USDA Natural Resources Conservation Service

Ecological site R043AP809MT
Upland Alpine Group

Last updated: 9/08/2023
Accessed: 05/05/2024

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): 043A–Northern Rocky Mountains

This MLRA is located in Montana (43 percent), Idaho (34 percent), and Washington (23 percent). It makes up about 31,435 square miles (81,460 square kilometers). It has no large cities or towns. It has many national forests, including the Okanogan, Colville, Kootenai, Lolo, Flathead, Coeur d'Alene, St. Joe, Clearwater, and Kaniksu National Forests.

This MLRA is in the Northern Rocky Mountains Province of the Rocky Mountain System. It is characterized by rugged, glaciated mountains; thrust- and block-faulted mountains; and hills and valleys. Steep-gradient rivers have cut deep canyons. Natural and manmade lakes are common.

The major Hydrologic Unit Areas (identified by four-digit numbers) that make up this MLRA are: Kootenai-Pend Oreille-Spokane (1701), 67 percent; Upper Columbia (1702), 18 percent; and Lower Snake (1706), 15 percent. Numerous rivers originate in or flow through this area, including, the Sanpoil, Columbia, Pend Oreille, Kootenai, St. Joe, Thompson, and Flathead Rivers.

This area is underlain primarily by stacked slabs of layered sedimentary or metasedimentary bedrock. The bedrock formations range from Precambrian to Cretaceous in age. The rocks consist of shale, sandstone, siltstone, limestone, argillite, quartzite, gneiss, schist, dolomite, basalt, and granite. The formations have been faulted and stacked into a series of imbricate slabs by regional tectonic activity. Pleistocene glaciers carved a rugged landscape that includes sculpted hills and narrow valleys filled with till and outwash. Continental glaciation over road the landscape in the northern half of the MLRA while glaciation in the southern half was confined to montane settings.

The average annual precipitation is 25 to 60 inches (635 to 1,525 millimeters) in most of this area, but it is as much as 113 inches (2,870 millimeters) in the mountains and is 10 to 15 inches (255 to 380 millimeters) in the western part of the area. Summers are dry. Most of the precipitation during fall, winter, and spring is snow. The average annual temperature is 32 to 51 degrees F (0 to 11 degrees C) in most of the area, decreasing with elevation. In most of the area, the freeze-free period averages 140 days and ranges from 65 to 215 days. It is longest in the low valleys of Washington, and it decreases in length with elevation. Freezing temperatures occur every month of the year on high mountains, and some peaks have a continuous cover of snow and ice.

The dominant soil orders in this MLRA are Andisols, Inceptisols, and Alfisols. Many of the soils are influenced by Mount Mazama ash deposits. The soils in the area have a frigid or cryic soil temperature regime; have an ustic, xeric, or udic soil moisture regime; and dominantly have mixed mineralogy. They are shallow to very deep, are very poorly drained to well drained, and have most of the soil texture classes. The soils at the lower elevations include Udivitrands, Vitrixerands and Haplustalfs. The soils at the higher elevations include Dystrocryepts, Eutrocryepts, Vitricryands , and Haplocryalfs. Cryorthents, Cryepts, and areas of rock outcrop are on ridges and peaks above timberline

This area is in the northern part of the Northern Rocky Mountains. Grand fir, Douglas-fir, western red cedar, western hemlock, western larch, lodgepole pine, subalpine fir, ponderosa pine, whitebark pine, and western white pine are the dominant overstory species, depending on precipitation, temperature, elevation, and landform aspect. The understory vegetation varies, also depending on climatic and landform factors. Some of the major wildlife species in this area are whitetailed deer, mule deer, elk, moose, black bear, grizzly bear, coyote, fox, and grouse. Fish, mostly in the trout and salmon families, are abundant in streams, rivers, and lakes.

More than one-half of this area is federally owned and administered by the U.S. Department of Agriculture, Forest Service. Much of the privately-owned land is controlled by large commercial timber companies. The forested areas are used for wildlife habitat, recreation, watershed, livestock grazing, and timber production. Meadows provide summer grazing for livestock and big game animals. Less than 3 percent of the area is cropland.

