USDA Natural Resources
Conservation Service

Ecological site BX013X01B063
Shallow Loamy Calcareous Bear River Valley 10-14" P.Z.

Last updated: 9/07/2023
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): 013X–Eastern Idaho Plateaus

Major Land Resource Area (MLRA) 13, Eastern Idaho Plateaus, consists of approximately 5 million acres in Idaho with a small part in Utah and Wyoming, it consists of 6 Land Resource Units (LRU). These units are divisions of the MLRA based on geology, landscape, common soils, water resources and plant community potentials. The elevation ranges from approximately 4500 to 6600 feet (1370 to 2010 m) on the plateaus and foothills to as much as 9500 feet (2895 m) on the mountains. Annual precipitation ranges from 10 to 48 inches (254 to 1220 mm), with the driest areas in the Bear River Valley on the far eastern portion and the wettest areas on the mountain summits. The Fort Hall Indian Reservation and several national forests are in this MLRA, including the Caribou, Cache, and Targhee National Forests. Yellowstone and Grand Teton National Parks occur just outside the northeast boundary.

LRU notes

The Bear River Valley LRU is located on the far eastern side of MLRA 13 between the Bear River Divide and the Monte Cristo Range, from Woodruff, Utah at the southern end to Cokeville, Wyoming at the northern end. The total area of the LRU is approximately 340,000 acres. It shares a boundary with MLRA 47 - Wasatch and Uinta Mountains, 43B - Central Rocky Mountains and 46 - Northern Rocky Mountain Foothills (proposed in Wyoming). This LRU differs from the others in its geology, which is comprised mostly of alluvium and colluvium from the Stump Formation. Its weather patterns are such that the soil moisture regime is xeric, meaning there is a slight peak in winter precipitation in this LRU, with typical yearly precipitation between 10 to 15 inches (254 to 380 mm). The soil temperature regime of this LRU is frigid with mean annual soil temperatures ranging from 44 to 48 degrees Fahrenheit (6.7 to 8.8 C). The elevation range is from 5700 to 7000 feet (1730 to 2130 m). The soils in the Bear River Valley are dominated by young aged very deep soils developed from sandstone and shale parent material re-worked with recent alluvium. Soils are dominated by Alfisols with young argillic horizons and by Fluvents in more recent alluvium.
The Bear River runs through this LRU, allowing for ample amounts of irrigation water used in the lowland areas to produce hay with smaller tributaries originating from the neighboring mountains.

Classification relationships

Relationship to Other Established Classification Systems
National Vegetation Classification System (NVC):
3 Semi-Desert
3.B.1 Cool Semi-Desert Scrub & Grassland Formation
3.B.1.Ne Western North American Cool Semi-Desert Scrub & Grassland Division
M170 Great Basin-Intermountain Dwarf Sagebrush Steppe & Shrubland Macrogroup
G308 Intermountain Low & Black Sagebrush Steppe and Shrubland Group
A3222 Black Sagebrush Steppe & Shrubland Alliance
CEGL001424 *Artemisia nova*/Pseudoroegnaria spicata Shrubland Association

Ecoregions (EPA):
Level I: 10 North American Deserts
Level II: 10.1 Cold Deserts
Level III: 10.1.4 Wyoming Basin

Ecological site concept

Shallow Loamy Calcareous Bear River Valley10-14" P.Z. (SwLyc-BRV) is an upland ecological site with gravelly or very gravelly variable surface textures in the top 6 inches that is limited by lithic contact or high amounts of rock fragments within 20 inches (50 cm) and high Calcium Carbonate Equivalent (CCE >15%) OR CCE <15% with secondary carbonates on all sides of rock fragments within 6-20 inches (15-50 cm) and very low water holding capacity (shallow or moderately deep and skeletal with <4" AWC).
• This site not does receive any additional water
• These soils are:
o not saline or sodic
o shallow, 10-20 inches (25-50 cm) or moderately deep and skeletal within 20 inches (50 cm) of the soil surface (> 35% rock fragments by volume)
o violently effervescent (>15% CCE) in the subsurface within 6-10 inches (15-25 cm) of the surface OR they are strongly effervescent with secondary carbonates on all sides of rock fragments
o with surface textures including gravelly and very gravelly sandy loam, loam, or sandy clay loam in top 6 inches (15 cm) of mineral soil
• have slopes that range from 5-35 percent
• have clay content less than 32 percent in top 6 inches (15 cm) of mineral soil

Climate:
xeric moisture regime
frigid temperature regime

Associated sites

BX013X01B022	**Loamy Bear River Valley 10-14" P.Z.** This site has similar surface textures, but is moderately deep to very deep and lacks the amounts of rock fragments and violent effervescence within the top 10 inches of the surface. Production and species composition potential are very different.
BX013X01B012	**Gravelly Bear River Valley 10-14" P.Z.** This site has similar surface textures and rock fragments, but lacks the violent effervescence within the top 10 inches of the surface. Rock fragments on this site are typically high at the surface and either stay similar or decrease with depth. Production and species composition potential are different.
BX013X01B062	**Shallow Loamy Bear River Valley 10-14" P.Z.** This site has similar surface textures and rock fragments, but lacks violent effervescence within the top 10 inches of the surface. Production and species composition potential are different.

Similar sites

R034AY263WY	**Shallow Loamy Calcareous Foothills and Basins West (SwLyCa)** Previous version of this site used in Wyoming
R034AA205UT	**Semi-desert Stony Loam (Black sagebrush)** Previous version of this site used in Utah

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia nova*
Herbaceous	(1) *Pseudoroegneria spicata*

Legacy ID

R013XA163WY

Physiographic features

This site occurs on hillslope and fan remnant landforms at elevations between 5,700 and 7,000 feet. This site occurs on all aspects. The slopes range from 5 to 35 percent. Runoff is low to medium and flooding and ponding do not occur on this site.

Landscape Definition:
hills -- A landscape dominated by hills and associated valleys.

valley -- An elongate, relatively large, externally drained depression of the Earth's surface that is primarily developed by stream erosion or glacial activity.

