Ecological site F006XC002WA
Cryic Moderately Moist Xeric Mountain Slopes (Western Hemlock Cool Moderately Moist)

Last updated: 9/11/2023
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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, MLR A6 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 mountain slopes and plateaus. 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 40 inches.

Other LRU'S where the site occurs:
CRA 6.1 - North Cascades Subalpine / Alpine
CRA 6.2 - Pasayten / Sawtooth Highland
CRA 6.3 - Okanogan Pine / Fir Hills
CRA 6.4 - Chelan Tephra Hills

Classification relationships

The ecological site relates to the Wenatchee National Forest plant association: western hemlock/Cascade Oregongrape

Ecological site concept

This ecological site typically resides on mountain slopes, at elevations of 3000 to 5400 feet on slopes of 8 to 65 percent. The climatic conditions are moderately moist and cool, with 40 to 85 frost-free days, mean annual precipitation of 40 to 60 inches, and mean annual air temperature of 41 to 45 degrees Fahrenheit. This ecological site represents the drier end of the western hemlock zone.

The soils are dominantly Andisols, specifically Xeric Vitricryands, with an ashy-skeletal particle-size class. Surface textures are typically ashy sandy loam and ashy loamy sand. The parent material is volcanic ash over colluvium and residuum from volcanic and sedimentary rock. The soils are dominantly well drained, and have no flooding, ponding or water table. They are typically 20 to greater than 60 inches deep to a root-restricting feature. These soils have a cryic soil temperature regime and xeric soil moisture regime.

The reference community has an overstory of TSHE and THPL with moist adapted understory. Seral species include PIMO3, PIPO, PICO, PSME at the warmer, drier lower elevations and ABAM, ABGR, LAOC, PICO at colder, higher elevations. The understory can include: ACTR, ARNE, CAGE2, CHUM, GOOB2, MANE2, PAMY, ROSA5, SPBEL, VASC, CLUN2, LIBOL, PTAQP2. MANE2 generally dominates throughout the series.

Abies grandis generally occurs in this site for 100 years and ACCI though present, lasts only ten years. Generally, ABAM occurs in more maritime sites while ABGR in warmer, continental climate areas. Fire is the main disturbance regime and occurs as rare, stand replacement events on a rotational interval of 100 to 200 years. Specifically, USFS FEIS states that TSHE in the Pacific Northwest has a fire return interval of 150 to 400 years, though in Wenatchee NF it is thought to be 100 to 200 years based on stand ages, and LANDFIRE BPS states all fire types occur in 400 year intervals, and that stand replacing severity is 99 percent of all fires. Diseases that occur on this site include: Laminated (Armillaria, Annosum) root rots, brown cubical rot, dwarf mistletoe.

Associated sites

F006XD002WA	**Cool Frigid Xeric Ashy Slopes (Grand fir Cool Dry Grass)** On slightly warmer, drier sites
F006XC003WA	**Cool Frigid Moist Xeric Mountain Slopes (Grand fir Cool Moist Shrub/Herb)** On slightly warmer and drier sites
F006XA006WA	**Cold Cryic Udic Mountain Slopes (Pacific Silver fir Cold Moist Shrub/Herb)** Cooler

Similar sites

F003XC305WA	**Low Mountain Slopes Moist Forest western hemlock** On slightly moister sites near the Cascade Mountains crest.

Table 1. Dominant plant species

Tree	(1) *Tsuga heterophylla* (2) *Thuja plicata*
Shrub	(1) *Mahonia nervosa*
Herbaceous	Not specified

Physiographic features

This ecological site typically resides on mountain slopes, at elevations of 3000 to 5400 feet on slopes of 8 to 65 percent.

Table 2. Representative physiographic features

Landforms	(1) Mountains > Mountain slope
Flooding frequency	None
Ponding frequency	None
Elevation	3,000–5,400 ft
Slope	8–65%
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

The climatic conditions are moderately moist and cool, with 40 to 85 frost-free days, mean annual precipitation of 40 to 60 inches, and mean annual air temperature of 41 to 45 degrees Fahrenheit. This ecological site represents the drier end of the western hemlock zone.

