Ecological site F006XD006WA
Cold Cryic Xeric Mountain Slopes (Whitebark Pine Cold Moderately Dry Shrub/Herb)

Last updated: 9/11/2023
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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): 006X–Cascade Mountains, Eastern Slope

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Stretching from northern Washington to southern Oregon, MLRA6 encompasses the mountain slopes, foothills, elevated plateaus and valleys on the eastern slopes of the Cascade mountains. This MLRA is a transitional area between the Cascade Mountains to the west and the lower lying Columbia Basalt Plateau to the east. Situated in the rain shadow of the Cascade Crest, this MLRA receives less precipitation than portions of the cascades further west and greater precipitation than the basalt plateaus to the east. Geologically, the majority of the MLRA is dominated by Miocene volcanic rocks, while the northern portion is dominated by Pre-Cretaceous metamorphic rocks and the southern portion is blanketed with a thick mantle of ash and pumice from Mount Mazama. The soils in the MLRA dominantly have a mesic, frigid, or cryic soil temperature regime, a xeric soil moisture regime, and mixed or glassy mineralogy. They generally are moderately deep to very deep, well drained, and loamy or ashy. Biologically, the MLRA is dominated by coniferous forest, large expanses of which are dominated by ponderosa pine, Douglas-fir or lodgepole pine. Areas experiencing cooler and moister conditions include grand fir, white fir, and western larch while the highest elevations include pacific silver fir, subalpine fir and whitebark pine. Economically, timber harvest and recreation are important land uses in these forests. Historically, many of these forests would have experienced relatively frequent, low and mixed severity fire favoring the development of mature forests dominated by ponderosa pine or Douglas-fir. In the southern pumice plateau forests, less frequent, higher severity fire was common and promoted the growth of large expanses of lodgepole pine forests.

LRU notes

This ecological site typically resides on mountain slopes and cirque floors, at elevations of 4900 to 7000 feet, on slopes of 35 to 75 percent.

Classification relationships

The ecological site relates to the Wenatchee National Forest plant associations:
CAS311- Whitebark pine/grouse huckleberry/smooth woodrush (PIAL/VASC/LUHI)
CAF321 - Whitebark pine/pinegrass (PIAL/CARU)

Ecological site concept

This ecological site typically resides on mountain slopes and cirque floors, at elevations of 4900 to 7000 feet, on slopes of 35 to 75 percent. The climate is cold and holds a heavy, persistent snowpack, with 55 to 80 frost-free days, mean annual precipitation of 30 to 55 inches, and mean annual air temperature is 37 to 41 degrees Fahrenheit.

The soils are typically Inceptisols, specifically Haploxerandic Haplocryepts, and Andisols, specifically Xeric Vitricryands. Particle-size classes are loamy-skeletal and ashy over loamy-skeletal, and surface textures ashy sandy loam and ashy loam. The parent material is volcanic ash over glacial till, colluvium, and residuum. The soils are well drained, and have no flooding, ponding or water table. They are typically 20 to greater than 60 inches deep to a root-restricting feature. These soils have a cryic soil temperature regime and xeric soil moisture regime.

The reference community has an overstory of PIAL and an understory of VASC and LUHI4 and CARU. Seral tree species include ABGR, ABLA, LAOC, PICO, PIEN. The understory can include VASC, LUGLH, ACMI2, CAGE2, CARO5, CARU, FEVI, PAMY, VAMY2.

This ecological site is defined as the highest extent of open canopy forest, above this trees grow in clumps. Harsh site conditions of high wind, deep and persistent snowpack and short growing season allow *Pinus albicaulis* to be the dominant tree species in the overstory of this open canopy forest with an understory of cold adapted species including: Arnica latifolia, Polemonium pulcherrimum, Calamagrostis rubescens, Vaccinium myrsinites, Vaccinium scopulorum, Luzula hitchcockii. At the highest elevations this relegates tree species to grow only in clumps within an alpine meadow. The understory species are adapted to site conditions and vary from drier areas with Calamagrostis rubescens, Festuca viridis and moister areas with Vaccinium scopulorum, Arnica latifolia, Polemonium pulcherrimum, and Luzula hitchcockii. The site conditions are the main limiting factor to tree growth, though rare stand replacing fire can occur at intervals of 300 years, based on the LANDFIRE models for *Pinus albicaulis*. Numerous lightning strikes can occur on this site, particularly on ridges, but the lack of continuous tree canopy and low fuels preclude fire spread and severity.

Associated sites

F006XA003WA	**Cryic Xeric Mountain Slopes (Subalpine fir Cool Moderately Dry Shrub/Herb)** On warmer, lower elevation sites.

Similar sites

F006XA008WA	**Cryic Xeric Mountain Slopes (Subalpine fir Cold Moderately Dry Shrub/Herb)** Lower elevation sites.

