USDA Natural Resources Conservation Service

Ecological site R043BP811MT
Shallow Sagebrush Shrubland Group

Last updated: 3/01/2024
Accessed: 05/02/2024

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): 043B–Central Rocky Mountains

The Central Rocky Mountains (MLRA 43B) of Montana occupy some 28,850 square miles and exist primarily in Central and SW portions of the state. The climate is extremely variable with precipitation lows of 9 to 100 inches per year and frost free days of less than 30 to over 110 days. The geology of the region is also highly variable. The combination of variable climate and geology create a complex relationship of plant communities. MLRA 43B elevations typically exist between 6000 and 12,799ft at Granite Peak (the highest point in Montana).

The Continental Divide runs through this MLRA effectively splitting its watershed to contribute to either the Missouri River to the East and the Columbia River to the West.

Ecological site concept

• Site does not receive any additional water
• Soils are
o Generally not saline or saline-sodic (limited extent)
o Shallow depth (less than 50cm (20 in) to bedrock, lithic, or paralithic root restrictive layer
o Typically less than 5% stone and boulder cover (<15% max)
o Not strongly or violently effervescent within surface mineral 4”
• Soil surface texture ranges from sandy loam to clay loam in surface mineral 4”
• Area of rugged mountain, hills, plateaus, and valleys of the Central Rocky Mountains in Southwest Montana.
• Site Landform: hillslopes, buttes, escarpment
• Moisture Regime: Ustic to Udic
• Temperature Regime: frigid to cryic
• Dominant Cover: rangeland - Sagebrush dominated
• Elevation Range: 4100-10000ft
• Slope: 0-80% (typically less than 45%)

Site Development and Testing Plan
This Provisional Ecological Site Description was developed to meet the criteria as defined in Soil Survey National Instruction part 306 (430-306-NI, April 2015) as interpreted by Regional Ecological Site Specialist. Information in this description are first approximations based on broad groupings of soil properties and vegetation characteristics associated with those groupings. Although this description has been through the quality control and quality assurance review process it has not been certified for use in conservation planning.

Associated sites

EX043B18H036	**Droughty 15-19 inches precipitation zone Cryic Beaverhead Mountains** The Droughty Site of LRU 18 Climate Subset D (15-19

EX043B18I036	**Droughty 19-24 inches precipitation zone Cryic Beaverhead Mountains** The Droughty Site of LRU 18 Climate Subset E (19-24
R043BP810MT	**Shallow Grassland Group** The Shallow Grassland shares landscape position and hydrological processes with the Shallow Sagebrush Shrubland.
R043BP812MT	**Shallow Shrubland Group** The Shallow Shrubland shares landscape position and hydrological processes with the Shallow Sagebrush Shrubland.

Similar sites

EX043B18H038	**Droughty Steep 15-19 inches precipitation zone Cryic Beaverhead Mountains** Droughty Steep Site produces a similar plant community however does not have a root restrictive layer which allows for greater production and a slightly more resilient plant community
EX043B18I038	**Droughty Steep 19-24" PZ Cryic Beaverhead Mountains** Droughty Steep Site produces a similar plant community however does not have a root restrictive layer which allows for greater production and a slightly more resilient plant community
R043BP810MT	**Shallow Grassland Group** The Shallow Grassland shares landscape position and hydrological processes with the Shallow Sagebrush Shrubland. The Shallow Grassland expresses a higher amount of big sagebrush. The Shallow Sagebrush Shrubland shares a State and Transition model
R043BP812MT	**Shallow Shrubland Group** The Shallow Shrubland shares landscape position and hydrological processes with the Shallow Sagebrush Shrubland. The Shallow Shrubland expresses a higher amount of deciduous shrubs. The Shallow Shrubland shares a State and Transition model

Table 1. Dominant plant species

Tree	(1) *Juniperus scopulorum* (2) *Pseudotsuga menziesii*
Shrub	(1) *Artemisia tridentata* (2) *Tetradymia canescens*
Herbaceous	(1) *Pseudoroegneria spicata* (2) *Festuca campestris*

Physiographic features

This ecological site occurs on nearly level to very steep hills, escarpments, and buttes. It often occurs in complex with other ecological sites. This site occurs on most slopes and exposures however typically less than 25 percent slope. Aspect sometimes becomes significant, especially on steep and very steep slopes. Variations in plant community composition and production can result due to aspect. Runoff and potential for water erosion are important features of this site. The amount of rock outcrop tend to increase as slopes increase.

