Ecological site R043BP805MT
Limy Sagebrush Shrubland Group

Last updated: 3/01/2024
Accessed: 05/17/2024

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

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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 Moderately deep, deep, or very deep
o Typically less than 5% stone and boulder cover (<15% max)
o Strongly or violently effervescent within soil surface mineral 4”; calcium carbonates increase with depth
• 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.
• Moisture Regime: aridic ustic to typic ustic
• Temperature Regime: frigid to cryic
• Dominant Cover: rangeland - Sagebrush dominated
• Elevation Range: 3800-9550ft (Representative Value 4500-7000ft)
• Slope Range: 2-60% (typically less than 15%)

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

R043BP804MT	**Limy Grassland Group** Limy Grassland is often immediately adjacent to and intermixed with the Limy Sagebrush Shrubland site as a complex. These sites share landscape position, hydrological processes, and often have the same soil components.
R043BP810MT	**Shallow Grassland Group** Shallow Grassland is often located higher on the landscape; positioned on the shoulders of nearby hills. The Shallow Grassland has root restrictive layers (such as lithic and paralithic contact) at less than 20 inches below the soil surface.
R043BP811MT	**Shallow Sagebrush Shrubland Group** Shallow Sagebrush Shrubland is often located higher on the landscape; positioned on the shoulders of nearby hills. The Shallow Sagebrush Shrubland has root restrictive layers (such as lithic and paralithic contact) at less than 20 inches below the soil surface.

Similar sites

R043BP804MT	**Limy Grassland Group** Limy Grassland is often intermixed with the Limy Sagebrush Shrubland site on a landscape level. These two sites share similar plant community species and have similar State and Transition Models. The Limy Sagebrush Shrubland will typically express a slightly lower overall production value
R043BP810MT	**Shallow Grassland Group** Shallow Grassland has a root restrictive layer less than 20 inches below soil surface. It shares similar plant community species and has similar State and Transition Models with the Limy Grassland. The Shallow Grassland will typically express lower overall production values.
R043BP811MT	**Shallow Sagebrush Shrubland Group** Shallow Sagebrush Shrubland has a root restrictive layer less than 20 inches below soil surface. It shares similar plant community species and has similar State and Transition Models with the Limy Grassland. The Shallow Sagebrush Shrubland will typically express lower overall production values.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia tridentata*
Herbaceous	(1) *Pseudoroegneria spicata* (2) *Hesperostipa comata*

Physiographic features

This ecological site occurs on slopes ranging from nearly level to 45 percent; however, the core concept of this ecological site is 4 to 15 percent slopes. Site exists on fan remnants, hillslopes, and mountain slopes.

Table 2. Representative physiographic features

Landforms	(1) Mountains > Hillslope (2) Mountains > Fan remnant (3) Mountains > Mountain slope
Runoff class	Low to medium
Flooding frequency	None
Ponding frequency	None
Elevation	1,158–2,377 m
Slope	0–45%
Water table depth	254 cm
Aspect	Aspect is not a significant factor

Climatic features

The climate of this site is variable and receives 10 to 30 inches of precipitation with 50 to 130 frost-free days.

Table 3. Representative climatic features

Frost-free period (characteristic range)	20-102 days
Freeze-free period (characteristic range)	52-135 days
Precipitation total (characteristic range)	305-508 mm
Frost-free period (actual range)	8-114 days
Freeze-free period (actual range)	37-144 days
Precipitation total (actual range)	305-508 mm
Frost-free period (average)	61 days
Freeze-free period (average)	96 days
Precipitation total (average)	406 mm

