USDA Natural Resources Conservation Service

Ecological site F006XA004WA
Cold Cryic Xeric Mountain Slopes (Subalpine fir Cold Dry Shrub)

Last updated: 9/11/2023
Accessed: 05/19/2024

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): 006X–Cascade Mountains, Eastern Slope

Major Land Resource Area (MLRA): 006X–Cascade Mountains, Eastern Slope.

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

Major Land Resource Area: 6 – Cascade Mountains, Eastern Slopes
Modal Land Resource Unit (LRU): Common Resource Area (CRA) 6.2 - Pasayten / Sawtooth Highland

This LRU occurs predominantly on mountain slopes and glacial outwash terraces. The soils are dominantly in the Andisols and Inceptisols taxonomic order . Soil parent materials are dominantly colluvium and residuum from igneous, sedimentary, and metamorphic rock, glacial outwash and glacial till, with a mantle or mixture of volcanic ash in the upper part. Taxonomic soil climate is a cryic temperature regime and xeric moisture regime with average annual precipitation of about 35 inches.

Other LRU'S where the site occurs:
CRA 6.1 - North Cascades Subalpine / Alpine
CRA 6.3 - Okanogan Pine / Fir Hills
CRA 6.5 - Chiwaukum Hills and Lowlands
CRA 6.6 - Yakima Plateau and Slopes
CRA 6.7 - Grand Fir Mixed Forest

Classification relationships

Forest Service Plant Associations:
CES426 (WEN); CE-S4-12 (OKAN) – Subalpine fir/grouse whortleberry (ABLA2/VASC)

Associated sites

F006XA003WA	**Cryic Xeric Mountain Slopes (Subalpine fir Cool Moderately Dry Shrub/Herb)** On warmer, lower elevation sites.
F006XA008WA	**Cryic Xeric Mountain Slopes (Subalpine fir Cold Moderately Dry Shrub/Herb)** Moister with Cascade azalea, generally little higher in elevation and little colder.

Similar sites

F006XA008WA	**Cryic Xeric Mountain Slopes (Subalpine fir Cold Moderately Dry Shrub/Herb)** Moister with Cascade azalea, generally little higher in elevation and little colder.

Table 1. Dominant plant species

Tree	(1) *Abies lasiocarpa*
Shrub	(1) *Vaccinium scoparium*
Herbaceous	Not specified

Physiographic features

This ecological site is on mountain slopes and glacial outwash terraces. It is found between 4000 and 7200 feet in elevation on all aspects. Slope gradients range from 0 to 65 percent.

Table 2. Representative physiographic features

Landforms	(1) Mountains > Mountain slope (2) Outwash terrace
Flooding frequency	None
Ponding frequency	None
Elevation	1,433–1,920 m
Slope	8–55%
Water table depth	203 cm
Aspect	W, NW, N, NE, E, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Flooding frequency	Not specified
Ponding frequency	Not specified
Elevation	1,219–2,195 m
Slope	0–65%
Water table depth	203 cm

Climatic features

Mean Annual precipitation
Total Range: 22 - 55 inches
Central tendency: 30 - 50 inches

Mean Annual Air Temperature
Total Range: 1.7 - 6.1 C (35 - 43 F)
Central tendency: 2.8 - 5.0 C (37 - 41 F)

Frost-free period (days)
Total range: 30 - 90
Central tendency: 45 - 80

Table 4. Representative climatic features

Frost-free period (characteristic range)	45-80 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	762-1,270 mm
Frost-free period (actual range)	30-90 days
Freeze-free period (actual range)	
Precipitation total (actual range)	559-1,397 mm

Influencing water features

Soil features

This ecological site is associated with several soil mapunit components. The components are dominantly Humic Xeric Vitricryands in the Andisols taxonomic order, and Haploxerandic and Vitrixerandic Haplocryepts in the Inceptisols order. Soils are dominantly moderately deep to very deep and have average available water capacity of about 3.1 inches (7.9 cm) in the 0 to 40-inches (0-100 cm) depth range. Soil parent material is dominantly volcanic ash deposits over glacial till, glacial outwash, and colluvium and residuum from granitic, volcanic, metamorphic, and sedimentary rock.
Dominant Soil Series: Bluebuck, Devore, Myerscreek, Naxing, Sitdown, Surgh, Treebutte