Table 2. Representative physiographic features

Geomorphic position, hills	(1) Crest
Landforms	(1) Mountains > Escarpment (2) Mountains > Butte (3) Mountains > Cuesta (4) Mountains > Ridge
Runoff class	Medium to high
Elevation	4,100–10,000 ft
Slope	2–45%
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

Climate is quite variable on this site but will typically receive between 10 to 30 inches of precipitation with approximately 20 to 100 frost-free days. The climate of this site makes it ideal for a herbaceous dominated system with little or no shrub production.

Table 3. Representative climatic features

Frost-free period (characteristic range)	10-51 days
Freeze-free period (characteristic range)	50-100 days
Precipitation total (characteristic range)	14-20 in
Frost-free period (actual range)	6-63 days
Freeze-free period (actual range)	40-107 days
Precipitation total (actual range)	12-21 in
Frost-free period (average)	34 days
Freeze-free period (average)	80 days
Precipitation total (average)	17 in

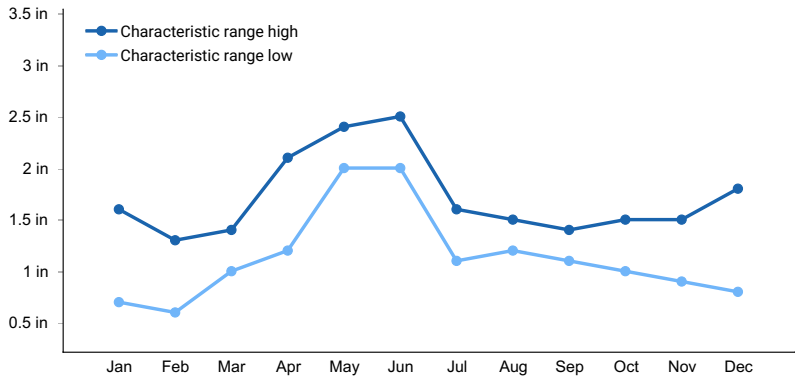


Figure 1. Monthly precipitation range

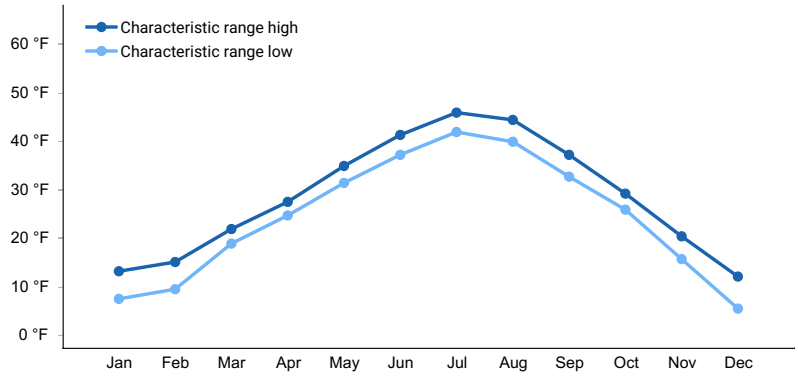