Ecological site concept

• Site does not receive additional water
• Dominant Cover: Grassland
• Soils are
o Generally not saline or saline-sodic or limy (limited extent)
o Moderately deep, deep or very deep
o Not ashy or medial textural family
o Typically less than 5% stone and boulder cover (<15% max)
• Soil surface texture very gravelly sandy loam and loam in surface mineral 4”
• Parent material is colluvium over residuum weathered from metasedimentary rock
• Drainage class is well drained; no flooding frequency
• Site Landform: cirque headwalls
• Moisture Regime: udic
• Temperature Regime: cryic
• Elevation Range: 5200-8600 ft
• Slope: 35-70%

Associated sites

F043AP908MT	**Upland Cold Woodland Group** These sites are associated with higher elevation areas, though R043AX971MT reaches far higher into the alpine lifezone.

Similar sites

R043AX971MT	**Alpine Solifluction Terrace Dryas octopetala (Arctostaphylos uva-ursi/Salix arctica)** These sites are similar in that they both reside in the alpine lifezone and experience harsh and dessicating winds, short growing seasons and very cold winter temperatures. The reference communities are similar including eight petal mountain avens and arctic willow.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Dryas octopetala* (2) *Salix arctica*
Herbaceous	(1) *Silene acaulis* (2) *Minuartia obtusiloba*

Physiographic features

• Site Landform: cirque headwalls
• Elevation Range: 5200-8600 ft
• Slope: 35-70%

Table 2. Representative physiographic features

Landforms	(1) Mountains > Cirque headwall
Elevation	1,585–2,621 m
Slope	35–70%
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

• Moisture Regime: udic
• Temperature Regime: cryic
INFORMATION REPRESENTATIVE OF THIS SITE:
• Representative Value (RV) of range of Mean Annual Precipitation: 45-85 inches
• Representative Value (RV) of range of Mean Average Annual Temperature: 32-39 degrees
• Representative Value (RV) of range of Frost Free Days: 25-50 days
INFORMATION IN TABLES BELOW ARE FROM CLIMATE STATIONS LOCATED IN VALLEYS AND MAY NOT BE REPRESENTATIVE OF THIS SITE.

Table 3. Representative climatic features

Frost-free period (characteristic range)	77-87 days
Freeze-free period (characteristic range)	126-130 days
Precipitation total (characteristic range)	584-787 mm
Frost-free period (actual range)	72-88 days
Freeze-free period (actual range)	124-130 days
Precipitation total (actual range)	533-813 mm
Frost-free period (average)	81 days
Freeze-free period (average)	128 days
Precipitation total (average)	686 mm