Parent Materials:
Kind – volcanic ash, residuum, colluvium, glacial till, glacial outwash
Origin – granitic rock, volcanic rock, schist, gneiss, sedimentary rock, mixed sources

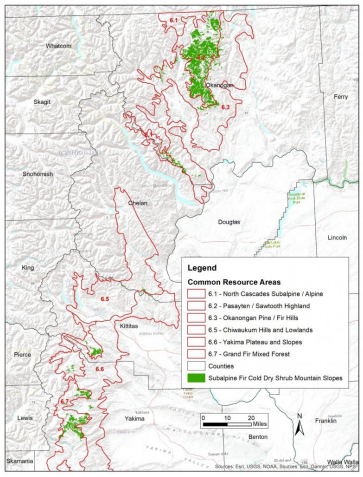


Figure 1. Map of soil mapunits with a major component linked to the Subalpine Fir Cold Dry Shrub Mountain Slopes Ecological Site

Table 5. Representative soil features

Surface texture	(1) Ashy silt loam (2) Ashy sandy loam (3) Ashy loam (4) Ashy fine sandy loam
Family particle size	(1) Ashy-skeletal over loamy-skeletal (2) Loamy-skeletal (3) Sandy-skeletal
Drainage class	Well drained
Surface fragment cover <=3"	0–50%
Surface fragment cover >3"	0–25%
Available water capacity (1.5-15.7cm)	Not specified
Soil reaction (1:1 water) (0-101.6cm)	5.1–7.3
Subsurface fragment volume <=3" (50.8-152.4cm)	Not specified
Subsurface fragment volume >3" (5.1-139.7cm)	Not specified

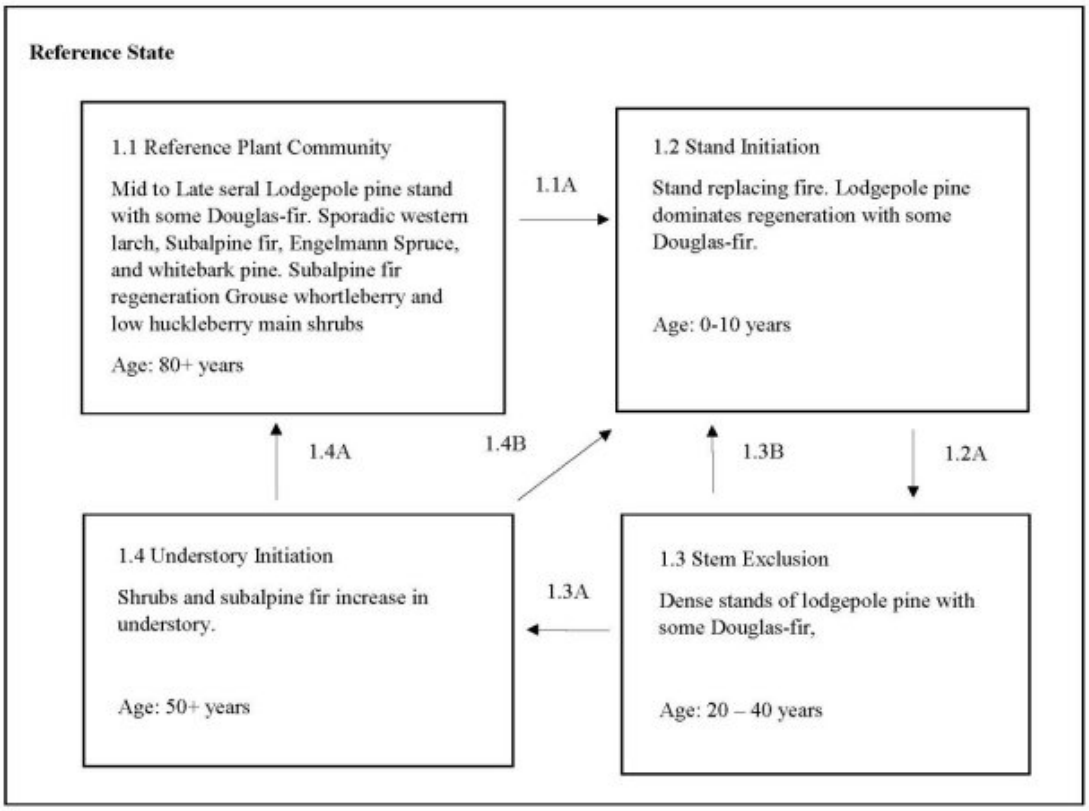
Table 6. Representative soil features (actual values)

