USDA Natural Resources Conservation Service

Ecological site R047XA309UT
Upland Loam (birchleaf mountain mahogany)

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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): 047X–Wasatch and Uinta Mountains

MLRA 47 occurs in Utah (86 percent), Wyoming (8 percent), Colorado (4 percent), and Idaho (2 percent). It encompasses approximately 23,825 square miles (61,740 square kilometers). The northern half of this area is in the Middle Rocky Mountains Province of the Rocky Mountain System. Parts of the western edge of this MLRA are in the Great Basin Section of the Basin and Range Province of the Intermontane Plateaus. The MLRA includes the Wasatch Mountains, which trend north and south. The steeply sloping, precipitous Wasatch Mountains have narrow crests and deep valleys. Active faulting and erosion are a dominant force in controlling the geomorphology of the area.
The mountains in this area are primarily fault blocks that have been tilted up. Alluvial fans at the base of the mountains are recharge zones for the basin fill aquifers. An ancient shoreline of historic Bonneville Lake is evident on the footslopes along the western edge of the area. Rocks exposed in the mountains are mostly Mesozoic and Paleozoic sediments.
The average precipitation is from 12 to 16 inches in the valleys and can range up to 73 inches in the mountains. Peak precipitation occurs in the winter months. The average annual temperature is 30 to 50 degrees Fahrenheit (-1 to 15 C). The freeze-free period averages 140 days and ranges from 60 to 220 days, generally decreasing in length with elevation.
The dominant soil orders in this MLRA are Entisols, Inceptisols, and Mollisols. The lower elevations are dominated by a frigid temperature regime, while the higher elevations experience cryic temperature regimes. The soil moisture regime is typically xeric. The minerology is generally mixed and the soils are very shallow to very deep, generally well drained, and loamy or loamy-skeletal.

LRU notes

This LRU includes the Wasatch Mountains which tend to run north and south. These steeply sloping, precipitous mountains have narrow crests and deep valleys. They are primarily fault blocks that have been tilted up. The alluvial fans located at the base of these mountains are important recharge zones for valley aquifers.

Ecological site concept

The soils of this site are deep, well-drained loams formed in slope alluvium derived from sandstone or quartzite. Virtually no rock fragments are present on the soil surface or throughout the soil profile. Soils have little or no rocks on the surface or throughout the profile. Permeability is moderate to moderately slow and available water holding capacity ranges from 6.3 to 7.9 inches of water in the upper 40 inches of soil. The soil moisture regime is aridic xeric and the soil temperature regime is frigid. Precipitation ranges from 16-22 inches annually.

Associated sites

R047XA308UT	**Upland Loam (basin big sagebrush)** Sites often occur adjacent to each other.

Similar sites

R047XA434UT	**Mountain Loam (shrub)** Similar in that they both have common deciduous shrubs, however this site is more diverse and at a slightly higher precipitation zone.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Cercocarpus montanus*
Herbaceous	Not specified

Physiographic features

This ecological site typically occurs on alluvial fans and hillslopes. Slopes normally range from 4 to 15 percent but may occasionally be steeper. Slope steepness, aspect and elevation will influence the vegetative floristics of this site. Sites are typically located between 6,000 to 7,000 feet in elevation. Runoff is low to medium.

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan (2) Hillslope
Runoff class	Low to medium
Flooding frequency	None
Ponding frequency	None
Elevation	6,000–7,000 ft
Slope	4–15%
Aspect	Aspect is not a significant factor

Climatic features

The climate of this site characterized by cold, snowy winters and cool summers. The average annual precipitation ranges from 12 to 16 inches. March thru May and August, are typically the wettest months with June and July being the driest. The most reliable sources of moisture for plant growth are the snow that accumulates over the winter, and spring rains. Summer thunderstorms are intermittent and sporadic in nature, and thus, are less reliable sources of moisture to support vegetative growth on this site.

Table 3. Representative climatic features

Frost-free period (characteristic range)	75-90 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	12-16 in
Frost-free period (average)	
Freeze-free period (average)	
Precipitation total (average)	14 in

Influencing water features

Due to its landscape position, this site is not influenced by streams or wetlands.

