

Ecological site AX003X04G001

High Cascades High Cryic 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 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 High Cascades land resource unit (LRU D) is located in western Oregon and Washington. It occurs on the young volcanic platform straddling the crest of the Cascade Mountains. It is more extensive in Oregon than in Washington. It is bounded on the south by the Mazama pumice zone beginning near Waldo Lake. Steeply-dissected terrain (LRUs E and C) lies to the west, and frequent-fire forests with xeric soil moisture regimes lie to the east. Major rivers draining this area include the Willamette and Deschutes.

Bedrock consists mainly of Plio-Pleistocene lavas (Orr, et al. 1992). Topography is gentle and undissected compared with areas located to the west. However, this area contains major stratovolcanoes such as Mt. Hood, Mt. Jefferson, and the Three Sisters. Large areas were covered in an alpine ice-sheet during the Pleistocene (Noller, et al. 2016). Till often lies above volcanic bedrock, except where lava flows postdate the last glacial maximum. Soil moisture regime is udic or aquic. Most soils have a cryic or frigid soil temperature regime. Mean annual precipitation is usually greater than 60 inches but ranges as low as 40 inches at some locations east of the Cascade crest. Soils usually contain large amounts of volcanic glass. Andisols and Spodosols are common soil orders. Conifer forest is the dominant vegetation. Natural fire is infrequent in most areas. At low elevations, Douglas-fir (*Pseudotsuga menziesii*) is a long-lived, early-seral tree; western hemlock (*Tsuga heterophylla*) is an associated shade-tolerant tree. At mid to high elevations lodgepole pine (*Pinus contorta*) is an early-seral tree; mountain hemlock (*Tsuga mertensiana*) or Pacific silver fir (*Abies amabilis*) are associated shade-tolerant trees. Natural fire can be moderately frequent in drier areas east of the Cascade Crest. In these areas, Ponderosa pine (*Pinus ponderosa*), Douglas-fir, and western larch (*Larix occidentalis*) are fire-tolerant, early-seral trees; grand fir (*Abies grandis*) is an associated shade-tolerant tree. Wetlands typically support shrubby or herbaceous vegetation throughout this LRU.

Classification relationships

This broad ecological site group is based on the TSME Dry, TSME Moist, and TSME Wet Plant Association Groups (Simpson, 2007). Similar Plant Associations are described by McCain and Diaz (2002).

Ecological site concept

This forested ecological site group occurs in the colder portion of the cryic soil temperature regime. It encompasses deep snowpack environments on both sides of the Cascade crest. Snowpack lasts until early summer. Soil moisture regime is udic. Thick, moderately or highly decomposed litter layers may be present; litter turnover and associated nutrient cycling may be very slow. Rooting depth may be restricted by soil temperature (McCain and Diaz, 2002). Mineral soil layers contain medial or ashy materials, but pumice is not usually present. Mountain hemlock is usually present in the overstory.

Associated sites

AX003X03F007	Glaciated Middle Cascades Cryic Udic Forest Group Slightly Lower elevations just below the crests of the mountains.
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Similar sites

AX003X00F005	Western Middle Cascades Low Cryic Udic Forest Group Similar vegetation, but lower elevation, one the mountain slopes off of the crest.
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Table 1. Dominant plant species

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

Legacy ID

F003XD001OR

Physiographic features

Landform: mountain slope, moraine

Elevation: 4200 to 6400 feet

Slope: 2 to 70 percent

Aspect: all aspects

Flooding: none

Ponding: none

Table 2. Representative physiographic features

Landforms	(1) Mountain slope (2) Moraine
Flooding frequency	None
Ponding frequency	None
Elevation	1,280–1,951 m
Slope	2–70%
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

Mean annual air temperature: 34 to 42 degrees F

Mean annual precipitation: 60 to 120 inches

Frost free period: 10 to 60 days

Precipitation occurs mainly during fall, winter, and spring. Summers are dry. A deep snowpack accumulates during winter and persists until early summer.

Influencing water features

None

Wetland description

None

Soil features

Drainage class: well drained to somewhat excessively drained
Parent material: colluvium, residuum, till, volcanic ash
Restrictive feature(s): moderately deep to very deep to bedrock
Soil temperature regime: cryic
Soil moisture regime: udic

Andisols (ashy Vitricryands and medial-skeletal Haplocryands) are mapped with this site. Spodosols may also be common. Fine-earth surface texture is usually sandy loam.

