Ecological site F006XE807OR
Cryic Aquic Pumice Basins (PICO/SPDO-VAUL)

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

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 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 cold wet basins within the larger pumice plateau. Soils are mantled with geologically recent pumice and ash deposited by the eruptions of Mount Mazama and Newberry Caldera. Distinct from the greater pumice plateau, these basins promote the occurrence of water tables within 60 inches of the soil surface and saturated conditions for at least part of the year.
Broad scale cold air pooling interacts with this condition to facilitate the dominance of lodgepole pine forests and large marsh complexes. Botanical diversity is higher than in most sites within the larger pumice plateau, with marsh systems providing essential habitat for migratory waterfowl.
Forest communities in this unit are shaped by occasional stand replacing fires, promoting young stands of mostly pure lodgepole pine on many sites. The climate of this unit is cold and wet with a soil climate defined by a cryic temperature regime and an aquic moisture regime.

Classification relationships

Forested Plant Associations of the Oregon East Cascades (Simpson 2007)
CLM313 – Pinus contorta/Spiraea douglasii
CLM314 – Pinus contorta/Spiraea douglasii/Carex eurycarpa
PICO riparian plant association group

Plant Associations of the Central Oregon Pumice Zone (Volland 1985)
CLM111- PICO/SEDGE-GRASS - WETLAND
CLM211- PICO/BEARBERRY
CLM 311- PICO/BLUEBERRY/FORB – WETLAND
CLM312- Pinus contorta/Vaccinium uliginosum/Carex angustata

Landfire Biophysical Setting (Landfire 2007)
0711670 - Rocky Mountain Poor-Site Lodgepole Pine Forest

Ecological site concept

This site represents a broad group of lodgepole pine (Pinus contorta) dominated forest communities receiving subsurface moisture. Supplemental moisture from streams and other adjacent riparian areas allows the long-term competitive dominance of lodgepole pine over other conifer species as well as a diverse understory composed of a host of wet adapted shrubs and herbaceous species. This broadly defined site encompasses reference vegetative communities that include both obligate and facultative wetland plants yet experience similar ecological dynamics. Common members include Douglas spiraea (Spiraea douglasii), bog blueberry (Vaccinium uliginosum), willows (Salix spp.), wax currant (Ribes cereum), widefruit sedge (Carex angustata), Baltic rush (juncus arcticus) and blue wildrye (Elymus glaucus). This site may be distinguished from nearby forest communities by its aquic soil moisture regime, commonly characterized by a water table within 48 inches of the soil surface and occasional ponding or flooding.

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

R006XB102OR	**Cold Wet Meadow** Occupying locations closer to water bodies with higher water tables

Similar sites

R006XB102OR	**Cold Wet Meadow** Water table closer to surface, meadows dominated by willows with few lodgepole

Table 1. Dominant plant species

Tree	(1) *Pinus contorta*
Shrub	(1) *Spiraea douglasii* (2) *Vaccinium uliginosum*
Herbaceous	Not specified

Physiographic features

This site occurs on floodplains, drainageways, stream terraces and depressions within the pumice basins of the Oregon pumice plateau. The soil surface may be ponded or flooded in spring, with water tables commonly ranging from 18 to 48 inches (45 to 120 cm). Slopes are nearly level, typically ranging from 0 to 4 percent. Elevations typically range from 4,200 to 5,000 feet (1,300 to 1500 m) but this site occurs between 4,000 to 6,500 feet (1,200 to 2,000 meters). As a nearly level site, this site is not significantly influenced by aspect.