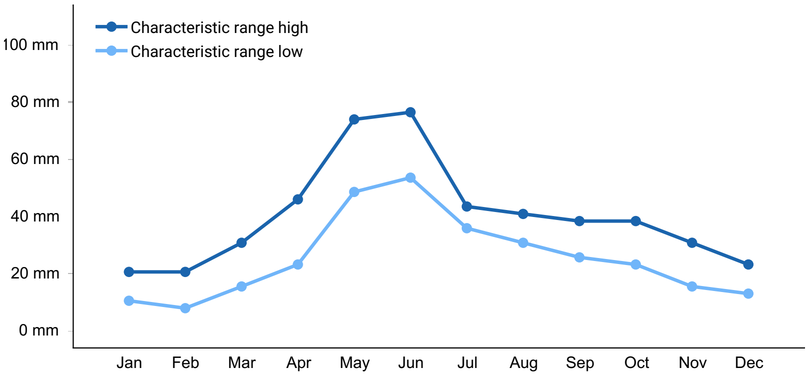


Figure 1. Monthly precipitation range

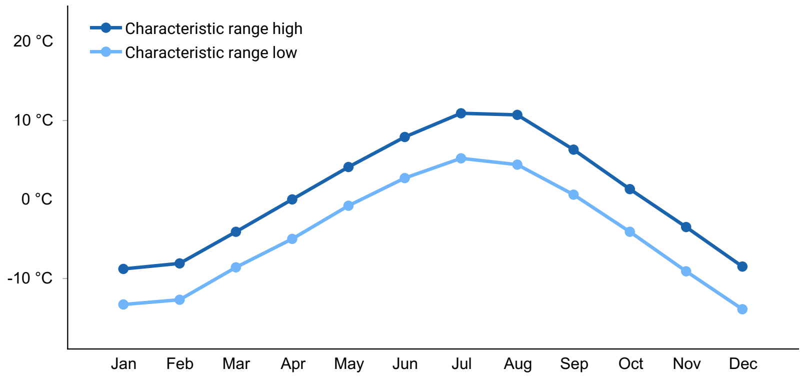


Figure 2. Monthly minimum temperature range

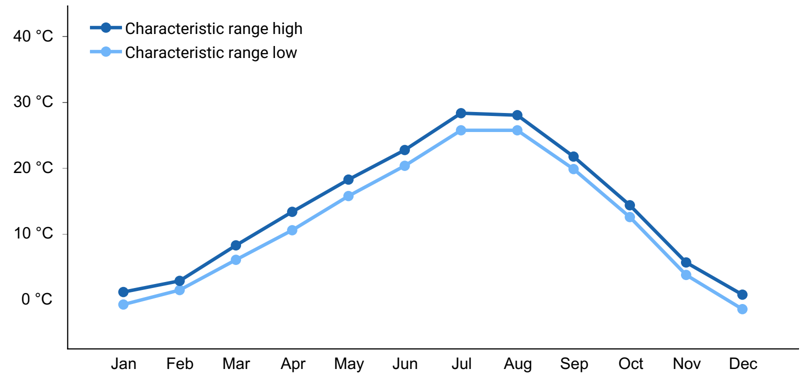


Figure 3. Monthly maximum temperature range

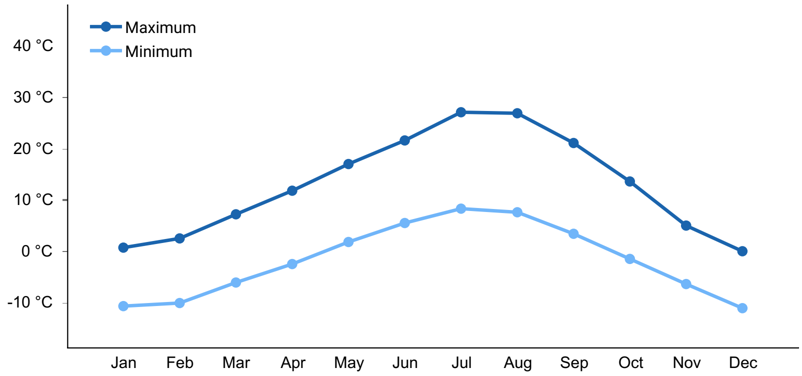


Figure 4. Monthly average minimum and maximum temperature

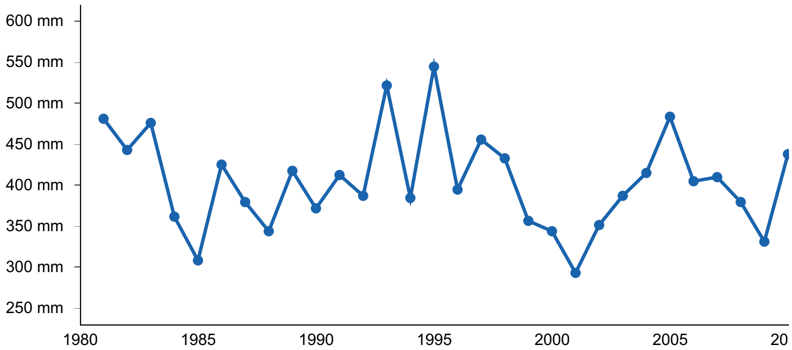


Figure 5. Annual precipitation pattern

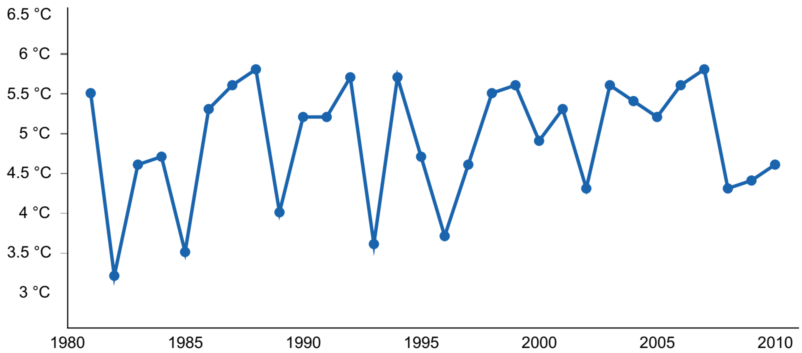


Figure 6. Annual average temperature pattern

Climate stations used

- (1) CANYON FERRY DAM [USC00241470], Helena, MT
- (2) NORRIS MADISON PH [USC00246157], Ennis, MT
- (3) DIVIDE [USC00242421], Wise River, MT

- (4) WISE RIVER 3 WNW [USC00249082], Wise River, MT
- (5) BIG SKY 2WNW [USC00240775], Gallatin Gateway, MT
- (6) WILSALL 8 ENE [USC00249023], Wilsall, MT
- (7) AUSTIN 1 W [USC00240375], Helena, MT

Influencing water features

n/a

Wetland description

n/a

Soil features

Soils of this site are moderately deep to deep and are strong or violently effervescent within 4 inches of the mineral soil surface. Typically calcium carbonates increase with depth. Soil textures vary from sandy loam to clay loam. Parent material is alluvium, slope alluvium and colluvium. Site typically exists on calcareous sedimentary rock.

Table 4. Representative soil features

Parent material	(1) Alluvium–sedimentary rock (2) Colluvium–sedimentary rock (3) Slope alluvium–sedimentary rock
Surface texture	(1) Sandy loam (2) Loam (3) Clay loam
Drainage class	Well drained to moderately well drained