Landform Definition:
hillslope -- A generic term for the steeper part of a hill between its summit and the drainage line, valley flat, or depression floor at the base of the hill.

fan remnant -- A general term for landforms that are the remaining parts of older, non-active fan- landforms, such as alluvial fans, fan aprons, inset fans, and fan skirts, that either have been dissected (erosional fan-remnants) or partially buried (non-buried fan-remnants). An erosional fan remnant must retain a relatively flat summit that is a relict fan-surface (greater than 50 percent intact). A non-buried fan-remnant is a relict surface in its entirety. Similar terms are eroded fan remnant, eroded fan remnant sideslope, ballena.

Table 2. Representative physiographic features

Landforms	(1) Hills > Hillslope (2) Valley > Fan remnant
Runoff class	Low to medium
Flooding frequency	None
Ponding frequency	None
Elevation	1,737–2,134 m
Slope	5–35%
Aspect	Aspect is not a significant factor

Climatic features

Annual precipitation in the Bear River Valley ranges from 10 to 14 inches per year. Wide fluctuations may occur in yearly precipitation and result in more below average years than those with above average precipitation. Temperatures show a wide range between summer and winter and between daily maximums and minimums. This is predominantly due to the high elevation and dry air, which permits rapid incoming and outgoing radiation. Cold air outbreaks in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Roughly 25 to 30 percent of the precipitation occurs during the critical growth period, but the majority of precipitation accumulates outside the growing season, creating xeric-like conditions. The wettest rainfall month is May. The dominant plants (sagebrush and cool season grasses) are well adapted to these conditions. Daytime winds are generally stronger than nighttime and occasional strong storms may bring brief periods of high winds with gusts to more than 50 mph. The growing season is short (60 to 90 days) and cool (critical growth period): primary growth typically occurs between May and June. Growth of native cool-season plants begins about mid-April and continues to approximately early July. Some green-up of cool-season plants usually occurs in September with adequate fall moisture.

All data is based on the 30 year average from 1981 through 2010.

Table 3. Representative climatic features

Frost-free period (characteristic range)	40-90 days
Freeze-free period (characteristic range)	50-110 days
Precipitation total (characteristic range)	254-356 mm
Frost-free period (actual range)	35-90 days
Freeze-free period (actual range)	30-110 days
Precipitation total (actual range)	203-406 mm
Frost-free period (average)	60 days
Freeze-free period (average)	80 days
Precipitation total (average)	305 mm

