Ecological site F006XB001WA
Frigid Xeric Mountain Slopes (Douglas-fir Moderately Dry Shrub/Herb)

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

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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) 6.5 - Chiwaukum Hills and Lowlands

This LRU occurs predominantly on mountains slopes and plateaus. The soils are dominantly in the Alfisols and Mollisols taxonomic order, with minor areas of Inceptisols and Andisols . Soil parent materials are dominantly colluvium and residuum from igneous, sedimentary, and metamorphic rock, glacial outwash, and glacial till, with a mixture of loess 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 27 inches.

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

Classification relationships

CDS638 (WEN) – Douglas-fir/snowberry/pinegrass (PSME/SYAL/CARU)

Ecological site concept

The bulk of this ecological site is in the lower elevation mountain slopes, located on lower mountain foothills and slopes under 3000 feet. This is a Douglas-fir/Snowberry/Pinegrass site that is warmer and has increased brush species in the understory and no western larch.

Associated sites

F006XD002WA	**Cool Frigid Xeric Ashy Slopes (Grand fir Cool Dry Grass)** Extends from Chelan to Klickitat. On moister sites with grand fir.
F006XB004WA	**Mesic Xeric Foothills and Mountain Slopes (Ponderosa Pine Hot Dry Shrub Grass)** Little warmer and drier.
F006XB003WA	**Frigid Xeric Mountain Slopes (Grand fir Warm Moderately Dry Low Shrub/Herb)** Little moister and cooler sites with Grand fir.

Similar sites

F006XA001WA	**Cool Frigid Xeric Ashy Slopes (Douglas-fir Cool Dry Grass)** Cooler sites with an understory dominated by pinegrass, and fewer shrubs. In association in Southern Chelan Co. and northern Kittitas Co.
F006XA007WA	**Warm Frigid Xeric Mountain Slopes (Douglas-fir Warm Dry Shrub/Herb)** Could be in association from Chelan to Yakima.

Table 1. Dominant plant species

Tree	(1) *Pseudotsuga menziesii*
Shrub	(1) *Symphoricarpos albus*
Herbaceous	(1) *Calamagrostis rubescens*

Physiographic features

This ecological site occurs mainly on mountain back slopes, plateaus and terraces. It is found between 1,200 feet and 5,700 feet in elevation on all aspects. Slope gradients generally range from 2 to 65 percent, but can be found on slopes up to 90 percent.

Table 2. Representative physiographic features

Landforms	(1) Mountains > Mountain slope (2) Plateau > Terrace (3) Hills > Hillslope (4) Alluvial fan
Flooding duration	Brief (2 to 7 days)
Flooding frequency	None to occasional
Elevation	1,200–5,500 ft
Slope	15–45%
Water table depth	80 in
Aspect	W, NW, N, NE, E, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Flooding duration	Not specified
Flooding frequency	Not specified
Elevation	200–6,500 ft

Slope	0–90%
Water table depth	15–80 in

Climatic features

Mean Annual precipitation
Total Range: 18 - 45 inches
Central tendency: 20 - 30 inches

Mean Annual Air Temperature
Total Range: 2.7 - 10.0 C (37 - 50 F)
Central tendency: 6.1 - 8.8 C (43 - 48 F)

Frost-free period (days)
Total range: 70 - 140
Central tendency: 90 - 120

Representative Climate Station: USC00451504 – Cle Elem, WA; latitude 47.189, longitude -120.913; elevation 1900 feet.

Table 4. Representative climatic features

Frost-free period (characteristic range)	90-120 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	20-30 in
Frost-free period (actual range)	70-140 days
Freeze-free period (actual range)	
Precipitation total (actual range)	18-45 in