Permeability class	Moderate to moderately rapid
Depth to restrictive layer	51–381 cm
Soil depth	51–381 cm
Surface fragment cover <=3"	0–30%
Surface fragment cover >3"	0–10%
Available water capacity (0-101.6cm)	13.97–17.02 cm
Calcium carbonate equivalent (0-50.8cm)	15%
Soil reaction (1:1 water) (0-101.6cm)	7.9–8.4
Subsurface fragment volume <=3" (25.4-50.8cm)	0–35%
Subsurface fragment volume >3" (25.4-50.8cm)	0–15%

Ecological dynamics

1 - Reference State - Shrub Bunchgrass State
1.1 Mid-statured bunchgrasses dominant plant type. Bluebunch wheatgrass tends to be the most common; however, rough fescue or spike fescue are possible as mid-statured bunchgrasses. Minor component of forbs growing between short-stature grasses. Forbs will rarely exceed 10 percent composition by weight. Big sagebrush species dominant shrub (Wyoming, Bonneville, and Mountain big sagebrush subspecies may be present).

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
T1A Catastrophic fire (extremely rare), multiple overgrazing events, long term drought, climate change
T1B Overgrazing, Catastrophic fire, introduction of invasive species

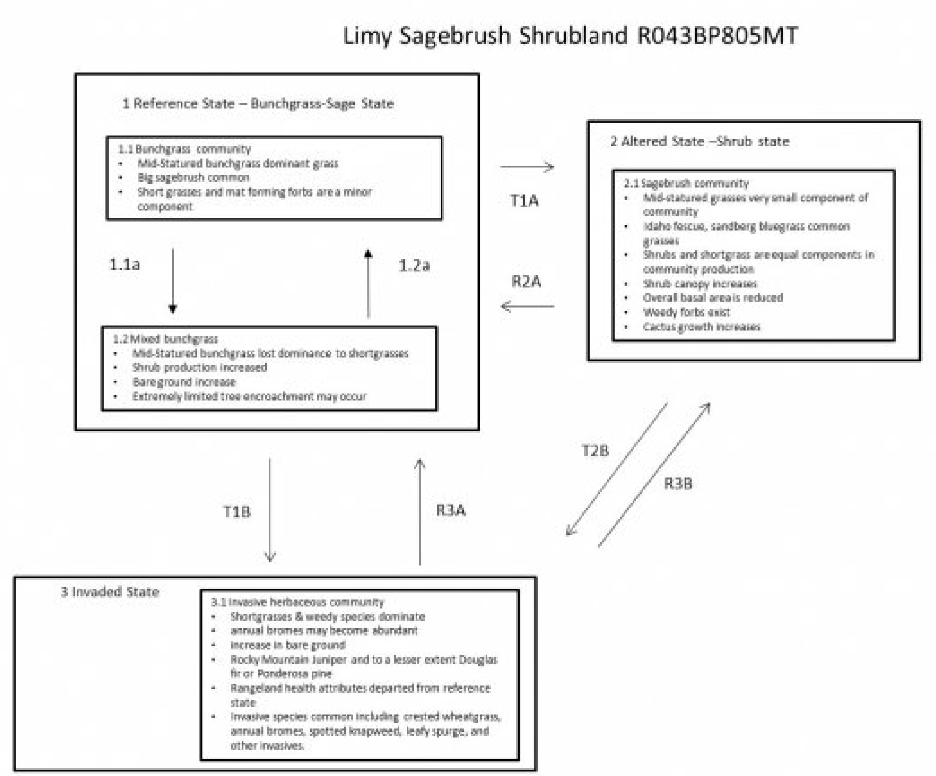
2 - Altered State - Shrub State
2.1 Short-statured grasses take over dominance with Sagebrush and forbs as a subdominant plant groups. Mid-statured bunchgrasses rare. Tree presence likely rare though may include Rocky Mountain juniper, Douglas fir, and ponderosa pine. Cactus presence increases. Shrub canopy increases as larger bunchgrasses are removed.