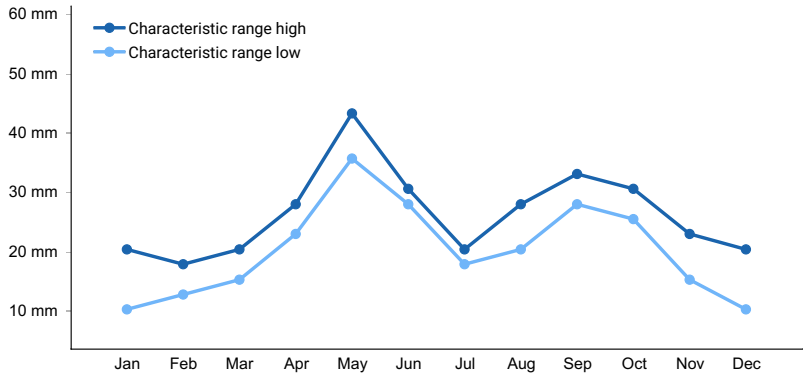


Figure 1. Monthly precipitation range

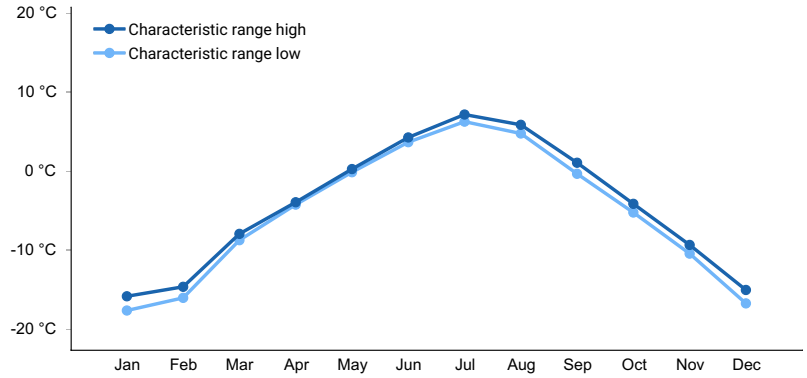


Figure 2. Monthly minimum temperature range

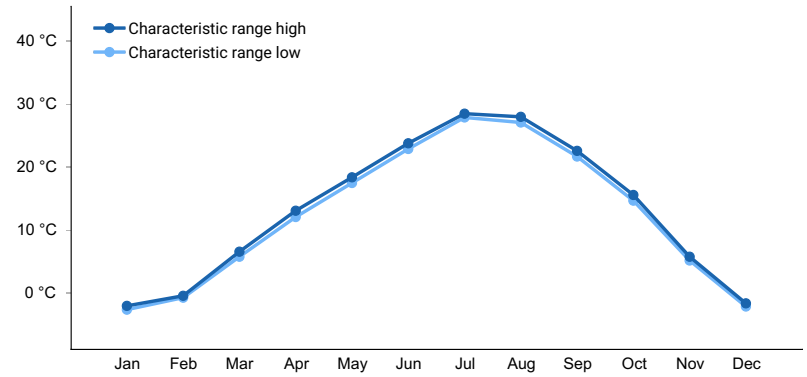


Figure 3. Monthly maximum temperature range

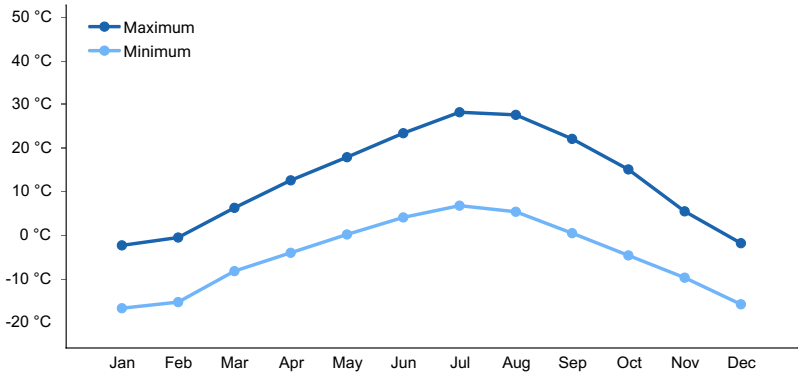


Figure 4. Monthly average minimum and maximum temperature

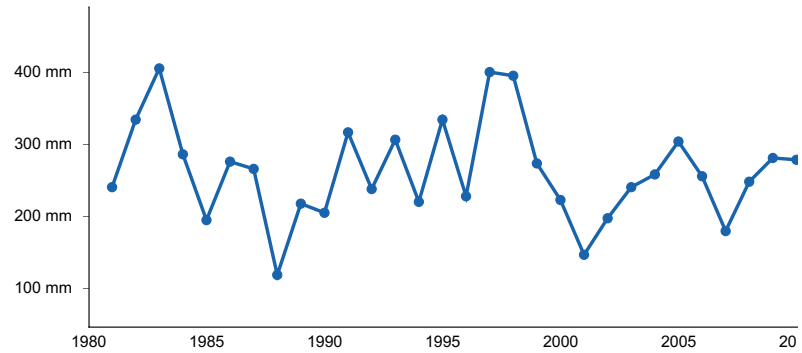


Figure 5. Annual precipitation pattern

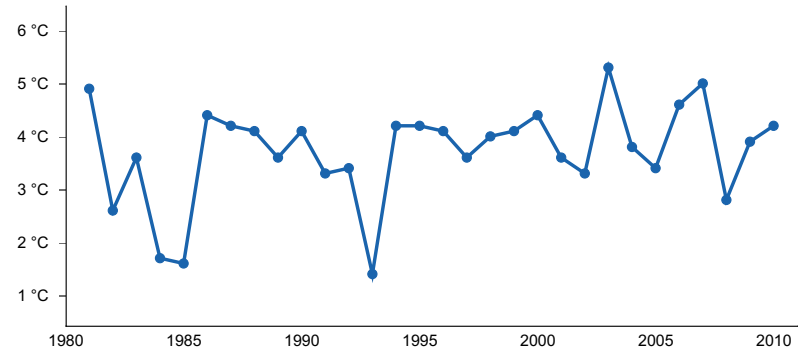


Figure 6. Annual average temperature pattern

Climate stations used

- (1) WOODRUFF [USC00429595], Woodruff, UT
- (2) RANDOLPH [USC00427165], Randolph, UT
- (3) SAGE 4 NNW [USC00487955], Cokeville, WY

Influencing water features

There are no influencing water features associated with this ecological site.

Wetland description

N/A

Soil features

The soils of this site are shallow (10 to 20 inches) or moderately deep (20 to 40 inches) and skeletal (greater than 35 percent rock fragment by volume) and formed in slope alluvium and colluvium derived from limestone and sandstone. Surface textures are typically gravelly or very gravelly sandy loam or loam, but also includes sandy clay

loam and clay loam (less than 32 percent clay). Soils are violently effervescent with high Calcium Carbonate Equivalent (CCE >15%) OR CCE less than 15 percent with secondary carbonates on all sides of rock fragments within 6 to 20 inches (15 to 50 cm). Rock fragments are commonly found on the soil surface and/or in the profile and make up 35 to 55 percent of the soil volume. These soils are well-drained and have moderately slow to moderate permeability.
The soil moisture regime is xeric and the soil temperature regime is frigid.

Major Soil Series correlated to this site include: Beazy, Chausse, Crossley

Representative Taxonomy: Coarse-loamy, mixed, superactive, frigid Typic Calcixerepts; Loamy-skeletal, mixed, superactive, frigid Calcic Haploxeralfs; Loamy-skeletal, mixed, superactive, frigid Typic Calcixerepts; and Loamy-skeletal, mixed, superactive, frigid Lithic Calcixerepts

Table 4. Representative soil features

Parent material	(1) Slope alluvium–limestone and sandstone (2) Colluvium–calcareous sandstone
Surface texture	(1) Gravelly, very gravelly loam (2) Gravelly, very gravelly loamGravelly, very gravelly sandy loam (3) Sandy clay loam
Drainage class	Well drained
Permeability class	Moderately slow to moderate
Depth to restrictive layer	25–51 cm
Soil depth	25–51 cm
Surface fragment cover <=3"	15–30%
Surface fragment cover >3"	0–15%
Available water capacity (0-101.6cm)	5.08–8.89 cm
Calcium carbonate equivalent (15.2-50.8cm)	15–40%
Clay content (0-15.2cm)	18–32%
Electrical conductivity (0-50.8cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-50.8cm)	0–3
Soil reaction (1:1 water) (0-50.8cm)	7.5–8
Subsurface fragment volume <=3" (25.4-50.8cm)	30–40%
Subsurface fragment volume >3" (25.4-50.8cm)	5–20%

Ecological dynamics

A State-and-Transition Model (STM) diagram is depicted in this section. Thorough descriptions of each state, transition, plant community phase, and pathway are found after the model in this document. This diagram is based on available experimental research, field observations, professional consensus, and interpretations. While based on the best available information, the STM will change over time as knowledge of ecological processes increases.

Plant community composition within the same ecological site has a natural range of variability across the LRU due to the naturally occurring variability in weather, soils, and aspect. Not all managers will choose the Reference Plant Community as the management goal. Other plant communities may be desired to meet land management

objectives. This is valid as long as the rangeland health attributes assessment departures are none to slight or slight to moderate from the Reference State. The biological processes on this site are complex; therefore, representative values are presented in a land management context. The species lists are representative and are not botanical descriptions of all species occurring, or potentially occurring, on this site. They are not intended to cover every situation or the full range of conditions, species, and responses for the site.

