The overstory has large trees (average diameter at breast height is 20 to 30 inches) and older (average age is at least 150 to 250 years). The understory includes thick tall and medium statured shrubs and herbaceous species include: vine maple, salal, Cascade barberry, California blackberry, red huckleberry, red alder, western brackenfern, western swordfern, redwood-sorrel.

Community 1.2 Pioneering herbaceous community

Immediately post-fire, on-site and windblown tree seeds establish such as western hemlock, western redcedar and Douglas fir, shrub and herbaceous plants resprout and pioneering herbaceous plants including fireweed and western brackenfern establish on mineral soil interspaces. This is a short duration community phase that usually lasts only a few years. After this period there is a perennial shrub community. This plant community contains a high diversity of shrubs including vine maple, salal, Cascade barberry, red huckleberry, California blackberry. Over the next twenty years, seedlings mature to saplings.

Community 1.3 Mid-development open canopy community

This phase is dominated by a mix of Douglas fir, western hemlock and western redcedar, and some deciduous trees including potentially red alder, that are pole sized (average diameter at breast height is less than 20 inches) are middle aged (ages vary from 20 to 100 years) and are in an open canopy due to windthrow, insects, root rot pockets and disease. The understory can have shrub species in various densities depending on amount of canopy closure. Shrub species that may occur include: vine maple, salal, Cascade barberry, california blackberry, red huckleberry.

Community 1.4

Late-development open canopy community

This phase is dominated by a mix of Douglas fir, western hemlock and western redcedar, and some deciduous trees including red alder, that are pole sized (average diameter at breast height is more than 20 inches) are mature (ages vary from 100 to 150 years) and are in an open canopy due to windthrow, insects, root rot pockets and disease. The understory can have shrub species in various densities depending on amount of canopy closure. Shrub species that may occur include: vine maple, salal, Cascade barberry, california blackberry, red huckleberry.

Community 1.5

Mid-development closed canopy community

This phase is dominated by a mix of Douglas fir, western hemlock and western redcedar and some deciduous trees including red alder that are pole sized (average diameter at breast height is less than 20 inches) are middle aged (ages vary from 20 to 100 years) and are in a closed canopy due lack of windthrow, insects, root rot pockets and disease. The understory can have shrub species in various densities depending on amount of canopy closure. Shrub species that may occur include: vine maple, salal, Cascade barberry, california blackberry, red huckleberry.

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.

Pathway 1.2b

Community 1.2 to 1.5

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

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.

Pathway 1.5a **Community 1.5 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 1.5b **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

Inventory data 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, 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	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:**

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):**
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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:**
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17. **Perennial plant reproductive capability:**
-