R1A Time and timely moisture, proper grazing management, brush management, possibly reseeding
T2B Overgrazing, Catastrophic fire, introduction of invasive species

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 Limy Sagebrush Shrubland R043BP805MT

Legend

- **1.1** Mid-statured bunchgrasses dominant plant type. Bluebunch tends to be the most common however Rough fescue or Spike fescue are possible as mid-statured bunchgrasses. Minor component of forbs growing between shortgrasses. Forbs will rarely exceed 10% composition by weight. Big sagebrush species dominant shrub (Wyoming, Bonneville, and Mountain big sagebrush subspecies may be present).
- 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 Rocky Mtn Juniper, Douglas Fir, and/or Ponderosa Pine. Cactus presence increases. 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 longterm. 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

The Limy Sagebrush Shrubland ecological site grouping provides for a variety of 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.

The relatively high grass component of the Reference Community provides excellent nesting cover for multiple neotropical migratory birds that select for open grasslands such as the Long-billed curlew and McCown’s longspur.

Greater sage grouse may be present on sites with suitable habitat, typically requiring a minimum of 15 percent sagebrush canopy cover (Wallestad 1975). The Bunchgrass Community (1.1) is likely to have minimal sage grouse present given its low sagebrush canopy cover. However, the potentially diverse forb component of the Reference State may provide important early season (spring) foraging habitat for the Greater sage grouse. Other communities on the site with sufficient sagebrush cover may harbor sage grouse populations specifically Community 2.1 where big sagebrush populations are under a reduced fire regime. Also as sagebrush canopy cover increases under Altered State (2), Pygmy rabbit, Brewer’s sparrow, and Mule deer use may also increase.

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. To maintain the productivity of the Limy 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 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 while preventing overuse of bluebunch wheatgrass.

Grazing season has more influence on winterfat than grazing intensity. Late winter or early spring grazing is detrimental. However, early winter grazing may actually be beneficial (Blaisdell 1984).

Continual non-prescribed grazing of this site will be detrimental, 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 Short-statured grass 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 Bunchgrass 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 (Thurow et al 1986). 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 like the water cycle in the Bluebunch Wheatgrass Community/Needle and thread (1.1). When the Mixed Bunchgrass Community (1.2) is compared to the Reference Community (1.1) infiltration rates are slightly reduced and surface runoff is slightly higher.

In the Altered Community and Invaded State (3) canopy and ground cover are greatly reduced compared to the Bunchgrass 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. (McCalla et al 1984)

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 Bluebunch Wheatgrass/Needle and thread Community (1.1) infiltration rates are slightly reduced and surface runoff is slightly higher.

In the Altered Community (2) and the Invaded State (3) canopy and ground cover are greatly reduced compared to the Bunchgrass 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 provides some limited recreational opportunities for hiking, horseback riding, big game and upland bird hunting. Some forbs have flowers that appeal to photographers. This site provides valuable open space.

Wood products

This site does not offer opportunity for wood products industry

Inventory data references

Site data sources from National Resources Inventory (NRI), BLM AIM, Field observations by NRCS, and professional knowledge/expertise by agency employees and partners.

Other references

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Contributors

Petersen, Grant

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	05/17/2024
Approved by	Kirt Walstad
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):

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:**