Ecological site F006XD002WA
Cool Frigid Xeric Ashy Slopes (Grand fir Cool Dry Grass)

Last updated: 9/11/2023
Accessed: 10/12/2024

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, 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) 6.6 - Yakima Plateau and Slopes

This LRU occurs predominantly on plateaus and slopes of hills and mountains. The soils are dominantly in the Andisols and Inceptisols taxonomic order, with some Alfisols and Mollisols . 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 30 inches.

Other LRU'S where the site occurs:
CRA 6.4 - Chelan Tephra Hills
CRA 6.5 - Chiwaukum Hills and Lowlands
CRA 6.7 - Grand Fir Mixed Forest
CRA 6.8 - Oak-Conifer Eastern Cascades - Columbia Foothills

Classification relationships

CWG124 - grand fir/pinegrass (modal) (WEN)

CWS336 - grand fir/common snowberry/pinegrass
CWG125 - grand fir/pinegrass-lupine
CWS554 - grand fir/oceanspray/pinegrass
CWS226 - grand fir/Cascade Oregongrape/pinegrass

Ecological site concept

This site combines the grand fir/pinegrass, grand fir/elk sedge and grand fir/snowberry/pinegrass plant associations. It occurs mostly on middle slopes and ridgetops with southern aspects and also, on level terrain in cool air drainages. Elevations ranges from 2000 to 5000 feet. Soils are deep with an ash or mixed ash layer.
Open stands of ponderosa pine and Douglas-fir, with a dominant sward of pinegrass or elk sedge in the understory, are typical of the site. Douglas-fir and grand fir may be present in the understory. A host of shrubs will be mixed in the understory. Western larch is absent from grand fir/pinegrass site due to xeric conditions, however, can be present on the grand fir/elk sedge sites and grand fir/snowberry/pinegrass sites. Lodgepole pine may be present in both.

Associated sites

F006XB003WA	**Frigid Xeric Mountain Slopes (Grand fir Warm Moderately Dry Low Shrub/Herb)** On slightly drier sites.
F006XB001WA	**Frigid Xeric Mountain Slopes (Douglas-fir Moderately Dry Shrub/Herb)** On slightly warmer, drier sites.
F006XD001WA	**Frigid Moist Xeric Ashy Slopes (Grand fir Warm Moist Shrub/Herb)** Increase moisture.

Similar sites

F006XA001WA	**Cool Frigid Xeric Ashy Slopes (Douglas-fir Cool Dry Grass)** On drier sites.

Table 1. Dominant plant species

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

Physiographic features

This ecological site occurs mainly on plateaus, and back slopes, shoulders and foot slopes of hills and mountains. It is typically found between 1,800 and 4,700 feet in elevation on all aspects. Slope gradients generally range from 5 to 45 percent but can be found on slopes up to 90 percent.

Table 2. Representative physiographic features

Landforms	(1) Plateau > Structural bench (2) Mountains > Mountain slope (3) Foothills > Hillslope
Flooding frequency	None
Ponding frequency	None
Elevation	1,800–4,700 ft
Slope	5–45%
Water table depth	20–80 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	1,200–6,000 ft
Slope	0–90%
Water table depth	Not specified

Climatic features

Mean Annual Air Temperature
Total Range: 3.3 to 8.8 degrees Celsius (38 to 48 degrees F)
Central tendency: 5.0 to 7.8 degrees Celsius (41 to 46 degrees F)

Table 4. Representative climatic features

Frost-free period (characteristic range)	85-120 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	25-45 in
Frost-free period (actual range)	70-120 days
Freeze-free period (actual range)	
Precipitation total (actual range)	18-55 in

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 map unit components. The components are dominantly Vitrixerands in the Andisol taxonomic order and Andic and Vitrandic taxonomic subgroups of Dystroxerept and Haploxerept great groups in the Inceptisols order. Soils are dominantly moderately deep to very deep and have average available water capacity of about 4.7 inches (11. 9 cm) in the 0 to 40-inches (0 to 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: Adamslake, Ardenmont, Choralmont, Jumpe, Keechelus, Satus, Singh, Tigit, Watergate

Parent Materials:
Kind – volcanic ash, glacial till, glacial outwash, colluvium, residuum
Origin – granitic, volcanic, metamorphic, and sedimentary rock

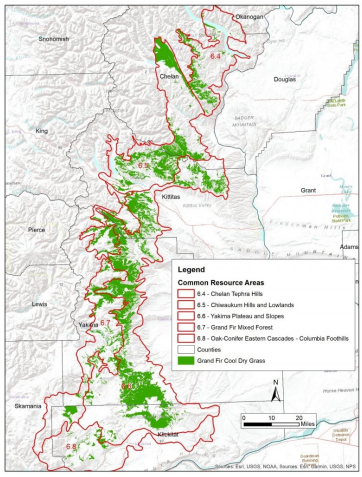


Figure 1. Map of soil mapunits with a major component linked to the Grand Fir Cool Dry Grass Ecological Site

