Ecological site AX003X06X001
Mazama Cascades Low Cryic Udic Forest Group

Last updated: 2/29/2024
Accessed: 04/27/2024

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 Mazama Cascades land resource unit (LRU F) is located in south-central Oregon, at the southern end of MLRA 3. Like the High Cascades (LRU D), it occurs on the young volcanic platform straddling the crest of the Cascade Mountains. Most areas are mantled with pumice and coarse volcanic ash from the eruption of Mount Mazama (Crater Lake), but areas outside the Mazama ash zone have finer ash from other sources. Mean annual precipitation is generally lower than in areas to the north. This area is approximately bounded by Waldo Lake on the north and Aspen Butte located in Winema National Forest on the south. Frequent-fire forests with a xeric soil moisture regime lie to the east and west. Major rivers draining this area include the Willamette, Umpqua, Rogue, Deschutes, and Klamath.
Bedrock consists mainly of Plio-Pleistocene lavas (Orr, et al. 1992). Topography is gentle and undissected compared with the Western Cascades (LRU E). Large areas were covered in an alpine ice-sheet during the Pleistocene (Noller, et al. 2016). Till often lies above volcanic bedrock. Many areas were mantled with coarse volcanic ash and pumice from the Holocene eruption of Mount Mazama, but some were not.
Soil moisture regime is udic or aquic. Soils have a cryic or frigid soil temperature regime. Mean annual precipitation is typically 30 to 80 inches. Andisols and Spodosols are common soil orders. Soils within the Mazama pumice zone (coarse ash and pumice) typically meet andic soil properties required characteristics 3, while soils outside the pumice zone usually meet only required characteristics 2 (Soil Survey Staff, 2014).
Due to low thermal conductivity, pumice soils may experience extreme diurnal temperature fluctuations at the soil surface (Cochran, et al. 1967). This helps explain why such sites can have notoriously short frost-free periods and cold temperatures within the rooting zone. Douglas-fir (*Pseudotsuga menziesii*) is usually absent on soils with deep pumice (Simpson, 2007). In these cases, its role as an early-seral species appears to be filled by lodgepole pine (Pinus contorta) or Shasta red fir (Abies magnifica var. shastensis). Because water drains rapidly, herbaceous species are usually drought-tolerant when thickness of coarse ash and pumice exceeds two feet (Simpson, 2007).
Conifer forest is the dominant vegetation. Natural fire is moderately frequent, except infrequent in high-elevation

forests associated with mountain hemlock (Tsuga mertensiana). Lodgepole pine is a widespread early-seral tree; mountain hemlock and Shasta red fir are relatively shade-tolerant. At lower elevations, ponderosa pine (Pinus ponderosa) and sugar pine (Pinus lambertiana) join lodgepole as fire-tolerant, early-seral trees; white fir (Abies concolor) is an associated shade-tolerant tree. Incense cedar (Calocedrus decurrens) also occurs. Wetlands support shrubby or herbaceous vegetation throughout this LRU.

Classification relationships

This ecological site group description is based on the ABMAS Moist Plant Association Group which includes the following Plant Associations (Simpson, 2007):

• Shasta red fir / pipsissewa
• Shasta red fir / giant chinquapin

Ecological site concept

This forested site occurs outside the pumice zone, in the warmer portion of the cryic soil temperature regime. Soil moisture regime is udic. Soils contain medial materials. Fine-earth textures are loamy. Shasta red fir is the dominant tree. Lodgepole pine is an important early-seral tree along with sugar pine and ponderosa pine. Douglas-fir (*Pseudotsuga menziesii*) is absent, perhaps due to cold air temperatures.

Associated sites

AX003X04X001	**High Cascades High Cryic Udic Forest Group** Higher elevation volcanic parent material forests.

Similar sites

AX003X04X001	**High Cascades High Cryic Udic Forest Group** Higher elevation volcanic parent material forests.