Soils that support this site include Jojo, Kuckup, Pinhead, and Piumpsha.

Table 3. Representative soil features

Parent material	(1) Colluvium (2) Residuum (3) Till (4) Volcanic ash
Drainage class	Well drained to somewhat excessively drained

Ecological dynamics

Central Concept:
This forested ecological site group occurs in the colder portion of the cryic soil temperature regime. It encompasses deep snowpack environments on both sides of the Cascade crest. Snowpack lasts until early summer. Soil moisture regime is udic. Thick, moderately or highly decomposed litter layers may be present; litter turnover and associated nutrient cycling may be very slow. Rooting depth may be restricted by soil temperature (McCain and Diaz, 2002). Mineral soil layers contain medial or ashy materials, but pumice is not usually present. Mountain hemlock is usually present in the overstory.
Contrasting sites occur in adjacent climatic zones: parkland consisting of mountain hemlock, whitebark pine (*Pinus albicaulis*), and subalpine fir (*Abies lasiocarpa*) occur at timberline; forest consisting of Douglas-fir and Pacific silver fir without mountain hemlock occurs at lower elevations, especially west of the Cascade crest; mixed conifer forests east of the Cascade crest containing grand fir usually reflect a frigid soil temperature regime.

Range in Variability:
Within this broad ecological site group, the coldest sites with the coarsest soils may have a nearly pure mountain hemlock overstory. Understories of late-successional communities are strikingly depauperate but contain small amounts of grouse whortleberry (*Vaccinium scoparium*) or smooth woodrush (*Luzula glabrata*). Lodgepole pine is the dominant early-seral conifer on these sites. Overstories on warmer, well drained sites may contain other conifers (sometimes including Douglas-fir) along with mountain hemlock. Understories usually contain thinleaf huckleberry (*Vaccinium membranaceum*) and common beargrass (*Xerophyllum tenax*). The warmest and wettest sites, especially west of the Cascade crest, may have lush and diverse shrubby or herbaceous understories. Separating environments within this ecological site group will be critical for developing useful state and transition models.

Disturbance:

Snow and wind may be the most frequent disturbances on this site. Fire is infrequent. Fire regime studies for mountain hemlock forests in the Oregon Cascades report fire return intervals ranging from 168 to 611 years (Simpson, 2007). Stand-replacing fires are typical, but smoldering fires that burn only the duff occur as well. Wetter sites may have fire return intervals near the long end of this range.

Insects capable of damaging trees include balsam woolly adelgid and mountain pine beetle. Tree diseases include rust red stringy rot, white pine blister rust, laminated root rot, Armillaria root disease, and annosus root disease (Simpson, 2007).

Vegetation composition:

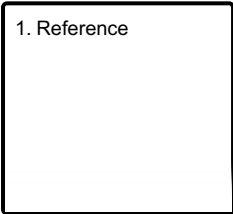
Mountain hemlock is usually a dominant overstory tree in mid to late-seral communities. Douglas-fir, lodgepole pine, Pacific silver fir, subalpine fir, western hemlock, western white pine (*Pinus monticola*), western larch, and Alaska cedar (*Callitropsis nootkatensis*) may also occur. Mountain hemlock is more shade-tolerant than lodgepole pine, western white pine (*Pinus monticola*), or Douglas-fir. Pacific silver fir can dominate in the sapling layer but it rarely dominates the overstory. Western larch may occur east of the Cascade crest, and Alaska cedar usually may occur to the west.

Understory shrubs may include grouse whortleberry (*Vaccinium scoparium*), pinemat manzanita (*Arctostaphylos nevadensis*), pipsissewa (*Chimaphila umbellata*), twinflower (*Linnaea borealis*), thinleaf huckleberry (*Vaccinium membranaceum*), Pacific rhododendron (*Rhododendron macrophyllum*), Cascade azalea (*Rhododendron albiflorum*), and rusty menziesia (*Menziesia ferruginea*). Most of these species are restricted to a subset of environments covered by this site.

