Ecological site EX044B01C031
Limy Droughty (LyDr) 15-19" PZ
Frigid
North

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General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

MLRA notes

Major Land Resource Area (MLRA): 044B–Central Rocky Mountain Valleys

Major Land Resource Area (MLRA) 44B, Central Rocky Mountain Valleys, is nearly 3.7 million acres of southwest Montana. This MLRA borders two other MLRAs: 43B, Central Rocky Mountains and Foothills, and 46, Northern and Central Rocky Mountain Foothills. The major watersheds of this MLRA are the Missouri and Yellowstone Rivers and their associated headwaters, such as the Beaverhead, Big Hole, Jefferson, Ruby, Madison, Gallatin, and Shields Rivers. Limited portions of the MLRA are west of the Continental Divide along the Clark Fork River. These waters allow for extensive irrigation for crop production in an area that is generally only compatible with rangeland and grazing. The Missouri River and its headwaters are behind several reservoirs used for irrigation water, hydroelectric power, and municipal water. The primary land use of this MLRA is production agriculture (grazing, small grain production, and hay) with limited mining. Urban development is high, with large expanses of rangeland being converted to subdivisions for a rapidly growing population. MLRA 44B consists of one Land Resource Unit (LRU) and 7 Climate-based LRU subsets. Annual precipitation ranges from a low of 9 inches to a high of near 24 inches. The driest areas tend to be in the valley bottoms of southwest Montana, in the rain shadow of the mountains. The wettest portions tend to be near the edges of the MLRA, where it borders MLRA 43B. Frost-free periods also vary greatly, with less than 30 days in the Big Hole Valley to approximately 110 days in the warm valleys along the Yellowstone and Missouri Rivers. MLRA 44B's plant communities are highly variable but are dominated by a cool-season grass and shrub-steppe community on the rangeland and a mixed coniferous forest in the mountains. Warm-season grasses occupy an extremely limited extent and number of species in this MLRA. Most subspecies of big sagebrush are present, to some extent, across the MLRA.

LRU notes

LRU 01 Subset C Central Concept: • Moisture Regime: Ustic • Temperature Regime: Frigid • Dominant Cover: rangeland (mixed grassland and sagebrush steppe) • Representative Value (RV) of range of Effective Precipitation: 15 to 19 inches • Representative Value (RV) of range of Frost Free Days: 75 to 105days This LRU subset exists in northern portion of MLRA 44B particularly in Meagher, Powell, Broadwater, Lewis and Clark, Granite, and Deer Lodge Counties.

Classification relationships

Mueggler and Stewart. 1980. Grassland and Shrubland habitat types of Western Montana 1. Stipa comata/Bouteloua gracilis h.t. 2. Agropyron spicatum/Bouteloua gracilis h.t. Montana Natural Heritage Program Vegetation Classification 1. Stipa comata - Bouteloua gracilis Herbaceous Vegetation (STICOM – BOUGRA) Needle-and-thread/Blue grama Natural Heritage Conservation Rank-G5 / S5 Edition / Author- 99-11-16 / S.V. Cooper, EPA Ecoregions of Montana, Second Edition: Level I: Northwestern Forested Mountains Level II: Western Cordillera Level III: Middle Rockies & Northern Great Plains Level IV: Paradise Valley Townsend Basin Dry Intermontane Sagebrush Valleys Shield-Smith Valleys National Hierarchical Framework of Ecological Units: Domain: Dry Division: M330 – Temperate Steppe Division – Mountain Provinces Province: M332 –Middle Rocky Mountain Steppe – Coniferous Forest – Alpine Meadow Section: M332D – Belt Mountains Section M332E – Beaverhead Mountains Section Subsection: M332Ej – Southwest Montana Intermontane Basins and Valleys M332Dk – Central Montana Broad Valleys

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 percent stone and boulder cover (15 percent maximum) o Soil surface texture ranges from sandy loam to clay loam in surface mineral 4 inches o Skeletal (greater than rock fragments) at a 10- to 20-inch soil control section o Strongly or violently effervescent within surface mineral 4 inches; calcium carbonates will often increase with depth. • Parent material is alluvium, slope alluvium, and colluvium (limited extent).

Associated sites

EX044B01C030	**Limy (Ly) 15-19" PZ Frigid North** The Limy ecological site occupies the same landscape position as the Limy Droughty.

