USDA Natural Resources Conservation Service

Ecological site F006XY718OR
Cryic Xeric Pumice Basins 18-25 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, the Cascade Mountains, Eastern Slope, spans the entirety of 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 rainshadow 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-Cretaceaus 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 a high, cold volcanic plateau with nearly level topography interspersed with numerous cinder cones. The defining characteristic of this unit is the thick mantle of geologically recent pumice and ash deposited by the eruptions of Mount Mazama and Newberry Caldera. These soils are often coarse textured, excessively drained and have low thermal conductivity and fertility. These qualities promote low botanical diversity and the dominance of relatively few tree, shrub and herbaceous species. Forests are dominated by lodgepole pine in flat areas where cold air pools and depressions with seasonal water tables; ponderosa pine on warmer slopes and rises with improved cold air drainage; and occasionally white fir or shasta red fir at higher elevations receiving greater precipitation. Dense stands of lodgepole pine promote a fire regime characterized by occasional stand replacing fires, whereas more open stands of ponderosa may experience more frequent, low severity fire. The climate of this unit is cold and dry with a soil climate defined by a cryic temperature regime and a xeric moisture regime. Geologically, vulcanism predominates with Quaternary deposits from Mount Mazama and Newberry Caldera in the west and north and Late Tertiary deposits from the Winema volcanic field and Bald mountain in the south and east.

Classification relationships

Forested Plant Associations of the Oregon East Cascades (Simpson 2007)
PICO dry Plant association group

CLS211 – Lodgepole pine/Bitterbrush/Western needlegrass
CLS214 - Lodgepole pine/Bitterbrush/Idaho fescue

Plant Associations of the Central Oregon Pumice Zone (Volland 1985)
CLS211 – Lodgepole pine/Bitterbrush/Needlegrass

US Forest Service TEUI Ecological type
PICO/PUTR2/ACOC3 pumice Lapine

Ecological site concept

This site represents a lodgepole pine (Pinus contorta) dominant site commonly found within the pumice plateau of South Central Oregon. In comparison to other lodgepole dominant communities, this site occupies areas receiving less mean annual precipitation and with less access to subsurface groundwater sources. These conditions, as well as deep, excessively drained pumice soils, result in relatively sparse understories lacking diversity. The reference plant community is characterized by an open overstory of lodgepole pine and an understory dominated by bitterbrush (Purshia tridentata), with western needlegrass (Achnatherum occidentalis) often the only herbaceous species with significant cover. In comparison to other forest types, this site is generally too cool for ponderosa pine dominance and too dry for white fir (Abies concolor) dominance. This site often exists near to forest communities historically dominated by ponderosa pine and is distinguished abiotically from these sites by occupying colder areas that restrict ponderosa pine establishment on deep pumice soils. These areas often include upper elevations as well as basins and depressions with cold air pooling.

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

F006XY712OR	**Cryic Xeric Pumice Uplands 18-25 PZ** Upslope positions where cold air pooling is uncommon
F006XY714OR	**Cryic Xeric Pumice Slopes 20-40 PZ** Upslope positions where cold air pooling is uncommon and precipitation is higher, greenleaf manzanita common
R006XB102OR	**Cold Wet Meadow** Occupying adjacent willow dominated meadows with water tables near the surface

Similar sites

F006XY712OR	**Cryic Xeric Pumice Uplands 18-25 PZ** Upslope positions where cold air pooling is uncommon
F006XY714OR	**Cryic Xeric Pumice Slopes 20-40 PZ** Upslope positions where cold air pooling is uncommon and precipitation is higher

Table 1. Dominant plant species

Tree	(1) *Pinus contorta*
Shrub	(1) *Purshia tridentata*
Herbaceous	(1) *Achnatherum occidentale*