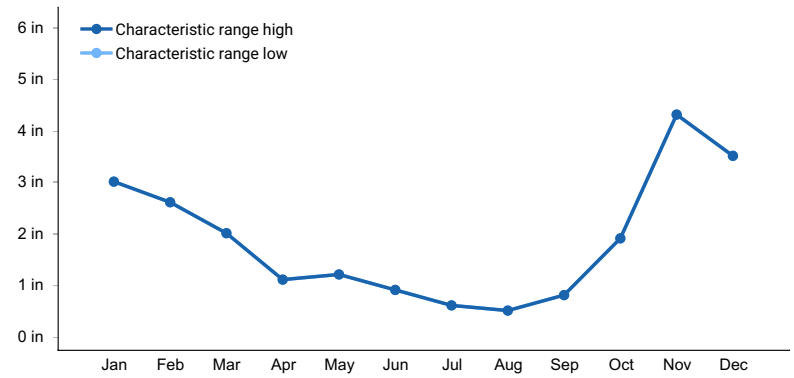


Figure 1. Monthly precipitation range

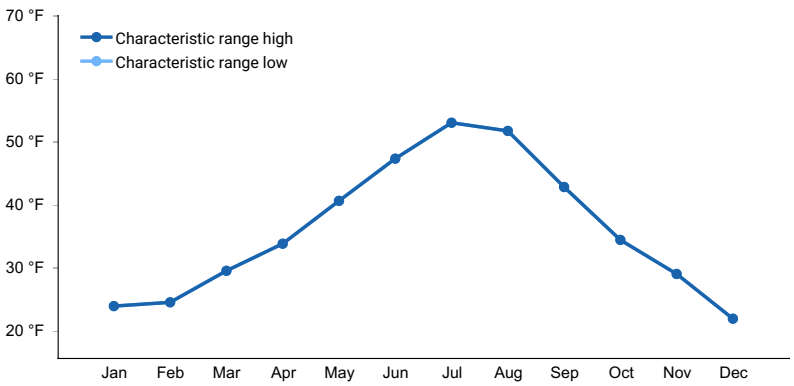


Figure 2. Monthly minimum temperature range

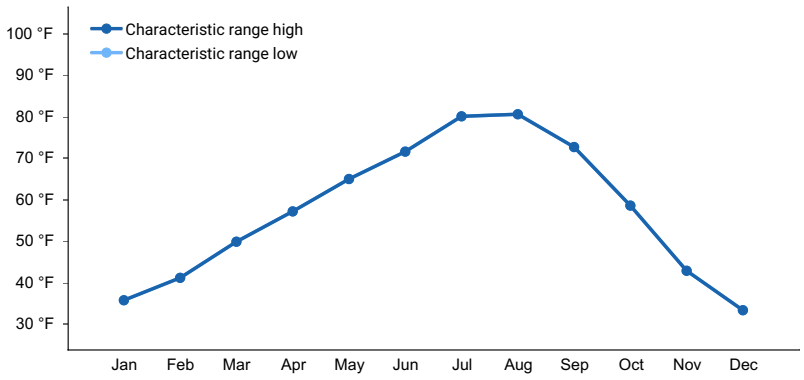


Figure 3. Monthly maximum temperature range

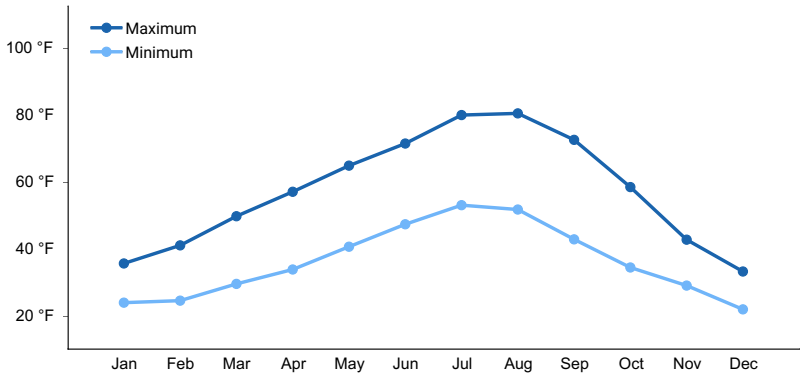


Figure 4. Monthly average minimum and maximum temperature

Climate stations used

- (1) CLE ELUM [USC00451504], 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 Vitrandic and Ultic taxonomic subgroups of Haploxeralf, Argixerolls and Haploxeroll great groups. Soils are dominantly moderately deep to very deep and have average available water capacity of about 5.8 inches (14.7 cm) in the 0 to 40-inches (0-100 cm) depth range. Soil parent material is dominantly colluvium and residuum from granitic, volcanic, metamorphic, and sedimentary rock, glacial outwash, and glacial till, with a mixture of loess volcanic ash in the upper part.
Dominant Soil Series: Nard, Suskin, Teanaway, Quiden, Maydol, Varelum, Ampad, Kaiders, Sauter

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

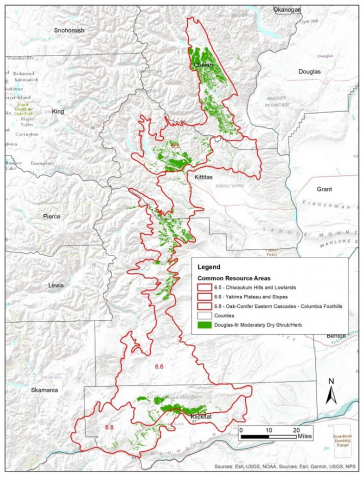


Figure 5. Map of soil mapunits with a major component linked to the Douglas-fir Moderately Dry Shrub/ Herb Ecological Site

