USDA Natural Resources Conservation Service

Ecological site F025XY510UT
High Mountain Loam (Subalpine Fir)

Last updated: 4/24/2024
Accessed: 05/13/2025

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): 025X–Owyhee High Plateau

MLRA Notes 25—Owyhee High Plateau
This area is in Nevada (56 percent), Idaho (30 percent), Oregon (12 percent), and Utah (2 percent). It makes up about 27,443 square miles. MLRA 25 is characteristically cooler and wetter than the neighboring MLRAs of the Great Basin. The western boundary is marked by a gradual transition to the lower and warmer basins of MLRA 24. The boundary to the south-southeast, with MLRA 28B, is marked by gradual changes in geology marked by an increased dominance of singleleaf pinyon and Utah juniper and a reduced presence of Idaho fescue. The boundary to the north, with MLRA 11, is a rapid transition from the lava plateau topography to the lower elevation Snake River Plain.
Physiography:
All of this area lies within the Intermontane Plateaus. The southern half is in the Great Basin section of the Basin and Range province. This part of the MLRA is characterized by isolated, uplifted fault-block mountain ranges separated by narrow, aggraded desert plains. This geologically older terrain has been dissected by numerous streams draining to the Humboldt River.
The northern half of the area lies within the Columbia Plateaus province. This part of the MLRA forms the southern boundary of the extensive Columbia Plateau basalt flows. Most of the northern half is in the Payette section, but the northeast corner is in the Snake River Plain section. Deep, narrow canyons draining into the Snake River have been incised into this broad basalt plain. Elevation ranges from 3,000 to 7,550 feet on rolling plateaus and in gently sloping basins. It is more than 9,840 feet on some steep mountains. The Humboldt River crosses the southern half of this area
Geology:
The dominant rock types in this MLRA are volcanic. They include andesite, basalt, tuff, and rhyolite. In the north and west parts of the area, Cretaceous granitic rocks are exposed among Miocene volcanic rocks in mountains. A Mesozoic igneous and metamorphic rock complex dominates the south and east parts of the area. Upper and Lower Paleozoic calcareous sediments, including oceanic deposits, are exposed with limited extent in the mountains. Alluvial fan and basin fill sediments occur in the valleys.
Climate:
The average annual precipitation in most of this area is typically 11 to 22 inches. It increases to as much as 49 inches at the higher elevations. Rainfall occurs in spring and sporadically in summer. Precipitation occurs mainly as snow in winter. The precipitation is distributed fairly evenly throughout fall, winter, and spring. The amount of precipitation is lowest from midsummer to early autumn. The average annual temperature is 33 to 51 degrees F. The freeze-free period averages 130 days and ranges from 65 to 190 days, decreasing in length with elevation. It is typically less than 70 days in the mountains.
Water:
The supply of water from precipitation and streamflow is small and unreliable, except along the Owyhee, Bruneau, and Humboldt Rivers. Streamflow depends largely on accumulated snow in the mountains. Surface water from mountain runoff is generally of excellent quality and suitable for all uses. The basin fill sediments in the narrow alluvial valleys between the mountain ranges provide some ground water for irrigation. The alluvial deposits along the large streams have the most ground water. Based on measurements of water quality in similar deposits in

