USDA Natural Resources Conservation Service

Ecological site F006XB802OR
Mesic Xeric North Slopes 15-25 PZ

Last updated: 9/11/2023
Accessed: 02/09/2025

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

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

This unit is characterized by ash mantled lava flows and glacial outwash plains on lower mountain slopes and foothills of the East Cascades in Oregon. Vegetation is largely dominated by forests of ponderosa pine with transitional dry mixed conifer forests where Douglas-fir and grand fir are sub dominant occurring in areas with greater effective precipitation.
Historically, these forests have been influenced by a fire regime whereby frequent to moderately frequent, low and mixed severity fires would have favored the development of open stands of mature ponderosa pine. The climate of this unit is cool and dry with a predominately xeric soil moisture regime and frigid soil temperature regime. Geologically, underlying lithologies are dominated by Quaternary and late Tertiary basalt and basaltic andesite as well as mixed grain sediments deposited during Pleistocene glacial retreat. Unlike the nearby pumice plateau, this unit lacks the coarse pumice fragments that dominate the soil profile and cooler temperatures that favor lodgepole pine. This unit is south of the climate influences of the Columbia gorge and therefore does not support woodlands of Oregon white oak.

Classification relationships

Plant Associations of the Commercial Forest of the Warm Springs Indian Reservation (Marsh 1987):
Ponderosa pine – Douglas-fir / Snowberry
Ponderosa pine – Douglas-fir / Snowberry (Mutton)

Landfire Biophysical Setting (Landfire 2007):
0710531: Rocky Mountain Ponderosa Pine Woodland and Savanna (Landfire 2007)

Ecological site concept

This site represents a dry forest community at the transition zone between the foothills of the eastern slopes of the Oregon cascades and the Columbia plateau. The distribution of this site is largely within the vicinity of Mutton Mountain yet it may occur elsewhere. The historical reference plant community is that of a ponderosa pine (Pinus ponderosa), Douglas-fir (Pseudotsuga menziesii) forest with Oregon white oak (Quercus garryana) found sporadically in openings, an herbaceous layer characterized by heartleaf arnica (Arnica cordifolia) and shrub layer dominated by common snowberry (Symphoricarpos albus).
This site is often found adjacent to drier ponderosa pine – bitterbrush (Purshia tridentata) communities and sites with shallow, clayey soils that include western juniper (Juniperus occidentalis) as a common woody associate. In comparison to adjacent East Cascade foothill plant communities which are not highly influenced by aspect, this site typically occupies north slopes which increase effective moisture and therefore encourage occupancy by Douglas-fir.
This site exists toward the southern-most extent of the white oak woodlands of the Northern Oregon cascades. In comparison to areas with greater maritime climate influence to the north, it supports a lower composition of white oak due to fewer frost free days within this precipitation range allowing Douglas-fir and ponderosa pine to attain greater dominance.

This is a provisional ecological site that groups characteristics at a broad scale with little to no field verification and is subject to extensive review and revision before final approval. All data herein was developed using existing information and literature and should be considered provisional and contingent upon field validation prior to use in conservation planning.

Associated sites

F006XB800OR	**Frigid Xeric Foothills 20-30 PZ** Upslope positions, frigid soil temperature regime
R006XB208OR	**Shallow Slopes 14-20 PZ** Adjacent south aspects with shallow soils, non-forested plant community
F006XY710OR	**Mesic Xeric Foothills 14-20 PZ** Occupying non-north aspects and warmer slope positions where the sites co-occur

Similar sites

F006XY709OR	**Mesic Xeric Foothills 20-25 PZ** More gentle slopes, higher precipitation, occupying all aspects, QUGA absent
F006XY710OR	**Mesic Xeric Foothills 14-20 PZ** More gentle slopes, occupying all aspects, warmer landscape positions and somewhat lower elevations
F006XB800OR	**Frigid Xeric Foothills 20-30 PZ** Somewhat higher elevations, frigid soil temperature regime, out of the modified maritime zone, QUGA absent

Table 1. Dominant plant species

Tree	(1) *Pseudotsuga menziesii* (2) *Pinus ponderosa*
Shrub	(1) *Symphoricarpos albus*
Herbaceous	Not specified

Physiographic features

This site is largely found occupying benches and side slopes at the foothills of the Eastern Cascades in Oregon. Its

range is largely restricted to areas around Mutton Mountain, mainly on the Confederated Tribes of the Warm Springs reservation. Elevations are commonly 2,600 to 3,800 feet (800 to 1,150 m) but can range from 2,200 to 4,000 feet (675 to 1,200 m). Slopes are most often 2 to 55 percent but can be as steep as 80 percent. This site is found primarily on north to west aspects. This site is not subject to ponding or flooding and no water table is present within 100 inches of the soil surface.