Figure 2. Monthly minimum temperature range

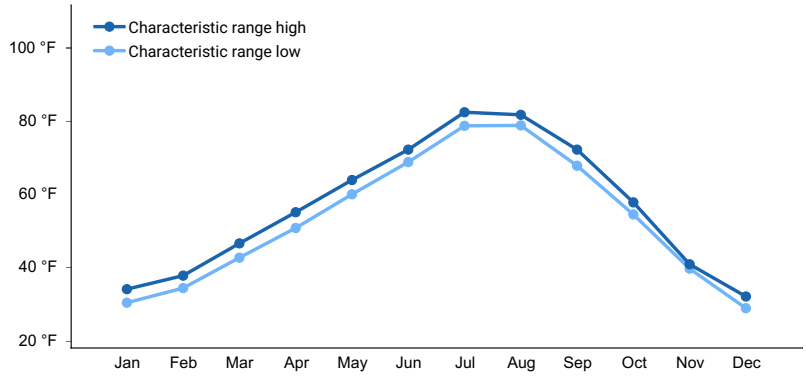


Figure 3. Monthly maximum temperature range

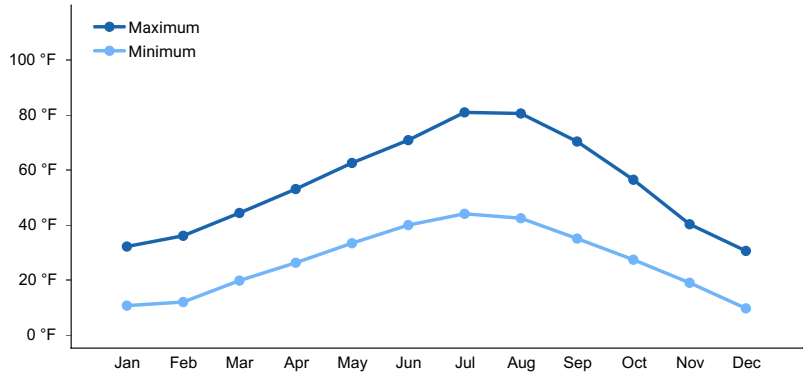


Figure 4. Monthly average minimum and maximum temperature

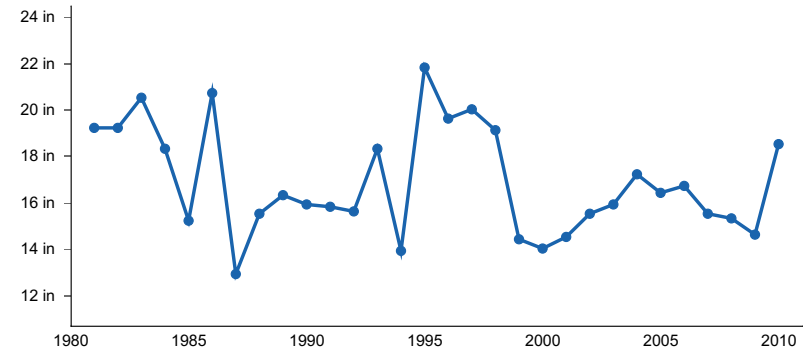


Figure 5. Annual precipitation pattern

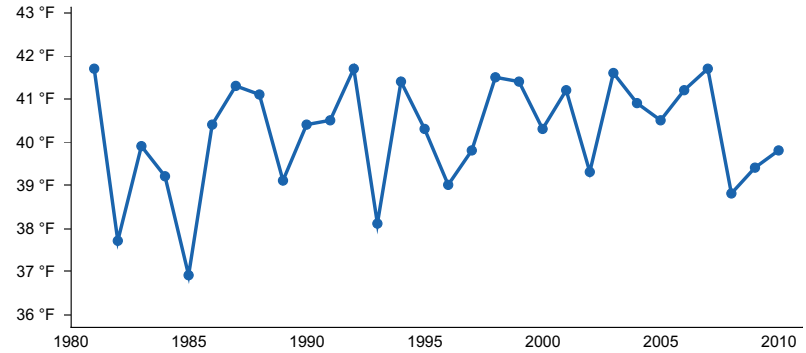


Figure 6. Annual average temperature pattern

Climate stations used

- (1) SEELEY LAKE RS [USC00247448], Bonner, MT
- (2) LINCOLN RS [USC00245040], Lincoln, MT
- (3) BUTTE BERT MOONEY AP [USW00024135], Butte, MT

- (4) YELLOWSTONE PK MAMMOTH [USC00489905], Yellowstone National Park, WY
- (5) NEIHART 8 NNW [USC00246008], Monarch, MT
- (6) GIBBONSVILLE [USC00103554], Gibbonsville, ID
- (7) LAKEVIEW [USC00244820], Lima, MT
- (8) WILSALL 8 ENE [USC00249023], Wilsall, MT
- (9) WISE RIVER 3 WNW [USC00249082], Wise River, MT
- (10) SULA 14 NE [USC00247967], Sula, MT
- (11) SULA 3 ENE [USC00247964], Sula, MT

Influencing water features

Site has root restrictive layer that may affect water infiltration; however, site is considered water limited with a low available water-holding capacity (AWC). Runoff is medium to high.