adjacent areas, the basin fill deposits probably contain moderately hard water. The water is suitable for almost all uses. The carbonate rocks in this area are considered aquifers, but they are little used. Springs are common along the edges of the limestone outcrops.
Soils:
The dominant soil orders in this MLRA are Aridisols and Mollisols. The soils in the area dominantly have a mesic or frigid temperature regime and an aridic, aridic bordering on xeric, or xeric moisture regime. Soils with aquic moisture regimes are limited to drainage or spring areas, where moisture originates or runs on and through. These soils are of a very limited extent throughout the MLRA. They generally are well drained, clayey or loamy, and shallow or moderately deep. Most of the soils formed in mixed parent material. Volcanic ash and loess mantle the landscape. Surface soil textures are loam and silt loam with ashy texture modifiers in some areas. Argillic horizons occur on the more stable landforms. They are exposed nearer the soil surface on convex landforms, where ash and loess deposits are more likely to erode. Soils that formed in carbonatic parent material in areas that receive less than 12 inches of precipitation are characterized by calcic horizons throughout the profile, while soils in areas that receive more than 12 inches of precipitation do not have calcic horizons in the upper part of the profile. Soils that formed on stable landforms at the lower elevations are dominated by ochric horizons. Soils that formed at the middle and upper elevations are characterized by mollic epipedons. Soils in drainage areas at all elevations that receive moisture running on or through them are characterized by thicker mollic epipedons.
Biological Resources:
This MLRA supports shrub-grass vegetation. Lower elevations are characterized by Wyoming big sagebrush associated with bluebunch wheatgrass, western wheatgrass, and Thurber’s needlegrass. Other important plants include bluegrass, squirreltail, penstemon, phlox, milkvetch, lupine, Indian paintbrush, aster, and rabbitbrush. Black sagebrush occurs but is less extensive. Singleleaf pinyon and Utah juniper occur in limited areas. With increasing elevation and precipitation, vast areas characterized by mountain big sagebrush or low sagebrush/early sagebrush in association with Idaho fescue, bluebunch wheatgrass, needlegrasses, and bluegrass become common. Snowberry, curl-leaf mountain mahogany, ceanothus, and juniper also occur. Mountains at the highest elevations support whitebark pine, Douglas-fir, limber pine, Engelmann spruce, subalpine fir, aspen, and curl-leaf mountain mahogany.
Major wildlife species include mule deer, bighorn sheep, pronghorn, mountain lion, coyote, bobcat, badger, river otter, mink, weasel, golden eagle, red-tailed hawk, ferruginous hawk, Swainson’s hawk, northern harrier, prairie falcon, kestrel, great horned owl, short-eared owl, long-eared owl, burrowing owl, pheasant, sage grouse, chukar, gray partridge, and California quail. Reptiles and amphibians include western racer, gopher snake, western rattlesnake, side-blotched lizard, western toad, and spotted frog. Fish species include bull, red band, and rainbow trout.

Ecological site concept

This site is on high elevation mountain side-slopes on all aspects. Slopes typically range from 15 percent to over 60 percent. Elevations are about 6,500 to 9,000 feet (1,981 to 2,743 meters).
These soils are deep to very deep. The soils are typically skeletal with 35 to 50 percent gravels, cobbles, or stones, by volume, distributed throughout the soil profile. There is normally a 1 to 3 inch (2.5 to 7.6 cm) thick layer of decomposing organic matter present on the soil surface. This duff layer reduces moisture loss due to evaporation.

The reference plant community is dominated by subalpine fir. Thimbleberry is the principal understory shrub. Ross’ sedge is the most prevalent understory grass or grass-like plant.

Associated sites

R025XY412UT	**Mountain Gravelly Loam (Mountain Big Sagebrush)** Mountain Gravelly Loam is shallow or moderately deep to bedrock.
R025XY418UT	**Mountain Windswept Ridge (Low Sagebrush)** Mountain Windswept Ridge is shallow to bedrock.

Similar sites

F025XY078NV	**High Mountain Loam** High Mountain Loam elevation ranges from 7,500-10,000 ft. and typically has an ochric epipedon.

Table 1. Dominant plant species

Tree	(1) *Abies lasiocarpa*
Shrub	(1) *Rubus parviflorus*
Herbaceous	(1) *Carex rossii*

Physiographic features

This site is found on mountain slopes on moderate to steep slopes between 15 and 60 percent. The elevation of the site ranges between 6,500 to 9,000 feet (1,981 to 2,743 meters). There is no flooding or ponding potential for this site.

Table 2. Representative physiographic features

Landforms	(1) Mountains > Mountain slope
Runoff class	High to very high
Flooding frequency	None
Ponding frequency	None
Elevation	1,981–2,743 m
Slope	15–60%
Water table depth	152 cm
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

The climate associated with this site is semiarid, characterized by cold, moist winters and warm, dry summers. Average annual precipitation is over 50 inches (127cm). Mean annual air temperature is 35 to 39 degrees F.

*The above data is averaged from the Climate Station ALTA in Utah and the Western Regional Climate Center.