Similar sites

EX044B01C030	**Limy (Ly) 15-19" PZ Frigid North** The Limy ecological site differs by being not skeletal within 20 inches. The plant community is similar and shares a state and transition model.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Chrysothamnus viscidiflorus* (2) *Artemisia tridentata ssp. wyomingensis*
Herbaceous	(1) *Pseudoroegneria spicata* (2) *Hesperostipa comata*

Legacy ID

R044BC031MT

Physiographic features

This ecological site occurs on slopes ranging from 0 to 60 percent; however, the representative slope is 4–10 percent. It is an area of dissected mountain valleys. The valleys are typically bordered by mountains trending from north to south. The parent material is tertiary valley fill and alluvium of mixed geology.

Table 2. Representative physiographic features

Landforms	(1) Intermontane basin > Terrace (2) Intermontane basin > Fan remnant (3) Intermontane basin > Alluvial fan
Ponding frequency	None
Elevation	1,370 – 1,830 m
Slope	0 – 10 %
Water table depth	110 cm

Aspect	Aspect is not a significant factor

Climatic features

The Central Rocky Mountain Valleys MLRA has a continental climate. 50 to 60 percent of the annual long-term average total precipitation falls between May and August with the highest in May and June. Most of the precipitation in the winter is snow on frozen ground. Average precipitation for LRU 01 Subset C is 15 inches, and the frost-free period averages 75 to 105 days.

Table 3 Representative climatic features

Frost-free period (characteristic range)	80-110 days
Freeze-free period (characteristic range)	110-140 days
Precipitation total (characteristic range)	360-430 mm
Frost-free period (actual range)	80-110 days
Freeze-free period (actual range)	110-140 days
Precipitation total (actual range)	330-510 mm
Frost-free period (average)	90 days
Freeze-free period (average)	120 days
Precipitation total (average)	380 mm

- (1) WILSALL 8 ENE [USC00249023], Wilsall, MT
- (2) ANACONDA [USC00240199], Anaconda, MT
- (3) AUSTIN 1 W [USC00240375], Helena, MT
- (4) PHILIPSBURG RS [USC00246472], Philipsburg, MT
- (5) LENNEP 5 SW [USC00244954], White Sulphur Springs, MT
- (6) BOZEMAN MONTANA ST U [USC00241044], Bozeman, MT

Influencing water features

There are no water features influencing this site.

Wetland description

Site is not associate with wetland characteristics.

Soil features

These soils are moderately deep to very deep, moderately to moderately rapid permeability, and well drained. These soils are formed from alluvium, colluvium, and slope alluvium. The top four (4) inches of soil have strong to violent effervescence. The calcium carbonate (lime) concentration often increases with soil depth. The soil consists of loamy-skeletal material (which averages 35 percent or greater rock fragments by volume in the 10–20-inch layer). This skeletal material decreases the water-holding capacity of the site. Typically, soil surface textures consist of loam, sandy loam, and loamy sand textures. Soils are also typically gravelly, channery, or cobbly. Common soil series are Windham and Winspect. These soils may exist across multiple ecological sites due to natural variations in slope, texture, rock fragments, and pH. An onsite soil pit and the most current ecological site key are required to classify an ecological site.

Table 4. Representative soil features

Parent material	(1) Alluvium – limestone, sandstone, and shale (2) Colluvium – limestone, sandstone, and shale (3) Slope alluvium – limestone, sandstone, and shale
Surface texture	(1) Gravelly loam (2) Channery loam (3) Cobbly loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained to well drained
Permeability class	Moderately slow to moderately rapid
Depth to restrictive layer	60 – 150 cm
Soil depth	60 – 250 cm
Surface fragment cover <=3"	0 – 20 %
Surface fragment cover >3"	10 %
Available water capacity (0-101.6cm)	5.59 – 13.21 cm
Calcium carbonate equivalent (0-101.6cm)	20 – 40 %
Electrical conductivity (0-101.6cm)	Not specified

Sodium adsorption ratio (0-101.6cm)	0 – 10
Soil reaction (1:1 water) (0-101.6cm)	7.9 – 8.4
Subsurface fragment volume <=3" (25.4-50.8cm)	10 – 40 %
Subsurface fragment volume >3" (25.4-50.8cm)	10 – 20 %

Table 5. Representative soil features (actual values)