Both percent species composition by weight and percent cover are used in this ESD. Most observers find it easier to visualize or estimate percent cover for woody species (trees and shrubs). Foliar cover is used to define plant community phases and states in the State-and-Transition Model. Cover drives the transitions between communities and states because of the influence of shade and interception of rainfall.

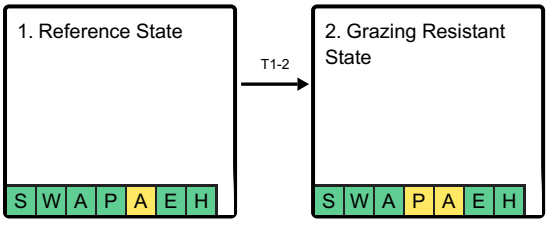
Species composition by dry weight remains an important descriptor of the herbaceous community and of site productivity as a whole and includes both herbaceous and woody species. Calculating similarity index requires data on species composition by dry weight.

Although there is considerable qualitative experience supporting the pathways and transitions within the State-and-Transition Model, no quantitative information exists that specifically identifies threshold parameters between reference states and degraded states in this ecological site. For information on STMs, see the following citations: Bestelmeyer et.al. 2003, Bestelmeyer et.al. 2004, Bestelmeyer et.al. 2010, Bestelmeyer and Brown 2005, Briske et.al. 2008, and Stringham et,al. 2003.

A resource concern risk assessment and dominant resource concerns are provided for each Land Use, State, and/or Plant Community Phase based on NRCS resource concern and planning criteria used to determine resource treatment levels during the conservation planning process. A resource concern is the resource condition that does not meet the minimum accepted levels established by planning criteria as shown in Section III of the NRCS Field Office Technical Guide (https://efotg.sc.egov.usda.gov/#/).
• Low risk means a low probability for the category of resource concerns and additional assessment is typically not necessary.
• Medium risk means that the category of resource concerns could occur, and additional assessment is recommended if the identified resource is a client concern and/or objective.
• High risk means that a resource concern in that category is likely to occur.
The resource categories are: S (soil), W (water), A (air), P (plant), A (animal), E (energy), and H (human). The dominant resource concerns further refine the resource category to a specific resource concern within that category.

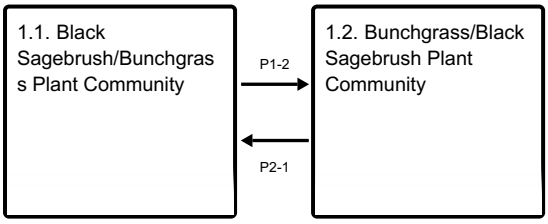
State and transition model

Ecosystem states



T1-2 - Herbivory (continuous or season-long, low to moderate stocking)

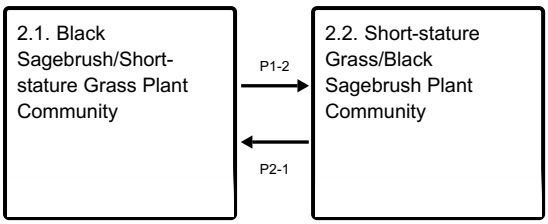
State 1 submodel, plant communities



P1-2 - Sage-thinning event (drought, prolonged soil saturation, freeze-kill, snow mold, herbivory)

P2-1 - Natural Succession

State 2 submodel, plant communities



P1-2 - Sage-killing event (herbivory, drought, prolonged soil saturation, freeze-kill, snow mold)

P2-1 - Natural Succession

State 1
Reference State

The Reference State consists of two plant communities: the Black Sagebrush/Bunchgrass Plant Community (1.1.1) and the Bunchgrass/Black Sagebrush Plant Community (1.1.2). Each plant community differs in percent composition and foliar cover of bunchgrasses and black sagebrush (*Artemisia nova*) as the dominant shrub. Forbs are a minor component. Two important processes occur in the reference state and result in plant community changes: 1) sagebrush-killing disturbances such as fire, herbivory, drought, and flood; and 2) time without those disturbances, generally referred to as "natural succession."

Characteristics and indicators. The shift between plant community phases is dependent upon sagebrush-killing disturbances, and without them sagebrush will increase even with proper grazing management. Improper grazing management may accelerate the rate of increase for the shrub component. Management actions or treatments are not prescribed or used to mimic the natural disturbance regime due to fragile nature of the soils and lower productivity potential on this site. Prescribed fire is not used due to land use and ownership patterns and lack of fine fuels (Clause and Randall, 2014).

Resilience management. This site has moderate resilience due to its xeric soil moisture regime and frigid temperature regime (Chambers et.al. 2014). Precipitation is typically adequate and more effective with cooler temperatures, but timing of precipitation lowers resilience. Moisture is often not present when needed to support recovery efforts. The site can usually recovery after disturbance but is susceptible to delays in recovery during extreme climatic events such as drought. The site has moderately low resistance to invasion by annual grasses because of climate suitability. Winter precipitation patterns favor annual invasion while cooler temperatures provide some resistance. The site is susceptible to invasion during hotter climatic periods. On the LRU scale, this site is more resistant to invasion by annual grasses due soil chemistry, mainly its calcium carbonate (CaCO3) equivalent greater than 15 percent.

Dominant plant species

- black sagebrush (*Artemisia nova*), shrub
- bluebunch wheatgrass (*Pseudoroegneria spicata*), grass

Dominant resource concerns

- Terrestrial habitat for wildlife and invertebrates
- Inadequate livestock water quantity, quality, and distribution

Community 1.1
Black Sagebrush/Bunchgrass Plant Community

This community is well adapted to Eastern Idaho Plateaus climatic conditions. The diversity in plant species allows for drought tolerance, and natural plant mortality is very low. These plants have strong, healthy root systems that allow production to increase significantly with favorable moisture conditions. Abundant plant litter is available for soil building and moisture retention. Plant litter is properly distributed with very little movement off-site. This plant community provides for soil stability and a properly functioning hydrologic cycle. The Black Sagebrush/Bunchgrass

Community (1.1) can occur across the entire ecological site or can occur in a mosaic with the Bunchgrass/Black Sagebrush Community (1.2). This community can occur over time without these disturbances and accelerated with added herbaceous grazing pressure. Black sagebrush is dominant with foliar cover ranging from 15 to 25 percent. At this sagebrush canopy level in this precipitation zone, there is some competition between the shrub over-story and the herbaceous under-story. (Winward 2007). There are generally few canopy gaps, and most basal gaps are moderate (three to 6 feet). Rock cover on the soil surface is common and often armors the site against soil erosion. Many plant inter-spaces have canopy or litter cover. Production of grasses is lower than in the Bunchgrass/Black Sagebrush Community (1.2).