Table 3. Representative climatic features

Frost-free period (characteristic range)	50-90 days
Freeze-free period (characteristic range)	70-150 days
Precipitation total (characteristic range)	762-1,016 mm
Frost-free period (actual range)	50-90 days
Freeze-free period (actual range)	70-150 days
Precipitation total (actual range)	762-1,016 mm
Frost-free period (average)	75 days
Freeze-free period (average)	91 days
Precipitation total (average)	914 mm

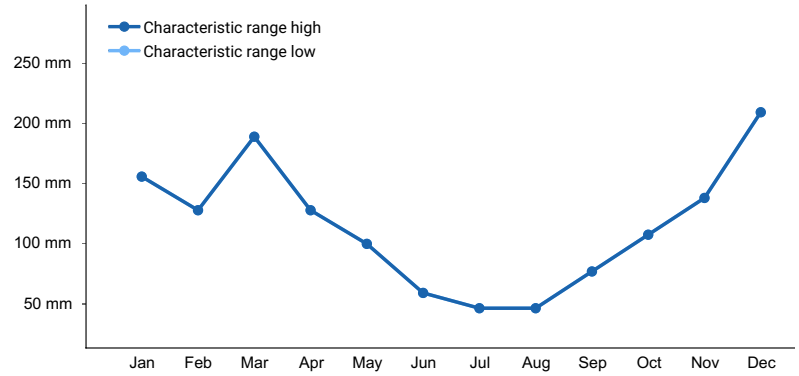


Figure 1. Monthly precipitation range

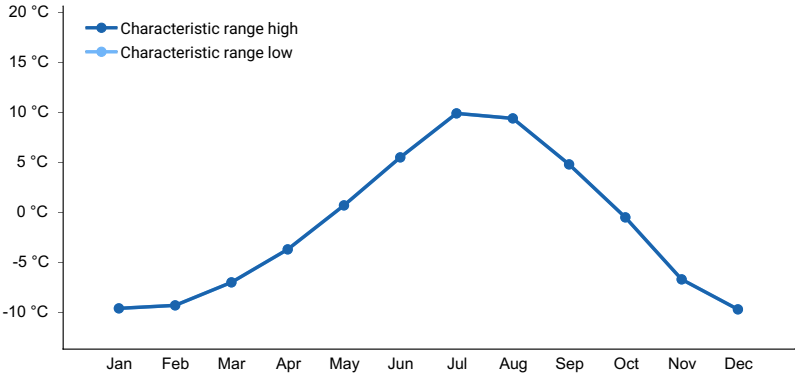


Figure 2. Monthly minimum temperature range

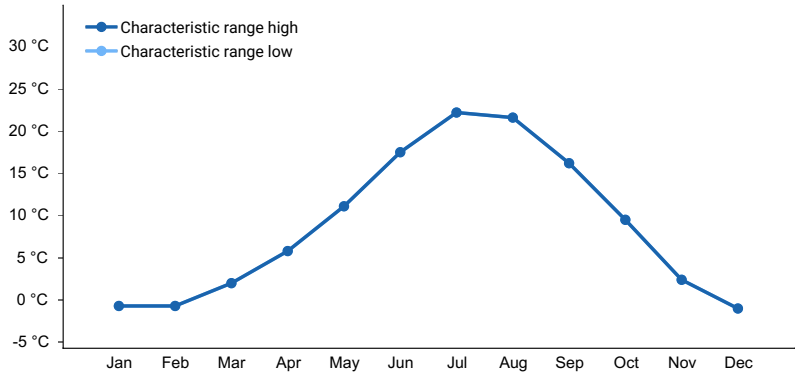


Figure 3. Monthly maximum temperature range

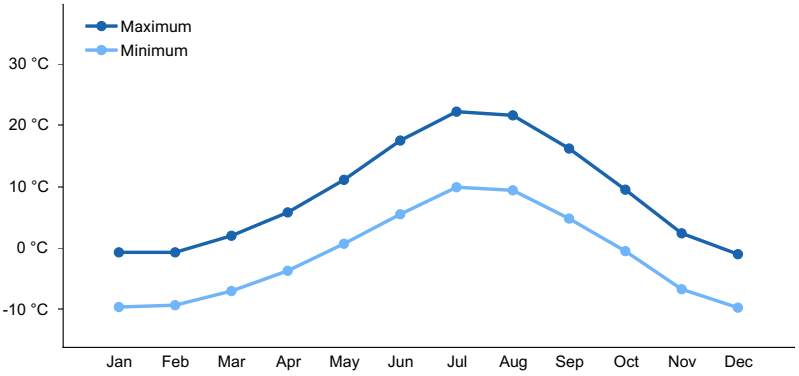


Figure 4. Monthly average minimum and maximum temperature

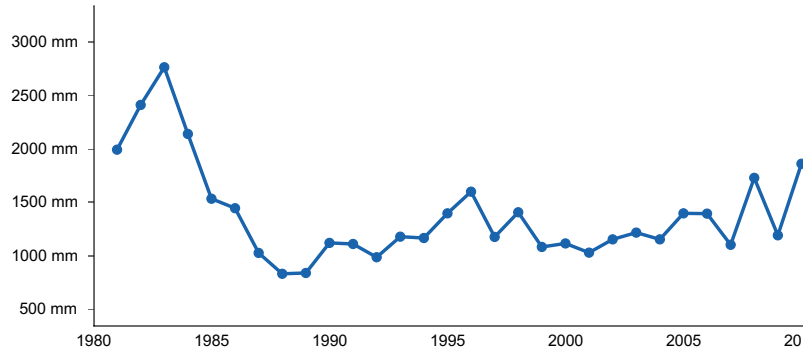


Figure 5. Annual precipitation pattern

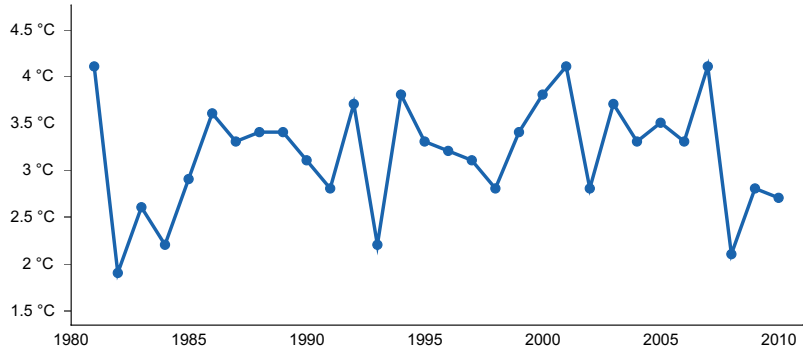


Figure 6. Annual average temperature pattern

Climate stations used

- (1) ALTA [USC00420072], Sandy, UT

Influencing water features

This site has no influencing water features.

Soil features

The soils on this site were formed in colluvium derived from quartzite and mica schist. The soils are well drained with moderate to moderately rapid permeability in the upper 10 inches (25cm) of soil. The soil does not have a restrictive layer within 20 inches (51cm) of the soil surface. The soil texture at the surface is gravelly loam or gravelly sandy loam. Surface rock fragments over 3 inches (7.6cm) is 0 to 3 percent cover, subsurface rock fragments over 3 inches (7.6cm) is 0 to 1 percent by volume. Surface rock fragments in inches between 2 and 3 (5 to 7cm) is 24 to 27 percent by cover and subsurface rock fragments of the same size is between 24 and 39 percent by volume. Available water capacity is between 3.1 and 4.7 in the upper 40 inches (101 cm) of soil. The soil pH ranges from 6.1 and 7.3. The soil temperature regime is frigid or cryic.