Table 5. Representative soil features

Parent material	(1) Volcanic ash
Surface texture	(1) Ashy loam (2) Ashy sandy loam (3) Ashy fine sandy loam
Drainage class	Moderately well drained to well drained
Depth to restrictive layer	20–60 in
Surface fragment cover <=3"	0–30%
Surface fragment cover >3"	0–40%
Available water capacity (0-40in)	1.5–10 in
Calcium carbonate equivalent (Depth not specified)	0%
Electrical conductivity (Depth not specified)	0 mmhos/cm
Sodium adsorption ratio (Depth not specified)	0
Soil reaction (1:1 water) (0-40in)	5.1–7.3
Subsurface fragment volume <=3" (Depth not specified)	0–63%
Subsurface fragment volume >3" (Depth not specified)	0–44%

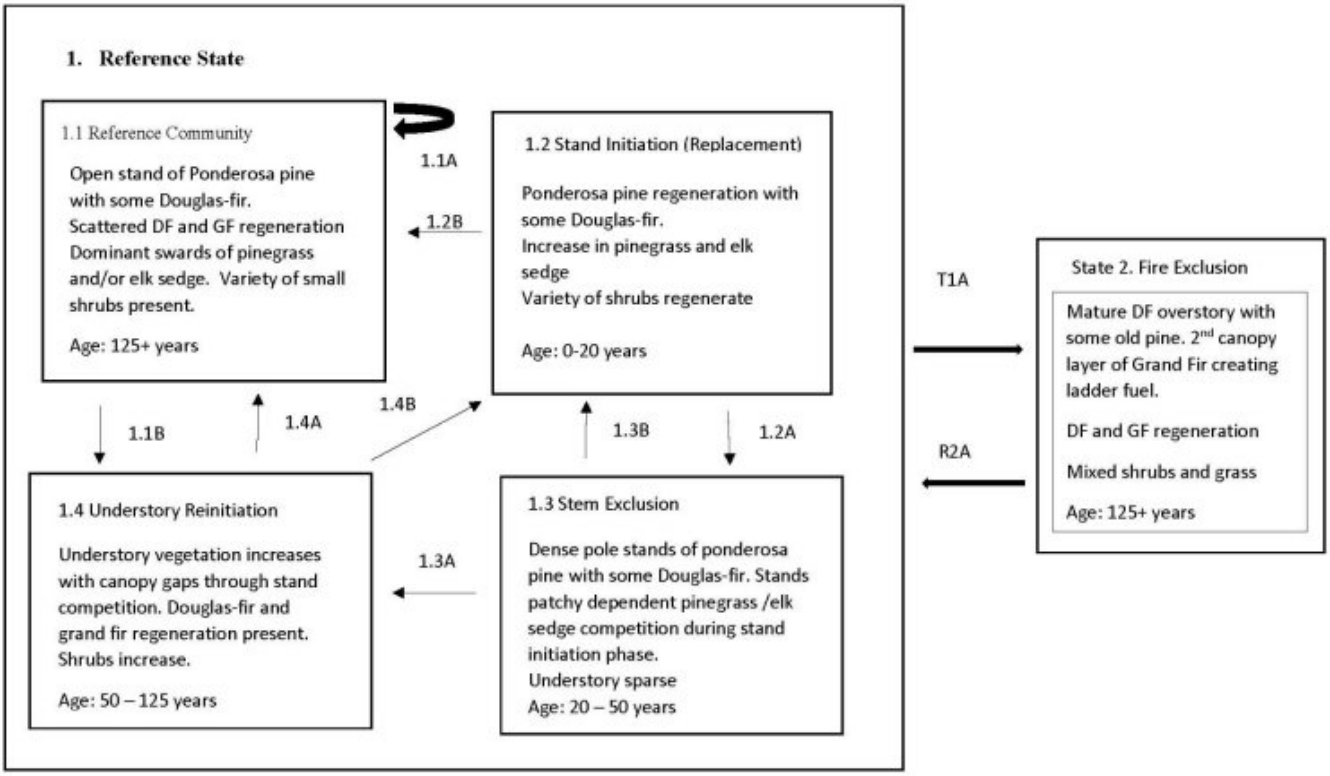
Ecological dynamics

This site combines the grand fir/pinegrass, grand fir/elk sedge and grand fir/snowberry/pinegrass plant associations. It has wide spread coverage from the northern and southern portions of CRA 6.5, and northern area of CRA 6.6 south of Ahtanum Ridge. It does not occur or is insignificant north of Entiat Ridge. It occurs mostly on middle slopes and ridgetops with southern aspects and also, on level terrain in cool air drainages. Elevations ranges from 2000 to 5000 feet. Soils are deep with an ash or mixed ash layer.

