

# **Ecological site R028AY456UT Mountain Stony Loam (Antelope Bitterbrush)**

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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): 028A–Ancient Lake Bonneville

MLRA 28A occurs in Utah (82%), Nevada (16%), and Idaho (2%). It encompasses approximately 36,775 square miles (95,246 square kilometers). A large area west and southwest of Great Salt Lake is a salty playa. This area is the farthest eastern extent of the Great Basin Section of the Basin and Range Province of the Intermontane Plateaus. It is an area of nearly level basins between widely separated mountain ranges trending north to south. The basins are bordered by long, gently sloping alluvial fans. The mountains are uplifted fault blocks with steep side slopes. Most of the valleys are closed basins containing sinks or playa lakes. Elevation ranges from 3,950 to 6,560 feet (1,204 to 2000 meters) in the basins and from 6,560 to 11,150 feet (1996 to 3398 meters) in the mountains. Much of the MLRA has alluvial valley fill and playa lakebed deposits at the surface from pluvial Lake Bonneville, which dominated this MLRA 13,000 years ago. A level line of remnant lake terraces on some mountain slopes indicates the former extent of this glacial lake. The Great Salt Lake is what remains of the pluvial lake.

Mountains in the interior of this MLRA consist of tilted blocks of marine sediments from Cambrian to Mississippian age with scattered outcrops of Tertiary continental sediments and volcanic rocks. The average annual precipitation is 5 to 12 inches (13 to 30 cm) in the valleys and ranges up to 49 inches (124 cm) in the mountains. Most of the rainfall in the southern LRU occurs as high-intensity, convective thunderstorms during the growing season (April through September). The driest period is from midsummer to early autumn in the northern LRU. Precipitation in winter typically occurs as snow. The average annual temperature is 39 to 53 °F (4 to 12 °C). The freeze-free period averages 165 days and ranges from 110 to 215 days, decreasing in length with increasing elevation. The dominant soil orders in this MLRA are Aridisols, Entisols, and Mollisols. Soils are

dominantly in the mesic or frigid soil temperature regime, aridic or xeric soil moisture regime, and mixed mineralogy. They generally are well drained, loamy or loamy-skeletal, and very deep.

## LRU notes

The Basin and Range North LRU exhibits dry summer with stronger xeric patterns than the Basin and Range South LRU. Ranges in the north LRU are about 50 percent Paleozoic sedimentary/metasedimentary (limestone/quartzite dominant) and about 10 percent Tertiary volcanics. The basin floors are between 4,200 and 5,100 feet (1280 to 1554 meters) in elevation. Pinyon and juniper sites have a greater percentage of Utah juniper (*Juniperus osteosperma*) in the plant community than pinyon pine (*Pinus edulis* or *monophylla*). The Basin and Range North have few semidesert ecological sites with Utah juniper. Cool season grasses, such as bluebunch wheatgrass (*Pseudoroegneria spicata*), are dominant in the plant community, while warm season grasses are largely absent or a small component of the plant community.

## Ecological site concept

This site is located on hillsides and mountainsides on steep slopes (30 to 60 percent) between 5,200 and 10,000 feet (1,585 to 3,048 meters). The soil is loamy-skeletal and moderately deep to lithic bedrock. The soil was formed in residuum and colluvium derived from quartzite and igneous rock. The precipitation ranges from 11 to 30 inches (279 to 762 mm). The dominant vegetation is mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), antelope bitterbrush (*Purshia tridentata*) and bluebunch wheatgrass (*Pseudoroegneria spicata*). Total canopy cover in the reference state is about 40 percent grasses, 5 percent forbs, and 20 percent shrubs.

## Associated sites

R028AY324UT	<b>Upland Shallow Loam (Utah Juniper - Singleleaf Pinyon)</b> This site occurs in shallow soils adjacent to site 456.
R028AY430UT	<b>Mountain Windswept Ridge</b> This site will occur on ridges.

## Similar sites

R047XA460UT	<b>Mountain Stony Loam (browse)</b> This site occurs in the adjacent Wasatch Mountains MLRA. It will have more diversity of shrubs.
R047XA456UT	<b>Mountain Stony Loam (antelope bitterbrush)</b> This site occurs in the adjacent Wasatch Mountains MLRA.