Table 2. Representative physiographic features

Landforms	(1) Foothills > Bench (2) Foothills > Hillslope
Flooding frequency	None
Ponding frequency	None
Elevation	2,600–3,800 ft
Slope	2–55%
Ponding depth	0 in
Water table depth	100 in
Aspect	W, NW, N

Table 3. Representative physiographic features (actual ranges)

Flooding frequency	Not specified
Ponding frequency	Not specified
Elevation	2,200–4,000 ft
Slope	2–80%
Ponding depth	Not specified
Water table depth	Not specified

Climatic features

The average annual precipitation ranges from 15 to 25 inches (375 to 625 mm) which occurs mainly between the months of November and June, mostly in the form of rain and snow. The average annual air temperature is 43 to 46 degrees Fahrenheit (6 to 8 °C) and the frost-free period ranges from 90 to 120 days. Soil temperature regime is mesic, soil moisture regime is xeric. The graphs below are populated from the closest available weather station to representative site locations and are provided to indicate general climate patterns.

Table 4. Representative climatic features

Frost-free period (characteristic range)	90-120 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	15-25 in
Frost-free period (average)	105 days
Freeze-free period (average)	
Precipitation total (average)	20 in

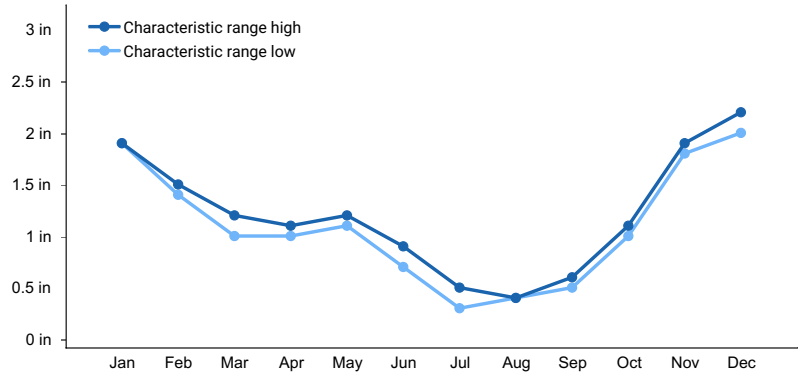