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	196	280	420
Grass/Grasslike	157	224	336
Forb	39	56	84
Total	**392**	**560**	**840**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	15-30%
Grass/grasslike foliar cover	20-25%
Forb foliar cover	1-5%
Non-vascular plants	0%
Biological crusts	0%
Litter	20-30%
Surface fragments >0.25" and <=3"	5-20%
Surface fragments >3"	0-10%
Bedrock	0-1%
Water	0%
Bare ground	20-35%

Table 7. Soil surface cover

Tree basal cover	0%
Shrub/vine/liana basal cover	1-5%
Grass/grasslike basal cover	1-5%
Forb basal cover	1-5%
Non-vascular plants	0%
Biological crusts	0%
Litter	40-60%
Surface fragments >0.25" and <=3"	15-30%
Surface fragments >3"	0-15%
Bedrock	0-1%
Water	0%
Bare ground	20-35%

Community 1.2
Bunchgrass/Black Sagebrush Plant Community

The Bunchgrass/Black Sagebrush Community (1.2) can occur across the entire ecological site on a given landscape but more likely occurs in a mosaic pattern associated with the disturbance cycle at any given location. Mid-stature bunchgrasses dominate and sagebrush is sub-dominant with foliar cover ranging from 5 to 15 percent. At this sagebrush canopy level in this precipitation zone, there is little, if any, competition between the shrub over-story and the herbaceous under-story. In fact, there is evidence to suggest that the under-story receives more benefit from the sage over-story than negative effects. (Winward 2007). There are generally few canopy gaps, and most basal gaps are generally small (one to two feet). Rock cover on the soil surface is common. Most shrub inter-spaces have canopy or litter cover. Production of grasses is higher than in the Black Sagebrush/Bunchgrass Community (1.1).

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	258	364	549
Shrub/Vine	95	140	207
Forb	39	56	84
Total	**392**	**560**	**840**

Table 9. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	5-15%
Grass/grasslike foliar cover	40-60%
Forb foliar cover	0-1%
Non-vascular plants	0%
Biological crusts	0%
Litter	20-30%
Surface fragments >0.25" and <=3"	5-20%
Surface fragments >3"	0-10%
Bedrock	0-1%
Water	0%
Bare ground	20-35%

Table 10. Soil surface cover

Tree basal cover	0%
Shrub/vine/liana basal cover	5-15%
Grass/grasslike basal cover	50-70%
Forb basal cover	1-10%
Non-vascular plants	0%
Biological crusts	0%
Litter	40-60%
Surface fragments >0.25" and <=3"	15-30%
Surface fragments >3"	0-15%
Bedrock	0-1%

Water	0%
Bare ground	20-35%

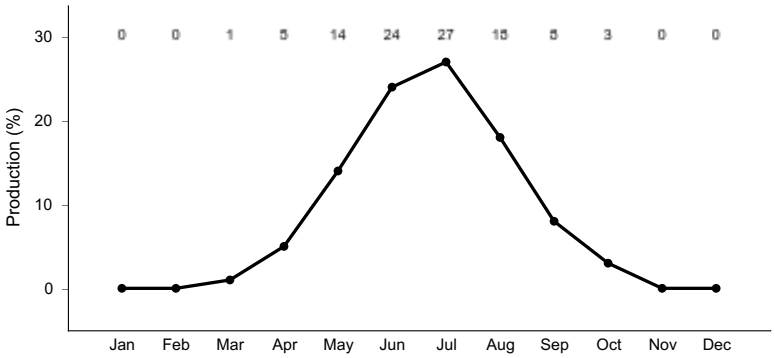


Figure 9. Plant community growth curve (percent production by month). WY13X01Bu, MLRA 13-Bear River Valley-upland. Forage Production (herbaceous only) Developed by using the Rangeland Analysis Platform (RAP).

Pathway P1-2
Community 1.1 to 1.2

Sagebrush thinning event via climatic events such as drought, prolonged soil saturation, freeze-kill, snow mold, and herbivory.

Context dependence. Thinning events are infrequent and often episodic with climatic events. They can occur suddenly with a particular event (precipitation, temperature, insect irruption, etc.) or can be gradual over a period of years such as during prolonged drought/warm or wet/cool periods. A successful pathway is contingent upon a grazing regime that allows for periodic critical growth period rest (May-June). An integrated pest management plan is needed to prevent, avoid, manage, and suppress invasive species.

Conservation practices

Prescribed Grazing

Pathway P2-1
Community 1.2 to 1.1

Natural succession (time without sagebrush killing event).

Context dependence. Time period for pathway is dependent upon weather events such as drought and above normal precipitation years. Drought results in slower pathway while favorable precipitation can result in a faster pathway. A grazing regime that mimics the historic regime (light intensity, episodic grazing events) will not alter the pathway, but a continuous grazing regime at moderate to heavy intensity can accelerate the pathway.

State 2
Grazing Resistant State

The Grazing Resistant State has seen a shift in under-story functional/structural group dominance. Due to herbivory pressure, there is a shift from mid-stature cool-season bunchgrasses to short-stature cool-season bunchgrasses such as Sandberg bluegrass and rhizomatous wheatgrasses like thickspike wheatgrass and western wheatgrass. Mat-forming forbs such as pussytoes (Antennaria spp.), Hood's phlox (*Phlox hoodii*), and buckwheat (Eriogonum spp.) increase and can become dominant on the sites.