Table 3. Representative climatic features

Frost-free period (actual range)	40-85 days
Freeze-free period (actual range)	
Precipitation total (actual range)	40-60 in

Influencing water features

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

Wetland description

N/A

Soil features

The soils are dominantly Andisols, specifically Xeric Vitricryands, with an ashy-skeletal particle-size class. Surface textures are typically ashy sandy loam and ashy loamy sand. The parent material is volcanic ash over colluvium and residuum from volcanic and sedimentary rock. The soils are dominantly well drained, and have no flooding, ponding or water table. They are typically 20 to greater than 60 inches deep to a root-restricting feature. These soils have a cryic soil temperature regime and xeric soil moisture regime.

Parent material:
volcanic ash over colluvium and residuum from volcanic and sedimentary rock

Table 4. Representative soil features

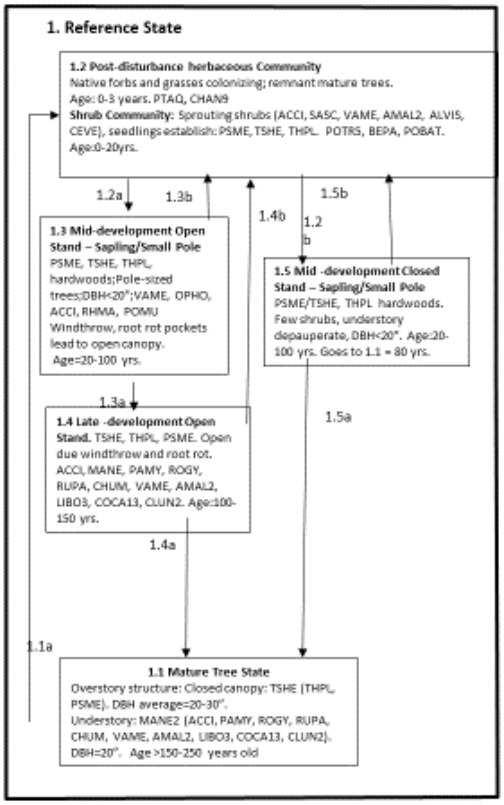
Parent material	(1) Volcanic ash (2) Colluvium–volcanic and sedimentary rock (3) Residuum–volcanic and sedimentary rock
Surface texture	(1) Ashy sandy loam (2) Ashy loamy sand (3) Ashy fine sandy loam
Family particle size	(1) Ashy-skeletal (2) Ashy-skeletal over loamy-skeletal
Drainage class	Well drained
Soil depth	20–60 in
Surface fragment cover <=3"	0–22%
Surface fragment cover >3"	0–15%

Available water capacity (0-40in)	1.8–6.9 in
Soil reaction (1:1 water) (Depth not specified)	5.1–7.3

Ecological dynamics

Ecological Dynamics Narrative: Fire is a rare, stand replacing event in this ecological site. Generally, the fire return interval is believed to be 100 to 300 years in Wenatchee NF, based on stand ages and 150 to 400 years for TSHE in the PNW as a whole. LANDFIRE BPS Models state that stand replacement fires occur in 400 year intervals (300 to 800 year range) for TSHE forests in WA and OR. Fire is a large patch disturbance while diseases such as Laminated (Armillaria, Annosum) root rots, brown cubical rot, dwarf mistletoe are small patch disturbance that allow the closed continuous canopy to open.

State and transition model



1 Reference State

1.1 This phase has an overstory dominated Western hemlock, with Western cedar and Douglas fir, with a lower tree canopy of these species; an understory of tall shrubs, and cool, moist adapted herbaceous species. Thick tall and medium statured shrubs and herbaceous species include: ACCI, ACTR, ARNE, CAGE2, CHUM, GOOB2, MANE2, PAMY, ROSA5, SPBEL, VASC, CLUN2, LIBOL, PTAQP2

1.2 Pioneering herbaceous community. Immediately post-fire, on-site and windblown tree seeds establish, shrub and herbaceous plants resprout and pioneering herbaceous plants establish on mineral soil interspaces. This is a short duration community phase. **Shrub Community**. This plant community contains a high diversity of shrubs including MANE2, ACCI, SASC, VAME, AMAL2, ALVIS, CEVE), seedlings establish: PSME, TSHE, THPL. POTR5, BEPA, POBAT. Seedlings mature to saplings.

1.3 Mid-development OPEN CANOPY community. This phase is dominated by a mix of PSME, TSHE, THPL and some deciduous trees that are pole sized and are in an open canopy due to windthrow, insects and disease.

1.4 LATE-development OPEN CANOPY community. This phase is dominated by a mix of large PSME, TSHE, THPL and some deciduous trees that are pole sized and are in an open canopy due to windthrow, insects and disease.

