USDA Natural Resources Conservation Service

Ecological site F006XA003WA
Cryic Xeric Mountain Slopes (Subalpine fir Cool Moderately Dry Shrub/Herb)

Last updated: 9/11/2023
Accessed: 05/11/2025

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

Major Land Resource Area: 6 – Cascade Mountains, Eastern Slopes
Modal Land Resource Unit (LRU): Common Resource Area (CRA) 6.3 - Okanogan Pine / Fir Hills

This LRU occurs predominantly on mountain slopes glacial outwash terraces, and glacial moraines. 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, 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 6.2 - Pasayten / Sawtooth Highland
CRA 6.4 - Chelan Tephra 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:
CEF222 (WEN); CE-F2-11 (OKAN) – Subalpine fir/twinflower (ABLA2/LIBOL)
CE-S3-12 (OKAN) – Subalpine fir/huckleberry (ABLA2/VACCI)
CES342 (WEN) – Subalpine fir/big huckleberry (ABLA2/VAME)
CES422 (WEN) – Subalpine fir/dwarf huckleberry (ABLA2/VACA)

Associated sites

F006XA004WA	**Cold Cryic Xeric Mountain Slopes (Subalpine fir Cold Dry Shrub)** On colder, higher elevation sites. Has grouse whortleberry in the understory.
F006XA008WA	**Cryic Xeric Mountain Slopes (Subalpine fir Cold Moderately Dry Shrub/Herb)** Colder and higher elevation with Cascade azalea and Grouse whortleberry.
F006XC001WA	**Cryic Xeric Mountain Slopes and Plateaus (Subalpine fir Cool Dry Grass)** Understory is dominated by pinegrass. Isolated locations through out MLRA6. Little higher in elevation; little moister and a little colder.

Similar sites

F006XA008WA	**Cryic Xeric Mountain Slopes (Subalpine fir Cold Moderately Dry Shrub/Herb)** Colder and higher elevation with Cascade azalea and Grouse whortleberry.

Table 1. Dominant plant species

Tree	(1) *Abies lasiocarpa*
Shrub	(1) *Vaccinium*
Herbaceous	(1) *Linnaea borealis*

Physiographic features

This ecological site is on mountain slopes, glacial outwash terraces, and glacial moraines. It is found between 2700 and 7000 feet in elevation on all aspects. Slope gradients general range from 3 to 75 percent, but can be found on slopes up to 90 percent.

Table 2. Representative physiographic features

Landforms	(1) Mountains > Mountain slope (2) Outwash terrace (3) Moraine
Flooding frequency	None to rare
Ponding frequency	None
Elevation	3,200–6,200 ft
Slope	3–75%
Water table depth	30–80 in
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	2,700–7,000 ft

Slope	0–90%
Water table depth	Not specified

Climatic features

Mean Annual precipitation
Total Range: 20 - 70 inches
Central tendency: 25 - 60 inches

Mean Annual Air Temperature
Total Range: 1.7 - 6.7 C (35 - 44 F)
Central tendency: 2.8 - 6.1 C (37 - 43 F)

Frost-free period (days)
Total range: 30 - 110
Central tendency: 45 - 100

Table 4. Representative climatic features

Frost-free period (characteristic range)	45-100 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	25-60 in
Frost-free period (actual range)	30-110 days
Freeze-free period (actual range)	
Precipitation total (actual range)	20-70 in

Influencing water features

Soil features

This ecological site is associated with several soil mapunit components. The components are dominantly Xeric Vitricryands in the Andisols taxonomic order and Haploxerandic Haplocryepts in the Inceptisols order. Soils are dominantly moderately deep to very deep and have average available water capacity of about 4.0 inches (10.2 cm) in the 0 to 40-inches (0-100 cm) depth range. Soil parent material is dominantly volcanic ash deposits over glacial till, and colluvium and residuum from granitic, volcanic, metamorphic, and sedimentary rock.
Dominant Soil Series: Azwell, Coopmont, Devore, Finney, Gatewall, Manley, Myerscreek, Naxing, Pird, Resner, Saydab, Surgh, Wedgemont