Wetland description

n/a

Soil features

These soils are shallow, moderate to moderately rapid permeability, and are well to somewhat excessively drained. These soils formed from residuum of mixed origins, primarily from non-calcareous geology. Typically soil surface textures consist of loam, clay loam, and silt loam textures. Soils commonly have a gravelly surface; however, will vary depending on its association with neighboring sites.

Table 4. Representative soil features

Parent material	(1) Residuum–igneous, metamorphic and sedimentary rock
Surface texture	(1) Gravelly loam (2) Silt loam (3) Clay loam
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderate to moderately rapid
Depth to restrictive layer	10–20 in
Soil depth	10–20 in
Surface fragment cover <=3"	0–30%
Surface fragment cover >3"	0–10%
Available water capacity (20in)	0.8–2.9 in
Soil reaction (1:1 water) (0-20in)	6.6–9
Subsurface fragment volume <=3" (10-20in)	0–45%
Subsurface fragment volume >3" (10-20in)	0–22%

Ecological dynamics

1 - Reference State - Bunchgrass
1.1 Mid-statured bunchgrasses dominant plant type. Bluebunch wheatgrass tends to be the most common; however, rough fescue or spike fescue are dominant as mid-statured bunchgrasses above 24 inches of REAP (relative effective annual precipitation). Minor component of forbs growing between short-statured grasses. Forbs will rarely exceed 10 percent composition by weight. Big sagebrush species dominant shrub (Bonneville and mountain big sagebrush subspecies).

1.1a Plant community experiences long-term drought, wildfire (low intensity), untimely grazing event

1.2 Mid-statured bunchgrasses share dominance with short-statured bunchgrasses. Sagebrush increases as well as forbs likely to increase. Limited tree cover may exist where fire has been suppressed for extended periods. Bare ground is expected to increase slightly

1.2a Plant community receives timely moisture and has an opportunity to rest from disturbance
T1A Catastrophic fire (extremely rare), multiple overgrazing events, long-term drought, climate change
T1B Overgrazing, Catastrophic fire, introduction of invasive species

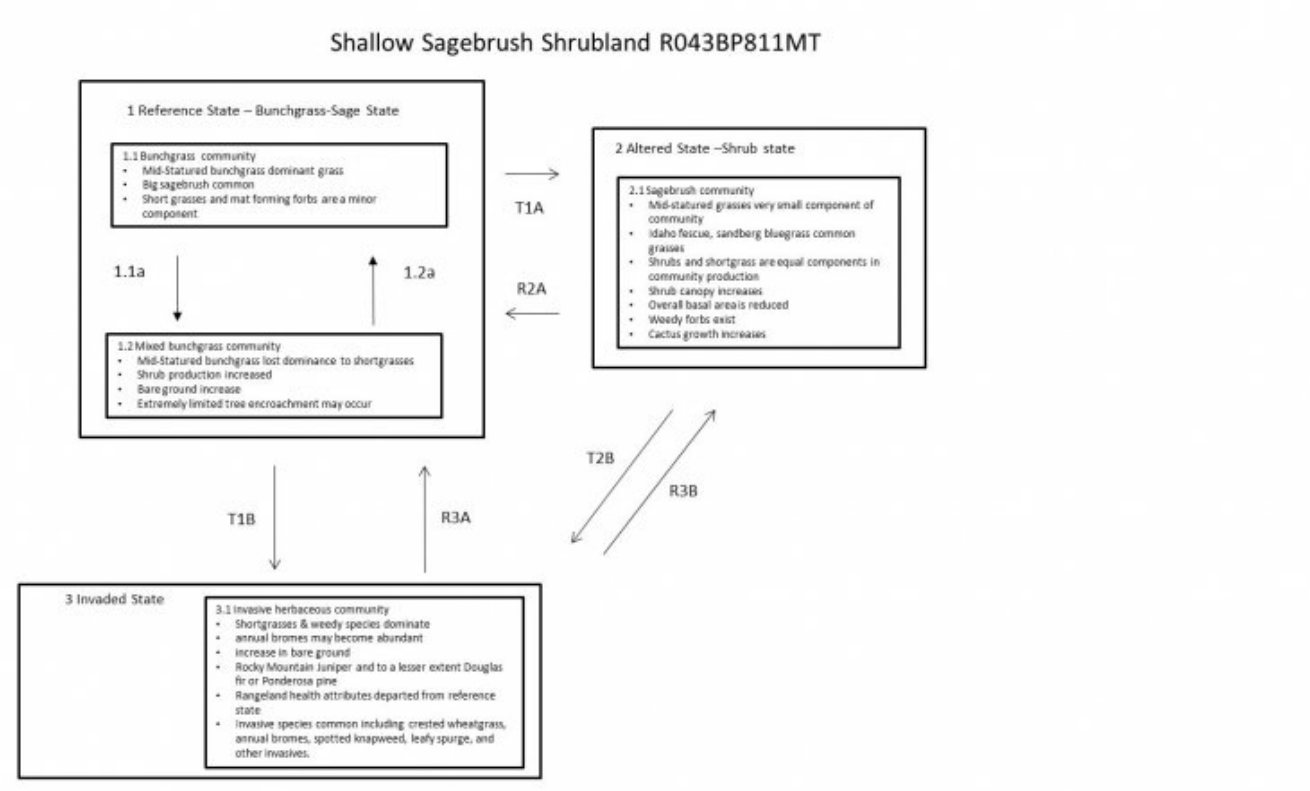
2 - Altered State - Short-statured Grass State
2.1 Short-statured grasses take over dominance with sagebrush and forbs as a subdominant plant groups. Mid-statured bunchgrasses rare. Tree presence likely rare though may include limber pine, Douglas fir, and juniper. Cactus presence increases (in areas of lower precipitation. Shrub canopy increases as larger bunchgrasses are removed.