Table 2. Representative physiographic features

Landforms	(1) Basin > Flood plain (2) Stream terrace (3) Drainageway (4) Depression
Flooding duration	Extremely brief (0.1 to 4 hours) to brief (2 to 7 days)
Flooding frequency	None to occasional
Ponding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Ponding frequency	None to occasional
Elevation	4,200–5,000 ft
Slope	0–4%
Ponding depth	0–4 in
Water table depth	18–48 in
Aspect	Aspect is not a significant factor

Table 3. Representative physiographic features (actual ranges)

Flooding duration	Not specified
Flooding frequency	Not specified
Ponding duration	Not specified
Ponding frequency	Not specified
Elevation	4,000–6,500 ft
Slope	Not specified
Ponding depth	Not specified
Water table depth	Not specified

Climatic features

The annual precipitation ranges from 18 to 35 inches (450 – 900 mm), most of which occurs in the form of rain and snow during the months of November through June. Despite dry summers receiving little precipitation, the soils of this site are subirrigated and therefore moist in lower horizons for most of the year. The soil moisture regime is Aquic. The soil temperature regime is cryic with a mean annual air temperature from 39 to 45 degrees Fahrenheit (4 to 7° C). The frost-free period ranges from 5 to 50 days. The graphs below are populated from the closest available weather stations to the dominant mapped location of this ecological site. 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)	5-50 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	18-35 in
Frost-free period (average)	25 days
Freeze-free period (average)	
Precipitation total (average)	26 in