Wetland description

N/A

Soil features

The soils of this site are deep, well-drained loams formed in slope alluvium derived from sandstone or quartzite. Virtually no rock fragments are present on the soil surface or throughout the soil profile. Soils have little or no rocks on the surface or throughout the profile. Permeability is moderate to moderately slow and available water holding capacity ranges from 6.3 to 7.9 inches of water in the upper 40 inches of soil. The soil moisture regime is xeric and the soil temperature regime is frigid. Precipitation ranges from 12 to 16 inches annually.

One soil map unit is correlated to this site:
Rich County SS (UT604) Cloud Rim, Dry (CBD)

Table 4. Representative soil features

Parent material	(1) Alluvium–metamorphic and sedimentary rock (2) Slope alluvium–metamorphic and sedimentary rock
Surface texture	(1) Loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderate
Available water capacity (0-40in)	6.3–7.9 in
Calcium carbonate equivalent (0-40in)	0%
Electrical conductivity (0-40in)	0 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	6.1–7.3
Subsurface fragment volume <=3" (0-40in)	0%
Subsurface fragment volume >3" (0-40in)	0%

Ecological dynamics

It is impossible to determine in any quantitative detail the Historic Climax Plant Community (HCPC) for this ecological site because of the lack of direct historical documentation preceding all human influence. In some areas, the earliest reports of dominant plants include the cadastral survey conducted by the General Land Office, which began in the late 19th century for this area (Galatowitsch 1990). However, up to the 1870s the Shoshone Indians, prevalent in northern Utah and neighboring states, grazed horses and set fires to alter the vegetation for their needs (Parson 1996). In the 1860s, Europeans brought cattle and horses to the area, grazing large numbers of them on unfenced parcels year-long (Parson 1996). Itinerant and local sheep flocks followed, largely replacing cattle as the browse component increased.

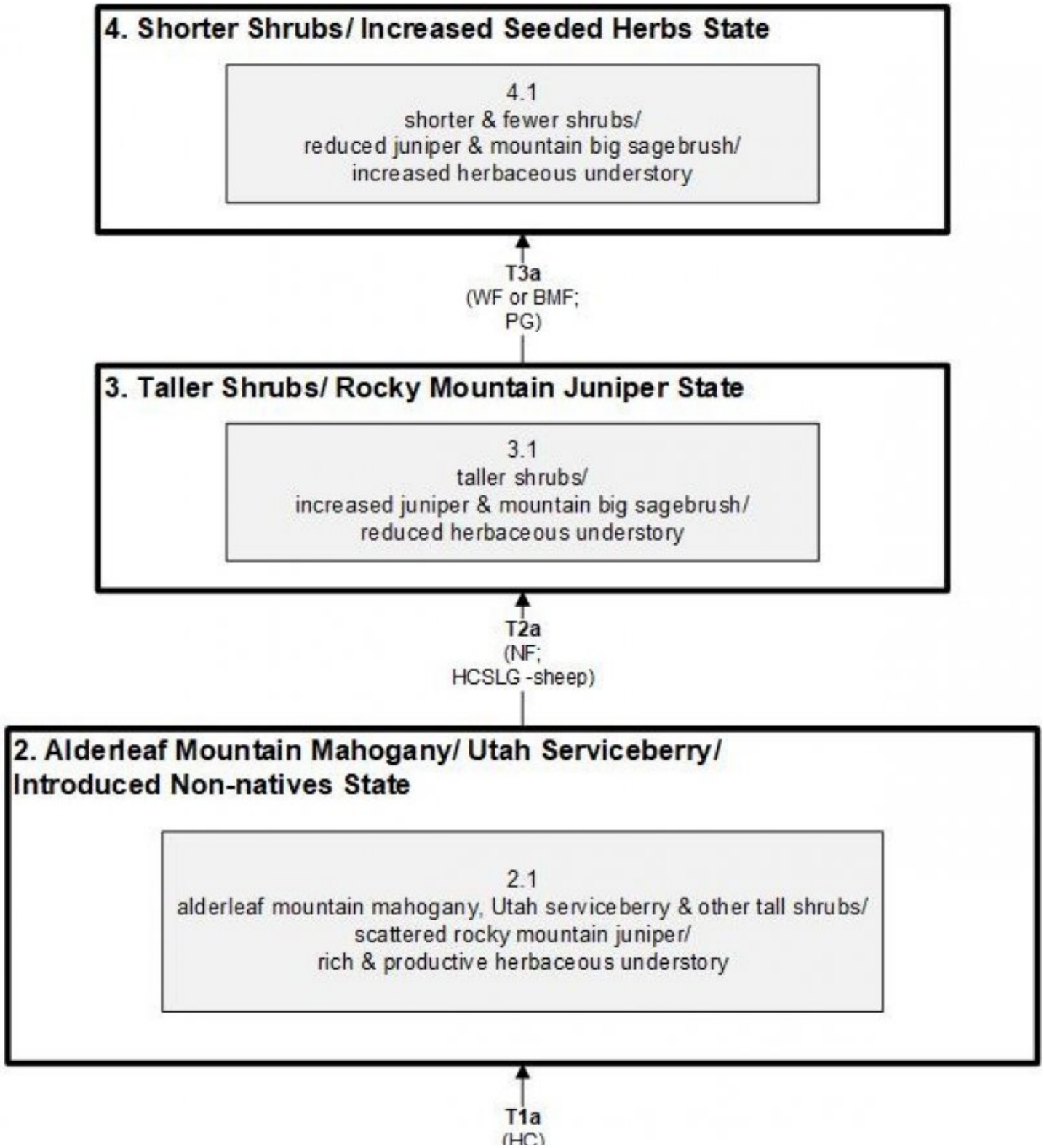
Below is a State and Transition Model diagram to illustrate the “phases” (common plant communities), and “states” (aggregations of those plant communities) that can occur on the site. Differences between phases and states depend primarily upon observations of a range of disturbance histories in areas where this ESD is represented. These situations include grazing gradients to water sources, fence-line contrasts, patches with differing dates of fire, herbicide treatment, tillage, etc. Reference State 1 illustrates the common plant communities that probably