Table 5. Representative soil features

Surface texture	(1) Ashy sandy loam (2) Ashy loam (3) Ashy silt loam
Family particle size	(1) Fine-loamy (2) Loamy-skeletal
Drainage class	Well drained
Surface fragment cover <=3"	0–23%
Surface fragment cover >3"	0–20%
Available water capacity (Depth not specified)	Not specified
Soil reaction (1:1 water) (0-10in)	Not specified
Subsurface fragment volume <=3" (Depth not specified)	Not specified
Subsurface fragment volume >3" (Depth not specified)	Not specified

Table 6. Representative soil features (actual values)

Drainage class	Somewhat poorly drained to well drained
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (Depth not specified)	2.5–7.8 in
Soil reaction (1:1 water) (0-10in)	5.6–7.3
Subsurface fragment volume <=3" (Depth not specified)	3–45%
Subsurface fragment volume >3" (Depth not specified)	0–32%

Ecological dynamics

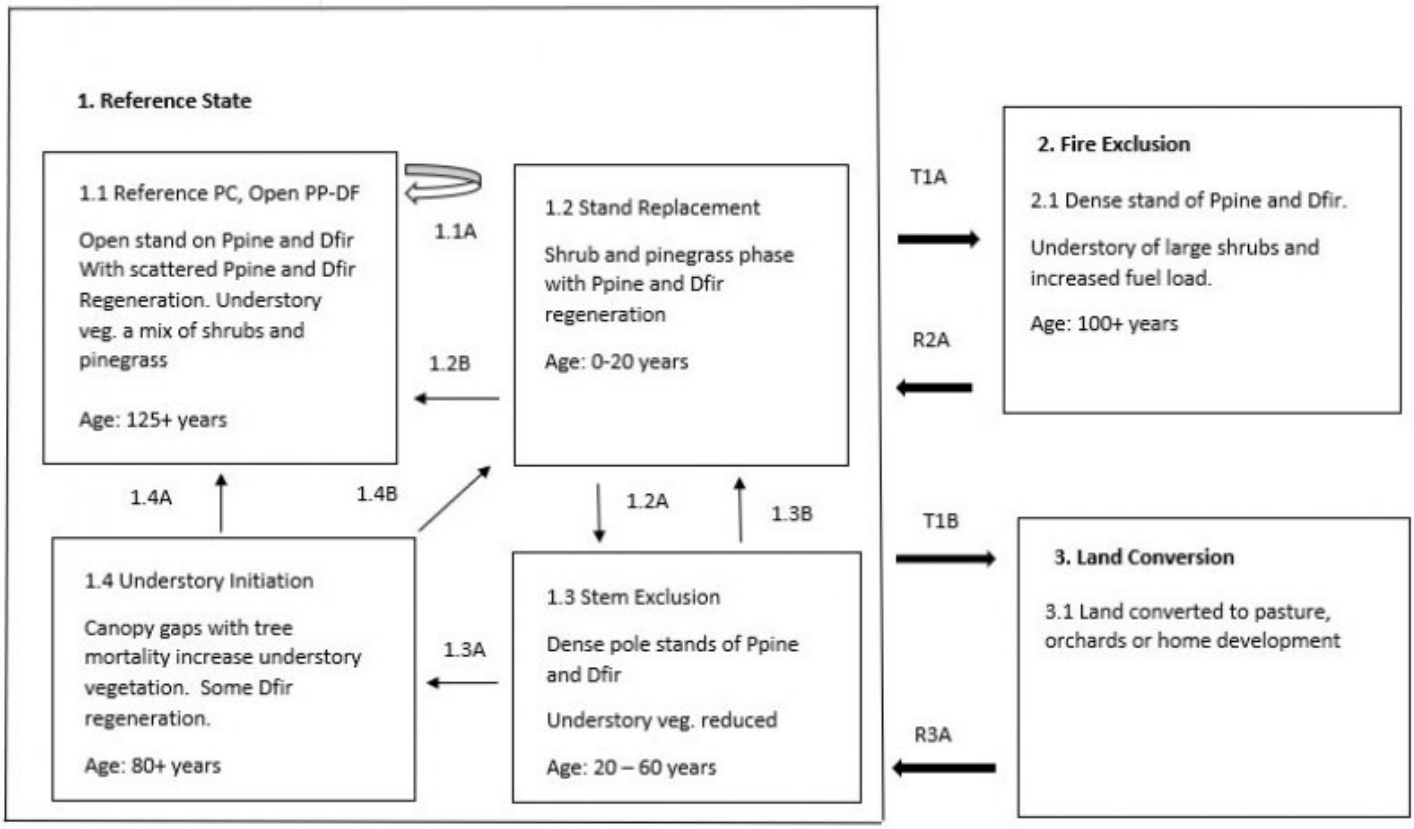
The bulk of this ecological site is in the lower elevation mountain slopes in the Leavenworth and Blewett Pass areas of CRA 6.5. It is also scattered in portions of CRA 6.6. It’s predominantly located on lower mountain foothills and