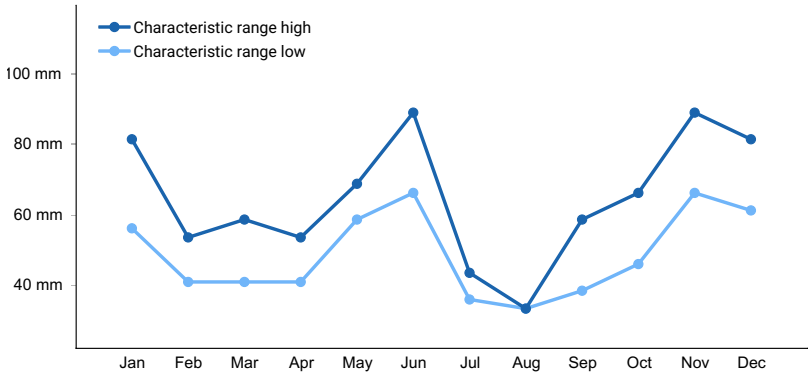


Figure 1. Monthly precipitation range

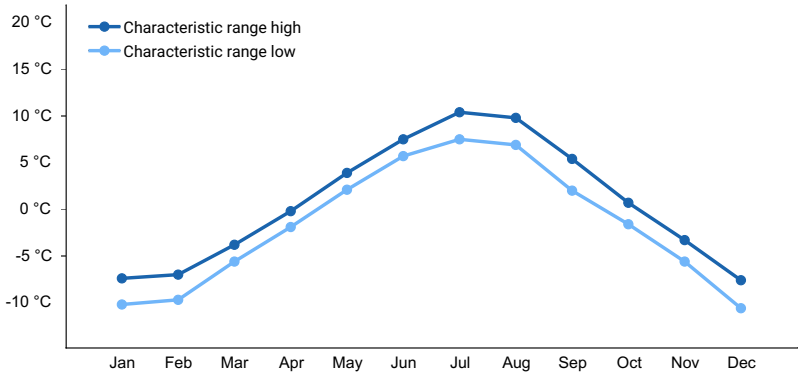


Figure 2. Monthly minimum temperature range

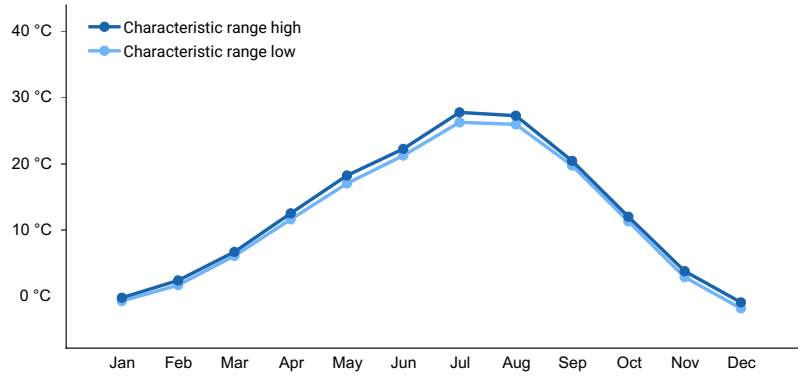


Figure 3. Monthly maximum temperature range

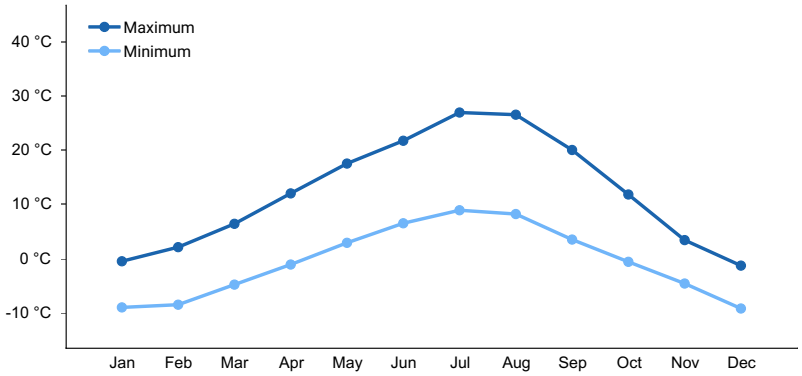


Figure 4. Monthly average minimum and maximum temperature

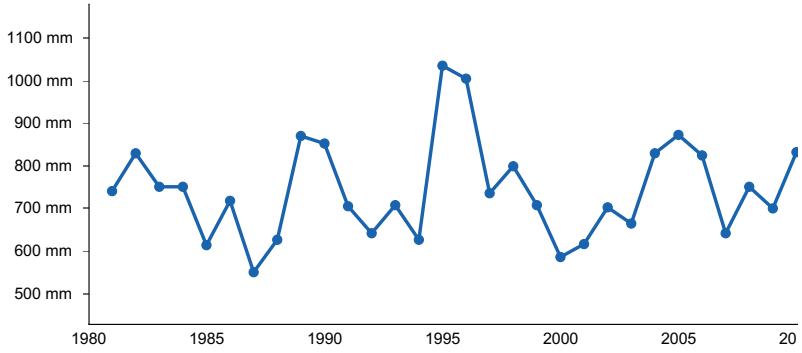


Figure 5. Annual precipitation pattern

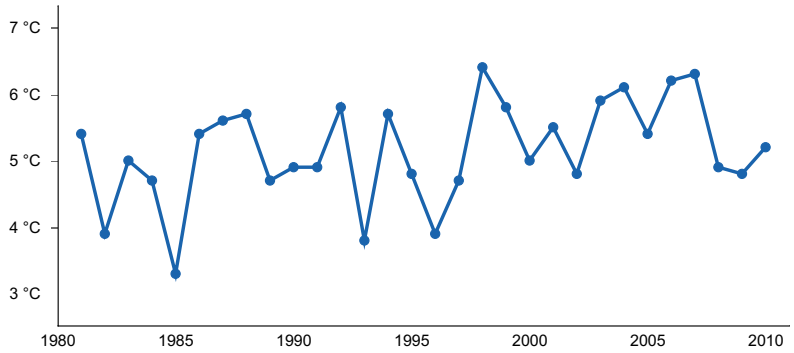


Figure 6. Annual average temperature pattern

Climate stations used

- (1) POLEBRIDGE 1 N [USC00246618], Essex, MT
- (2) LINDBERGH LAKE [USC00245043], Seeley Lake, MT
- (3) HUNGRY HORSE DAM [USC00244328], Kalispell, MT
- (4) WEST GLACIER [USC00248809], Kalispell, MT

Influencing water features

• Site does not receive additional water
NO WATER FEATURES

Wetland description

DOES NOT APPLY

Soil features

• Soils are
o Generally not saline or saline-sodic or limy (limited extent)
o Moderately deep, deep or very deep
o Not ashy or medial textural family
o Typically less than 5% stone and boulder cover (<15% max)
• Soil surface texture very gravelly sandy loam and loam in surface mineral 4”
• Parent material is colluvium over residuum weathered from metasedimentary rock
• Drainage class is well drained; no flooding frequency

Table 4. Representative soil features

Parent material	(1) Colluvium (2) Residuum
Surface texture	(1) Very gravelly sandy loam (2) Very gravelly loam
Drainage class	Well drained
Soil depth	51–254 cm

Ecological dynamics

STATE 1.0
COMMUNITY PHASE 1.1: *Dryas octopetala* (*Arctostaphylos uva-ursi*/*Salix arctica-Silene acaulis-Minuartia obtusiloba*)/*Smelowskia calycina-Erigeron compositus-Polygonum viviparum*/*Carex rupestris*.

COMMUNITY PHASE 1.2: This community has sustained either human trampling, heavy grazing or browsing, which has reduced the cover and vigor of species present in community phase 1.1.

COMMUNITY PHASE 1.3: This community has sustained fire and is the herbaceous dominated phase with resprouting shrubs.

Community Phase Pathway 1.1.A
This pathway represents fire disturbance.

Community Phase Pathway 1.2.A
This pathway represents a cessation of human trampling, heavy grazing or browsing for sustained periods of time.