Physiographic features

This site occurs on Eastern Cascade lava plateaus overlaid with deep pumice mantles from the eruption of Newberry Caldera and Mount Mazama approximately 4000 and 7700 years ago respectively. This region is characterized by broad, relatively flat terrain with numerous cinder cones and enclosed basins. Across this

landscape the site occupies a narrow group of landforms including lava plains, alluvial fans and pyroclastic flows. Critical to the competitive dominance of lodgepole, this site most commonly occurs in depressions and on flat to gentle slopes (commonly nearly level to 3 percent but range to 6 percent) where cold air pooling favors lodgepole over ponderosa pine. This site commonly occupies elevations between 4,500 to 5,000 feet (1,400 to 1,500 meters) but can be found from 4,000 to 6,000 feet (1,200 to 1,850 meters). This site occurs on all 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

Hillslope profile	(1) Toeslope
Landforms	(1) Lava plateau > Lava plain (2) Lava plateau > Alluvial fan (3) Lava plateau > Pyroclastic flow
Flooding frequency	None
Ponding frequency	None
Elevation	4,500–5,000 ft
Slope	0–3%
Ponding depth	0 in
Water table depth	100 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	4,000–6,000 ft
Slope	0–6%
Ponding depth	Not specified
Water table depth	Not specified

Climatic features

The average annual precipitation is generally 12 to 30 in (300 to 750 mm) which occurs mainly between the months of November and April, mostly in the form of snow. Winters are long and growing seasons are generally short on this site. The average annual air temperature is 42 degrees Fahrenheit (5.5°C) but ranges from 39 to 43 degrees Fahrenheit (4 to 6°C) and the frost-free period ranges from 10 to 30 days. The soil temperature regime is cryic, 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)	10-30 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	12-30 in
Frost-free period (average)	20 days
Freeze-free period (average)	
Precipitation total (average)	16 in