T2B Overgrazing, Catastrophic fire, introduction of invasive species
R2A Time and timely moisture, proper grazing management, brush management, possibly reseeding

3 - Invaded State
3.1 Site becomes invaded with invasive forbs and grasses. Tree encroachment also occurs particularly where fire has been excluded long-term. Bare ground typically high

R3A Removal of invasive species (if possible), proper grazing management, time
R3B Removal of invasive species (if possible), proper grazing management, time

State and transition model



MLRA 43B Shallow Sagebrush Shrubland R043BP811MT

Legend

- **1.1** Mid-statured bunchgrasses dominant plant type. Bluebunch tends to be the most common however Rough fescue or Spike fescue are dominant as mid-statured bunchgrasses above 24" REAP. Minor component of forbs growing between shortgrasses. Forbs will rarely exceed 10% composition by weight. Big sagebrush species dominant shrub (Bonneville and Mountain big sagebrush subspecies).
- 1.1a Plant community experiences long term drought, wildfire (low intensity), untimely grazing event
- **1.2** Mid-statured bunchgrasses share dominance with short bunchgrasses. Sagebrush increases as well as forbs likely to increase. Limited tree cover may exist where fire has been suppressed for extended periods. Bare ground is expected to increase slightly
- 1.2a Plant community receives timely moisture and has an opportunity to rest from disturbance

- **2.1** Shortgrasses take over dominance with Sagebrush and forbs as a subdominant plant groups. Mid-statured bunchgrasses rare. Tree presence likely rare though may include Limber Pine, Douglas Fir, and Juniper. Cactus presence increases (in areas of lower precip. Shrub canopy increases as larger bunchgrasses are removed.
- T1A Catastrophic fire (extremely rare), multiple overgrazing events, long term drought, climate change
- R1A Time and timely moisture, proper grazing management, brush management, possibly reseeding

- **3.1** Site becomes invaded with invasive forbs and grasses. Tree encroachment also occurs particularly where fire has been excluded long-term. Bare ground typically high
- T1B Overgrazing, Catastrophic fire, introduction of invasive species
- R3A Removal of invasive species (if possible), proper grazing management, time
- T2B Overgrazing, Catastrophic fire, introduction of invasive species
- R3B Removal of invasive species (if possible), proper grazing management, time

Animal community

This site provides wildlife habitat for an array of species. Prior to the settlement of this area, large herds of antelope, elk and bison roamed. Though the bison have been replaced, mostly with domesticated livestock, elk and antelope still frequently utilize this largely intact landscape for winter habitat in areas adjacent to forest. Sites with large quantities of curlleaf mountain mahogany are considered important winter range for mule deer, elk, and moose. In some areas it is considered critical habitat for dwindling wild ungulate populations.