1.5 MID-development CLOSED CANOPY community. This phase is dominated by a mix of PSME, TSHE, THPL and some deciduous trees that are pole sized and are in a closed canopy configuration.

1.1a; 1.3b; 1.4b; 1.5b: Rare, stand-replacement fire that kills significant number of mature trees and top-kills shrubs and herbaceous plants. This disturbance causes a return to the pioneering, herbaceous community with resprouting shrubs.

1.2a:With time, the tree seedlings and small saplings go to the mid development community and due to the occurrence of mixed severity fire the canopy is in an open configuration.

1.2b:With time, the tree seedlings and small saplings go to the mid development community grow into the closed canopy configuration.

1.3a: With time, the pole sized trees develop to large mature trees in the late development phase.

1.4a: With time, the large mature trees develop into the closed configuration of the reference phase without the occurrence of mixed severity fire.

1.5a: With time, the large mature trees develop into the closed configuration of the reference phase without the occurrence of mixed severity fire.

State 1
Reference State

Dominant plant species

- Douglas-fir (*Pseudotsuga menziesii*), tree
- western hemlock (*Tsuga heterophylla*), tree
- western white pine (*Pinus monticola*), tree
- grand fir (*Abies grandis*), tree
- western redcedar (*Thuja plicata*), tree
- western larch (*Larix occidentalis*), tree
- lodgepole pine (*Pinus contorta*), tree
- noble fir (*Abies procera*), tree
- Cascade barberry (*Mahonia nervosa*), shrub
- pipsissewa (*Chimaphila umbellata*), shrub
- twinflower (*Linnaea borealis*), shrub
- thinleaf huckleberry (*Vaccinium membranaceum*), shrub

- Oregon boxleaf (*Paxistima myrsinites*), shrub
- sidebells wintergreen (*Orthilia secunda*), shrub
- dwarf rose (*Rosa gymnocarpa*), shrub
- whiteveined wintergreen (*Pyrola picta*), shrub
- liverleaf wintergreen (*Pyrola asarifolia*), shrub
- vine maple (*Acer circinatum*), shrub
- western rattlesnake plantain (*Goodyera oblongifolia*), other herbaceous

Community 1.1
Mature Tree State

This phase has an overstory dominated western hemlock, with western cedar and Douglas-fir, with a lower tree canopy of these species; an understory of tall shrubs, and cool, moist adapted herbaceous species. Thick, tall, and medium statured shrubs and herbaceous species include: ACCI, ACTR, ARNE, CAGE2, CHUM, GOOB2, MANE2, PAMY, ROSA5, SPBEL, VASC, CLUN2, LIBOL, PTAQP2

Dominant plant species

- western hemlock (*Tsuga heterophylla*), tree
- western redcedar (*Thuja plicata*), tree
- Douglas-fir (*Pseudotsuga menziesii*), tree
- vine maple (*Acer circinatum*), shrub
- pinemat manzanita (*Arctostaphylos nevadensis*), shrub
- Cascade barberry (*Mahonia nervosa*), shrub
- Oregon boxleaf (*Paxistima myrsinites*), shrub
- rose (*Rosa*), shrub
- white spirea (*Spiraea betulifolia*), shrub
- grouse whortleberry (*Vaccinium scoparium*), shrub
- sweet after death (*Achlys triphylla*), other herbaceous
- Geyer's sedge (*Carex geyeri*), other herbaceous
- pipsissewa (*Chimaphila umbellata*), other herbaceous
- western rattlesnake plantain (*Goodyera oblongifolia*), other herbaceous
- bride's bonnet (*Clintonia uniflora*), other herbaceous
- longtube twinflower (*Linnaea borealis ssp. longiflora*), other herbaceous
- hairy brackenfern (*Pteridium aquilinum var. pubescens*), other herbaceous

Community 1.2
Pioneering herbaceous community

Immediately post-fire, on-site and windblown tree seeds establish, shrub and herbaceous plants re-sprout and pioneering herbaceous plants establish on mineral soil interspaces. This is a short duration community phase. Shrub Community. This plant community contains a high diversity of shrubs including MANE2, ACCI, SASC, VAME, AMAL2, ALVIS, CEVE), seedlings establish: PSME, TSHE, THPL. POTR5, BEPA, POBAT. Seedlings mature to saplings.