R047XA461UT	<b>Mountain Stony Loam (mountain big sagebrush)</b> This site occurs in the adjacent Wasatch Mountains MLRA and is dominated by mountain big sagebrush with fewer other shrubs species.
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**Table 1. Dominant plant species**

Tree	Not specified
Shrub	(1) <i>Purshia tridentata</i> (2) <i>Artemisia tridentata ssp. vaseyana</i>
Herbaceous	(1) <i>Pseudoroegneria spicata</i>

## Physiographic features

This site occurs on hillsides and mountainsides. This site is found on all aspects at elevations between 5,200 and 10,000 feet (1,585 to 3,048 meters). Slopes are steep (30 to 60 percent). Flooding does not occur on this site.

**Table 2. Representative physiographic features**

Landforms	(1) Hillside or mountainside
Flooding frequency	None
Ponding frequency	None
Elevation	1,585–3,048 m
Slope	30–60%
Aspect	Aspect is not a significant factor

## Climatic features

The climate is characterized by warm, dry summers, cold, snowy winters and moist springs. The average annual precipitation is between 12 and 21 inches. October through May is the wettest part of the year and June through August are the driest. The effective moisture for plant growth is the 60 percent that falls during the plant dormant period, which wets the soil deeply in the spring.

**Table 3. Representative climatic features**

Frost-free period (characteristic range)	
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	279-762 mm
Frost-free period (average)	
Freeze-free period (average)	

Precipitation total (average)