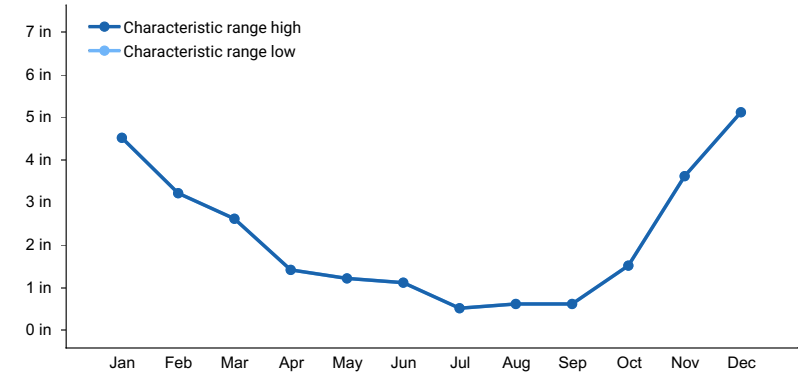


Figure 1. Monthly precipitation range

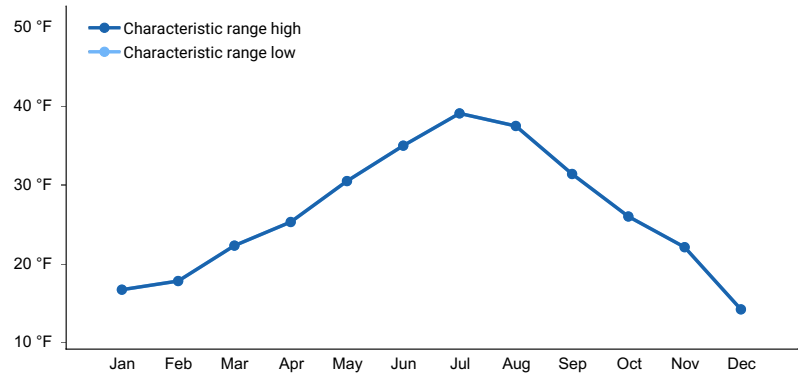


Figure 2. Monthly minimum temperature range

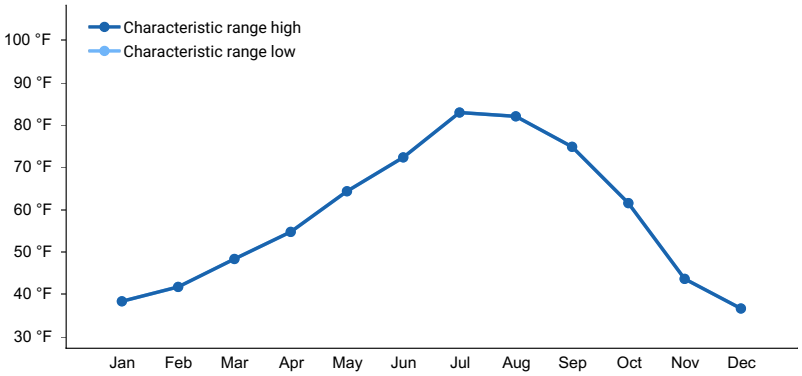


Figure 3. Monthly maximum temperature range

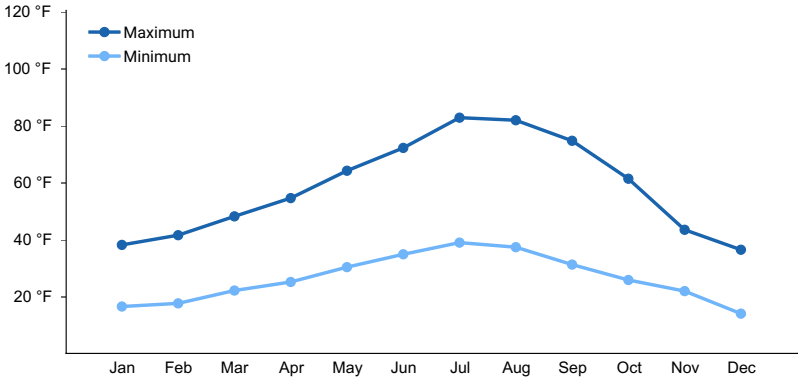


Figure 4. Monthly average minimum and maximum temperature

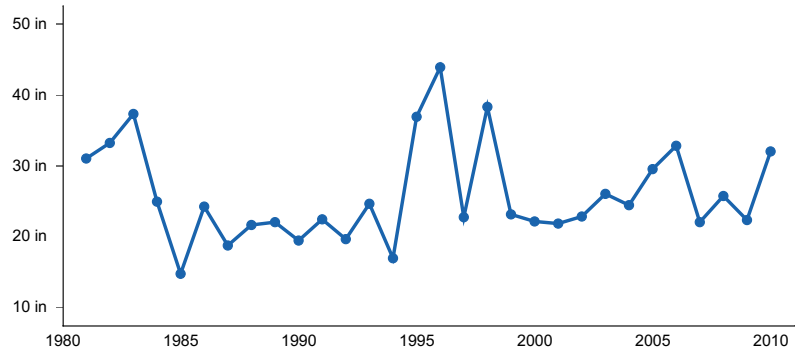


Figure 5. Annual precipitation pattern

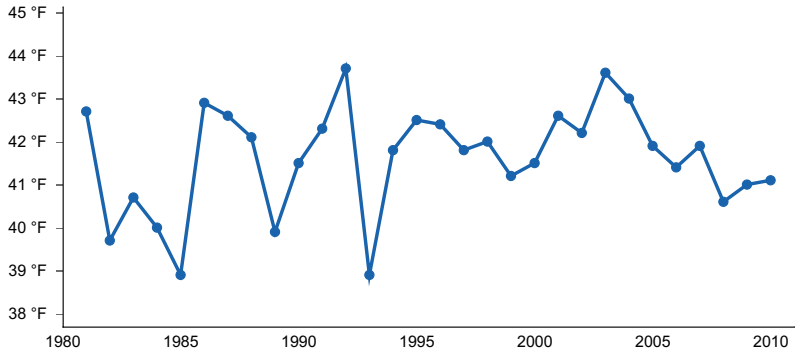


Figure 6. Annual average temperature pattern

Climate stations used

- (1) CHEMULT [USC00351546], Chemult, OR

Influencing water features

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

Wetland description

N/A

Soil features

The soils that typify this site concept are very deep and formed in thick deposits of volcanic ash and pumice derived from dacite. These are somewhat excessively to excessively drained soils with very rapid permeability. Characteristic of these deep pumice and ash deposits, these soils are generally low in Nitrogen, Phosphorus, and Sulphur, have high water holding capacity, low bulk density and low thermal conductivity. Surface soil textures are commonly very coarse, ranging from paragravelly loamy coarse sand, paragravelly coarse sandy loam to ashy loamy coarse sand. Paragravels in the upper horizons are almost exclusively pumice fragments and can make up a large portion of the soil volume. Beneath these recent pumice and ash deposits, buried soil layers occur at depths ranging from 14 to over 60 