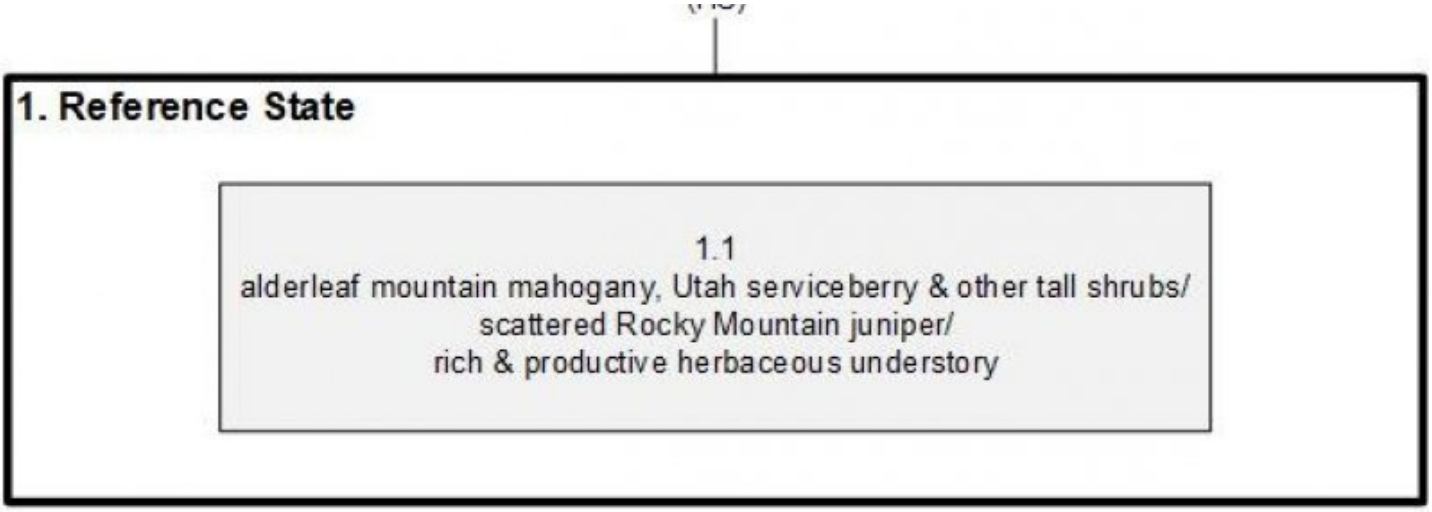
existed just prior to European settlement.