508 mm

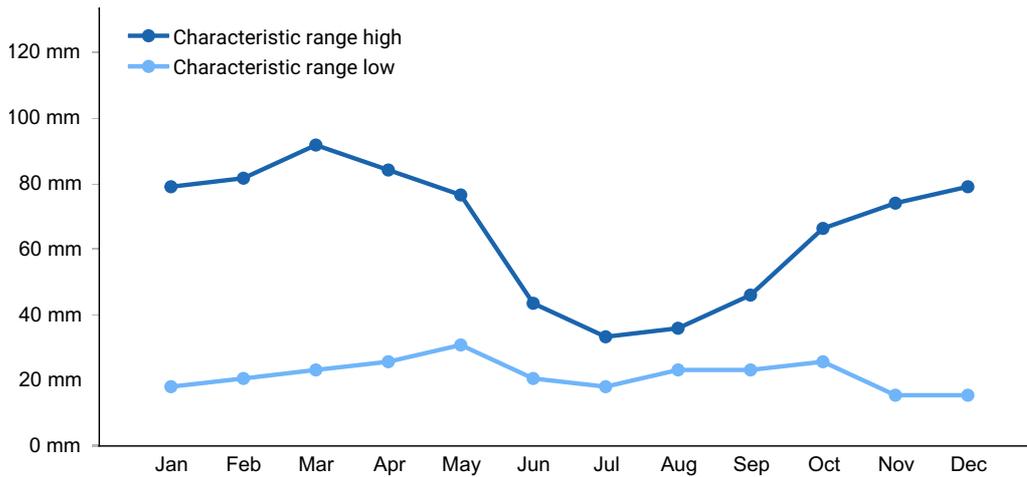


Figure 1. Monthly precipitation range

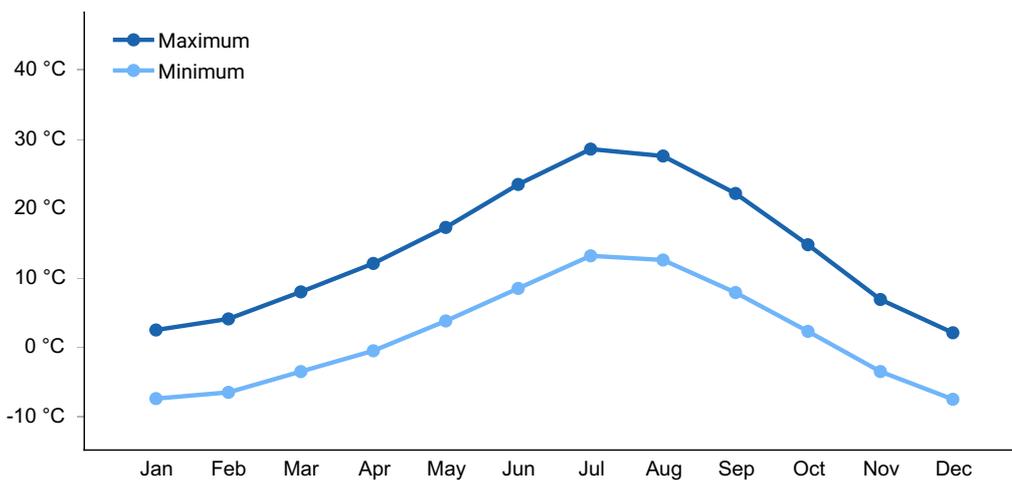


Figure 2. Monthly average minimum and maximum temperature

## Influencing water features

Due to its landscape position, this site is not typically influenced by streams or wetlands. It can sometimes be influenced by overland flow during heavy thunder storms and/or during wetter spring runoff periods.

## Soil features

The characteristic soils of this site are greater than 20 inches deep and well drained. The soil was formed in colluvium and residuum derived from quartzite. The surface horizon has a cobbly loam texture. Rock fragments commonly occur on the soil surface and make up greater than 35 percent of the soil volume. Available water capacity ranges from 1.8 to 4.5 inches in the upper 40 inches of soil. These soils are neutral and are not calcareous on the surface. The soil moisture regime is xeric and the soil temperature regime is frigid.

Soil Map Units that may contain this site:

Soil Survey Area: Soil Components (Map units in parentheses)

NV779: Podmor (6120, 6138)

Fairfield-Nephi Area (UT608): Parkay (FcF, PeF)

Tooele Area, Utah – Tooele County and Parts of Box Elder, Davis, and Juab Counties (UT611): Broad (48); Podmor (14, 20, 38, 47)

West Millard-Juab Area, Utah, Parts of Millard and Juab Counties (UT617): Broad (64); Podmor (61)

**Table 4. Representative soil features**

Parent material	(1) Colluvium–quartzite (2) Residuum–quartzite
Surface texture	(1) Very cobbly loam (2) Cobbly loam
Drainage class	Well drained
Permeability class	Moderate
Depth to restrictive layer	51–152 cm
Soil depth	51–152 cm
Surface fragment cover ≤3"	11–24%
Surface fragment cover >3"	8–28%
Available water capacity (Depth not specified)	4.57–11.43 cm
Electrical conductivity (Depth not specified)	0–2 mmhos/cm
Soil reaction (1:1 water) (Depth not specified)	6.6–8.4
Subsurface fragment volume ≤3" (Depth not specified)	21–30%
Subsurface fragment volume >3" (Depth not specified)	14–22%

## **Ecological dynamics**

This site is found in the Great Salt Lake Area of the Basin and Range Ecological Province. It developed under the natural ecological conditions found there, including the normal influences of native wildlife herbivory, fire and climate. Mountain big sagebrush and antelope bitterbrush dominate the shrub layer. A mix of other shrubs including snowberry and serviceberry are commonly found. Perennial herbaceous species occurrence and production is directly related to overstory canopy density with bluebunch wheatgrass, Nevada bluegrass and Indian ricegrass found most often. This site can be invaded by annual grasses and forbs, but these species have only been documented with low

cover/production.

