USDA Natural Resources Conservation Service

Ecological site F006XC003WA
Cool Frigid Moist Xeric Mountain Slopes (Grand fir Cool Moist 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, MLRA 6 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

Common Resource Area (CRA) 6.7 - Grand Fir Mixed Forest

This LRU occurs predominantly on slopes of hills and mountains. The soils are dominantly in the Andisols and Inceptisols taxonomic order, with some Alfisols . 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 primarily a frigid temperature regime and xeric moisture regime with average annual precipitation of about 50 inches.

Other LRU'S where the site occurs:
CRA 6.8 - Oak-Conifer Eastern Cascades - Columbia Foothills
CRA 6.5 - Chiwaukum Hills and Lowlands
CRA 6.6 - Yakima Plateau and Slopes

Classification relationships

CWS525 - grand fir/vanilla leaf (ABGR/ACTR)

Ecological site concept

This site is recognized as Grand Fir Cool Moist Shrub/Herb. It occurs on steep north slopes, benches, and bottoms. Elevations ranges from 2000 to 4800 feet. Precipitation ranges from 40 to 60 inches. Its main tree components are grand fir, Douglas-fir, western larch, and western white pine. Engelmann spruce can be present on the moist bottom sites and ponderosa pine can occur on the warmer end. Lodgepole pine will occur after severe fire. Main understory tree species are grand fir and Douglas-fir.

Key understory species are vanilla leaf, Cascade Oregon grape, twinflower, western prince's pine, pachistima, sidebells pyrola, big huckleberry, baldhip rose, queencup beadlily, western rattlesnake plantain, trillium, and wester starflower.

The USFS plant association for this site is Grand fir/vanilla leaf (ABGR/ACTR)

Associated sites

F006XD005WA	**Frigid Xeric Mountain Slopes and Plateaus (Grand fir Warm Moderately Dry Shrub)** Has western hazel in the understory.
F006XB003WA	**Frigid Xeric Mountain Slopes (Grand fir Warm Moderately Dry Low Shrub/Herb)** On warmer and drier sites.
F006XC003WA	**Cool Frigid Moist Xeric Mountain Slopes (Grand fir Cool Moist Shrub/Herb)** Moister site.

Similar sites

F006XD002WA	**Cool Frigid Xeric Ashy Slopes (Grand fir Cool Dry Grass)** Drier and higher elevation.

Table 1. Dominant plant species

Tree	(1) *Abies grandis*
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

This ecological site is on mountain slopes, glacial outwash terraces, and hillslopes. It is typically found between 1400 and 4200 feet in elevation on all aspects. Slope gradients range from 5 to 45 percent.

Table 2. Representative physiographic features

Landforms	(1) Mountains > Mountain slope (2) Hills > Outwash terrace (3) Hillslope
Flooding frequency	None
Ponding frequency	None
Elevation	1,400–4,200 ft
Slope	5–45%
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	500–5,000 ft
Slope	2–60%

Climatic features

Mean Annual Air Temperature
Total Range: 41 to 48 degrees Fahrenheit
Central tendency: 43 to 47 degrees Fahrenheit

Table 4. Representative climatic features

Frost-free period (characteristic range)	80-135 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	40-60 in
Frost-free period (actual range)	70-160 days
Freeze-free period (actual range)	
Precipitation total (actual range)	25-75 in