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

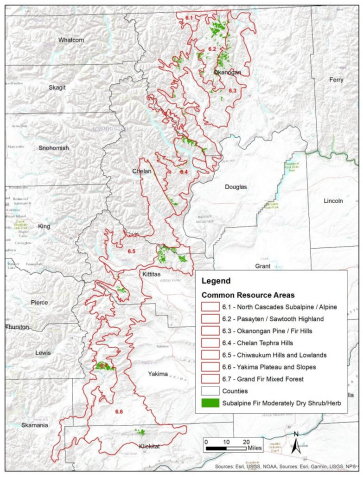


Figure 1. Map of soil mapunits with a major component linked to the Subalpine Fir Cool Moderately Dry Shrub/Herb Ecological Site

Table 5. Representative soil features

Surface texture	(1) Ashy fine sandy loam (2) Ashy silt loam (3) Ashy sandy loam
Family particle size	(1) Ashy over loamy-skeletal (2) Ashy-skeletal (3) Loamy-skeletal
Drainage class	Moderately well drained to well drained
Depth to restrictive layer	20–60 in
Surface fragment cover <=3"	0–35%
Surface fragment cover >3"	0–30%
Available water capacity (0-40in)	1.3–7.5 in
Calcium carbonate equivalent (0in)	Not specified
Electrical conductivity (0in)	Not specified
Sodium adsorption ratio (0in)	Not specified
Soil reaction (1:1 water) (0-10in)	5.1–7.8
Subsurface fragment volume <=3" (Depth not specified)	0–53%
Subsurface fragment volume >3" (Depth not specified)	0–35%

Table 6. Representative soil features (actual values)

Drainage class	Not specified
Depth to restrictive layer	Not specified
Surface fragment cover <=3"	0–35%
Surface fragment cover >3"	0–30%
Available water capacity (0-40in)	1.3–7.5 in

Calcium carbonate equivalent (0in)	0%
Electrical conductivity (0in)	0 mmhos/cm
Sodium adsorption ratio (0in)	0
Soil reaction (1:1 water) (0-10in)	5.1–7.8
Subsurface fragment volume <=3" (Depth not specified)	0–53%
Subsurface fragment volume >3" (Depth not specified)	0–35%