Dominant plant species

- Douglas-fir (*Pseudotsuga menziesii*), tree
- western hemlock (*Tsuga heterophylla*), tree
- western redcedar (*Thuja plicata*), tree
- quaking aspen (*Populus tremuloides*), tree
- paper birch (*Betula papyrifera*), tree
- black cottonwood (*Populus balsamifera ssp. trichocarpa*), tree
- Cascade barberry (*Mahonia nervosa*), shrub
- vine maple (*Acer circinatum*), shrub
- Scouler's willow (*Salix scouleriana*), shrub
- thinleaf huckleberry (*Vaccinium membranaceum*), shrub
- Saskatoon serviceberry (*Amelanchier alnifolia*), shrub
- Sitka alder (*Alnus viridis ssp. sinuata*), shrub

- snowbrush ceanothus (*Ceanothus velutinus*), shrub

Community 1.3
Mid-development OPEN CANOPY community.

This phase is dominated by a mix of PSME, TSHE, THPL and some deciduous trees that are pole-sized and are in an open canopy due to windthrow, insects and disease.

Dominant plant species

- Douglas-fir (*Pseudotsuga menziesii*), tree
- western hemlock (*Tsuga heterophylla*), tree
- western redcedar (*Thuja plicata*), tree

Community 1.4
LATE-development OPEN CANOPY community.

This phase is dominated by a mix of large PSME, TSHE, THPL and some deciduous trees that are pole-sized and are in an open canopy due to windthrow, insects and disease.

Dominant plant species

- western hemlock (*Tsuga heterophylla*), tree
- western redcedar (*Thuja plicata*), tree
- Douglas-fir (*Pseudotsuga menziesii*), tree

Community 1.5
MID-development CLOSED CANOPY community.

This phase is dominated by a mix of PSME, TSHE, THPL and some deciduous trees that are pole-sized and are in a closed canopy configuration.

Dominant plant species

- Douglas-fir (*Pseudotsuga menziesii*), tree
- western hemlock (*Tsuga heterophylla*), tree
- western redcedar (*Thuja plicata*), tree

Pathway 1.1a
Community 1.1 to 1.2

Rare, stand-replacement fire that kills significant number of mature trees and top-kills shrubs and herbaceous plants. This disturbance causes a return to the pioneering, herbaceous community with re-sprouting shrubs.

Pathway 1.2a
Community 1.2 to 1.3

With time, the tree seedlings and small saplings go to the mid-development community and due to the occurrence of mixed severity fire the canopy is in an open configuration.

Pathway 1.2b
Community 1.2 to 1.5

With time, the tree seedlings and small saplings go to the mid-development community grow into the closed canopy configuration.

Pathway 1.3b
Community 1.3 to 1.2

Rare, stand-replacement fire that kills significant number of mature trees and top-kills shrubs and herbaceous plants. This disturbance causes a return to the pioneering, herbaceous community with resprouting shrubs.

Pathway 1.3a
Community 1.3 to 1.4

With time, the pole sized trees develop to large mature trees in the late-development phase.

Pathway 1.4a
Community 1.4 to 1.1

With time, the large mature trees develop into the closed configuration of the Reference Phase without the occurrence of mixed severity fire.

Pathway 1.4b
Community 1.4 to 1.2

Rare, stand-replacement fire that kills significant number of mature trees and top-kills shrubs and herbaceous plants. This disturbance causes a return to the pioneering, herbaceous community with resprouting shrubs.

Pathway 1.5a
Community 1.5 to 1.1

With time, the large mature trees develop into the closed configuration of the Reference Phase without the occurrence of mixed severity fire.

Pathway 1.5b
Community 1.5 to 1.2

Rare, stand-replacement fire that kills significant number of mature trees and top-kills shrubs and herbaceous plants. This disturbance causes a return to the pioneering, herbaceous community with re-sprouting shrubs.

Additional community tables

Table 5. 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*	50	130	57	214	–	–	–	
Douglas-fir	*PSME*	50	100	29	114	–	–	–	
western hemlock	*TSHE*	70	90	72	100	–	–	–	
western white pine	*PIMO3*	40	49	57	100	–	–	–	
Engelmann spruce	*PIEN*	75	85	72	86	–	–	–	
lodgepole pine	*PICO*	70	80	72	86	–	–	–	
ponderosa pine	*PIPO*	78	80	57	80	–	–	–	
western larch	*LAOC*	45	60	43	72	–	–	–	
subalpine fir	*ABLA*	55	95	–	–	–	–	–	

Inventory data references

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

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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	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:**