slopes under 3000 feet. This DF/Snowberry/Pinegrass site is warmer and differs than the Douglas-fir/pinegrass sites to the north due to the increased brush species in the understory and no western larch. It is a productive site with good tree stocking of Douglas-fir and ponderosa pine. Both species dominate the site with an understory of variety of shrubs along with pinegrass and elk sedge. Stands would normally be open grown with frequent low intensity fires (Fire Regime 1 in LANDFIRE 2007); however, fire exclusion has caused stand density to increase with mixed severity and stand replacing fires the norm.

State and transition model

State and Transition Diagram

State Transition Model – Ecological Site
Douglas-fir Moderately Dry Shrub/Herb
Douglas-fir/Snowberry/Pinegrass



Plant Community, Transition, and Restoration Pathways

1.1A – Reoccurring frequent ground fires keep reference community in a stable open condition.
1.2A – Tree regeneration grows into dense pole stands.
1.2B – Time. Reoccurring sporadic ground fires create open stand conditions.
1.3A – Time. Pole stands grow and canopy gaps occur from stand competition.
1.3B – Stand replacing fire back to shrub/grass phase.
1.4A – Time, sporadic mixed severity fires create mosaic of open stand conditions.
1.4B - Stand replacing fire.
T1A – Long intervals of fire exclusion creating dense stand and large fuel load conditions.
R2A – Selective tree removal and prescribed burning.
T1B – Forest converted to other land uses.
R3A – Conversion back to forest through site preparation, tree planting, and maintenance.

State 1
Reference State

Moderately open stands of ponderosa pine and Douglas-fir with reoccurring ground fires keeping shrubs and regeneration from increasing into dense stands. This site has good productivity and tree stocking so fires would have to reoccur regularly to keep stand density down. Understory vegetation is dominated by shrubs like snowberry, serviceberry, oceanspray, spiraea, and Scouler willow. Pinegrass and elk sedge were also abundant. Regeneration would include both Douglas-fir and ponderosa pine. As shade increases Douglas-fir regeneration would be more prominent. Fire exclusion has caused much of these sites to have dense stands of Douglas-fir and some ponderosa pine. Ladder fuels and fuel loads increase from understory brush. Stand replacing fires are more common now with ceanothus and other shrub species occupying the sites. Most of this site occurs on lower foothills and human activity has led to land conversion to fruit orchards, pasture, and home developments. Major insects for Douglas-fir that can cause mortality are the fir engraver, western spruce budworm, and Douglas-fir beetle. The Douglas-fir tussock moth can also cause concern. Drought and dense stands developing from prolonged fire intervals enhance beetle attack and tree mortality. The western pine beetle, mountain pine beetle and pine engraver can cause mortality in ponderosa pine. Dwarf mistletoe can be a found on both Douglas-fir and ponderosa 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. These root rot diseases are enhanced through soil compaction and root damage though selective logging and road building.

Community 1.1
Reference Plant community, Open PP-DF

Figure 6. Mid-seral moderately open stand of DF and Ppine with shrub/pinegrass understory

Open to moderately open stands of mature ponderosa pine and Douglas-fir with a mixture of shrubs, pinegrass, elk sedge, and Douglas-fir and ponderosa pine regeneration. Open stand on Ppine and Dfir With scattered Ppine and Dfir Regeneration. Understory veg. a mix of shrubs and pinegrass Age: 125+ years

Resilience management. Community Pathway 1.1A Reoccurring frequent ground fires maintain open stand conditions

Dominant plant species

- Douglas-fir (*Pseudotsuga menziesii*), tree
- ponderosa pine (*Pinus ponderosa*), tree
- common snowberry (*Symphoricarpos albus*), shrub
- Saskatoon serviceberry (*Amelanchier alnifolia*), shrub
- white spirea (*Spiraea betulifolia*), shrub
- oceanspray (*Holodiscus discolor*), shrub
- Scouler's willow (*Salix scouleriana*), shrub
- Cascade barberry (*Mahonia nervosa*), shrub
- redstem ceanothus (*Ceanothus sanguineus*), shrub
- pinegrass (*Calamagrostis rubescens*), grass
- Geyer's sedge (*Carex geyeri*), grass