inches. These soils are often of loamy texture classes and have lower permeability compared to upper horizons, altering hydrologic dynamics. Soils of this site are classified as xeric vitricryands (cold, dry soils formed in volcanic parent materials).

Representative soil associated with this site:

Lapine paragravelly ashy coarse sandy loam, cold, 1 to 6 percent slopes

Table 5. Representative soil features

Parent material	(1) Volcanic ash (2) Pumice–dacite
Surface texture	(1) Paragravelly coarse sandy loam (2) Paragravelly loamy coarse sand (3) Ashy loamy coarse sand
Family particle size	(1) Ashy (2) Ashy-pumiceous (3) Ashy over loamy-skeletal (4) Ashy over loamy
Drainage class	Somewhat excessively drained to excessively drained
Permeability class	Very rapid
Depth to restrictive layer	60–80 in
Soil depth	60–80 in
Surface fragment cover <=3"	0–45%
Surface fragment cover >3"	0–45%
Available water capacity (0-40in)	3.4–5.2 in
Soil reaction (1:1 water) (0-40in)	5.6–7.3
Subsurface fragment volume <=3" (4-60in)	10–35%
Subsurface fragment volume >3" (4-60in)	0–10%

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)	2.2–6.8 in
Soil reaction (1:1 water) (0-40in)	Not specified
Subsurface fragment volume <=3" (4-60in)	Not specified
Subsurface fragment volume >3" (4-60in)	Not specified

Ecological dynamics

Reference Plant community:

The reference native plant community under the natural disturbance regime is characterized by an open stand of mature lodgepole pine, with a shrub layer dominated by bitterbrush.

Ecology:

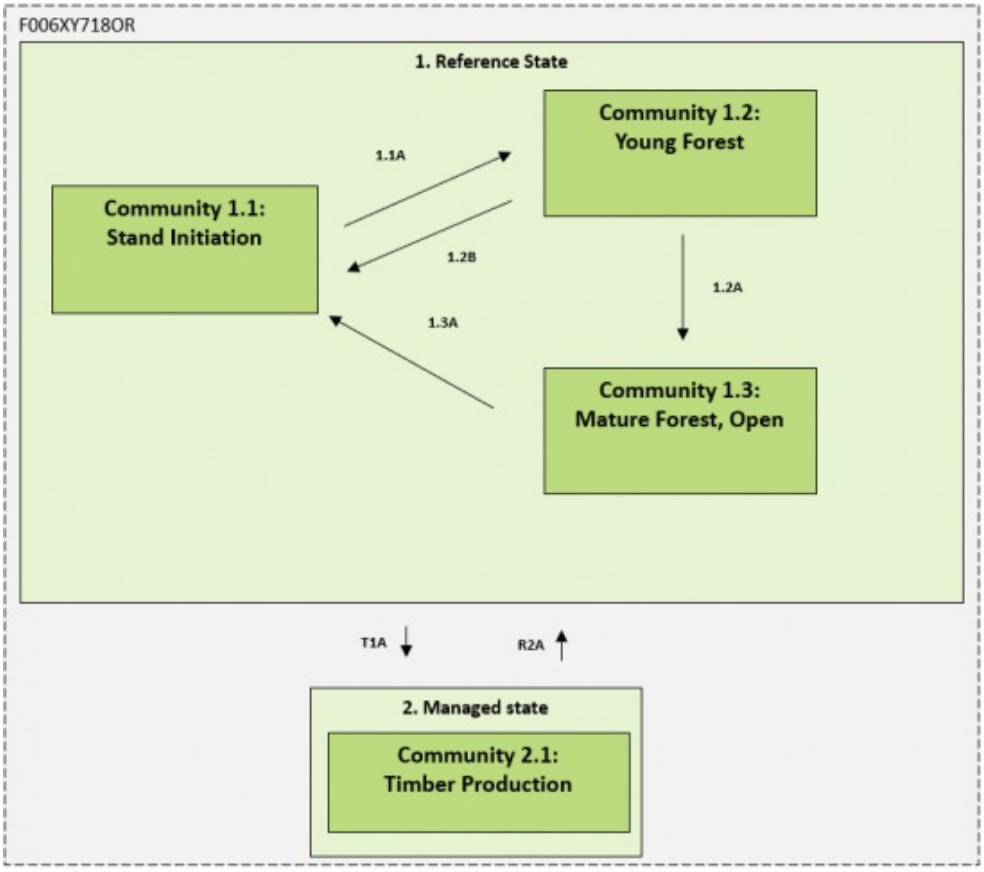
Most forests dominated by lodgepole pine are seral community phases that eventually yield to the dominance of other conifers (Agee 1993). Lodgepole pine forests on the pumice plateau however, represent a scenario where lodgepole pine will remain the overstory dominant through time due to topographic and edaphic characteristics that favor its competitive dominance. These features include low landscape positions where cold air pooling favors lodgepole over less cold tolerant ponderosa pine, low precipitation favoring lodgepole over less drought-adapted white fir and pumice soils with unique characteristics. Pumice soils have low thermal conductivity and are subject to frost heave, allowing lodgepole greater competitiveness against ponderosa pine in cold areas (Geist and Cochran 1991).

Disturbance:

Lodgepole pine forests on the pumice plateau were historically subject to infrequent mixed severity fire, occasional replacement severity fires and relatively frequent outbreaks of insects and disease and windthrow events (Landfire 2007). Fire regimes for pumice plateau lodgepole pine forests are classified by Landfire as group IV: 35-100+ year frequency, replacement severity (Landfire 2007). Overtime, these disturbance events, in addition to natural self-thinning processes, would have favored the development of mature lodgepole pine stands with open canopies. Lodgepole pine has thin bark and shallow roots which render the tree very susceptible to mortality from fire (Cope 1993). However, as a prolific seed producer with a relatively long seed viability, it is a highly aggressive post fire colonizer. While bitterbrush may re-sprout following low severity fire, high severity fire may lead to mortality and long-term response of bitterbrush to intact or altered fire regimes may vary (Agee 1993, Busse and Riegel 2009, Heyerdahl et al. 2014). With longer time between fire, increased development of understory fuels such as young lodgepole pine and woody fuels, along with the development of a closed canopy, may promote an increased frequency of stand replacing fires and insect outbreaks. Sites adjacent to ponderosa dominated stands may experience greater frequency of low severity fire (Heyerdahl et al. 2014). Mountain pine beetle (Dendroctonus ponderosae) outbreaks are especially common in ponderosa and lodgepole pine forests and drought conditions and high stand densities may render stands more vulnerable to these outbreaks (Agee 1993). Large acreages have of this site type have been subject to bark beetle outbreaks, which can influence subsequent fire characteristics. Stands with higher productivity may be used for commercial timber harvesting which will have varying effects on stand structure and composition depending on harvest type.