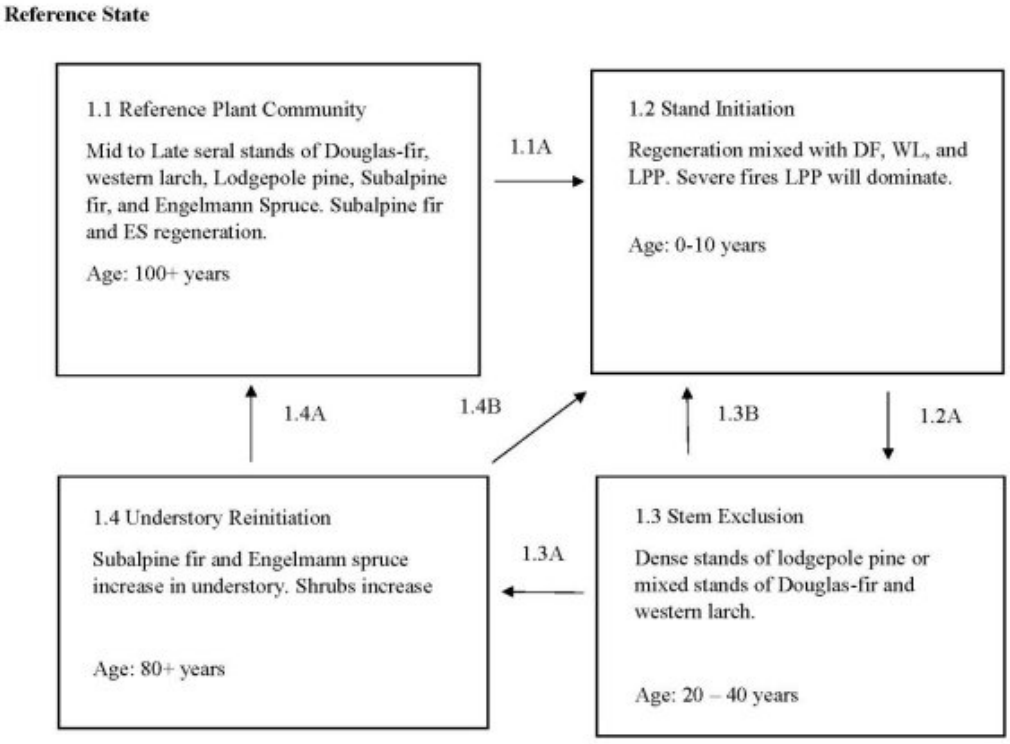
Ecological dynamics

This ecological site includes subalpine fir (ABLA) sites that range in elevation from 2000 feet to 5700 feet. They occur on north slopes, benches, or terraces at lower elevations and on ridgetops, or warm south and west aspects at higher elevations. They are warmer than ABLA/VASC sites which occur at higher elevations, although some have frost problems. Subalpine fir and Engelmann spruce are the shade tolerant climax species with no severe or reoccurring fires. Lodgepole pine can dominate stands that have stand replacing fires. Douglas-fir and western larch are the dominant seral species and can occur in older stands along with subalpine fir and spruce. Ponderosa pine is absent from these sites due to its cool climate. Understories are shrub dominant with twinflower, pachistima and several huckleberry species. Below are the plant associations included in this ecological site biophysically described as Subalpine fir Cool Moderately Dry Shrub/Herb.
ABLA/LIBO – Identified in both Okanogan and Wenatchee NF Plant Association Guides
ABLA/VACCI – Identified in Okanogan NF PA Guide
ABLA/VAME – Identified in Wenatchee PA Guide
ABLA/VACA – Identified in Wenatchee PA Guide

The ABLA/VACA site is described in more detail in MLRA 43A ecological site - Subalpine fir Cool Shrub, low elevation

They occur mainly in the North and Central Zones in CRAs 6.2, 6.3, 6.4, 6.5, 6.6, and 6.7.

State and transition model



State 1
Reference State

Most of this site will have a mix stand of mature Douglas-fir, western larch, lodgepole pine and some subalpine fir and Engelmann spruce. Subalpine fir and Engelmann spruce will be the main understory tree species. Intermittent mix severity or ground fires will maintain a mixed stand. Severe stand replacing fires will lead to dense lodgepole stands with subalpine fir and Engelmann spruce regeneration underneath. Long fire intervals of 100 - 200 years will produce a fir/spruce climax forest. This seldom occurs.

Dominant plant species

- lodgepole pine (*Pinus contorta*), tree
- Douglas-fir (*Pseudotsuga menziesii*), tree
- western larch (*Larix occidentalis*), tree
- Engelmann spruce (*Picea engelmannii*), tree
- subalpine fir (*Abies lasiocarpa*), tree
- western white pine (*Pinus monticola*), tree
- grand fir (*Abies grandis*), tree
- grouse whortleberry (*Vaccinium scoparium*), shrub
- whortleberry (*Vaccinium myrtillus*), shrub
- thinleaf huckleberry (*Vaccinium membranaceum*), shrub
- Oregon boxleaf (*Paxistima myrsinites*), shrub
- twinflower (*Linnaea borealis*), shrub
- kinnikinnick (*Arctostaphylos uva-ursi*), shrub
- pipsissewa (*Chimaphila umbellata*), shrub

- Douglas maple (*Acer glabrum var. douglasii*), shrub
- dwarf rose (*Rosa gymnocarpa*), shrub
- white spirea (*Spiraea betulifolia*), shrub
- whiteveined wintergreen (*Pyrola picta*), shrub
- pinegrass (*Calamagrostis rubescens*), other herbaceous
- American trailplant (*Adenocaulon bicolor*), other herbaceous
- bride's bonnet (*Clintonia uniflora*), other herbaceous
- starry false lily of the valley (*Maianthemum stellatum*), other herbaceous
- western rattlesnake plantain (*Goodyera oblongifolia*), other herbaceous
- strawberry (*Fragaria*), other herbaceous
- white hawkweed (*Hieracium albiflorum*), other herbaceous