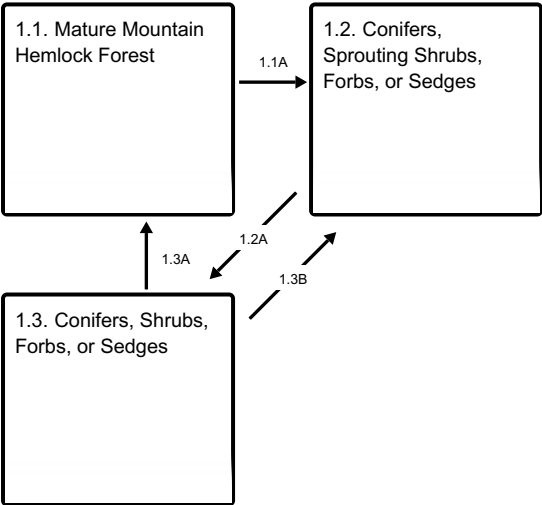
Forbs and grasses may include smooth woodrush (*Luzula glabrata*), long-stolon sedge (*Carex inops*), common beargrass (*Xerophyllum tenax*), bride's bonnet (*Clintonia uniflora*), British Columbia wildginger (*Asarum caudatum*), and sweet after death (*Achlys triphylla*). Most of these species are restricted to a subset of environments covered by this site.

State and transition model

Ecosystem states



State 1 submodel, plant communities



**State 1
Reference**

Community 1.1

Mature Mountain Hemlock Forest

The community phase features a mature, closed forest canopy. Mountain hemlock may be virtually the only overstory tree in cold, dry environments but is usually codominant with other conifers in warm, wet environments. Understory shrub cover and stature is usually low in cold and dry environments but high in warm, wet environments. In nearly all environments, Pacific silver fir occurs in the seedling-sapling layer. Snow, wind or disease may topple overstory trees and open canopy gaps. 1.1 Structure: mature forest; Overstory trees: mountain hemlock (major), may include other conifers. Understory trees: Pacific silver fir (major), mountain hemlock, may include other conifers. Shrubs: evergreen to deciduous, low to tall; Forbs or sedges: very low to high cover

Community 1.2

Conifers, Sprouting Shrubs, Forbs, or Sedges

Shrubs resprout following disturbance. Forbs or sedges may also increase in cover. Conifer seedlings including mountain hemlock establish. Structure: shrubfield; Shrubs: evergreen to deciduous, low to tall, high cover; Tree seedlings/saplings: mountain hemlock, may include lodgepole pine (sometimes dominant), other conifers; Forbs or sedges: high to low cover.

Community 1.3

Conifers, Shrubs, Forbs, or Sedges

The overstory is mainly pole-sized. Lodgepole pine may form nearly pure stands in cold and dry environments. Pacific silver fir seedlings establish in the understory. Structure: pole-sized forest; Overstory trees: mountain hemlock, may include lodgepole pine (sometimes dominant), other conifers; Understory trees: mountain hemlock, Pacific silver fir, may include other conifers. Shrubs: evergreen to deciduous, low to tall. Forbs or sedges: low to high cover.

Pathway 1.1A

Community 1.1 to 1.2

Pathway 1.2A

Community 1.2 to 1.3

Seedlings and saplings mature to pole-sized trees forming a closed canopy.

Pathway 1.3A

Community 1.3 to 1.1

growth. Mountain hemlock cover may increase relative to other trees due to superior tolerance to deep snow and ice.

Pathway 1.3B

Community 1.3 to 1.2

Fire disturbance returns this site to community phase 1.2.

Additional community tables

Other references

McCain, Cindy and Nancy Diaz. 2002. Field guide to the forested plant associations of the westside central Cascades of northwest Oregon. United States Department of Agriculture Forest Service Pacific Northwest region Technical Paper R6-NR-ECOL-TP-02-02. 403 pp.

Noller, J., C. Ringo, K. Bennett, J. Hobson, and S. Hash. (2016). Landtype Associations of the Pacific Northwest National Forests. [Online]. Available at <https://ecoshare.info/projects/landtype-associations/> (accessed on 5/1/2020).

Orr, E., W. Orr, and E. Baldwin. (1992). Cascade Mountains. p. 141-166. In Geology of Oregon. 4th ed. Kendall/Hunt Publishing Company.

Simpson, Michael. (2007). Forested Plant Associations of the Oregon East Cascades. Technical Paper R6-NR-

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:**

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