Table 1. Dominant plant species

Tree	(1) *Pinus albicaulis* (2) *Abies lasiocarpa*
Shrub	(1) *Vaccinium scoparium* (2) *Vaccinium myrtillus*
Herbaceous	(1) *Luzula glabrata var. hitchcockii*

Physiographic features

This ecological site typically resides on mountain slopes and cirque floors, at elevations of 4900 to 7000 feet, on slopes of 35 to 75 percent.

Table 2. Representative physiographic features

Landforms	(1) Mountains > Mountain slope (2) Cirque floor
Flooding frequency	None
Ponding frequency	None
Elevation	4,900–7,000 ft
Slope	35–75%
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

The climate is cold and holds a heavy, persistent snowpack, with 55 to 80 frost-free days, mean annual precipitation of 30 to 55 inches, and mean annual air temperature is 37 to 41 degrees Fahrenheit.

Influencing water features

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

Wetland description

N/A

Soil features

The soils are typically Inceptisols, specifically Haploxerandic Haplocryepts, and Andisols, specifically Xeric Vitricryands. Particle-size classes are loamy-skeletal and ashy over loamy-skeletal, and surface textures ashy sandy loam and ashy loam. The parent material is volcanic ash over glacial till, colluvium, and residuum. The soils are well drained, and have no flooding, ponding or water table. They are typically 20 to greater than 60 inches deep to a root-restricting feature. These soils have a cryic soil temperature regime and xeric soil moisture regime.

Table 3. Representative soil features

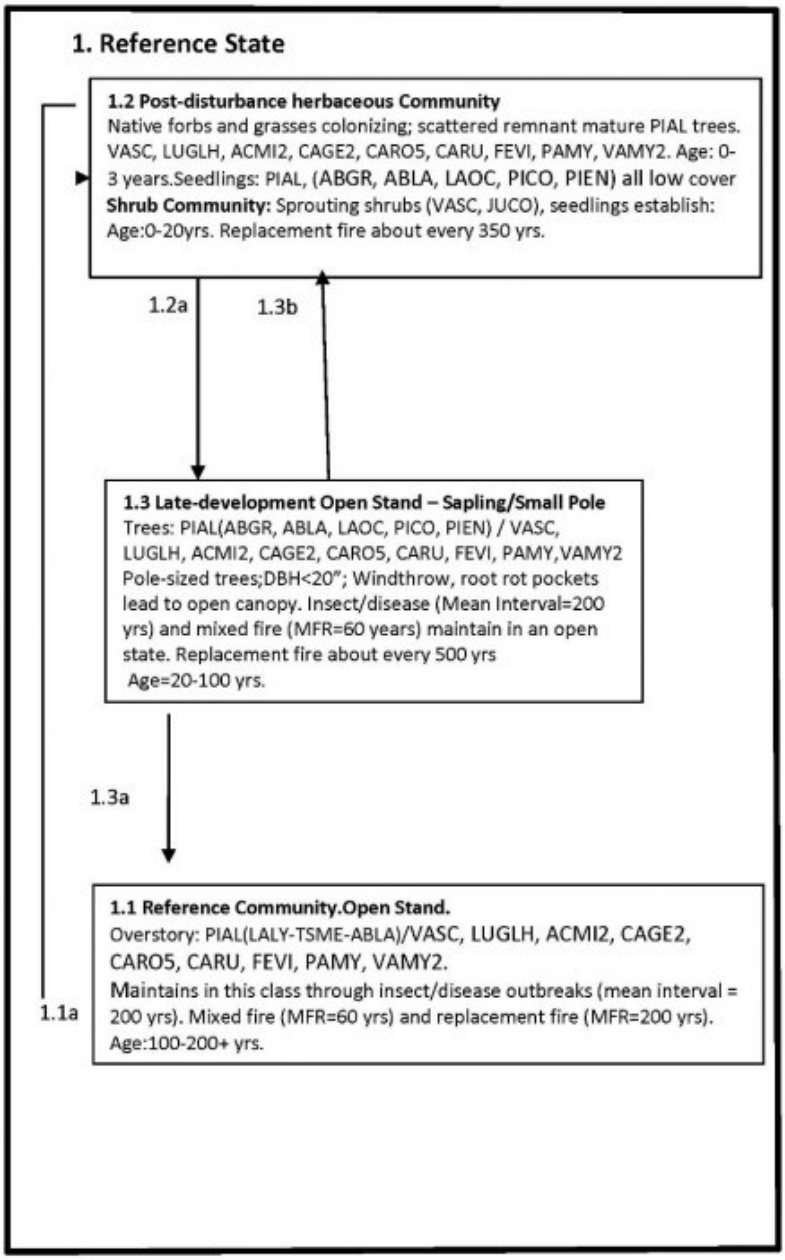
Parent material	(1) Volcanic ash (2) Colluvium (3) Residuum
Surface texture	(1) Ashy sandy loam (2) Ashy loam
Family particle size	(1) Loamy-skeletal (2) Ashy over loamy-skeletal
Drainage class	Well drained
Depth to restrictive layer	20–60 in
Soil depth	20–60 in
Surface fragment cover <=3"	0–15%
Surface fragment cover >3"	0–25%
Available water capacity (0-40in)	2.2–5.5 in
Calcium carbonate equivalent (Depth not specified)	0%
Soil reaction (1:1 water) (0-40in)	5.1–7.3