The state and transition model below represents a generalized and simplified version of forest change in response to major disturbance types in this ecological site. 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. As this site is updated in future iterations, descriptions will include more thorough treatments of disturbance and ecological change. It is largely based on Landfire biophysical settings models 0711670 and US Forest Service TEUI “PICO/PUTR2/ACOC3 Pumice Lapine Ecological Type” landtype (Landfire 2007, USFS 2008).

State and transition model



Community Pathways

1.1A	Self thinning of densely stocked trees
1.2A	Insect / disease outbreak, windthrow
1.2B	High severity, stand replacing fire occurs
1.3A	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. Historically, many dry lodgepole pine forests would have cycled from a dense stand initiation phase (1.1) to a young forest stage (1.2) to a mature forest phase (1.3). These pathways are defined by a disturbance regime characterized by self-thinning and disease and insect outbreaks which allows the canopy to open over time and mature lodgepole pine to develop in the overstory. The Reference Native Plant Community under this natural disturbance regime is represented by Community 1.3.

Dominant plant species

- lodgepole pine (*Pinus contorta*), tree
- antelope bitterbrush (*Purshia tridentata*), shrub
- western needlegrass (*Achnatherum occidentale*), grass

Community 1.1
Stand Initiation

Shrub and grass dominated community with a dense stand of young, even aged lodgepole pine developing. Frequent, severe fire will maintain this community. All other communities may transition to this phase after stand replacing fires. Tree regeneration will depend on local seed sources and climate cycles (especially incidences of frost heaving).

Community 1.2
Young Forest

Canopy stocked with young to intermediate aged lodgepole pine. Shrub and herbaceous cover variable in understory, decreasing with canopy closure. This is the most commonly occurring community within the Reference State.

Community 1.3
Reference plant community: Mature, open canopy

This is the Reference Community of a mature, open canopy forest. Uneven aged stand with mature lodgepole pine trees in the overstory. Shrub and bunchgrass cover variable in understory. Frequent disturbance including windthrow, disease and insect outbreaks and mixed severity fire will maintain this community. The Reference Native Plant Community under the natural disturbance regime, is characterized by an open stand of lodgepole pine, with a shrub layer dominated by bitterbrush. The herbaceous layer often lacks diversity and ranges from depauperate, to predominantly western needlegrass with low foliar cover. Lodgepole pine often occupies a considerable component of the sub-canopy vegetation, especially given longer intervals between fire. Forbs do not make up a substantial component of the groundcover, yet strawberry (Fragraria spp.), velvet lupine (*Lupinus leucophyllus*) and common yarrow (*Achillea millefolium*) may be common. Other common yet sparsely distributed species may include bottlebrush squirreltail (*Elymus elymoides*), Ross' sedge (*Carex rossii*), and wax currant (*Ribes cereum*). Ponderosa pine may occasionally be present on warmer slope positions and rises in topography, but generally occupies less than five percent cover. Significantly greater cover of ponderosa indicates potential for a different ecological site type. Plant community understory cover often ranges from 15 to 20 percent for shrubs, and 15 to 20 percent for grasses.

Pathway 1.1A
Community 1.1 to 1.2

Time and stand maturation allows for self thinning of densely stocked trees

Pathway 1.2B
Community 1.2 to 1.1

High severity, stand replacing fire occurs

Pathway 1.2A
Community 1.2 to 1.3

Insect and disease outbreak, windthrow

Pathway 1.3A
Community 1.3 to 1.1

High severity, stand replacing fire occurs

State 2
Managed state

In this state the stand is used for timber harvesting. This may result in a number of manipulated community types and pathways depending on strategies surrounding harvest, weed control and replanting.

Dominant plant species

- lodgepole pine (*Pinus contorta*), tree

Transition T1B
State 1 to 2

Extensive timber harvest followed by management prioritizing timber production.

Restoration pathway R2A
State 2 to 1

Selective thinning, prescribed burning or shelter-wood production systems may increase chances of forest

restoration. Stand replacing fire may return to a reference state if soil compaction is not severe and seed source is available.

Context dependence. 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):**

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:**