Drainage class	Not specified
Surface fragment cover <=3"	0–50%
Surface fragment cover >3"	0–25%
Available water capacity (1.5-15.7cm)	1.52–15.75 cm
Soil reaction (1:1 water) (0-101.6cm)	5.1–7.3
Subsurface fragment volume <=3" (50.8-152.4cm)	20–60%
Subsurface fragment volume >3" (5.1-139.7cm)	2–55%

Ecological dynamics

This is high elevation site occurs on cold shallow soils. Elevations range from 4000 to 7000 feet, occurring on all aspects of upper or middle slopes. The site is dominated with lodgepole pine with some Douglas-fir. Western larch, Engelmann spruce, and whitebark pine will occur sporadically. Subalpine fir is the major regeneration tree species under the lodgepole canopy. Sites rarely reach a climax stand of subalpine fir due to stand replacing fires within a 100 year period. Lodgepole pine dominates the regeneration after disturbance. The major shrub species are grouse whortleberry and low huckleberry with low amounts of pachistima, spirea, and cascade azalea. Herb species are sparse and include broadleaf arnica, western rattlesnake plantain and lupine. This site is recognized as subalpine fir/grouse whortleberry in the Okanogan and Wenatchee National Forests Plant Association Guides.
A similar site is subalpine fir/grouse whortleberry/pinegrass (ABLA/VASC/CARU). It occurs on warmer slopes at lower elevations. Lodgepole pine and Douglas-fir are the main tree species and western larch is more likely to be present. Pinegrass is more prominent in the understory along with the huckleberries.

State and transition model



State 1
Reference State

This reference state is usually dominated by dense stands of lodgepole pine regenerated after stand replacing fires. Subalpine fir would take over the overstory in climax stands, however, this rarely occurs due to stand replacing fires within a 100-200 year period. Douglas-fir is the second most prominent tree in mid-seral stands. Western larch and Engelmann Spruce will occur on warmer areas of this site. Whitebark pine can occasionally be found. Subalpine is the major understory tree regenerating under the lodgepole pine canopy. Lodgepole pine regenerates quickly after stand replacing fires and grows into dense stands with some Douglas-fir and larch. Lodgepole pine stands 80-100 years old are susceptible to severe fire and the cycle repeats itself again.

Dominant plant species

- lodgepole pine (*Pinus contorta*), tree
- Douglas-fir (*Pseudotsuga menziesii*), tree
- western larch (*Larix occidentalis*), tree
- Engelmann spruce (*Picea engelmannii*), tree
- whitebark pine (*Pinus albicaulis*), tree
- subalpine fir (*Abies lasiocarpa*), tree
- grouse whortleberry (*Vaccinium scoparium*), shrub
- whortleberry (*Vaccinium myrtillus*), shrub
- thinleaf huckleberry (*Vaccinium membranaceum*), shrub
- Oregon boxleaf (*Paxistima myrsinites*), shrub
- white spirea (*Spiraea betulifolia*), shrub
- twinflower (*Linnaea borealis*), shrub

- Cascade azalea (*Rhododendron albiflorum*), shrub
- western Labrador tea (*Ledum glandulosum*), shrub
- heartleaf arnica (*Arnica cordifolia*), other herbaceous
- common yarrow (*Achillea millefolium*), other herbaceous
- pinegrass (*Calamagrostis rubescens*), other herbaceous
- northwestern sedge (*Carex concinnoides*), other herbaceous
- lupine (*Lupinus*), other herbaceous

Community 1.1
Reference Plant Community Phase

Mid to Late Seral stand of lodgepole pine with a variable mix of Douglas-fir, western larch, and subalpine fir. Occasional Engelmann spruce and white bark pine could be present. Understory regeneration dominated by subalpine fir with some Douglas-fir, western larch, and Engelmann spruce. Main understory shrub is grouse whortleberry with some low huckleberry, pachistima, spirea, twinflower, and cascade azalea.