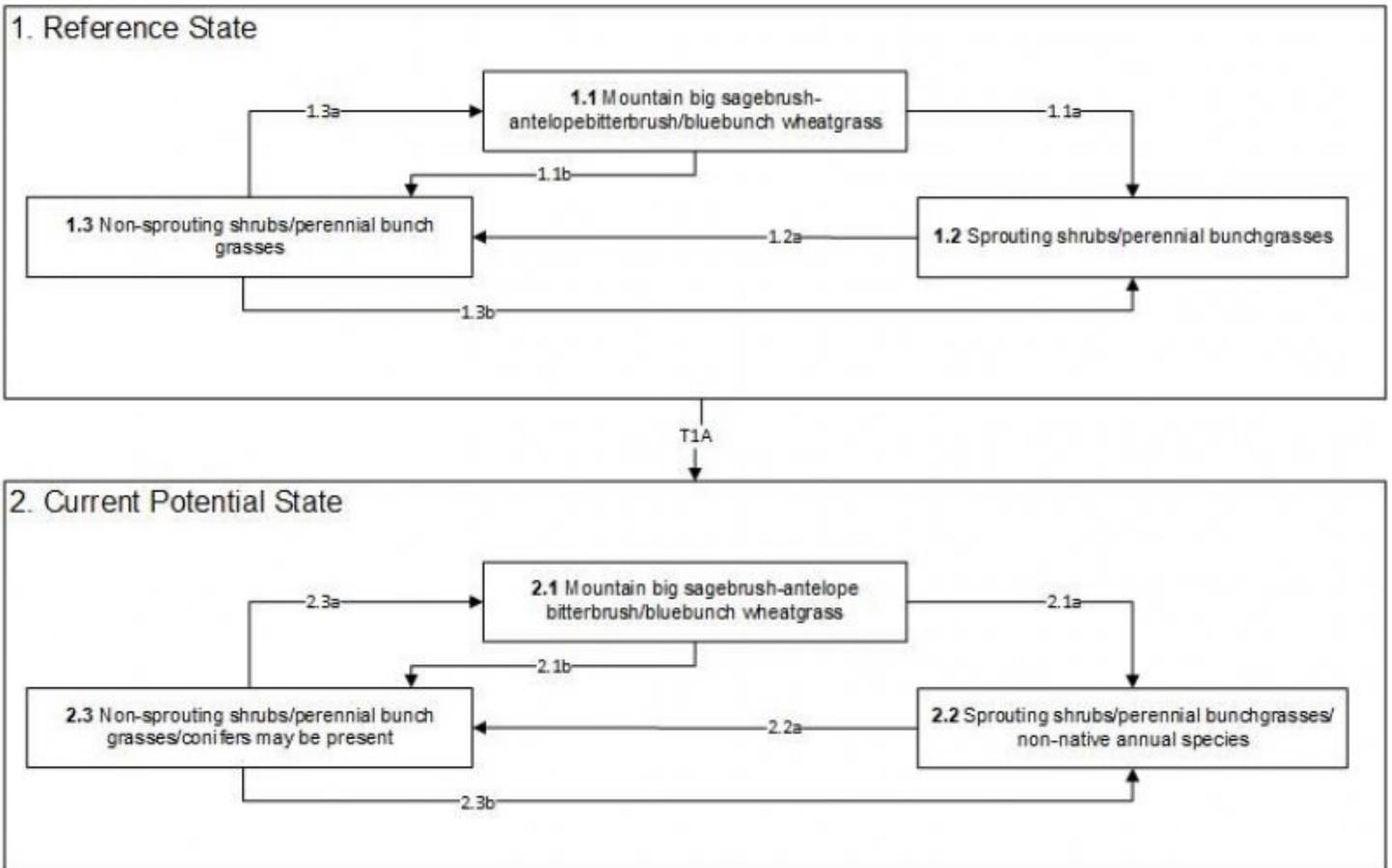
As vegetative communities respond to changes caused by natural or manmade events that cause them to cross ecological thresholds, a return to previous states may not be possible. The amount of effort needed to affect desired vegetative shifts depends on the present biotic and abiotic features and the desired results. This site ranges from moderately to moderately high resilience and resistance to wildfire and subsequent invasive annual grass invasion (Miller et al. 2015).

These plant communities may not represent every possibility, but they are the most prevalent and repeatable plant communities. As more data is collected, some of these plant communities may be revised or removed and new ones may be added. None of these plant communities should necessarily be thought of as the “desired plant community”. According to the USDA NRCS National Range and Pasture Handbook, the desired plant community will be determined by the decision makers and will meet minimum quality criteria established by the NRCS. The main purpose for including any description of a plant community here is to capture the current knowledge and experience at the time of this revision.

Two possible alternative stable states have been hypothesized for this ecological site. The Reference State contains three community phases, shrub/grass dominated, sprouting-shrub dominated, and a non-sprouting shrub dominated phase. The primary drivers in this state are fire, drought, and/or insect or disease. The Current Potential State is like the Reference State; however, non-native species have been introduced in the system which alters the resilience and resistance of the state. Specific community phases and transitions will be described in the narratives below.