Figure 1. Monthly precipitation range

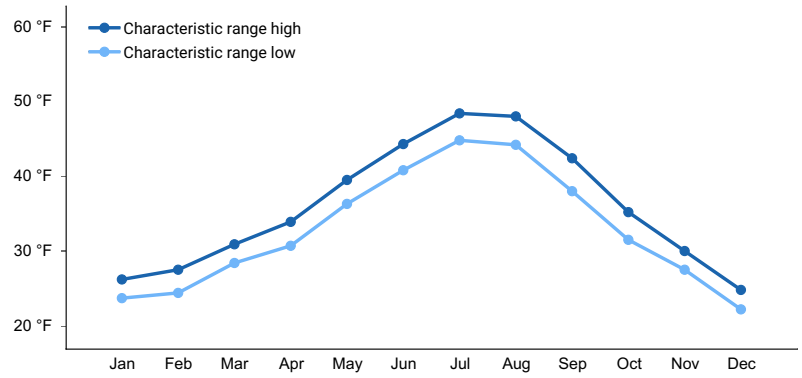


Figure 2. Monthly minimum temperature range

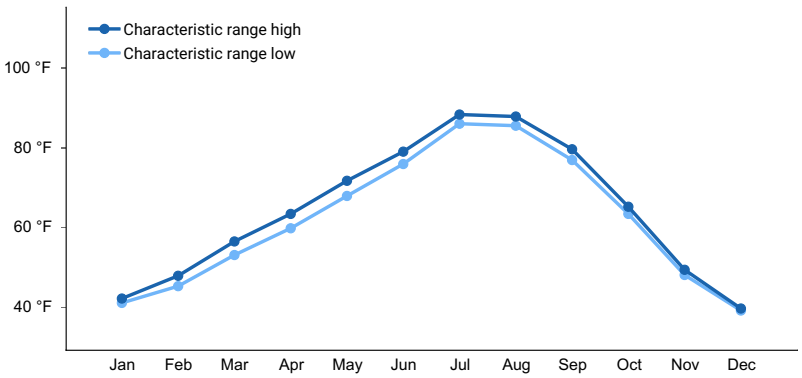


Figure 3. Monthly maximum temperature range

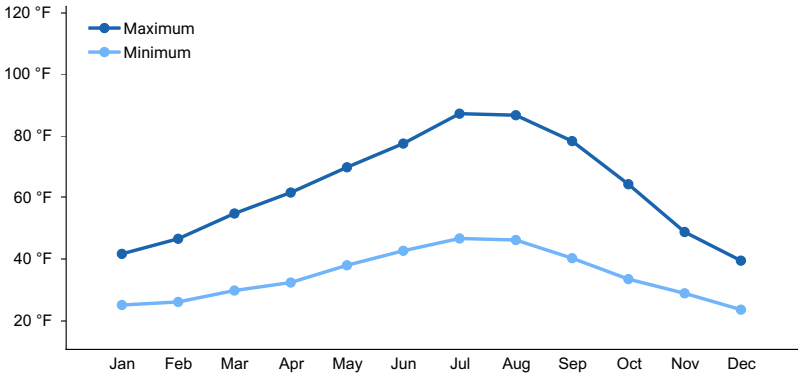


Figure 4. Monthly average minimum and maximum temperature

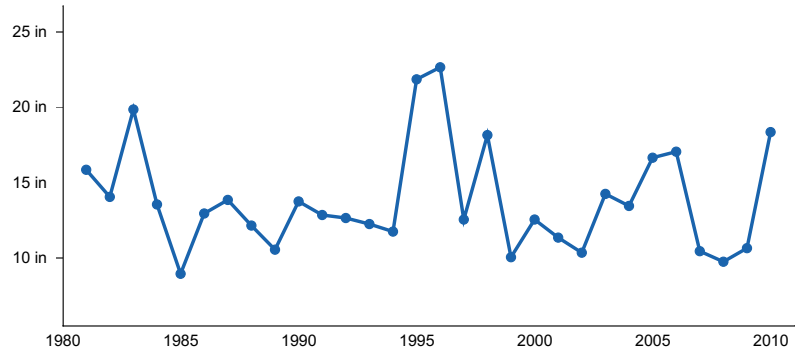


Figure 5. Annual precipitation pattern

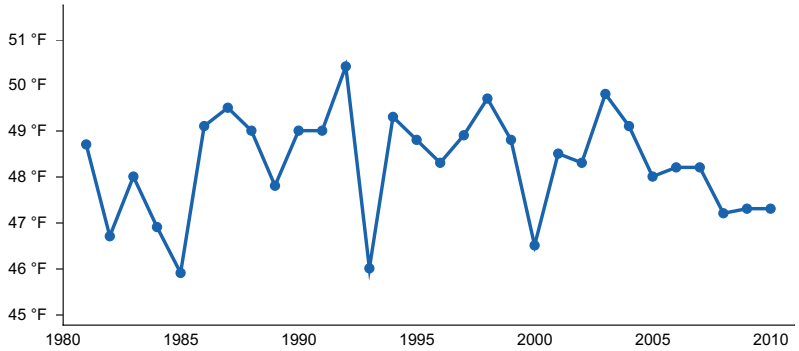


Figure 6. Annual average temperature pattern

Climate stations used

- (1) SISTERS [USC00357857], Sisters, OR
- (2) DUFUR [USC00352440], Dufur, OR

Influencing water features

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

Wetland description

N/A

Soil features

The soils of this site are typically shallow to very deep over lithic and paralithic bedrock. These are primarily well drained soils with surface layers influenced by volcanic ash over parent material composed of colluvium and residuum derived from tuff and sedimentary rock. This site may also occur on soils derived from glacial outwash and pumice residuum. Surface soil textures are commonly loams or silt loams but range from very gravelly loams to very cobbly silt loams. Volcanic ash will increase water holding capacity and productivity of these soils while rock fragments will decrease water holding capacity.