Characteristics and indicators. There are fewer mid-size bunchgrasses and they are typically found under the shrub canopy where they are protected from herbivory. The shrub canopy inter-spaces are occupied by grazing tolerant grasses as well as mat-forming forbs. Drier site conditions result in lower productivity and less herbaceous production potential. Surface rock fragments and mat-forming species typically armor the site and protect it from soil

erosion. In many cases, the transition to the Grazing Resistant State may have occurred many decades ago during an era of higher stocking rates and continuous grazing during the growing season. However, continual grazing during the critical growth period (roughly May-June) at proper stocking rates will facilitate the transition to this state and maintain it as a stable state.

Resilience management. Site resilience is lower than the Reference State. Site hydrology has been modified due to moisture being utilized by shallower rooting species. Therefore, the site is drier earlier in the season and unable to recover as quickly after a disturbance. This state is more drought-prone, and therefore more vulnerable to invasion by annual invasive species. However, existing sagebrush canopy and remnant perennial vegetation provide some amount of resiliency. Rhizomatous grasses form mats that provide soil protection by protecting the soil from raindrop impact, decreasing the risk of soil erosion. However, overall soil stability is lower than the reference state, primarily due to a reduction in soil organic matter due to a reduction in litter. Site resistance to invasion by annual grasses is lower due to niches in the under-story for establishment as well as site water availability during the time suited for winter annuals such as cheatgrass (*Bromus tectorum*). Episodic and limited moisture is more suited to annual life forms. However, high calcium carbonate equivalent (CCE) soil chemistry adds additional resistance to invasion.

Dominant plant species

- black sagebrush (*Artemisia nova*), shrub
- Sandberg bluegrass (*Poa secunda*), grass
- thickspike wheatgrass (*Elymus lanceolatus ssp. lanceolatus*), grass
- western wheatgrass (*Pascopyrum smithii*), grass

Dominant resource concerns

- Plant productivity and health
- Plant structure and composition
- Terrestrial habitat for wildlife and invertebrates
- Feed and forage imbalance
- Inadequate livestock water quantity, quality, and distribution

Community 2.1
Black Sagebrush/Short-stature Grass Plant Community

This plant community is characterized as black big sagebrush dominated with a diminished under-story. The under-story has lost much of the mid-stature cool-season bunchgrasses, and they have been replaced with short-stature bunchgrasses such as Sandberg bluegrass, rhizomatous wheatgrasses, and mat-forming forbs. Shrub foliar cover is often >25% and typically comprising over have of total annual production. Areas that catch and retain snow are more likely to have higher shrub cover. Herbaceous production and foliar cover has decreased. There are sometimes small amounts of annual invasive grasses, mostly less than 5% foliar cover. There is often a slight increase in sprouting shrubs (<10% composition by weight). Total annual production is lower than in Reference State (1), leading to lower soil organic matter content and therefore lower soil stability than in the Reference State. Total annual production ranges from 200 to 600 lbs/ac with a RV of 400 lbs/ac. Biotic integrity is affected by the change in functional/structural group dominance.

Community 2.2
Short-stature Grass/Black Sagebrush Plant Community

This plant community is characterized by a dominance of short-stature grasses such as Sandberg bluegrass, rhizomatous grasses and grass-likes, and mat-forming forbs. A sagebrush killing event has happened recently, and Wyoming big sagebrush foliar cover is typically less than 25%. There can be an initial flush of invasive annuals, mainly cheatgrass, within the first few years of a sagebrush killing event, but they are expected to reduce to less than 5% foliar cover. There is often a slight increase in sprouting shrubs (<10% composition by weight).Total annual production ranges from 200 to 600 lbs/ac with a RV of 400 lbs/ac. Biotic integrity is affected by the change in functional/structural group dominance.

Pathway P1-2
Community 2.1 to 2.2

Sagebrush killing event, mainly natural climatic events such as herbivory, drought, prolonged soil saturation, freeze-kill, or snow mold. Fire is not typically a driver in this state due to the lack of fine fuels in the under-story.

Context dependence. Killing events are often episodic with climatic events and can occur suddenly with a particular event (fire, precipitation, temperature, insect irruption, etc.). This pathway relies upon close to normal precipitation and temperature as well as a grazing regime that is low to moderate intensity. If extreme conditions/disturbances such as hot temperatures, drought, or high intensity grazing occur, there is risk of a transition to either the Disturbed State or Invaded State depending upon severity and cumulative disturbance.

Pathway P2-1
Community 2.2 to 2.1

Natural succession (time without sagebrush killing event).

Context dependence. Time period for pathway is dependent upon weather events such as drought and above normal precipitation years. Drought results in slower pathway while favorable precipitation can result in a faster pathway. A grazing regime that mimics the historic regime (light intensity, episodic grazing events) will not alter the pathway, but a continuous grazing regime at moderate to heavy intensity can accelerate the pathway.

Transition T1-2
State 1 to 2

Herbivory pressure in excess of normal Reference State conditions. A typical scenario is continuous spring or season-long grazing with low stocking intensity.

Constraints to recovery. Recovery is inhibited by continued herbivory pressure, reduced seedbank, and drought conditions. Annual grasses are likely in small amounts.

Context dependence. Drought and annual invasion are most likely variables to prevent restoration.