Table 1. Dominant plant species

Tree	(1) *Abies magnifica var. shastensis* (2) *Pinus contorta*
Shrub	Not specified
Herbaceous	Not specified

Legacy ID

F003XF001OR

Physiographic features

Landform: mountain slope
Elevation: 4600 to 6400 feet
Slope: 2 to 65 percent
Aspect: all aspects
Flooding: none
Ponding: none

Table 2. Representative physiographic features

Landforms	(1) Mountain slope
Flooding frequency	None
Ponding frequency	None

Elevation	4,600–6,400 ft
Slope	2–65%
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

Mean annual air temperature: 40 to 45 degrees F
Mean annual precipitation: 35 to 70 inches
Frost free period: 10 to 50 days

Precipitation occurs mainly during fall, winter, and spring. Summers are dry. Deep snowpack accumulates during winter.

Influencing water features

None

Wetland description

None

Soil features

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

Andisols are the typical soil order. Medial soil materials with loamy apparent field textures are typical. This contrasts with the coarse ash and pumice (paragravelly sands and loamy sands) often associated with Shasta red fir elsewhere in this LRU.

Soil that support this site include Oatman and Otwin.

Table 3. Representative soil features

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

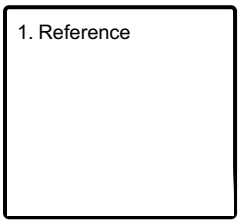
Ecological dynamics

Central Concept: This forested site occurs outside the pumice zone, in the warmer portion of the cryic soil temperature regime. Soil moisture regime is udic. Soils contain medial materials. Fine-earth textures are loamy. Shasta red fir is the dominant tree. Lodgepole pine is an important early-seral tree along with sugar pine and ponderosa pine. Douglas-fir (*Pseudotsuga menziesii*) is absent, perhaps due to cold air temperatures.
Contrasting sites occur in adjacent climatic zones: mountain hemlock forests occur in the colder portion of the cryic temperature regime; mixed conifer forests where white fir is prevalent reflect a frigid soil temperature regime.
Disturbance:
Mixed severity fires dominate in this vegetation type. Simpson’s (2007) review of fire regime literature for Shasta red fir forests reports average fire return intervals ranging from 39 to 65 years.
Insects capable of tree damage include mountain pine beetle and fir engraver. Tree diseases include Armillaria root

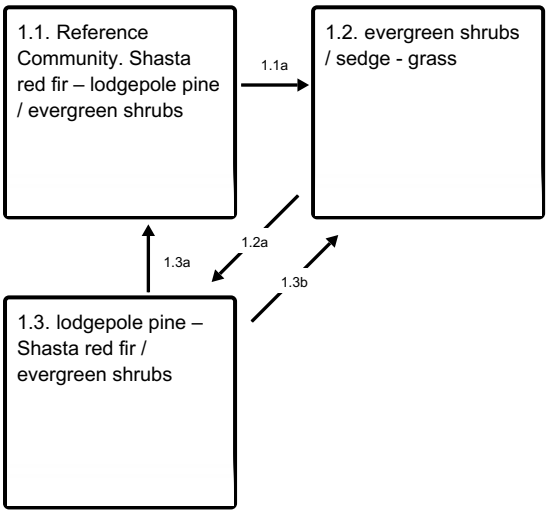
disease, annosus root disease, white pine blister rust, western and lodgepole pine dwarf mistletoes (Simpson, 2007).
Vegetation composition:
Shasta red fir is a dominant overstory tree in most community phases. It grows in full sun following stand-replacing disturbance along with lodgepole pine, ponderosa pine, sugar pine, and western white pine (*Pinus monticola*). Shasta red fir is more shade-tolerant than any of these associates. White fir is virtually absent.
A few evergreen understory shrub species occur. Cover may be very low under closed forest canopy. Pipsissewa (*Chimaphila umbellata*) is almost always present. Pinemat manzanita (*Arctostaphylos nevadensis*) and greenleaf manzanita (*Arctostaphylos patula*) resprout following disturbance and may be dominant in open conditions. Giant chinquapin (*Chrysolepis chrysophylla*) and snowbrush ceanothus (*Ceanothus velutinus*) may also occur in the shrub layer.
Forb and graminoid layers can be species-poor and relatively depauperate under closed tree canopy. Sidebells wintergreen (*Orthilia secunda*), whiteveined wintergreen (*Pyrola picta*), and long-stolon sedge (*Carex inops*) occur. Long-stolon sedge cover may increase significantly following disturbance. Western needlegrass (*Achnatherum occidentale*) grows in open conditions following disturbance.