Table 5. Representative soil features

Parent material	(1) Volcanic ash (2) Colluvium–tuff (3) Residuum–tuff (4) Colluvium–sedimentary rock (5) Residuum–sedimentary rock

Surface texture	(1) Loam (2) Silt loam (3) Very cobbly silt loam (4) Very gravelly loam
Family particle size	(1) Ashy-skeletal (2) Fine
Drainage class	Well drained
Permeability class	Slow to moderate
Depth to restrictive layer	10–80 in
Soil depth	10–80 in
Surface fragment cover <=3"	0–45%
Surface fragment cover >3"	0–45%
Available water capacity (0-40in)	4.1–5.6 in
Soil reaction (1:1 water) (0-40in)	6–6.5
Subsurface fragment volume <=3" (4-60in)	10–30%
Subsurface fragment volume >3" (4-60in)	0–15%

Table 6. Representative soil features (actual values)

Drainage class	Not specified
Permeability class	Not specified
Depth to restrictive layer	Not specified
Soil depth	Not specified
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-40in)	3.1–6.1 in
Soil reaction (1:1 water) (0-40in)	6–7.3
Subsurface fragment volume <=3" (4-60in)	10–40%
Subsurface fragment volume >3" (4-60in)	0–40%

Ecological dynamics

Reference Plant Community:

Occupying a dry, warm ponderosa pine - Douglas-fir elevation band, this site transitions into juniper woodland and sagebrush steppe communities at its lower elevations, white oak communities to the north, and ponderosa pine – bitterbrush communities on lower slope angles and south aspects. The reference native plant community is dominated by ponderosa pine, Douglas-fir, common snowberry and heartleaf arnica. Some Oregon white oak may be present in openings. Elk sedge (*Carex geyeri*) and Idaho fescue (*Festuca idahoensis*) are common herbaceous species. Variability in density and composition is dependent on variation in aspect that occur within the site, including microclimatic conditions. Bitterbrush is more common on more doughty aspects. White oak is more common on heavier soil textures. Historically, this site was likely typified by an open stand of ponderosa pine and Douglas-fir with sedges and grasses, yet at present likely more often occurs as a denser stand of pine and fir with

less little grass and forb component in the understory.

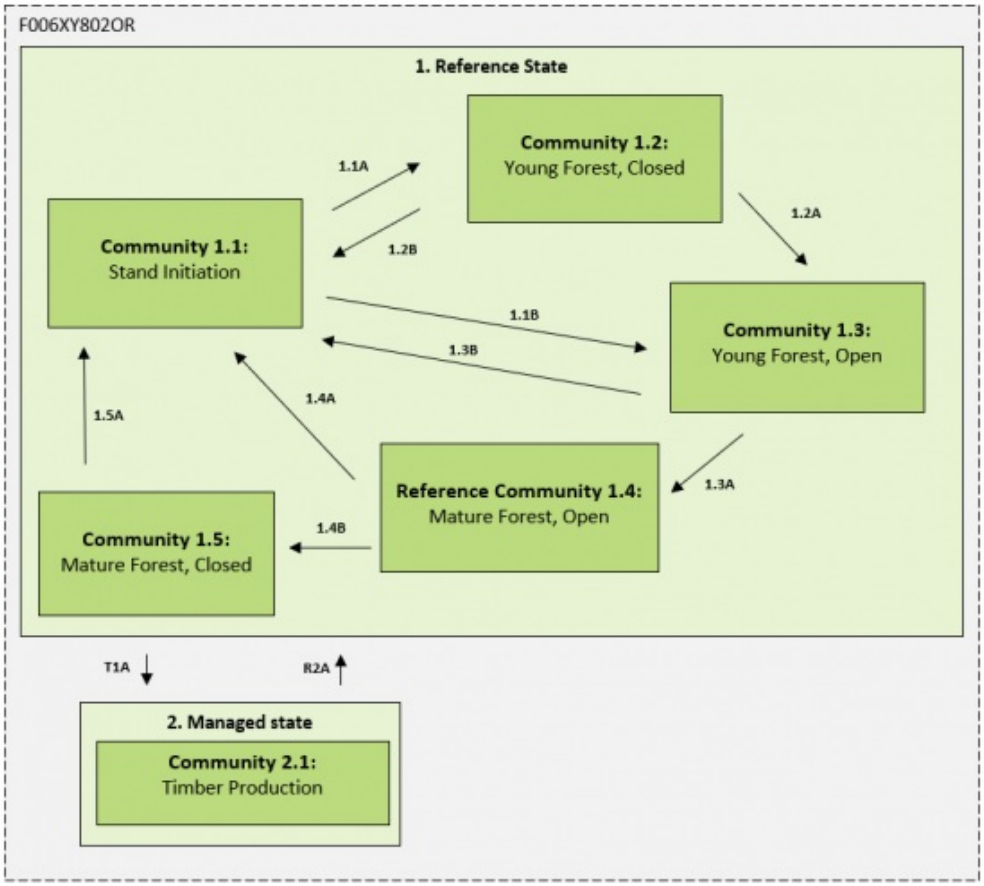
Disturbance:

Dry ponderosa pine and Douglas-fir forests were historically subject to frequent surface fires. These low intensity fires would have decreased the density of young regenerating understory trees, which may otherwise act as ladder fuels to ignite crown fires and lead to stand replacing events. Overtime, frequent low intensity fires, as well as occasional mixed severity fires, would have favored the development of mature, even-aged ponderosa pine and Douglas-fir stands with open canopies (Landfire 2007). Fire resistant ponderosa pine is well adapted to these conditions, developing increasing fire resistance with age by growing thick bark and self-thinning lower limbs (Fryer 2008). Douglas-fir is less fire resistant than ponderosa pine yet more shade resistant when young, but can becoming increasingly tolerant of fire with age. For this reason, as fire is suppressed, Douglas-fir may become an increasingly important overstory species with time (Hessberg et al. 2005). Oregon white oak can be a pioneer species on this site following fire due to its shade tolerance when young and its ability to re-sprout from bases. However, with age, white oak loses much of its shade tolerance and will often be outcompeted by conifers, especially if fire is suppressed (Gucker 2007). With longer time between fire, increased development of understory fuels, especially shade tolerant trees such as Douglas-fir and shrubs such as bitterbrush, along with the development of a closed canopy, can promote an increased frequency of stand replacing fires and insect outbreaks. As the understory changes as a result of increased shading, elk sedge and other forage bunchgrasses lose vigor and decrease in the stand. Prolonged anthropogenic fire suppression may lead to cycles of overstocking and high severity fires, yet evidence is insufficient for the characterization of this pattern as an alternative state. These dense forest conditions characterize much of the historically open canopy, dry Douglas-fir and ponderosa pine forests due to a history of selective logging and fire suppression (Ritchie et al 2005).

Historically, low elevation ponderosa pine forests were harvested extensively for timber products (Ritchie et al. 2005). Sites with higher productivity are especially attractive for commercial timber harvesting which will have varying effects on stand structure and composition depending on harvest practices. Selective logging of large shade tolerant ponderosa pine trees may favor the development of stands dominated by more shade tolerant Douglas-fir overtime (Hessberg et al. 2005). This site provides only fair range value, especially in dense canopies.

The state and transition model below represents a generalized and simplified version of forest change in response to fire in this ecological site. It does not attempt to model the complex effects of forestry practices, insect outbreaks or climate change on ecosystem function or process. Emerging evidence is suggesting that climate change is leading to hotter and drier conditions in western forests that will increase fire frequency and extent and lengthen fire seasons (Halofsky et al. 2020). When combined with the interacting impacts of fire suppression, drought, and insect outbreaks, it is possible that this ecological system will experience unpredictable ecosystem shifts and additional alternative states. For warm and dry sites, this may include the possibility of regeneration failure following wildfire disturbance (Halofsky et al. 2020). The Reference State of the current model is largely based on Landfire biophysical settings model 0710531: Rocky Mountain Ponderosa Pine Woodland and Savanna (Landfire 2007).