Community 1.1
Reference Plant Community

This plant community can vary from 100 plus year old stands of Douglas-fir, western larch, lodgepole pine, subalpine fir and Engelmann spruce with subalpine fir and spruce regeneration to a mature lodgepole pine stand with fir and spruce regeneration. It’s dependent on past fire severity and occurrence. Mixed severity or lower intensity ground fires allow an older canopy of Douglas-fir and Western larch over possible lodgepole pine regeneration. Severe fires would create conditions for older stands of lodgepole pine. Long fire intervals would allow a subalpine fir and Engelmann spruce forest to exist. Shrub understories consist 76 of huckleberries and twinflower. The ABLA/LIBO plant associations (PAs) in the Wenatchee NF are moister than the LIBO PAs in the Okanogan NF. Both these PAs have no frost problems. Frost and cool air drainage can occur on the ABLA/VACCI, ABLA/VAME, and ABLA/VACA PAs. The ABLA/LIBO and ABLA/VACA are also at lower elevations than the other PAs.

Community 1.2
Stand Initiation

Young stands of mixed species including Douglas-fir, western larch, and lodgepole pine will dominate on mixed or low severity fires. Subalpine fir and Engelmann spruce can also be present. Severe stand replacing fires will produce dense regeneration of lodgepole pine.

Community 1.3
Stem Exclusion

Dense stands of mixed tree species or dense lodgepole pine stands.

Community 1.4
Understory Reinitiation

Over time mixed stands or single lodgepole pine stands thin out through competition or insect/disease mortality allowing subalpine fir and Engelmann spruce to establish. Other species like Douglas-fir, western larch, and lodgepole pine may also be present in understory. Shrub understory increases.

Pathway 1.1A
Community 1.1 to 1.2

Mixed severity fires create as mosaic of mixed stands with all tree species present. Severe fires create dense lodgepole pine stands to establish.

Pathway 1.2A
Community 1.2 to 1.3

Mixed severity or severe stand replacing fires create conditions for tree regeneration.

Pathway 1.3B

Community 1.3 to 1.2

Mixed or severe fire back to stand initiation phase.

Pathway 1.3A
Community 1.3 to 1.4

Canopy openings from tree mortality allow subalpine fir and Engelmann spruce regeneration.

Pathway 1.4A
Community 1.4 to 1.1

Over time mixed stands or solid stands of lodgepole pine grow into mature stands. Subalpine fir and Engelmann dominate the regeneration and 2nd layer canopy.

Pathway 1.4B
Community 1.4 to 1.2

Mixed or severe fire back to stand initiation plant community phase.

Additional community tables

Other information

Overall, this ecological site has a higher site productivity than the ABLA/VASC or ABLA/CARU sites. This would be due to supporting higher stocking densities. High site index variability exists due to frost 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*	50	93	37	114	100	–	–	
Engelmann spruce	*PIEN*	55	100	44	109	125	–	–	
subalpine fir	*ABLA*	45	91	34	93	140	–	–	
Douglas-fir	*PSME*	43	79	29	79	116	–	–	
western larch	*LAOC*	35	67	39	57	–	–	–	
grand fir	*ABGR*	–	60	76	–	120	–	–	

Inventory data references

Relationship to Other Established Classifications:
United States National Vegetation Classification (2008) – A3643 Subalpine fir – Engelmann Spruce Rocky Mt. Mesic Forest Alliance.
Washington Natural Heritage Program. Ecosystems of Washington State, A Guide to Identification, Rocchio and Crawford, 2015 –
Rocky Mountain Subalpine fir Mesic-Wet Spruce-fir Forest and Woodland Group.

USDA NRCS Common Resource Areas 6.2 – 6.7
Level III and IV Ecoregions of WA, US EPA, June 2010 – 77e – 77f, 77h, 9b
This ecological site includes the following USDA Forest Service Plant Associations: ABLA/LIBO, ABLA/VACCI, ABLA/VAME, ABLA/VACA. Lillibridge e. al. PNW GTR – 359, Oct. 1995, Williams et al. R6-Ecol-132b-1983, September 1983

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

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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	05/11/2025
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:**

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7. **Amount of litter movement (describe size and distance expected to travel):**

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

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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:**

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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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:

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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):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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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:**