## **State and transition model**

Mountain Stony Loam (Antelope bitterbrush)		
See attached descriptions	8/13/2018	R028AA456UT



## State 1 Reference State

This state includes the plant communities that were best adapted to the unique combination of factors associated with the ecological site. It was in a natural dynamic equilibrium with the historic biotic, abiotic, climatic factors on its ecological site in North America at the time of European immigration and settlement. This dominant aspect of the plant community is mountain big sagebrush, antelope bitterbrush, and bluebunch wheatgrass. The community production by dry weight is 50 percent grass 10 percent forbs and 40 percent shrubs.

### Dominant plant species

- antelope bitterbrush (*Purshia tridentata*), shrub
- mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*), shrub
- bluebunch wheatgrass (*Pseudoroegneria spicata*), grass

## **Community 1.1**

### **Mountain big sagebrush-antelope bitterbrush/bluebunch wheatgrass**

This community is dominated by mountain big sagebrush, antelope bitterbrush, and bluebunch wheatgrass. Forbs and other grasses make up smaller components.

## **Community 1.2**

### **Sprouting shrubs/perennial bunchgrasses**

This community phase is characteristic of a post-disturbance, early-seral community. Bluebunch wheatgrass, other perennial bunchgrasses, and sprouting shrubs like rabbitbrush dominate. Depending on fire severity or intensity, patches of intact sagebrush and bitterbrush may remain.

## **Community 1.3**

### **Non-sprouting shrubs/perennial bunchgrasses**

Mountain big sagebrush and bitterbrush begin to increase in the absence of disturbance or with grazing management that favors shrubs. Decadent sagebrush dominates the overstory and the deep-rooted perennial bunchgrasses in the understory are reduced either from competition with shrubs or from grazing management. Utah juniper and/or singleleaf pinyon may be present.

## **Pathway 1.1a**

### **Community 1.1 to 1.2**

Fire will decrease or eliminate the overstory of sagebrush and allow for the perennial bunchgrasses to dominate the site. Fires will typically be low severity resulting in a mosaic pattern due to low fuel loads. A fire following an unusually wet spring may be more severe and reduce sagebrush cover to trace amounts. Coupled with drought conditions, a severe infestation of Aroga moth could also reduce sagebrush within the community, giving a competitive advantage to the perennial grasses and forbs. This phenomenon is more likely at the lower end of the precipitation range.

## **Pathway 1.1b**

### **Community 1.1 to 1.3**

Time and lack of disturbance allows the sagebrush and other shrubs to dominate.

## **Pathway 1.2a**

### **Community 1.2 to 1.3**

Time and lack of disturbance will allow sagebrush and bitterbrush to increase.

## **Pathway 1.3a**

### **Community 1.3 to 1.1**

A low severity fire will reduce the sagebrush overstory and create a sagebrush/grass mosaic. Coupled with drought, Aroga moth infestation may reduce sagebrush dominance and allow recovery of the perennial bunchgrass understory.

## **Pathway 1.3b**

### **Community 1.3 to 1.2**

Fire will decrease or eliminate the overstory of sagebrush and allow for the perennial bunchgrasses to dominate the site. Fires will typically be low severity, resulting in a mosaic pattern due to low fine fuel loads. A fire following an unusually wet spring or a change in management favoring an increase in fine fuels may be more severe and reduce sagebrush cover to trace amounts.

## **State 2**

### **Current Potential State**

This state is like the Reference State 1 with similar community phases. Ecological function has not changed; however, the resiliency of the state has been reduced by the presence of invasive weeds. Non-natives may increase in abundance but will not become dominant within this state. These non-natives can be highly flammable and can promote fire where historically fire had been infrequent. Negative feedbacks enhance ecosystem resilience and contribute to the stability of the state. These feedbacks include the presence of all structural and functional groups, low fine fuel loads, and retention of organic matter and nutrients. Positive feedbacks decrease ecosystem resilience and stability of the state. These include the nonnatives' high seed output, persistent seed bank, rapid growth rate, ability to cross pollinate, and adaptations for seed dispersal. Additionally, the presence of highly flammable, non-native species reduces State resilience because these species can promote fire where historically fire has been infrequent leading to positive feedbacks that further the degradation of the system.