Drainage class	Moderately well drained to well drained
Permeability class	Moderately slow to moderately rapid
Depth to restrictive layer	50 – 150 cm
Soil depth	50 – 250 cm
Surface fragment cover <=3"	0 – 20 %
Surface fragment cover >3"	0 – 20 %
Available water capacity (0-101.6cm)	5.59 – 14.73 cm
Calcium carbonate equivalent (0-101.6cm)	20 – 50 %
Electrical conductivity (0-101.6cm)	0 mmhos/cm

Sodium adsorption ratio (0-101.6cm)	0 – 10
Soil reaction (1:1 water) (0-101.6cm)	6.6 – 8.4
Subsurface fragment volume <=3" (25.4-50.8cm)	10 – 40 %
Subsurface fragment volume >3" (25.4-50.8cm)	20 – 40 %

Ecological dynamics

The reference plant community is dominated by bluebunch wheatgrass (Pseudoroegneria spicata) and needle and thread (Hesperostipa comata). Subdominant species trend toward rough fescue (Festuca scabrella), winterfat (Krascheninnikovia lanata), and Indian ricegrass (Achnatherum hymenoides). This potential is suggested by investigations showing a predominance of perennial grasses on near-pristine range sites (Ross et al., 1973).

The Limy Droughty ecological site LRU 01 Subset B occurs across a relatively small landscape, though slight variations exist due to elevation, frost-free days, and relative effective annual precipitation. Bluebunch wheatgrass, for example, occupies all known combinations of elevation and climate in this subset. Conversely, colder, wetter sites within this subset often exhibit slight increases in rough fescue and Wyoming big sagebrush. Unique to the Limy Droughty and Limy ecological sites of Subset C, there is an increased probability of Idaho fescue as Relative Effective Annual Precipitation increases to beyond 17 inches. This seems to be the threshold for precipitation to push the concentration of carbonates deeper into the soil profile. This correlation is also expressed in higher amounts of rough fescue.

A shift to the dominance of shrubs may occur in response to improper grazing management, drought, or where Wyoming big sagebrush occurs due to a lack of fire. Shrub encroachment by a variety of species, including broom snakeweed (Gutierrezia sarothrae), prairie sagewort (Artemisia frigida), Wyoming big sagebrush (Artemisia tridentata ssp. wyomingensis), rubber rabbitbrush (Ericameria nauseosa), yellow rabbitbrush (Chrysothamnus viscidiflorus), and plains prickly pear (Opuntia polyacantha) occurs within this site as the mid-stature bunchgrasses decrease. Shrub dominance and grass loss are associated with soil erosion and, ultimately, thinning of the native soil surface. Subsequent loss of soil could lead to a Degraded State. All states could also lead to the Invaded State when there is a lack of weed prevention and control measures.

Historical records indicate that prior to the introduction of livestock (cattle and sheep) during the late 1800s, elk and bison grazed this ecological site. Due to bison's nomadic nature and herd structure, grazed areas received periodic high intensity, short duration grazing pressure. The gold boom in the 1860s brought the first herds of livestock overland from Texas, and homesteaders began settling the area. During this time, cattle were the primary domestic grazers in the area. In the 1890s, Montana sheep production began to increase (by more than 400 percent) and dominated the livestock industry until the 1930s. Since the 1930s, cattle production has dominated the livestock industry in the region (Wyckoff and Hansen 2001).

Natural fire as well as prescribed fire utilized by indigenous peoples was a major ecological driver of this not only this ecological site but the entire MLRA. Indigenous peoples have utilized fire on this ecological site for thousands of years prior to European settlement as a means to move wildlife populations for harvest (Roos Christopher I. et al. 2018). Fire tended to restrict tree and shrub growth to small patches and promoted an herbaceous plant community. The natural fire return interval was highly variable, but it was likely shorter than 30 years. With the historically recent, since 1910, suppression of fire, shrubs and coniferous trees have increased significantly.

Due to the slightly alkaline to moderately alkaline nature and rockiness of the soils on this site, the potential for crop production is extremely limited. This ecological site remains mostly unconverted.

Some of the major invasive species that can occur on this site include spotted knapweed (Centaurea stoebe), leafy spurge (Euphorbia esula), and cheatgrass (Bromus tectorum). Nonnative invasive weeds are generally not common in most of this ecological site and tend to occupy limited areas in small patches near traditional watering facilities, along roads, and other areas that receive high soil disturbance.

Plant Communities and Transitions
A state and transition model (STM) for this ecological site is depicted below. Thorough descriptions of each state, transition, plant community, and pathway follow the model. This model is based on available experimental research, field data, field observations, and interpretations by experts. It is likely to change as knowledge increases.