Soils correlated with this site:
Box Elder Co UT601 – Dateman (54), Datemark (24), Jughandle (42)

Table 4. Representative soil features

Parent material	(1) Colluvium
Surface texture	(1) Gravelly loam (2) Gravelly sandy loam
Family particle size	(1) Loamy-skeletal (2) Coarse-loamy
Drainage class	Well drained

Permeability class	Moderate to moderately rapid
Depth to restrictive layer	152 cm
Soil depth	152 cm
Surface fragment cover <=3"	24–27%
Surface fragment cover >3"	0–3%
Available water capacity (0-101.6cm)	7.87–11.94 cm
Calcium carbonate equivalent (0-101.6cm)	0%
Electrical conductivity (0-101.6cm)	0 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	6.1–7.3
Subsurface fragment volume <=3" (Depth not specified)	24–39%
Subsurface fragment volume >3" (Depth not specified)	0–1%

Ecological dynamics

a. Herbaceous:

Vegetation is dominated by grasses and forbs under full sunlight. This stage is experienced after a major disturbance such as crown fire or tree harvest. Skeleton forest (dead trees) remaining after fire or residual trees left following harvest have little or no affect on the composition and production of the herbaceous vegetation.

b. Shrub-Herbaceous:

Herbaceous vegetation and woody shrubs dominate the site. Various amounts of tree seedlings (less than 20 inches in height) may be present up to the point where they are obviously a major component of the vegetal structure. Under natural conditions fir seeds lie dormant under the snow and germinate the following spring. Although germination and early survival of subalpine fir are generally best on exposed mineral soil and moist humus, the species is less exacting in its seedbed requirements than most of its common associates. Establishment and early survival of subalpine fir are favored by relatively deep shade. It grows very slowly at first and growth is never rapid. Trees 10 to 20 inches in diameter are often 150 to 200 years old.

c. Sapling:

In the absence of disturbance, the tree seedlings develop into saplings (20 inches to 4.5 feet in height) with a range in canopy cover of about 5 to 10 percent. Vegetation consists of grasses, forbs, and shrubs in association with tree saplings.

d. Immature Forest:

The visual aspect and vegetal structure are dominated by subalpine fir greater than 4.5 feet in height. Seedlings and saplings are present in the understory. Understory vegetation is moderately influenced by a tree overstory canopy about 10 to 20 percent.

e. Mature Forest:

The visual aspect and vegetal structure are dominated by subalpine fir that have reached or are near maximal heights for the site. Trees attain heights of 60-100 feet with diameters of 18 to 24 inches. Tree canopy cover ranges

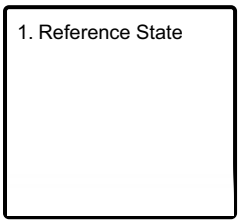
from 20 to 40 percent. Subalpine fir grows in pure stands most often on sites so severe that it has little commercial value. Understory vegetation is strongly influenced by tree competition, overstory shading, duff accumulation, etc. Few seedlings and/or saplings of the major overstory tree species occur in the understory.

f. Climax Forest:

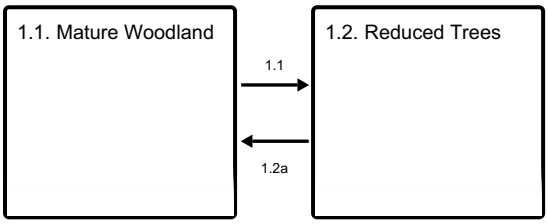
In the absence of wildfire or other naturally occurring disturbances, the tree canopy on this site can become very dense. This stage is dominated by trees that have reached maximal heights for the site. Understory vegetation is sparse to absent due to tree competition, overstory shading, duff accumulation, etc. Tree canopy cover is at a maximum for the site and is commonly greater than 50 percent.

State and transition model

Ecosystem states



State 1 submodel, plant communities



State 1
Reference State

The Reference State is a representative of the natural range of variability under pristine conditions. This site has two general community phases; a mature woodland phase and a reduced tree phase. State dynamics are maintained by interactions between climatic patterns and disturbance regimes. Negative feedbacks enhance ecosystem resilience and contribute to the stability of the state. These include the presence of all structural and functional groups, fuel loads, and retention of organic matter and nutrients. Plant community phase changes are primarily driven by fire, periodic long-term drought and/or insect or disease attack.