## **Community 2.1**

### **Mountain big sagebrush-antelope bitterbrush/bluebunch wheatgrass**

This community phase is similar to the Reference State Community Phase 1.1, with the presence of non-native species in trace amounts.

## **Community 2.2**

### **Sprouting shrubs/perennial bunchgrasses/non-native annual species**

This community phase is characteristic of a post-disturbance; early seral community where annual non-native species are present. Sagebrush is present in trace amounts;

perennial bunchgrasses dominate the site. Depending on fire severity patches of intact sagebrush may remain. Rabbitbrush may be sprouting. Perennial forbs may be a significant component for several years following fire. Annual non-native species are stable or increasing within the community.

### **Community 2.3**

#### **Non-sprouting shrubs/perennial bunchgrasses/conifers may be present**

Sagebrush and bitterbrush dominate the overstory and perennial bunchgrasses in the understory are reduced from competition with shrubs, inappropriate grazing, or both. Rabbitbrush may be a significant component.

### **Pathway 2.1a**

#### **Community 2.1 to 2.2**

Fire reduces the shrub overstory and allows for perennial bunchgrasses to dominate the site. Fires are typically low severity resulting in a mosaic pattern due to low fuel loads. A fire following an unusually wet spring or a change in management favoring an increase in fine fuels may be more severe and reduce sagebrush cover to trace amounts. Annual non-native species are likely to increase after fire. Aroga moth infestations can also cause mortality of the mountain big sagebrush overstory.

### **Pathway 2.1b**

#### **Community 2.1 to 2.3**

Time and lack of disturbance allows for sagebrush to increase and become decadent. Long term drought reduces fine fuels and leads to a reduced fire frequency, allowing big sagebrush to dominate the site. Inappropriate grazing management reduces the perennial bunchgrass understory.

### **Pathway 2.2a**

#### **Community 2.2 to 2.3**

Time and lack of disturbance and/or grazing management that favors the establishment and growth of sagebrush allows the shrub component to recover. The establishment of big sagebrush can take many years.

### **Pathway 2.3a**

#### **Community 2.3 to 2.1**

A change in grazing management that reduces shrubs will allow for the perennial bunchgrasses in the understory to increase. Heavy late-fall/winter grazing may cause mechanical damage and subsequent death to sagebrush, facilitating an increase in the herbaceous understory. Brush treatments with minimal soil disturbance will also decrease

sagebrush and release the perennial understory. Annual non-native species are present and may increase in this community.

## **Pathway 2.3b**

### **Community 2.3 to 2.2**

Fire reduces or eliminates the overstory of sagebrush and allows for the understory perennial grasses to increase. Fires will typically be low severity resulting in a mosaic pattern due to low fine fuel loads. Following an unusually wet spring or a change in management favoring an increase in fine fuels, a fire may be more severe and reduce the shrub component to trace amounts. Annual non-native species respond well to fire and may increase post-burn.

## **Transition T1A**

### **State 1 to 2**

Trigger: This transition is caused by the introduction of non-native annual plants, such as cheatgrass, mustards, and bur buttercup. Slow variables: Over time the annual non-native species will increase within the community. Threshold: Any amount of introduced non-native species causes an immediate decrease in the resilience of the site. Annual non-native species cannot be easily removed from the system and have the potential to significantly alter disturbance regimes from their historic range of variation.

## **Additional community tables**

### **Other references**

Miller, R.F., J.C. Chambers, M. Pellant. 2015. A field guide for rapid assessment of post-wildfire recovery potential in sagebrush and pinon-juniper ecosystems in the Great Basin: Evaluating resilience to disturbance and resistance to invasive annual grasses and predicting vegetation response. Gen. Tech. Rep. RMRS-GTR-338. Fort Collins, CO:U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, 70p.

### **Contributors**

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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	03/18/2026
Approved by	Kendra Moseley
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

## Indicators

**1. Number and extent of rills:**

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**2. Presence of water flow patterns:**

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**3. Number and height of erosional pedestals or terracettes:**

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**4. Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

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**5. Number of gullies and erosion associated with gullies:**

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**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:**

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