Community 1.2
Stand Initiation

Lodgepole pine regeneration grows into dense stand with some Douglas-fir and western larch.

Community 1.3
Stem Exclusion

Dense stands of lodgepole pine with some Douglas-fir and western larch. Understory sparse.

Community 1.4
Understory Initiation

Mid seral stand of mixed lodgepole pine, Douglas-fir, and western larch. Subalpine fir regeneration in understory along with increase of shrubs and herbs.

Pathway 1.1A
Community 1.1 to 1.2

Stand replacing fire in the lodgepole pine overstory moves the plant community to plant community phase 1.2.

Pathway 1.2A
Community 1.2 to 1.3

Lodgepole pine regeneration grows into dense stand with some Douglas-fir and western larch.

Pathway 1.3B
Community 1.3 to 1.2

Stand replacing fire back to plant community phase 1.2.

Pathway 1.3A
Community 1.3 to 1.4

Dense stands thin out allowing understory regeneration of subalpine fir and increase in shrub and herb vegetation. Moves to plant community phase 1.4.

Pathway 1.4A
Community 1.4 to 1.1

Time. Stand reaching late seral stage susceptible to stand replacing fire. Lodgepole susceptible to bark beetle

mortality increasing fire hazard. Subalpine fir reaching into the 2nd level canopy producing ladder fuels.

Pathway 1.4B
Community 1.4 to 1.2

Stand replacing fire back to plant community phase 1.2. Fire severity could also be mixed creating a mosaic of stands and regeneration composition.

Additional community tables

Other information

Site index /Culmination Mean Annual Increment (CMAI)

Overall, this site has a high range of site index for the main tree species due to cold and shallow soils, however, the average site index would be considered low due to site conditions. Site indexes are measured on 50 year and 100 year tables based on Breast Height Age (BA) or Total Age (TA). CMAI indicates the sites ability to produce wood at a certain age of a stand's maximum annual growth measured in cubic feet per acre.

Table 7. 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
lodgepole pine	*PICO*	55	95	43	91	100	–	–	
subalpine fir	*ABLA*	55	90	43	91	125	–	–	
Engelmann spruce	*PIEN*	55	95	43	91	125	–	–	
Douglas-fir	*PSME*	50	70	35	57	116	–	–	
western larch	*LAOC*	35	65	39	57	–	–	–	

Inventory data references

Relationship to Other Established Classifications:

United States National Vegetation Classification (2008) – A3643 Subalpine fir – Engelmann Spruce Rocky Mt. Dry-Mesic Forest Alliance. CEGL000314 Subalpine fir – Engelmann Spruce / Grouse Whortleberry Forest Association.

Washington Natural Heritage Program. Ecosystems of Washington State, A Guide to Identification, Rocchio and Crawford, 2015 –
Rocky Mountain Subalpine fir Dry-Mesic Spruce-fir Forest and Woodland Group.

USDA NRCS Common Resource Areas 6.2 – Pasayten / Sawtooth Highland
Level III and IV Ecoregions of WA, US EPA, June 2010 – 77d – Pasayten / Sawtooth Highlands

This ecological site includes the following USDA Forest Service Plant Associations: ABLA/VASC and ABLA/VASC/CARU, Lillibridge et. al PNW GTR – 359, Oct. 1995

Other references

Forest Plant Associations of the Wenatchee National Forest, PNW-GTR-359. October 1995. Lillybridge et al.
Forest Plant Associations of the Okanogan National Forest, R6-Ecol-132b-1983, September 1983
NRCS Soil and Site Index data for MLRA B6 in form of excel spreadsheets.
SSURGO MLRA B6 Soil Component Forest Ecoclasses (Plant Associations)

Contributors

Gary Kuhn

Frank Gariglio
Carri Gaines
Steve Campbell

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	05/19/2024
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:**