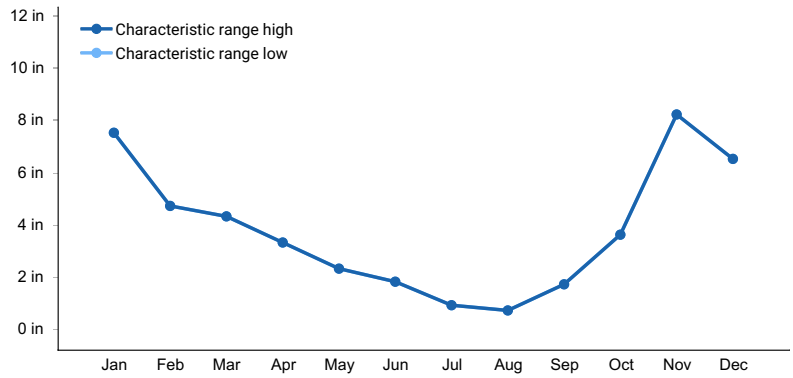


Figure 1. Monthly precipitation range

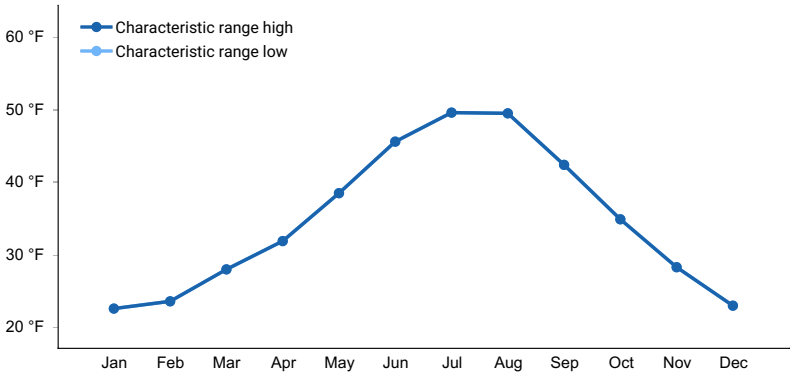


Figure 2. Monthly minimum temperature range

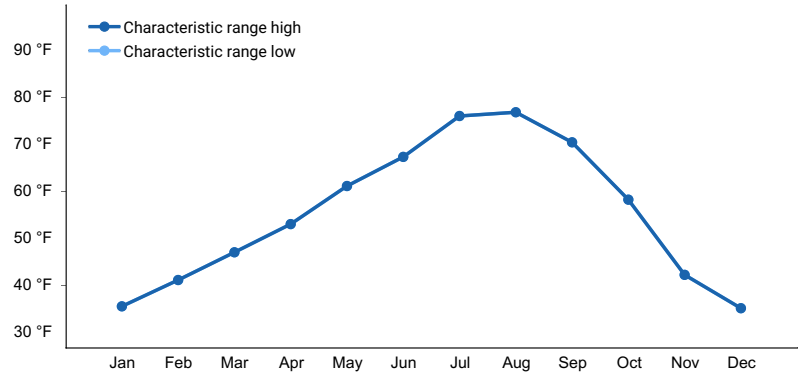


Figure 3. Monthly maximum temperature range

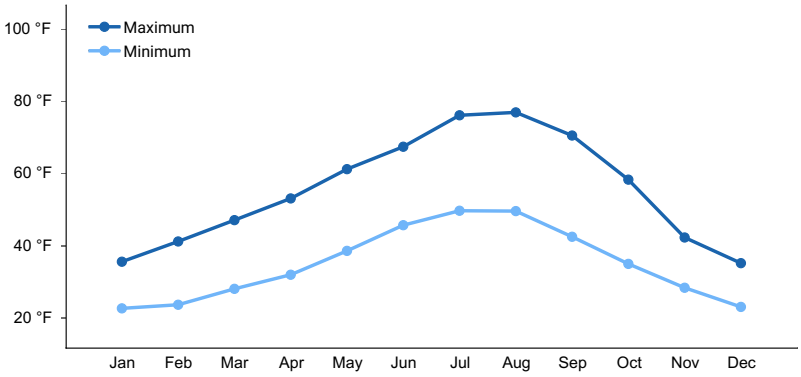


Figure 4. Monthly average minimum and maximum temperature

Climate stations used

- (1) EASTON [USC00452384], Cle Elum, WA

Influencing water features

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

Wetland description

N/A

Soil features

This ecological site is associated with several soil mapunit components. The components are dominantly Humic Vitrixerands in the Andisols order and Andic Dystroxerepts in the Inceptisols order. Soils are dominantly moderately deep to very deep and have average available water capacity of about 4.8 inches (10.9 cm) in the 0 to 40-inches (0 to 100 cm) depth range. Soil parent material is dominantly volcanic ash over colluvium and residuum from volcanic, granitic, and metamorphic rock, and glacial outwash.
Dominant Soil Series: Bearrun, Bertolotti, Chemawa, Culving, Saydab, Sugarbowl

Parent Materials:
Kind – volcanic ash, colluvium, residuum, glacial outwash
Origin – volcanic, granitic, and metamorphic rock; mixed sources

Table 5. Representative soil features

Surface texture	(1) Ashy loam (2) Ashy sandy loam

Family particle size	(1) Ashy (2) Loamy-skeletal (3) Ashy-skeletal
Drainage class	Well drained
Soil depth	20–60 in
Surface fragment cover <=3"	0–15%
Surface fragment cover >3"	0–7%
Available water capacity (0-40in)	2.4–7.7 in
Electrical conductivity (Depth not specified)	0 mmhos/cm
Sodium adsorption ratio (Depth not specified)	0
Subsurface fragment volume <=3" (Depth not specified)	4–63%
Subsurface fragment volume >3" (Depth not specified)	0–32%