Ecological dynamics

This ecological site is defined by harsh site conditions that preclude continuous closed tree canopy cover, relegating trees to grow in open canopy configuration or in clumps within an alpine meadow glade with heath shrub species and other shrubs at the very highest elevations. At these highest elevations, the main disturbance is rodent or bear digging within the meadow areas and very rare stand replacing fire. Fire spread and severity would be limited due to lack of continuous tree canopy and low fuels. This site is bounded at higher elevations by the Alpine PES which lacks all tree species, and by the Mountain Hemlock PES below. The site conditions are the main limiting factor to tree growth, though rare stand replacing fire can occur at intervals of 300 years (200 to 400 years, stand replacing fire and mixed severity fires occur 80 to 120 years), based on the LANDFIRE models for *Pinus albicaulis*. Numerous lightning strikes can occur on this site, particularly on ridges, but the lack of continuous tree

canopy and low fuels preclude fire spread and severity.

State and transition model



State 1
Reference State

Community 1.1
Reference Community-Open Stand

This phase has an overstory dominated by *Pinus albicaulis* (whitebark pine) growing in an open canopy configuration with an understory of VASC, LUGLH, ACMI2, CAGE2, CARO5, CARU, FEVI, PAMY, VAMY2.

Dominant plant species

- whitebark pine (*Pinus albicaulis*), tree
- mountain hemlock (*Tsuga mertensiana*), tree
- subalpine larch (*Larix lyallii*), tree
- subalpine fir (*Abies lasiocarpa*), tree
- Engelmann spruce (*Picea engelmannii*), tree
- grouse whortleberry (*Vaccinium scoparium*), shrub
- whortleberry (*Vaccinium myrtillus*), shrub
- Geyer's sedge (*Carex geyeri*), grass
- pinegrass (*Calamagrostis rubescens*), grass
- greenleaf fescue (*Festuca viridula*), grass
- Hitchcock's smooth woodrush (*Luzula glabrata var. hitchcockii*), grass
- common yarrow (*Achillea millefolium*), other herbaceous
- Oregon boxleaf (*Paxistima myrsinites*), other herbaceous

Community 1.2
Post-disturbance Herbaceous Community

Pioneering herbaceous community. Immediately post-fire, on-site and windblown tree seeds establish, shrub and herbaceous plants re-sprout 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 including VASC, PAMY, VAMY2. Seedlings mature to saplings of the species: *Pinus albicaulis*, *Tsuga mertensiana*, *Larix lyallii*.

Dominant plant species

- whitebark pine (*Pinus albicaulis*), tree
- mountain hemlock (*Tsuga mertensiana*), tree
- subalpine larch (*Larix lyallii*), tree
- grouse whortleberry (*Vaccinium scoparium*), shrub
- whortleberry (*Vaccinium myrtillus*), shrub
- Oregon boxleaf (*Paxistima myrsinites*), shrub

Community 1.3
Mid-development Open Stand - Sapling/Small Pole

Mid-development OPEN CANOPY community. This phase is dominated by either an open stand of young *Pinus albicaulis* or a tree clump with *Tsuga mertensiana* and *Larix lyallii* trees that are pole-sized and are in an open canopy due to windthrow, insects and disease.

Dominant plant species

- whitebark pine (*Pinus albicaulis*), tree
- mountain hemlock (*Tsuga mertensiana*), tree
- subalpine larch (*Larix lyallii*), tree

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 1.3a
Community 1.3 to 1.1

With time, the tree pole sized trees mature to the Reference Community.

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 re-sprouting shrubs.

Additional community tables

Table 4. Representative site productivity

Common Name	Symbol	Site Index Low	Site Index High	CMAI Low	CMAI High	Age Of CMAI	Site Index Curve Code	Site Index Curve Basis	Citation
Douglas-fir	*PSME*	50	90	–	–	–	–	–	
Engelmann spruce	*PIEN*	55	75	–	–	–	–	–	
lodgepole pine	*PICO*	55	65	–	–	–	–	–	
western larch	*LAOC*	45	46	–	–	–	–	–	
subalpine fir	*ABLA*	55	85	–	–	–	–	–	

Inventory data references

Information presented here has been derived from NRCS data. Field observations from range trained personnel were also used. Other sources used as references include USDA NRCS Water and Climate Center, USDA NRCS National Range and Pasture Handbook, and USDA NRCS Soil Surveys from various counties.

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).
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.
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LANDFIRE, 2007, Biophysical Settings Model Descriptions, LANDFIRE 1.1.0, U.S. Department of the Interior, USDA Forest service, Accessed 20 April 2020 at https://www.landfire.gov/bps-models.php

Contributors

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Approval

Kirt Walstad, 9/11/2023

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	10/12/2024
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:**