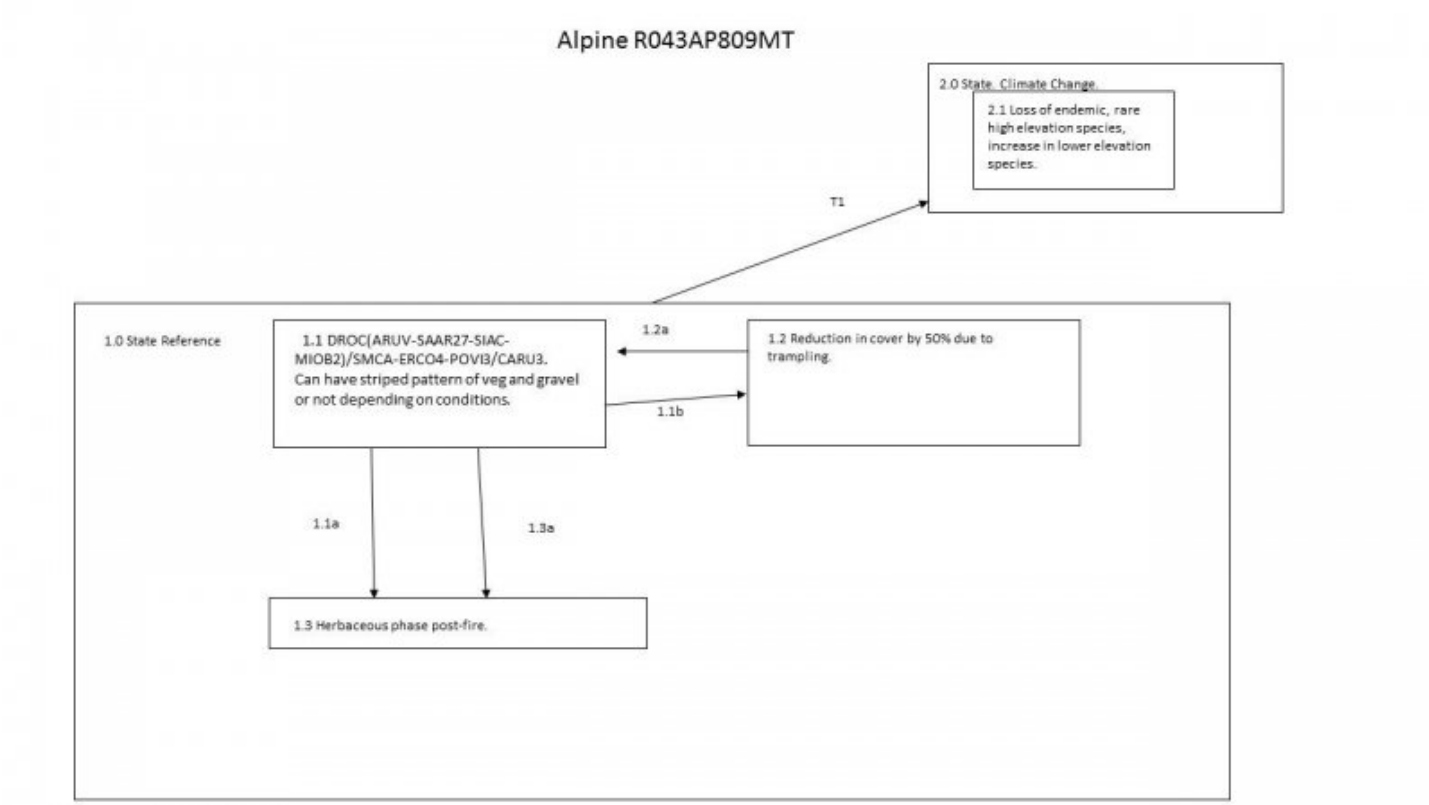
Community Phase Pathway 1.1.B
This pathway represents human trampling, heavy grazing or browsing for sustained periods of time.

Community Phase Pathway 1.3.A
This pathway represents a time since fire disturbance in which the resprouting shrubs have resumed the cover found in community phase 1.1.

Transition 1
This pathway represents climate change in which the Reference State plant composition is irreversibly changed with the warming temperatures reducing snowpack, increasing growing season length and summer drought, and therefore allowing invasion by associated site species. The amount of time this would take is unknown at this time.

STATE 2
COMMUNITY PHASE 2.1:
This community has a loss of endemic, rare high elevation species and an increase in low elevation species.

State and transition model



Animal community

Generally, grazing and human disturbance can be limited due to inaccessibility or low forage cover. Asebrook (2010) found that this site is in pristine condition with no invasion by exotic species and little invasion by tree

species. Species of this site are fragile due to the extremely limited growing season and less soil development. Species generally are slow-growing and decrease in cover and vigor in areas of trampling or heavy grazing.