State and transition model

Ecosystem states



State 1 submodel, plant communities



State 1
Reference

Community 1.1
Reference Community. Shasta red fir – lodgepole pine / evergreen shrubs

This community phase features a multi-layered, laterally heterogenous overstory dominated by Shasta red fir and lodgepole pine. Shasta red fir, ponderosa, sugar, and western white pine attain a larger stature compared with lodgepole. Shasta red fir is also present in the understory and mid canopy. All pine species (shade-intolerant) regenerate in canopy gaps. Where tree cover is high, understory shrub cover can be very low. The reference community may be maintained by fire that spares many of the trees in the stand. Disease also kills trees and opens canopy gaps within the stand. Generally, fire deferral allows canopy cover of Shasta red fir to increase and causes ponderosa, sugar, and western white pine to decline. 1.1 Reference Community. Shasta red fir – lodgepole pine / evergreen shrubs STRUCTURE: Multi-layered, laterally heterogenous forest OVERSTORY TREES: Shasta red fir (major), lodgepole pine (major), ponderosa pine, sugar pine, western white pine UNDERSTORY TREES: Shasta red fir (major), pine species (in canopy gaps) SHRUBS: pipsissewa, pinemat manzanita, giant chinquapin, greenleaf

manzanita SEDGES AND HERBS: long-stolon sedge, wintergreen

Community 1.2
evergreen shrubs / sedge - grass

Evergreen shrubs resprout vigorously following disturbance. Long-stolon sedge may increase in cover and western needlegrass may appear. A few mature legacy trees may be present. Fir and pine seedlings establish, but lodgepole may be dominant. 1.2 evergreen shrubs / sedge - grass STRUCTURE: evergreen shrubfield; a few mature “legacy” trees may be present SHRUBS: snowbrush ceanothus, greenleaf manzanita TREE SEEDLINGS/SAPLINGS: lodgepole pine (major), Shasta red fir (major), ponderosa pine, sugar pine, western white pine SEDGES AND GRASSES: long-stolon sedge, western needlegrass

Community 1.3
lodgepole pine – Shasta red fir / evergreen shrubs

The overstory is mainly pole-sized and dominated by lodgepole pine and Shasta red fir. A few mature legacy trees may be present. Shasta red fir seedlings establish in the understory. Evergreen shrubs persist but at lower cover than community phase 1.2. 1.3 lodgepole pine – Shasta red fir / evergreen shrubs STRUCTURE: pole-sized forest. A few mature “legacy” trees may be present. OVERSTORY TREES: lodgepole pine (major), Shasta red fir (major), ponderosa pine, sugar pine, western white pine UNDERSTORY TREES: Shasta red fir SHRUBS: greenleaf manzanita, snowbrush ceanothus, pinemat manzanita, giant chinquapin TREE SEEDLINGS/SAPLINGS: Shasta red fir GRASSES: long-stolon sedge

Pathway 1.1a
Community 1.1 to 1.2

1.1a Stand-replacing disturbance (fire, regeneration harvest) initiates community phase 1.2.

Pathway 1.2a
Community 1.2 to 1.3

1.2a Seedlings and saplings mature to pole-sized trees, forming a closed canopy.

Pathway 1.3a
Community 1.3 to 1.1

1.3a Attrition of the lodgepole pine cohort releases understory Shasta red fir. Long-lived conifer species in the overstory continue growing.

Pathway 1.3b
Community 1.3 to 1.2

1.3b Fire or other disturbance returns this site to community phase 1.2.

Additional community tables

Other references

Cochran, P.H., L. Boersma, C.T. Youngberg. (1967). Thermal properties of a pumice soil. Soil Science Society of America Journal, 31(4), pp.454-459. https://doi.org/10.2136/sssaj1967.03615995003100040013x
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-ECOL-TP-03-2007. U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. https://ecoshare.info/2009/12/16/forested-plant-associations-of-the-oregon-east-cascades/

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Approval

Kirt Walstad, 2/29/2024

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):**

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:**