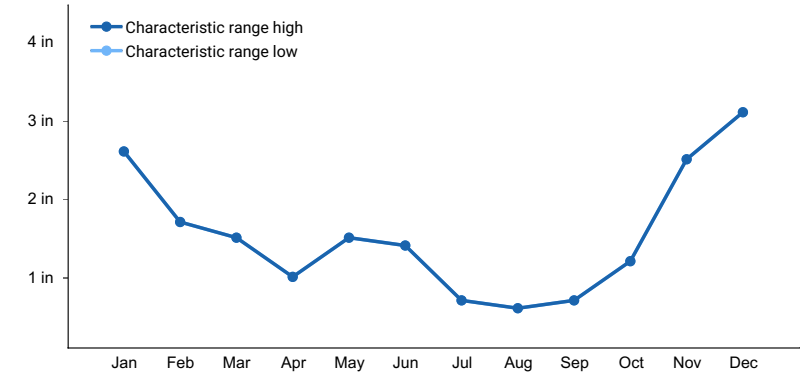


Figure 1. Monthly precipitation range

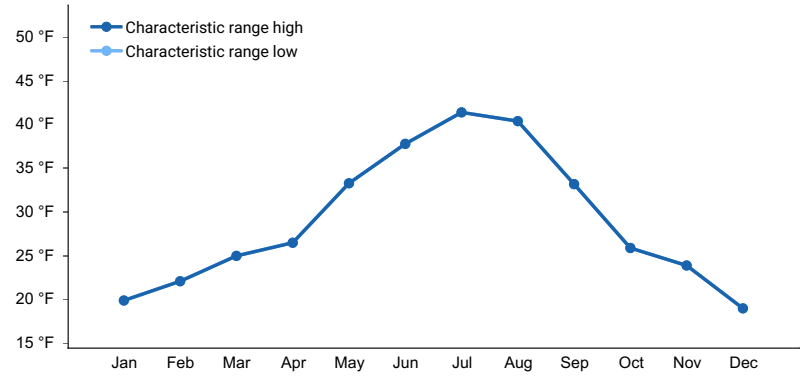


Figure 2. Monthly minimum temperature range

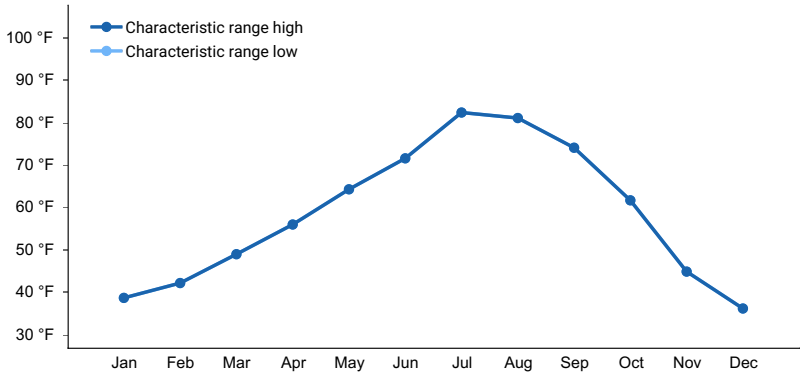


Figure 3. Monthly maximum temperature range

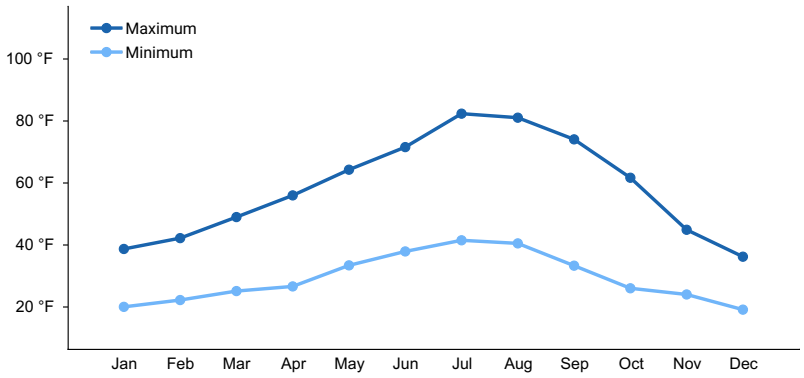


Figure 4. Monthly average minimum and maximum temperature

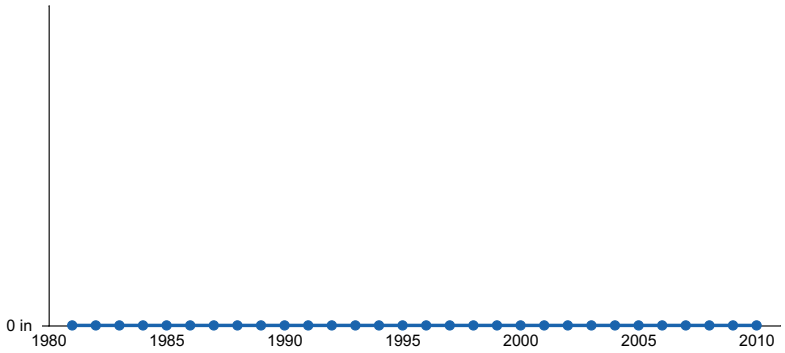


Figure 5. Annual precipitation pattern

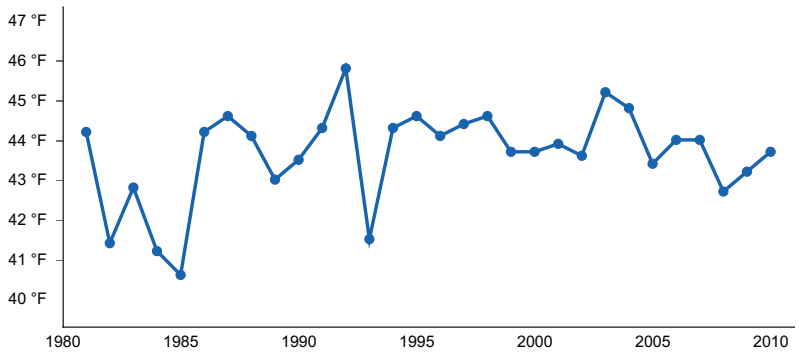


Figure 6. Annual average temperature pattern

Climate stations used

- (1) SUNRIVER [USC00358246], Bend, OR

Influencing water features

This site receives subsurface moisture from nearby streams and springs as well as snowmelt from upland sources, that collects in drainages, depressions and floodplains and creates the conditions for an aquic soil moisture regime. Some sites may experience occasional to frequent flooding, occasional ponding and water tables may be near the surface for days to weeks.