Additional community tables

Table 11. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**PERENNIAL MID-SIZE COOL SEASON GRASSES**			112–224	
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	56–224	10–50
	needle and thread	HECO26	*Hesperostipa comata*	28–112	5–30
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	28–112	5–10
	Letterman's needlegrass	ACLE9	*Achnatherum lettermanii*	28–112	5–10

	Sandberg bluegrass	POSE	*Poa secunda*	28–56	5–10
	muttongrass	POFE	*Poa fendleriana*	28–56	5–10
	prairie Junegrass	KOMA	*Koeleria macrantha*	6–56	1–5
	squirreltail	ELEL5	*Elymus elymoides*	6–56	1–5
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–56	0–5
2	**RHIZOMATOUS GRASSES**			28–56	
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	28–56	5–10
	western wheatgrass	PASM	*Pascopyrum smithii*	28–56	5–10
3	**MISC. GRASSES/GRASSLIKES**			39–84	
	plains reedgrass	CAMO	*Calamagrostis montanensis*	0–28	0–5
	needleleaf sedge	CADU6	*Carex duriuscula*	0–28	0–5
	Sandberg bluegrass	POSE	*Poa secunda*	6–28	1–5
Forb					
4	**PERENNIAL FORBS**			28–50	
	buckwheat	ERIOG	*Eriogonum*	6–28	1–5
	lupine	LUPIN	*Lupinus*	0–28	0–5
	aster	SYMPH4	*Symphyotrichum*	0–28	0–5
	spiny phlox	PHHO	*Phlox hoodii*	6–28	1–5
	longleaf phlox	PHLO2	*Phlox longifolia*	0–17	0–3
	flaxleaf plainsmustard	SCLI	*Schoenocrambe linifolia*	0–17	0–3
	ragwort	SENEC	*Senecio*	0–17	0–3
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–17	0–3
	stemless mock goldenweed	STAC	*Stenotus acaulis*	0–17	0–3
	fleabane	ERIGE2	*Erigeron*	0–17	0–3
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–17	0–3
	bluebells	MERTE	*Mertensia*	0–17	0–3
	locoweed	OXYTR	*Oxytropis*	0–17	0–3
	beardtongue	PENST	*Penstemon*	0–17	0–3
	milkvetch	ASTRA	*Astragalus*	0–17	0–3
	pussytoes	ANTEN	*Antennaria*	0–17	0–3
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	0–17	0–3
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–17	0–3
	agoseris	AGOSE	*Agoseris*	0–17	0–3
	onion	ALLIU	*Allium*	0–6	0–1
	cryptantha	CRYPT	*Cryptantha*	0–6	0–1
	larkspur	DELPH	*Delphinium*	0–6	0–1
	rockcress	ARABI2	*Arabis*	0–6	0–1
	sandwort	ARENA	*Arenaria*	0–6	0–1
	Indian paintbrush	CASTI2	*Castilleja*	0–6	0–1
	Douglas' dustymaiden	CHDO	*Chaenactis douglasii*	0–6	0–1
	pale bastard toadflax	COUMP	*Comandra umbellata ssp. pallida*	0–6	0–1
	western wallflower	ERAS2	*Erysimum asperum*	0–6	0–1

	ipomopsis	IPOMO2	*Ipomopsis*	0–6	0–1
	bitter root	LERE7	*Lewisia rediviva*	0–6	0–1
	desertparsley	LOMAT	*Lomatium*	0–6	0–1
	stonecrop	SEDUM	*Sedum*	0–6	0–1
	sagebrush buttercup	RAGL	*Ranunculus glaberrimus*	0–6	0–1
	hollyleaf clover	TRGY	*Trifolium gymnocarpon*	0–6	0–1
	clover	TRIFO	*Trifolium*	0–6	0–1
	violet	VIOLA	*Viola*	0–6	0–1
	deathcamas	ZIGAD	*Zigadenus*	0–6	0–1
5	**ANNUAL FORBS**			0–6	
	rockjasmine	ANDRO3	*Androsace*	0–6	0–1
	bushy bird's beak	CORA5	*Cordylanthus ramosus*	0–6	0–1
Shrub/Vine					
6	**SAGEBRUSH**			56–112	
	black sagebrush	ARNO4	*Artemisia nova*	56–112	5–15
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	0–28	0–5
	little sagebrush	ARARL	*Artemisia arbuscula ssp. longiloba*	0–28	0–5
7	**MISC. SHRUBS**			17–28	
	greasewood	SAVE4	*Sarcobatus vermiculatus*	0–28	0–5
	Gardner's saltbush	ATGA	*Atriplex gardneri*	0–28	0–5
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	6–28	1–5
	winterfat	KRLA2	*Krascheninnikovia lanata*	6–28	1–5
	granite prickly phlox	LIPU11	*Linanthus pungens*	0–17	0–3
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–17	0–3
	slender buckwheat	ERMIL2	*Eriogonum microthecum var. laxiflorum*	0–17	0–3
	spineless horsebrush	TECA2	*Tetradymia canescens*	0–17	0–3
	shortspine horsebrush	TESP2	*Tetradymia spinosa*	0–17	0–3
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–6	0–1
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	0–6	0–1

Animal community

The following table lists suggested stocking rates for cattle under continuous season-long grazing under normal growing conditions with a harvest efficiency (HE) of 25 percent. These are conservative estimates that should be used only as guidelines in the initial stages of the conservation planning process. Often, the current plant composition does not entirely match any particular plant community (as described in this ecological site description). A field visit is required to document actual plant composition and production. More precise carrying capacity estimates, considering forage preference and accessibility (slope, distance to water, etc.), should be calculated using field data, particularly when grazers other than cattle are involved. Under more intensive grazing management, improved harvest efficiencies (up to 35 percent) can result in an increased carrying capacity, but recovery time for upland sites is much longer. If distribution problems occur, stocking rates should be reduced or facilitating conservation practices (i.e., cross-fencing, water development) implemented to maintain plant health and vigor.

Stocking rates are expressed in Animal Unit Months (AUMs) which is defined as the amount of forage consumed by a 1,000 pound cow with a less than 4 month old calf at her side.

Plant Community Production (lbs./ac.) Initial Suggested Stocking Rate (AUMs/ac.)* Ac./AUM
1.1 Black Sagebrush/Bunchgrass 350-500-750 0.05 20
1.2 Bunchgrass/Black Sagebrush 350-500-750 0.09 11
2.1 Black Sagebrush/Short-stature grass 200-400-600 0.03 33
2.2 Short-stature grass/Black sagebrush 200-400-600 0.04 25

* Continuous, season-long grazing by cattle under average growing conditions.

Calculation for stocking rates are as follows: Using RV values for production, take forage palatable to grazing cattle and multiply by 0.25 HE and divide by 912.5 lbs./AUM air-dry weight (ADW) to arrive at the initial suggested stocking rate in AUMs/acre.