Open stands of ponderosa pine and Douglas-fir, with a dominant sward of pinegrass or elk sedge in the understory, are typical of the site. Douglas-fir and grand fir may be present in the understory. A host of shrubs will be mixed in the understory. Western larch is absent from grand fir/pinegrass site due to xeric conditions, however, can be present on the grand fir/elk sedge sites and grand fir/snowberry/pinegrass sites. Lodgepole pine may be present in both.

Frequent ground fires favor ponderosa pine in the overstory and increases pinegrass or elk sedge in the understory. Infrequent fires favor an increase of Douglas-fir and grand fir with more Douglas-fir in the overstory mixed with old ponderosa pine and a secondary canopy layer of grand fir. Due to fire suppression much of the acreage is in this condition. Grand fir is susceptible to insect and disease mortality due to moisture competition. This increase in stand density with a ladder fuel layer of grand fir can lead to a stand replacing fire.

State and transition model



State 1
Reference State

Figure 2. Reference PC (Restoration), GF/Pinegrass Shelterwood cut with prescribed burn

Figure 3. GF / Elk Sedge Shelterwood cut and prescribed burn

Mature open stands of ponderosa pine and Douglas-fir with swards of pinegrass with elk sedge were common before increased fire protection. Frequent low intensity ground fires kept tree regeneration scattered and increased pine grass and elk sedge cover. With longer intervals between fires grand fir and Douglas-fir regeneration will become more prevalent in the overstory and shrubs will increase. Grand fir will develop into a second canopy level creating ladder fuels leading to a potential stand replacing fire. Ponderosa pine will be the major tree regenerating after severe fires with Douglas-fir and some grand fir filling in later. Western larch can be present in some of the mature stands in the elk sedge sites and snowberry sites. Lodgepole pine can sometimes be found in pockets. Dwarf mistletoe can present on Douglas-fir and some root and bole rots can found on all the tree species, but not extreme. Major insects that can cause mortality are the fir engraver and western spruce budworm The Douglas-fir tussock moth can also cause concern. Overstocked late seral stands with increased grand fir developing from prolonged fire intervals enhance beetle, budworm and tussock moth attack. The western pine beetle and the mountain pine beetle can cause mortality in ponderosa pine. Dwarf mistletoe is a major concern in western larch causing major growth loss and mortality. It will also be found on Douglas-fir, ponderosa pine, and lodgepole pine. Dwarf mistletoe was found in over 40 percent of the acreages in the Eastern Cascades where Douglas fir was a major stand component. Again, dense stands underneath infected trees from prolonged fire intervals causes mistletoe to spread easier. Fuel loads and ladder fuels increase fire intensity as a result. Other diseases include Annosum, laminated, and Armillaria root rots. Armillaria can be present in close to 80 percent of the sites with grand fir. Indian paint fungus can be found on sites with increased grand fir stocking. These root rot diseases are enhanced through soil compaction and root damage though selective logging and road building. The root rot diseases are less of a concern in productive grand fir sites and worse in drier sites.

Dominant plant species

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

- grand fir (*Abies grandis*), tree
- white spirea (*Spiraea betulifolia*), shrub
- Oregon boxleaf (*Paxistima myrsinites*), shrub
- hollyleaved barberry (*Mahonia aquifolium*), shrub
- Saskatoon serviceberry (*Amelanchier alnifolia*), shrub
- oceanspray (*Holodiscus discolor*), shrub
- dwarf rose (*Rosa gymnocarpa*), shrub
- pipsissewa (*Chimaphila umbellata*), shrub
- Scouler's willow (*Salix scouleriana*), shrub
- common snowberry (*Symphoricarpos albus*), shrub
- pinegrass (*Calamagrostis rubescens*), grass
- Geyer's sedge (*Carex geyeri*), grass
- heartleaf arnica (*Arnica cordifolia*), other herbaceous
- white hawkweed (*Hieracium albiflorum*), other herbaceous
- sandwort (*Arenaria*), other herbaceous

Community 1.1
Reference Community

Open grown ponderosa pine with some Douglas-fir and dense swards of pinegrass and elk sedge in understory. Some Douglas-fir and grand fir regeneration may be present. A variety of shrubs are inconspicuous within the pinegrass or elk sedge stand. This phase perpetuated by frequent low intensity ground fires.

Resilience management. Community Phase Pathway 1.1A A reoccurring event every 10 to 15 years with frequent ground fires maintaining this plant community in an open stand condition.