Ecological dynamics

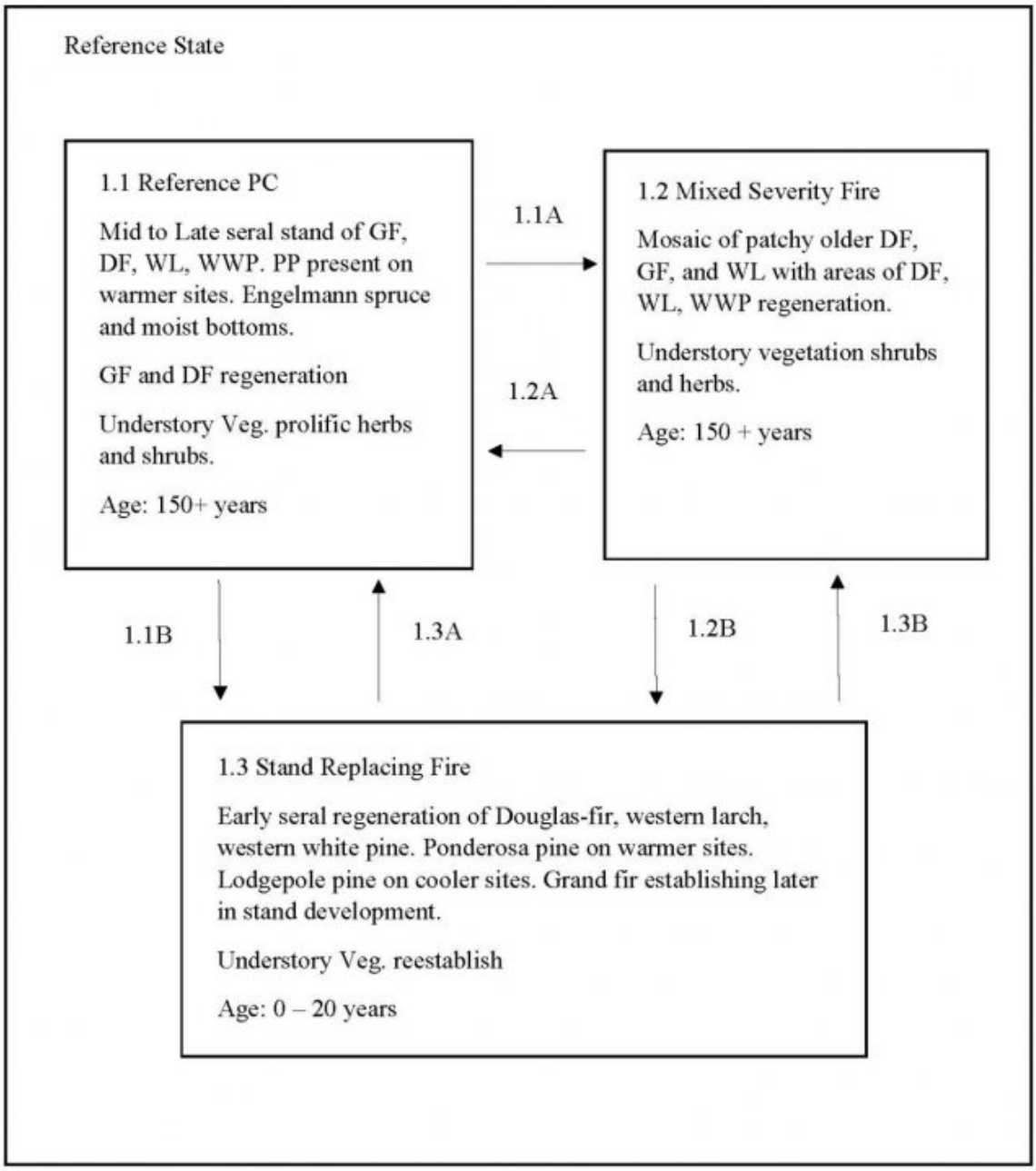
This site is recognized as Grand Fir Cool Moist Shrub/Herb. It occurs on steep north slopes, benches, and bottoms. Elevations ranges from 2000 to 4800 feet. Precipitation ranges from 40 to 60 inches. Its main tree components are grand fir, Douglas-fir, western larch, and western white pine. Engelmann spruce can be present on the moist bottom sites and ponderosa pine can occur on the warmer end. Lodgepole pine will occur after severe fire. These moist cool areas have a long fire intervals allowing grand fir to become a main overstory species. Older Douglas-fir and western larch will be present. Western white pine would have been more prominent if not for the white pine blister rust reducing its numbers.
Mixed severity fires will create a mosaic of stands with older remnant patches along with early seral species like larch and Douglas-fir. Main understory tree species are grand fir and Douglas-fir.