Not all kinds of livestock or wildlife have the same forage demand as a 1000-pound lactating cow. In addition, forage demand varies within a species depending on its class, i.e., its growth rate (e.g. heifers and steers vs. mature cow), lactating and maintenance (e.g., dry cow vs cow with calf). For this reason, animal unit equivalents (AUE) are provided in the National Range & Pasture Handbook to assist with this approximate determination of forage demand based on the kind, class and size of animal (NRPH, 2003). For cattle with a different average weight than a 1000 pound average, AUE can be adjusted (i.e., every 100 pounds of animal weight equates to about 0.10 Animals Units thus a 1200-pound cow with a calf would be 1.2 AUE .

Grazing by domestic livestock is one of the major income-producing industries in the area. Rangeland in this area may provide year-long forage for cattle, sheep, or horses. During the dormant period, the forage for livestock must be supplemented with protein because the quality does not meet minimum livestock requirements.

Distance to water, shrub density, and slope can affect grazing capacity within a management unit. Accessibility adjustments should be made for the planning area as necessary. For example, 30 percent of a management unit may have 25 percent slopes and distances of greater than one mile from water, resulting in a 50 percent reduction in grazing access; therefore, the adjustment is calculated for 30 percent of the unit (i.e. 50 percent reduction on 30 percent of the management unit). Fencing, slope length, management, access, terrain, kind and class of livestock, and breeds are all factors that can increase or decrease the percent of grazing access within a management unit. Adjustments should be made that incorporate these factors when calculating the carrying capacity of a management unit.

Wildlife Interpretations:
Sagebrush grassland habitats are critically important for wildlife. The LRU provides crucial winter range for mule deer, elk, pronghorn and moose. Portions of the LRU fall within overlapping crucial winter range delineated for three species of big game. Nearly all of the LRU in Wyoming supports a designated migration corridor and numerous associated stopover habitats, where thousands of mule deer from the Wyoming Range Herd Unit move north and south between summer and winter ranges. Healthy vegetative communities within migration stopover areas are extremely important as forage and cover where mule deer may spend several days resting and feeding to refuel before moving again. The middle segment of the LRU (east and west of the Bear River) is within sage grouse core habitat, providing breeding leks, nesting, early brood rearing, late brood rearing, and winter habitats. Maintaining intact high quality sagebrush grassland habitats with a diversity of successional stages is vitally important for meeting the needs of wildlife using this landscape.

Wildlife Habitat Threats:
Winter moisture characteristics of the BRV LRU promote environmental conditions ideal for cheatgrass establishment and persistence. Cheatgrass presence is increasing and competing with native perennial grasses and forbs to deteriorate habitat function for big game, sage grouse and other sagebrush obligate wildlife. Advanced cheatgrass invasion is expected to alter fire regimes to a short Fire Return Interval outside the natural range of variability, where sagebrush stands burn frequently resulting in a reduction of browse and cover availability for wildlife. Eventually, shrub cover dominance could revert to green (aka yellow rabbitbrush in USDA PLANTS) or rubber rabbitbrush, significantly impacting wildlife dependent on sagebrush in this landscape for survival.
Current and future anthropogenic impacts to sagebrush grasslands include agriculture expansion, energy development, water storage projects, and subdivision/residential development. Increasing demand for expanding private lands hay production has seen conversion of sagebrush stands in and near sage grouse core habitat to center pivot sprinkler irrigation. Sage grouse may use these new fields during the late brood rearing period, but

there is a loss of important sagebrush cover for escape, lekking, nesting, and winter cover/forage as critical life stage habitat needs for sage grouse. Energy transmission projects have recently created interest and opportunities for solar farm development in the LRU. These solar energy projects could permanently convert site specific sagebrush-grassland habitat to industrial development locations with negative cumulative impacts for sage grouse, wintering big game, and other sagebrush dependent wildlife. Aesthetic values of the Cokeville area may attract future demand for small acreage home developments, especially in the Smith's Fork River Valley and Raymond Mountain foothills. Increased fencing and sagebrush removal usually associated with residential development could be extremely detrimental to big game migration and migration stopover habitats.

Wildlife Habitat Uses:
This site supports black sagebrush stands on ridgetops and slopes. Black sagebrush palatability can be variable, as there are two different varieties with one being very palatable and other not so palatable. However, the location of black sagebrush on south and west aspect slopes and windswept ridge tops during winter months with little to no snow accumulation make it an important browse component for pronghorn, mule deer, and elk. Associated bunchgrasses and rhizomatous grasses may exhibit low productivity, but serve as readily available winter forage for elk due to the same site characteristics.

Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group B and C. Infiltration ranges from moderately slow to moderately rapid. Runoff potential for this site varies from moderate to high depending on soil hydrologic group and ground cover. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. Areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff (refer to Part 630, NRCS National Engineering Handbook for detailed hydrology information).

Rills are rare, but may occur on steeper slopes and are small and widely spaced. Some water flow patterns may be observable, but are short and only rarely connected. Pedestals are only slightly present in association with bunchgrasses. Herbaceous litter expected to move only in short distances (to leeward side of shrubs) due to wind. Herbaceous and woody litter will show short movement (less than 3 feet) associated with large precipitation events on steeper slopes (greater than 8 percent). Chemical and physical crusts are rare to non-existent.

Recreational uses

This site provides hunting opportunities for upland game species. The wide variety of plants which bloom in the spring have an aesthetic value that appeals to recreationists.

Inventory data references

Information presented here has been derived from historic and recent clipping data and other inventory data. Field observations from range trained personnel were also used.
Inventory Data Resources include:
1 Soil Survey-ESI point (2019)

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Other references

Site concept, plant community data, and interpretations are based on ecological site descriptions (ESDs) from MLRA 34A-Foothills and Basins West (10-14W).
This ESD replaces R034AY263WY Shallow Loamy, calcareous MLRA 34A-Foothills and Basins West (SwLyc 10-14W), but only within geographic extent of the Bear River Valley LRU.

Further data collection and ecological site refinement are ongoing until the ESD has reached "Approved" status.

Contributors

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Approval

Kirt Walstad, 9/07/2023

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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	05/17/2024
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:**