The major successional pathways within states, (“community pathways”) are indicated by arrows between phases. “Transitions” are indicated by arrows between states. The drivers of these changes are indicated in codes decipherable by referring to the legend at the bottom of the page and by reading the detailed narratives that follow the diagram. The transition between Reference State 1 and State 2 is considered irreversible because of the naturalization of exotic species of both flora and fauna, possible extinction of native species, and climate change. There may have also been accelerated soil erosion.

When available, monitoring data (of various types) were employed to validate more subjective inferences made in this diagram.

State and transition model





BMF	Brush Management (fire)
HC	Historic Change
HCSLG	Heavy Continuous Season Long Grazing
NF	No Fire
PG	Prescribed grazing
WF	Wildfire

State 1
Reference State

The Reference State is a description of this ecological site just prior to Euro-American settlement but long after the arrival of Native Americans. The description of the Reference State was determined by NRCS Soil Survey Type Site Location information and familiarity with rangeland relict areas where they exist. The least modified plant community would have been a tall shrub-dominated community with occasional Rocky Mountain juniper (*Juniperus scopulorum*), and a rich and productive understory of graminoids and forbs (1.1). Dominant shrubs would have included alderleaf mountain mahogany (*Cercocarpus montanus*), Utah serviceberry (*Amelanchier utahensis*), along with the associated shrubs mountain big sagebrush (*Artemisia tridentata* ssp. vaseyana), mountain snowberry (*Symphoricarpos oreophilus*), and antelope bitterbrush (*Purshia tridentata*). Primary grasses would have included bluebunch wheatgrass (*Pseudoroegneria spicata*), sheep fescue (*Festuca ovina*), mountain brome (*Bromus marginatus*), and Columbia needlegrass (*Achnatherum nelsonii*). Dominant forbs would have included arrowleaf balsamroot (*Balsamorhiza sagittata*), tailcup lupine (*Lupinus caudatus* ssp. caudatus), and longleaf phlox (*Phlox longifolia*) among others. A more complete list of species by lifeform for the Reference State is available in accompanying tables in the “Plant Community Composition by Weight and Percentage” section of this document. Wildfires would have maintained a balance between woody and non-woody vegetation, as many of the primary shrub species are root-sprouters and respond quickly following fire.

Community 1.1
Alderleaf mountain mahogany, Utah serviceberry & other tall shrubs/ scattered Rocky Mountain juniper/ rich & productive herbaceous understory

This plant community would have been characterized by tall shrub-dominated vegetation, primarily alderleaf mountain mahogany and Utah serviceberry, with scattered Rocky Mountain juniper, and a rich and productive native perennial herbaceous understory. Other associated shrubs would have included mountain big sagebrush, mountain snowberry, and antelope bitterbrush. Understory grasses would have included bluebunch wheatgrass, sheep fescue, and Columbia needlegrass. Dominant forbs would have included arrowleaf balsamroot, tailcup lupine, and longleaf phlox among others.

State 2
Alderleaf Mountain Mahogany/ Utah Serviceberry/ Introduced Non-natives State

State 2 is a description of the ecological site shortly following Euro-American settlement, which has been influenced

by the introduction of several non-native plants and animals, possible extinctions of native species, and a different climate. The plant community will be very similar to State 1 with the exception that some introduced species are likely to be present. This state can be regarded as the current potential. The site is dominated by a mixture of tall shrubs including alderleaf mountain mahogany, Utah serviceberry, mountain big sagebrush, mountain snowberry, antelope bitterbrush and scattered Rocky Mountain juniper. A rich and productive native perennial herbaceous understory will also be present (2.1). Because of the steepness of these sites, the vegetation was not heavily used by cattle and horses. However, herding of sheep was quite prevalent during the first half of the 20th Century. This vegetation was and still remains a favorite of big game. Because these classes of animals focus on browse, the understory is more intact than less steep nearby sites. Wildfires are important in rejuvenating the woody component, as the majority of the shrubs on these sites respond and recover rapidly following fire. Because soils on this site are rocky, they are considered “self armoring,” thus making the site resistant to the effects of erosion. Another factor contributing to the resiliency of this state is that the most desirable species are long-lived and are root-sprouters. Resiliency, however, will be reduced by excessive utilization which results in insufficient regeneration of the desirable species. Without regeneration of desirable species, some populations over-mature making them susceptible to catastrophic, sudden losses, and as a result unpalatable invaders can take over the site.