Wetland description

Associated with wetland areas, but no wetland designation made.

Soil features

The soils of this site are very deep and somewhat poorly drained to very poorly drained. These soils are typically formed in pumice, ash and diatomaceous earth alluvium, some of which is buried by mantles of ash and pumice. Ash content increases water holding content relative to soils without this constituent. Typically, the surface layer is a loamy coarse sand, loamy sand or sandy loam but some soils with greater organic matter accumulation have peat surface textures.

Table 5. Representative soil features

Parent material	(1) Volcanic ash (2) Pumice (3) Alluvium–diatomite (4) Diatomaceous earth

Surface texture	(1) Loamy coarse sand (2) Loamy sand (3) Sandy loam (4) Peat
Family particle size	(1) Ashy (2) Ashy-pumiceous (3) Ashy over loamy
Drainage class	Somewhat poorly drained to very poorly drained
Permeability class	Moderately rapid to rapid
Depth to restrictive layer	60–80 in
Soil depth	60–80 in
Surface fragment cover <=3"	0–15%
Surface fragment cover >3"	0–15%
Available water capacity (0-40in)	4.1–11.8 in
Soil reaction (1:1 water) (0-40in)	5.1–7.8
Subsurface fragment volume <=3" (4-60in)	5–45%
Subsurface fragment volume >3" (4-60in)	0–20%

Ecological dynamics

Reference Plant Community:

The Reference Plant Community of this site is characterized by an overstory dominated by lodgepole pine and a lush understory composed largely of shrubs, sedges, grasses and a diverse community of forbs. Minor trees that may be associated with these communities include white fir (*Abies concolor*), Engelmann spruce (*Picea engelmannii*), quaking aspen (*Populus tremuloides*) and ponderosa pine (*Pinus ponderosa*). Shrub and herbaceous species will vary depending on soil texture and depth to water table. Common shrubs may include Douglas spiraea, bearberry (*Arctostaphylos uva-ursi*), Lemmon's willow (*Salix lemmonii*), Booth's willow (*Salix boothii*) and bog blueberry. Sites within this concept with deeper water tables will support few obligate wetland species instead favoring shrubs such as bitterbrush (Purshia tridentate), bearberry (*Arctostaphylos uva-ursi*), and wax currant. Common herbaceous species may include Nebraska sedge (*Carex nebrascensis*), blue wildrye, bluejoint reedgrass (*Calamagrostis canadensis*), tufted hairgrass (Deschampsia caespitosa), widefruit sedge, strawberry (Fragaria spp.) and Baltic rush.

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. In the case of this site, low landscape positions and high water tables promote saturated soil conditions which the shallow-rooted lodgepole to

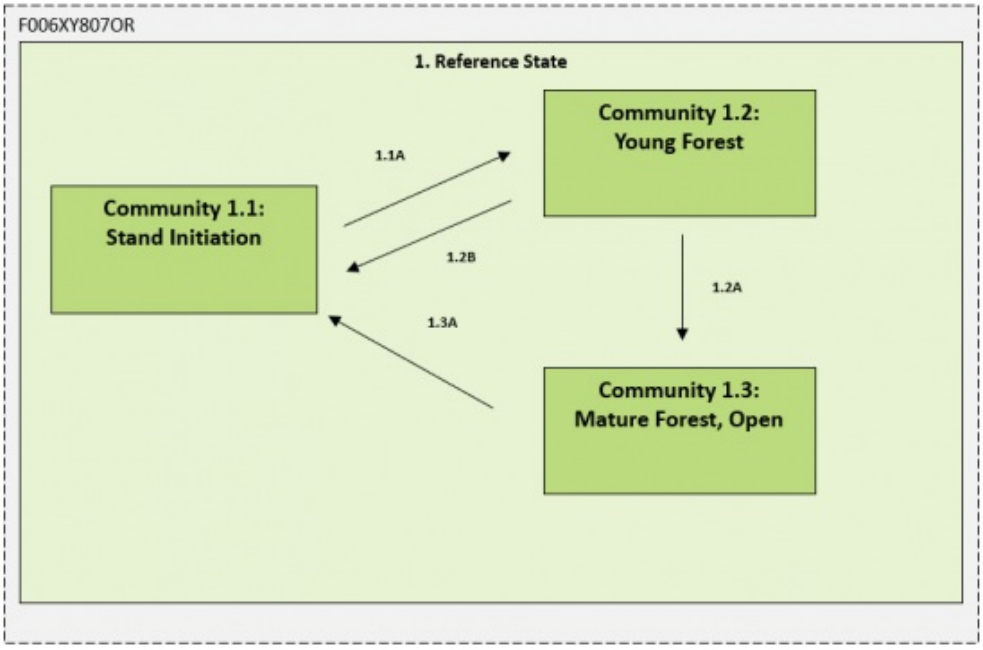
Disturbance:

Lodgepole pine forests on the pumice plateau were historically subject to occasional replacement severity fires and relatively frequent outbreaks of insects and disease and windthrow events. Fire regimes for pumice plateau lodgepole 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 stands with open canopies. Lodgepole 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). In riparian stands, many of the understory species in these communities are adapted to rebound following fire by re-sprouting from their crowns (Crowe et al. 2004).
Some sites without saturated soil conditions have been used for livestock grazing. Overgrazing may lead to loss of shrubs by compaction and trampling that impacts soil water availability and decreases plant vigor, and leads to increases in drier facultative species such as the non-native Kentucky bluegrass (*Poa pratensis*) and weedy forbs and increases in bare ground. At sustained levels of improperly managed grazing, some sites may experience bank erosion, channel incision and lowering of water tables, shifting plant community composition to dominance of plant species adapted to lower soil moisture conditions (Crowe et al 2004). 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 of this site type have been subject to bark beetle outbreaks, which can influence subsequent fire severity and impacts (Agee 1993).

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 display the complicated interactions between grazing, drought, channel morphology alteration, insects and disease on plant community change, many of which will vary at scales smaller than that represented by this 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. The reference state of the current model is largely informed by Landfire biophysical settings model 0711670, Rocky Mountain Poor-Site Lodgepole Pine Forest (Landfire 2007).

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

State 1
Reference Plant Community

The Reference Community is an open, uneven age stand dominated by lodgepole pine and represented by community 1.3. A moist, cold 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. Historically, many moist lodgepole forests would have cycled through 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 to develop in the overstory, eventually resembling the reference community 1.3

Dominant plant species

- lodgepole pine (*Pinus contorta*), tree
- rose spirea (*Spiraea douglasii*), shrub
- bog blueberry (*Vaccinium uliginosum*), shrub

Community 1.1
Stand initiation

This is a shrub and grass dominated community with a dense stand of young, even-aged lodgepole developing. Frequent, severe fires 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, closed

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

Community 1.3
Reference Community Phase: Mature, open canopy

This is the Reference Community consisting of a mature, open canopy lodgepole pine forest. It is characterized by an uneven aged stand with mature lodgepole pine trees in the overstory. Shrub and graminoid cover increased in understory. Frequent disturbances include windthrow, disease and insect outbreaks and mixed severity fire will maintain this community.

Pathway P1.1a
Community 1.1 to 1.2

Self thinning of densely stocked trees

Pathway P1.2b
Community 1.2 to 1.1

High severity, stand replacing fire occurs

Pathway P1.2a
Community 1.2 to 1.3

Extended time with periodic disturbance such as insect and disease outbreaks and windthrow

Pathway P1.3a
Community 1.3 to 1.1

High severity, stand replacing fire occurs

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.

References

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Volland, L. 1985 Plant associations of the central Oregon pumice zone. Portland, Or. U.S. Dept. of Agriculture, Forest Service, Pacific Northwest Region.

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	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:

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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:**