Community 1.2
Stand Initiation (Replacement)

Regeneration of trees, shrubs, and grass after stand replacement fire. Ponderosa pine more abundant in tree regeneration than Doulas-fir or grand fir. Depending on fire intensity pinegrass can quickly reestablish and spread. Fire damage to soil may lead to ceanothus abundance.

Community 1.3
Stem Exclusion

Dense pole stands of ponderosa pine, Douglas-fir mix compete for resources and some mortality starts to occur. Understory vegetation will be sparse.

Community 1.4
Understory Re-initiation

Ponderosa pine and Douglas-fir pole stands mature through time and competition. Canopy gaps allow understory vegetation to increase including Douglas-fir and grand fir regeneration.

Pathway 1.1B
Community 1.1 to 1.4

Lack of ground fires allow Douglas-fir and grand fir regeneration to grow into overstory. Shrub coverage increases. Periodic mixed severity fires open up a patchy mosaic of open stands.

Pathway 1.2B
Community 1.2 to 1.1

Time with reoccurring sporadic ground fires opening up pole stands creating open stand conditions.

Pathway 1.2A
Community 1.2 to 1.3

Long intervals without fire will allow tree regeneration to grow into dense pole stands. These pole stands may occur as a mosaic on the site depending on tree regeneration competing with pinegrass and shrubs.

Pathway 1.3B
Community 1.3 to 1.2

Dense pole stands killed by fire reverting back to stand initiation phase.

Pathway 1.3A
Community 1.3 to 1.4

Canopy gaps occur due to stand competition and mortality. Shrubs and grass increase along with tree regeneration. Douglas-fir and grand fir are the major regeneration tree species.

Pathway 1.4A
Community 1.4 to 1.1

Time with sporadic mixed severity fires create a mosaic of open stands.

Pathway 1.4B
Community 1.4 to 1.2

Stand replacing fire due to ladder fuels back to grass/shrub phase.

State 2
Fire Exclusion

Community 2.1
Fire Exclusion

Figure 4. Fire exclusion. Grand fir and Douglas-fir ladder fuels between old ponderosa pine.

Figure 5. Fire exclusion. Grand fir disease and insect mortality.

Main overstory is large ponderosa pine and some Douglas-fir with a second canopy layer of a grand fir and Douglas-fir mix. Mix of shrubs and grass along with more grand fir and Douglas-fir regeneration. In drought years grand fir and Douglas-fir susceptible to defoliators and bark beetle mortality.

Transition T1A
State 1 to 2

Prolonged fire exclusion allows the grand fir regeneration to grow into a second level canopy layer creating ladder fuels for a potential stand replacing fire.

Restoration pathway R2A
State 2 to 1

Selective overstory and second canopy level removal followed by prescribed fire to open up stand.

Additional community tables

Other information

Site index / Culmination Mean Annual Increment (CMAI)

Overall, this site is productive for Douglas-fir, ponderosa pine, and grand fir. Ponderosa pine and Douglas-fir being the preferred species for management. 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 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
grand fir	*ABGR*	77	101	108	155	–	–	–	
Douglas-fir	*PSME*	82	94	86	123	–	–	–	
lodgepole pine	*PICO*	92	100	112	119	–	–	–	
ponderosa pine	*PIPO*	82	105	72	75	–	–	–	

Inventory data references

Relationship to Other Established Classifications:
United States National Vegetation Classification (2008) – A3362 Abies grandis – Pseudotsuga menziesii Central Rocky Mt. Forest & Woodland Alliance.

Washington Natural Heritage Program. Ecosystems of Washington State, a Guide to Identification, Rocchio and Crawford, 2015 –
Northern Rocky Mt. Mesic Montane Mixed Conifer Forest.

USDA NRCS Common Resource Areas 6.5 (Chiwaukum Hills and Lowlands) and CRA 6.6 (Yakima Plateau and Slopes)
Level III and IV Ecoregions of WA, US EPA, June 2010 – 77h (Chiwaukum Hills and Lowlands, 9a (Yakima Plateau and Slopes)

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

Forest Service Plant Associations:
CWG124 - grand fir/pinegrass (modal)
CWS336 - grand fir/common snowberry/pinegrass
CWG125 - grand fir/pinegrass-lupine
CWS554 - grand fir/oceanspray/pinegrass
CWS226 - grand fir/Cascade Oregongrape/pinegrass

Yakama Nation Habitat Type:
08 - grand fir/elk sedge
09 - grand fir/pinegrass (modal)

Other references

Forest Plant Associations of the Wenatchee National Forest, PNW-GTR-359. October 1995. Lillybridge et al.
Forest Plant Associations of the Yakima Indian Reservation, May 1988, John, Tart, Clausnitzer.
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
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	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:**