Managed livestock grazing is suitable on this site due to the potential to produce an abundance of high quality forage. This is often a preferred site for grazing by livestock, and animals tend to congregate in these areas. In order to maintain the productivity of the site, grazing on adjoining sites with less production must be managed carefully to be sure utilization on this site is not excessive. Management objectives should include maintenance or improvement of the native plant community. Careful management of timing and duration of grazing is important. Shorter grazing periods and adequate deferment during the growing season are recommended for plant maintenance, health, and recovery. According to McLean et al, early season defoliation of bluebunch wheatgrass can result in high mortality and reduced vigor of plants. They also suggest, based on prior studies, that the opportunity for regrowth is necessary before dormancy to reduce injury to bluebunch wheatgrass.

Since needle and thread normally matures earlier than bluebunch wheatgrass and produces a sharp awn this species is usually avoided after seed set. Changing grazing season of use will help utilize needle and thread more efficiently.

Continual non-prescribed grazing of this site will be injurious, will alter the plant composition and production over time, and will result in transition to the Altered State. Transition to other states will depend on duration of poorly managed grazing as well as other circumstances such as weather conditions and fire frequency.

The Altered State is subject to further degradation to the Degraded Shortgrass State or Invaded State. Management should focus on grazing management strategies that will prevent further degradation, such as seasonal grazing deferment or winter grazing where feasible. Communities within this state are still stable and healthy under proper management. Forage quantity and quality may be substantially decreased from the Reference State.

Grazing is possible in the Invaded State. Invasive species are generally less palatable than native grasses. Forage production is typically greatly reduced in this state. Due to the aggressive nature of invasive species, sites in the

Invaded State face increased risk for further degradation to the Invasive Dominated Communities. Grazing has to be carefully managed to avoid further soil loss and degradation and possible livestock health issues.

Prescriptive grazing can be used to manage invasive species. In some instances, carefully targeted grazing (sometimes in combination with other treatments) can reduce or maintain species composition of invasive species. In the Degraded Shortgrass State, grazing may be possible but is generally not economically or environmentally sustainable.

Hydrological functions

The hydrologic cycle functions best in the Reference State (1) with good infiltration and deep percolation of rainfall; however, the cycle degrades as the vegetation community declines. Rapid rainfall infiltration, high soil organic matter, good soil structure, and good porosity accompany high bunchgrass canopy cover. High ground cover reduces rain drop impact on the soil surface, which keeps erosion and sedimentation transport low. Water leaving the site will have minimal sediment load, which allows for high water quality in associated streams. High rates of infiltration will allow water to move below the rooting zone during periods of heavy rainfall. The Bluebunch Wheatgrass Community (1.1) should have no rills or gullies present and drainage ways should be vegetated and stable. Water flow patterns, if present, will be barely observable. Plant pedestals are essentially non-existent. Plant litter remains in place and is not moved by wind or water.

Improper grazing management results in a community shift to the Mixed Bunchgrass Community (1.2). This plant community has a similar canopy cover, but bare ground will be less than 15 percent. Therefore, the hydrologic cycle is functioning at a level similar to the water cycle in the Bluebunch Wheatgrass Community/Needle and thread (1.1). Compared to the Reference Community (1.1) infiltration rates are slightly reduced and surface runoff is slightly higher.

In the Invaded State (4) canopy and ground cover are greatly reduced compared to the Reference State (1), which impedes the hydrologic cycle. Infiltration will decrease and runoff will increase due to reduced ground cover, presence of shallow-rooted species, rainfall splash, soil capping, reduced organic matter, and poor structure. Sparse ground cover and decreased infiltration can combine to increase frequency and severity of flooding within a watershed. Soil erosion is accelerated, quality of surface runoff is poor, and sedimentation increases.

Recreational uses

This site is often utilized for photography, hiking, hunting, bird watching, and flower collecting.

Inventory data references

Information presented was derived from NRCS inventory data, literature, field observations, and personal contacts with range-trained personnel (i.e., used professional opinion of agency specialists, observations of land managers, and outside scientists).

Other references

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Contributors

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Approval

Kirt Walstad, 3/01/2024

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	05/02/2024
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:

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:**