State and transition model



Community Pathways

1.1A	Fire cycle(s) missed
1.1B	Historical disturbance regime sustained for extended duration
1.2A	Mixed severity fire occurs
1.2B	High severity, stand replacing fire occurs
1.3A	Historical fire regime sustained for extended duration
1.3B	High severity, stand replacing fire occurs
1.4A	High severity, stand replacing fire occurs
1.4B	Fire cycle(s) missed
1.5A	High severity, stand replacing fire occurs

Transitions / Restoration Pathways

T1A	Extensive timber harvest
R2A	Forest restoration, stand replacing fire

State 1
Historical Reference State

A forested community, this site occurs across the landscape as a mosaic of plant community phases characterized by variation in forest structural stage (tree age, density and cover) and plant community composition and driven by historic fire regimes. Historically, many dry ponderosa pine – Douglas-fir forests would have cycled from a shrub/tree initiation phase (1.1) to a young forest stage (1.3) to a mature forest phase (1.4) with a fire regime characterized by frequent surface and mixed fires. Fire exclusion can lead to closed canopy and dense understory stocking conditions represented by Communities 1.2 and 1.5 which can be more vulnerable to stand replacing fires. The Reference Community within this state is that of an open, mature, savanna like ponderosa pine stand represented by Community Phase 1.4. Historical evidence suggests that this community type was common across the landscape prior to selective logging and widespread fire suppression, which can alter fire regimes, reduce understory cover, and lead to a greater frequency of high severity fire. Given the likelihood that this state, even in the best condition and highest potential, will almost always include at least some component of exotic species regardless of management inputs, this may also be referred to as the “current potential state”. In this document, the term “reference state” is used synonymously with “current potential state” for the sake of simplicity.

Dominant plant species

- Douglas-fir (*Pseudotsuga menziesii*), tree
- ponderosa pine (*Pinus ponderosa*), tree
- common snowberry (*Symphoricarpos albus*), shrub

Community 1.1
Stand Initiation

Plant community dominated by shrubs and herbaceous species. Ponderosa pine and Douglas-fir initiating, with some locally present Oregon white oak. Frequent, severe fire will maintain this community. All other communities may transition to this phase after stand replacing fires.

Community 1.2
Young Forest, Closed

Closed canopy, densely stocked with young to intermediate aged ponderosa pine and Douglas-fir.

Community 1.3
Young Forest, Open

Open overstory of uneven aged ponderosa pine, Douglas-fir with understory regeneration.

Community 1.4
Reference Plant Community: Mature Forest, Open

Mature, open canopy of ponderosa pine and Douglas-fir. Frequent, low severity fires maintain this community, lack of fire will increase understory infill and vulnerability to severe fire.

Community 1.5
Mature Forest, Closed

Mature closed canopy of ponderosa pine and Douglas-fir in the overstory.

Pathway 1.1A
Community 1.1 to 1.2

Fire cycle(s) missed

Pathway 1.1B
Community 1.1 to 1.3

Historical disturbance regime sustained for extended duration

Pathway 1.2B
Community 1.2 to 1.1

High severity, stand replacing fire occurs

Pathway 1.2A
Community 1.2 to 1.3

Mixed severity fire occurs

Pathway 1.3B
Community 1.3 to 1.1

High severity, stand replacing fire occurs

Pathway 1.3A
Community 1.3 to 1.4

Historical fire regime sustained for extended duration

Pathway 1.4A
Community 1.4 to 1.1

High severity, stand replacing fire occurs

Pathway 1.4B
Community 1.4 to 1.5

Fire cycle(s) missed

Pathway 1.5A
Community 1.5 to 1.1

High severity, stand replacing fire occurs

State 2
Managed state

This alternative state represents the many variations of timber harvesting that can occur on this site. This may result in a number of manipulated community types and pathways depending on strategies surrounding harvest, weed control and replanting. Selective removal of large ponderosa pine may advance succession and favor maturation of shade tolerant trees such as Douglas-fir.

Dominant plant species

- Douglas-fir (*Pseudotsuga menziesii*), tree

Transition T1B
State 1 to 2

Extensive timber harvest followed by continual management for timber production that has significantly altered species compositions and resulting disturbance responses.

Restoration pathway R2A
State 2 to 1

Ecological forestry practices may promote a return to Reference State. Stand replacing fire may lead to a transition to Community 1.1 of the Reference State if soil compaction is not severe, species composition has not been significantly altered and tree seed source is available.

Context dependence. Alterations of forest tree species composition, as well as soil compaction and surface disturbances due to large machine usage may hinder passive forest reestablishment.

Additional community tables

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.

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Contributors

Andrew Neary - Original PES site concept

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	02/09/2025
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:**

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:**