Community 1.1
Mature Woodland

a.Nature of Forest Community On exposed sites near timberline, subalpine fir is often reduced to a prostrate shrub; but, under closed-forest conditions, it attains diameters of 12-24 inches and heights of 45-100 feet, depending upon the site quality and stand density. The overstory tree canopy cover is about 50 percent. Common understory plants are ross sedge, slender wheatgrass, heartleaf arnica, western thimbleberry, and creeping Oregon grape. Understory composition by air-dry weight is about 10 percent perennial grasses and grasslike plants, 10 percent forbs, and 80 percent shrubs. Understory production ranges from 100 pounds per acre in favorable years to about 40 pounds per acre in unfavorable years. Understory production includes the total annual production of all species within 4 ½ feet of the ground surface.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	36	63	90
Forb	4	8	11
Grass/Grasslike	4	8	11
Total	**44**	**79**	**112**

Community 1.2
Reduced Trees

Disturbance reduces tree cover either in patches or larger areas depending on the disturbance. Open canopy areas can be dominated by more herbaceous and shrub species as saplings establish in the understory.

Pathway 1.1
Community 1.1 to 1.2

Disturbance to reduce tree canopy cover. Includes wind throw, disease, fire or other natural disturbance.

Pathway 1.2a
Community 1.2 to 1.1

Lack of disturbance, allows tree saplings to mature into larger trees.

Additional community tables

Animal community

a. Livestock Grazing

This site is suited to cattle and sheep grazing during the summer and fall. Livestock will often concentrate on this site taking advantage of the shade and shelter offered by the tree overstory. Many areas are not used because of steep slopes or lack of adequate water. Attentive grazing management is required due to steep slopes and erosion hazards. Harvesting trees under a sound management program can open up the tree canopy to allow increased production of understory species desirable for grazing.

b. Initial Stocking Rates

Stocking rates vary in accordance with such factors as kind and class of grazing animal, season of use, and fluctuation in climate. Actual use records for individual sites, together with a determination of the degree to which the sites have been grazed and an evaluation of trend in site condition, offer the most reliable basis for developing initial stocking rates. Selection of initial stocking rates for given grazed units is a planning decision. This decision should be made only after careful consideration of the total resources available, evaluation of alternatives for use and treatment, and establishment of objectives by the decisionmaker.

Wildlife species seeking food and cover in this forest site include moose, elk, mule deer, bear, porcupine, snowshoe hare, owl, and woodpecker.

Wood products

a.Harvest cut selectively or in small patches (size dependent upon site conditions) to enhance forage production.

1.Thinning and improvement cutting – removal of poorly formed, diseased, and low vigor trees.

2.Harvest cutting – selectively harvest surplus trees to achieve desired spacing. Save large, healthy, full-crowned trees. Do not select only “high grade” trees during harvest.

b.Prescription burning program – to maintain desired canopy cover and manage site reproduction.

c.Selective tree removal on suitable sites – to enhance forage production and manage site reproduction.

d.Pest Control – use necessary and approved control for specific pests or diseases.

e.Fire hazard – fire is usually not a problem in mature grazed stands.

Other products

4. Limitations and Considerations
a.Potential for sheet and rill erosion is moderate to severe depending on slope.
b.Moderate to severe equipment limitations on steeper slopes and on sites having extreme surface stoniness.
c.Proper spacing is the key to a well managed multiple use and multi-product forest.

5. Essential Requirements
a.Adequately protect from uncontrolled burning.
b.Protect soils from accelerated erosion.
c.Apply proper grazing management practices (see management guides)

Table 6. Representative site productivity

Common Name	Symbol	Site Index Low	Site Index High	CMAI Low	CMAI High	Age Of CMAI	Site Index Curve Code	Site Index Curve Basis	Citation
subalpine fir	*ABLA*	28	33	34	39	–	–	–	

Inventory data references

Soils and Physiographic Features were gathered from the NASIS database.

Type locality

Location 1: Beaver County, UT	
Township/Range/Section	T14N R17W S15
Location 2: Box Elder County, UT	
Township/Range/Section	T14N R17W S15

Other references

“Silvics of North America,” Agriculture Handbook 654, Volume 1, confers

Mauk, Ronald L., Henderson, Jan A. “Coniferous Forest Habitat Types of Northern Utah,” General Technical Report INT 170, July 1884 ABLA/BERE/RIMO, Page 47-49

Contributors

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Approval

Kendra Moseley, 4/24/2024

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	05/13/2025
Approved by	Kendra Moseley
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:**