Hydrological functions

The Alpine Solifluction Terrace ecological site spans high elevation areas that have harsh growing conditions for plants due to wind scouring, very cold winter temperatures, and a short growing season. Due to the wind scouring, these areas are often snow-free during the winter, which means they have less insulation from drying wind and less moisture during spring melt-out of snow. These areas are also subjected to high ultraviolet radiation and surface temperatures in the summer, which leads to a dry environment. The cover of gravel and cobble is high, but rarely are stone-sized rocks between the vegetation stripes. There is some organic matter accumulation in soils under the vegetated stripes and none under the rock-covered stripes. These stripes of vegetation and rock are on slopes subjected to downward movement due to slope steepness and frost heaving. These stair-steps generally form perpendicular to the slope. The growing season is very short, and vegetation is low- to very low-statured due to the wind and harsh environmental conditions. At the turf-banked terraces, the vegetation cover is lower to moderate, whereas lower downslope there are no stripes and the vegetation can be nearly continuous (75-90 percent). Species are highly adapted to this dry environment and grow in cushioned, matted, or succulent forms or grow as flat rosettes often with thick cuticles or dense covers of hairs. Many of these cushion plants are very long-lived and are adapted to the dry environment by their deep, fleshy taproots. Shrub species can be dominated by *Dryas octopetala* or can be a mixture with *Arctostaphylos uva-ursi* and *Salix arctica* as well. *Dryas octopetala* and Dasiphora fruticosa are nitrogen-fixing, as are other alpine leguminous species including Lupinus argenteus, Hedysarum sulphurescens, Astragalus alpine, Astragalus bourgovii, Oxytropis campestris, and Oxytropis sericea. Nitrogen aids in soil fertility. As well, litter can accumulate under the matted vegetation. Thus, these vegetated areas can facilitate additional species colonization within the mats. Many endemic and rare species are found in these alpine communities. Generally, the most wind-blasted areas are dominated by the very low-growing *Silene acaulis*, *Minuartia obtusiloba*, and Arenaria capillaris.
Nearly all species present at the site do not have affinities for wetland conditions, and have an upland, facultative upland or facultative wetland designation. Typical snow-loving tundra species are present including Arnica rydbergii, Arenaria capillaris, Astragalus bourgovii, Hedysarum suphurescens, Gentiana calycosa, *Silene acaulis*, *Carex rupestris*, *Minuartia obtusiloba*, *Polygonum viviparum*, Pedicularis contorta, *Erigeron compositus*, and *Smelowskia calycina* (Damm, 2001). Ubiquitous species occur as well, including Achillea millefolium, Galium boreale, Lupinus argenteus, Agoseris glauca, Poa alpina, and Trisetum spicatum. There are wetland facultative designated species present, but these are low in cover and in frequency. These include Anemone parviflora, Carex praegracilis, Polygonum bistortoides, Ranunculus eschscholtzii, Salix nivalis, and Vahlodea atropurpurea. Sedum lanceolatum occurs frequently at this site. Incidental species that occur infrequently, but in moderate to high cover when they do include Juniperus horizontalis, Carex scirpoidea, and Dryas drummondii.

Recreational uses

Species generally are slow-growing and decrease in cover and vigor in areas of trampling or heavy grazing. However, the 1985 INT-350 paper by the US Forest Service (USFS) found that the *Dryas octopetala* alpine cushion community had a 50 percent reduction in cover, approximately, with 400 passes of human trampling, but this levelled to slightly less cover with 800 passes.

Wood products

NONE

Other information

Climate change will impact the Alpine Solifluction Terrace ecological site, because the resident species are highly adapted to this site, and change could impact the distribution of peripheral species, endemics, and rare species. The Montana Natural Heritage Program has designated this ecosystem as a S5, and state that it is likely to increase as perennial ice and snow disappear. Desiccation and loss of alpine turf may also increase this ecosystems occupancy. Lesica (2014) found that in moist-turf (dominated by *Dryas octopetala*, Salix reticulata, and Carex scirpoidea) sites in Glacier National Park (GNP), there was a decline in arctic-alpine plants over two decades, with an approximate increase in temperature of 0.6 and 0.7 degrees Celsius than the previous four decades. There was a greater decline in dicots than monocots, and plants more restricted to high elevations

declined more than species with broader elevational amplitude. Lesica's paper documented upward migration of low-elevation species and declines in high-elevation species, and stated that the fluctuations were associated with increased temperature rather than declines in precipitation.

Contributors

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Approval

Kirt Walstad, 9/08/2023

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	12/18/2020
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):**

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

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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:**