Community 2.1
Alderleaf mountain mahogany, Utah serviceberry & other tall shrubs/ scattered Rocky Mountain juniper/ rich & productive herbaceous understory

This plant community is characterized by a mixture of tall shrubs including alderleaf mountain mahogany, Utah serviceberry, mountain big sagebrush, mountain snowberry, antelope bitterbrush and scattered Rocky Mountain juniper. The understory is composed of grasses including bluebunch wheatgrass, sheep fescue, and Columbia needlegrass. Dominant forbs would include arrowleaf balsamroot, tailcup lupine, and longleaf phlox among others.

State 3
Taller Shrubs/ Rocky Mountain Juniper State

Lengthening of the fire cycle directly through fire control and indirectly through heavy livestock grazing reduces the fine fuels, ultimately tipping the balance toward woody plants and increasing the proportion of non-sprouters such as Rocky Mountain juniper and mountain big sagebrush (3.1). Because soils on this site are rocky they are considered “self armoring,” thus making the site resistant to the effects of erosion. The state will maintain stability with cool season fires, whereas hot summer fires are likely to reduce state stability.

Community 3.1
Taller shrubs/ increased juniper & mountain big sagebrush/ reduced herbaceous understory

This plant community is characterized by taller, denser shrubs, including the non-sprouting species such as Rocky Mountain juniper and mountain big sagebrush. The herbaceous understory is diminished due to heavy livestock grazing during the growing season of grasses.

State 4
Shorter Shrubs/ Increased Seeded Herbs State

State 4 is dominated by shorter, mostly re-sprouting shrubs, and an herbaceous understory composed of both native and introduced perennials. Native shrubs include mountain big sagebrush and yellow rabbitbrush (*Chrysothamnus viscidiflorus*). Wildfire or prescribed burning followed by a period of grazing deferment will provide a balance between woody and non-woody plants. If increased grazing is allowed too soon after fire, introduced species may dominate the understory (4.1). This state will lose stability with the increase in exotics and the loss of native herbs and grasses.

Community 4.1
Shorter & fewer shrubs/ reduced juniper & mountain big sagebrush/ increased herbaceous understory

This plant community is dominated by re-sprouting shrubs, such as yellow rabbitbrush, with an understory of

grazing-tolerant native herbs and invaded herbs, such as arrowleaf balsamroot.

Transition T1A
State 1 to 2

The simultaneous introduction of exotic species, both plants and animals, possible extinctions of native flora and fauna, and climate change has caused State 1 to transition to State 2. Reversal of such historic changes (i.e. a return pathway) back to State 1 is not practical.

Transition T2A
State 2 to 3

Heavy utilization primarily by sheep and occasionally by cattle and horses during the first half of the 20th century, combined with fire suppression, reduced much of the understory and allowed the shrubs to take over the site. Big game then hedged and high-lined the remaining shrubs. The survivors are all taller with the canopies having a marked browse line.

Transition T3A
State 3 to 4

Prescribed burning or wildfire accompanied by aerial seeding, followed by grazing deferment, offers the only logical way to proactively promote a more diverse state with a better balance between woody and non-woody plants. Shrubs will be shorter, with non-sprouting species temporarily be reduced. Fire may potentially produce an increase in invasive herbs. If increased grazing is allowed too soon after fire, introduced species are given an additional advantage. A key indicator of the approach to this transition is the build up of fuels, and fire is the trigger for the transition. Because of steep slopes on this site, a restoration pathway is impracticable.

Additional community tables

Inventory data references

Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range trained personnel were also used.

Other references

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Approval

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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	05/12/2025
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:**

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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:**