Key understory species are vanilla leaf, Cascade Oregon grape, twinflower, western prince’s pine, pachistima, sidebells pyrola, big huckleberry, baldhip rose, queencup beadlily, western rattlesnake plantain, trillium, and wester starflower.

The USFS plant association for this site is Grand fir/vanilla leaf (ABGR/ACTR)

Main insect and disease problems are armillaria root rot, Douglas-fir beetle, fir engraver, spruce budworm, Douglas-fir tussock moth, western pine beetle and mountain pine beetle. Dwarf mistletoe may occur in western larch.

State and transition model



State 1
Reference State

Community 1.1
Reference PC

Mid- to Late-seral stand of grand fir, Douglas-fir, western larch, western white pine. Ponderosa pine present on warmer sites. Engelmann spruce and moist bottoms. GF and DF regeneration Understory vegetation prolific herbs and shrubs. Age: 150+ years

Dominant plant species

- grand fir (*Abies grandis*), tree
- Douglas-fir (*Pseudotsuga menziesii*), tree
- western larch (*Larix occidentalis*), tree
- western white pine (*Pinus monticola*), tree
- ponderosa pine (*Pinus ponderosa*), tree
- Engelmann spruce (*Picea engelmannii*), tree

Community 1.2
Mixed Severity Fire

Mosaic of patchy older Douglas-fir, grand fir, and western larch with areas of Douglas-fir, western larch, western white pine regeneration. Understory vegetation shrubs and herbs. Age: 150 + years

Dominant plant species

- Douglas-fir (*Pseudotsuga menziesii*), tree
- grand fir (*Abies grandis*), tree
- western larch (*Larix occidentalis*), tree
- western white pine (*Pinus monticola*), tree

Community 1.3
Stand Replacing Fire

Early seral regeneration of Douglas-fir, western larch, western white pine. Ponderosa pine on warmer sites. Lodgepole pine on cooler sites. Grand fir establishing later in stand development. Understory vegetation reestablish Age: 0 – 20 years

Dominant plant species

- Douglas-fir (*Pseudotsuga menziesii*), tree
- western larch (*Larix occidentalis*), tree
- western white pine (*Pinus monticola*), tree
- ponderosa pine (*Pinus ponderosa*), tree
- lodgepole pine (*Pinus contorta*), tree

Pathway 1.1A
Community 1.1 to 1.2

Mixed severity fire in late seral to climax stand creating patchwork of old trees with regeneration.

Pathway 1.1B
Community 1.1 to 1.3

Stand replacing fire back to tree seedling-shrub-forb stage of PC 1.3

Pathway 1.2A
Community 1.2 to 1.1

Time. Lack of mixed severity fires allows tree growth into late seral stage of PC 1.1.

Pathway 1.2B
Community 1.2 to 1.3

Time. Ladder fuels with lack of fire enhance susceptibility of stand replacing fire.

Pathway 1.3A
Community 1.3 to 1.1

Time. Long fire intervals of 100+ years allow young stand to develop into mature overstory and reference PC 1.1

Pathway 1.3B
Community 1.3 to 1.2

Time. Mixed severity fires every 50 years create patchy overstory and conditions of PC 1.2.

Additional community tables

Table 6. 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*	60	115	–	–	–	–	–	
ponderosa pine	*PIPO*	100	135	–	–	–	–	–	
western larch	*LAOC*	50	65	–	–	–	–	–	
lodgepole pine	*PICO*	80	90	–	–	–	–	–	
grand fir	*ABGR*	75	105	–	–	–	–	–	

Inventory data references

Forest Service Plant Association: CWS525 - grand fir/vanilla leaf (ABGR/ACTR)

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

Field Guide for Forest Plant Associations of the Wenatchee National Forest. Lillybridge et al. PNW-GTR-359. October 1995
Washington Natural Heritage Program. Ecosystems of Washington State, A Guide to Identification, Rocchio and Crawford, 2015 – East Cascades Mesic Montane Mixed-Conifer Forest and Woodland
USDA, NRCS Forest-Soil Eco classifications.
Field reconnaissance by Gary Kuhn, ACES Forester and Steve Campbell NRCS Soil Scientist. July 2019

Contributors

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Steve Campbell
Carri Gaines

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:**

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:

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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:**