Community 1.2
Stand Replacement

Grass/shrub/regeneration phase after disturbance like fire. Shrub competition could be severe depending seed source for tree regeneration. Shrub and pinegrass phase with Ppine and Dfir regeneration Age: 0-20 years

Community 1.3
Stem Exclusion

Dense stands of Douglas-fir and ponderosa pine grow and stem to stem competition begins. Understory vegetation limited under dense stands. Dense pole stands of Ppine and Dfir Understory veg. reduced Age: 20 – 60 years

Community 1.4
Understory Initiation

Understory vegetation increases with canopy gaps. Ponderosa pine and Douglas-fir stands continue to grow into mature stands. Shrub species increase and Douglas-fir regeneration present. Canopy gaps with tree mortality increase understory vegetation. Some Douglas-fir regeneration. Age: 80+ years

Pathway 1.2B
Community 1.2 to 1.1

Reoccurring fires reduce tree regeneration and shrubs allowing regeneration survivors to grow in open stand conditions.

Pathway 1.2A
Community 1.2 to 1.3

Tree regeneration grows into dense pole stands of Douglas-fir and ponderosa pine. These stands may occur as a mosaic on the landscape depending tree-shrub competition during the establishment phase 1.2.

Pathway 1.3B
Community 1.3 to 1.2

Fire pushes site back to shrub/grass/regeneration phase. Ceanothus and other shrubs pose competition for tree establishments.

Pathway 1.3A
Community 1.3 to 1.4

Pole stands grow and canopy gaps occur from stand competition increasing shrub understory.

Pathway 1.4A
Community 1.4 to 1.1

Sporadic mixed severity fires open up stands in a mosaic and reoccurring ground fires create conditions as in reference phase 1.1.

Pathway 1.4B
Community 1.4 to 1.2

Stand replacing fire pushes site back to shrub/grass/regeneration phase. Ceanothus and other shrubs pose competition for tree establishments.

State 2

Fire Exclusion

Homogenous dense stands of Douglas-fir and ponderosa pine with large understory shrub fuel loads are now typical of this ecological site due to fire exclusion. This leads to more probability of severe stand replacing fires.

Community 2.1
Dense stand of Ppine and Dfir. Understory of large shrubs and increased fuel load. Age: 100+ years

Homogenous dense stands of Douglas-fir and ponderosa pine with large understory shrub fuel loads are now typical of this ecological site due to fire exclusion. This leads to more probability of severe stand replacing fires.

Dominant plant species

- Douglas-fir (*Pseudotsuga menziesii*), tree
- ponderosa pine (*Pinus ponderosa*), tree

State 3
Land Conversion

Lower landscapes of this ecological site are converted to orchards, pastures, and other human developments.

Community 3.1
Land conversion

Land converted to pasture, orchards or home development

Transition T1A
State 1 to 2

Fire exclusion causing increased tree density and fuel load buildup in mature stands

Transition T1B
State 1 to 3

Forest converted to orchards, pasture, or human developments.

Restoration pathway R2A
State 2 to 1

Selective tree removal and prescribed burning to restore open stand conditions.

Restoration pathway R3A
State 3 to 1

Conversion back to forest through intensive site preparation, tree planting, and maintenance.

Additional community tables

Other information

Site index /Culmination of Mean Annual Increment (CMAI)

Overall this site is productive for Douglas-fir, ponderosa pine. Douglas-fir and ponderosa pine 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 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
ponderosa pine	*PIPO*	65	106	14	100	–	–	–	
Douglas-fir	*PSME*	60	90	43	68	–	–	–	

Inventory data references

Forest Service Plant Associations:
CDS638 (WEN) – Douglas-fir/snowberry/pinegrass (PSME/SYAL/CARU)

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. Thomas, Hart, and Clausnitzer
Washington Natural Heritage Program. Ecosystems of Washington State, a Guide to Identification, Rocchio and Crawford, 2015 –
Northern Rocky Mt. Dry-Mesic Montane Mixed Conifer Forest
NRCS MLRA 6 Soil-Forest Productivity data base
NRCS Common Resource Area Maps (CRAs)
NRCS MLRA 6 Soil-Forest Plant Association data base
On site field reviews of Central and South CRAs with professional interpretation. June and July 2019. Kuhn, Campbell

Contributors

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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):

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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:**