The plant communities within the same ecological site will differ across the MLRA due to the naturally occurring variability in weather, soils, and aspect. 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 intended to cover the core species and the known range of conditions and responses.

State and transition model

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Grass/Grasslike					
1	**Mid-Statured Cool Season Bunchgrass**			706-1177	
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	443-673	25-55
	needle and thread	HECO26	*Hesperostipa comata*	67-202	5-15
	green needlegrass	NAVI4	*Nassella viridula*	67-129	3-6
	rough fescue	FECA4	*Festuca campestris*	0-112	0-5
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0-73	0-2
2	**Shortgrasses/Grasslikes**			101-235	
	prairie Junegrass	KOMA	*Koeleria macrantha*	17-67	1-3
	Sandberg bluegrass	POSE	*Poa secunda*	17-67	1-3
	blue grama	BOGR2	*Bouteloua gracilis*	11-62	0-3
	Idaho fescue	FEID	*Festuca idahoensis*	0-34	0-3
	threadleaf sedge	CAFI	*Carex filifolia*	0-34	0-2
	needleleaf sedge	CADU6	*Carex duriuscula*	0-17	0-2
3	**Rhizomatous Grasses**			45-157	
	thickspike wheatgrass	ELLA3	*Elymus lanceolatus*	45-112	1-3
	western wheatgrass	PASM	*Pascopyrum smithii*	45-112	1-3
	plains reedgrass	CAMO	*Calamagrostis montanensis*	0-67	0-1
Forb					
4	**Forbs**			11-157	
	dotted blazing star	LIPU	*Liatris punctata*	22-129	0-5
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	11-67	0-3
	spiny phlox	PHHO	*Phlox hoodii*	17-67	0-3
	bastard toadflax	COUM	*Comandra umbellata*	11-67	0-3
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	22-67	0-3
	American vetch	VIAM	*Vicia americana*	11-50	0-3
	fleabane	ERIGE2	*Erigeron*	22-50	0-2
	desertparsley	LOMAT	*Lomatium*	0-50	0-2
	common yarrow	ACMI2	*Achillea millefolium*	0-50	0-2
	rosy pussytoes	ANRO2	*Antennaria rosea*	0-45	0-2
	Drummond's milkvetch	ASDR3	*Astragalus drummondii*	0-39	0-2
	locoweed	OXYTR	*Oxytropis*	0-17	0-1
Shrub/Vine					

5	**Shrubs**			45-157	
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	45-140	5-15
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0-67	0-5
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0-34	0-3
	spineless horsebrush	TECA2	*Tetradymia canescens*	0-22	0-1
	plains pricklypear	OPPO	*Opuntia polyacantha*	0-11	0-1
6	**Subshrubs**			22-78	
	winterfat	KRLA2	*Krascheninnikovia lanata*	22-78	1-3
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0-34	0-1
	prairie sagewort	ARFR4	*Artemisia frigida*	0-22	0-1
	slender buckwheat	ERMI4	*Eriogonum microthecum*	0-11	0-1

Table 7. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 8. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 9. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 10. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 11. Community 4.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 12. Community 5.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Animal community

The Limy Droughty ecological site of the MLRA 44B provides 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. 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 Mid-Statured Bunchgrass Community is likely to have a minimal sage grouse presence given its low sagebrush canopy cover and forb components. 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 and Degraded State, 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 Droughty site, grazing on adjacent sites with lower productivity must be carefully managed to ensure that utilization on this site is not excessive. Management objectives should include maintenance or improvement of the native plant community. Careful management of the 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. Early-season defoliation of bluebunch wheatgrass can result in high mortality and reduced vigor in plants. The opportunity for regrowth is necessary before dormancy to reduce injury. 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 the transition to the Altered State. The transition to other states will depend on the 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 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/or 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 an increased risk of further degradation. Grazing has to be carefully managed to avoid further soil loss and degradation and possible livestock health issues. Prescribed grazing can be used to manage invasive species. In some instances, carefully targeted grazing (sometimes in combination with other treatments) can reduce or maintain the species composition of invasive species. Grazing may be possible in a degraded state, but it is generally not economically or environmentally sustainable.

Hydrological functions

The hydrologic cycle functions best in the Reference State 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 a high bunchgrass canopy cover of around 80 percent. High ground cover reduces raindrop impact on the soil surface, which keeps erosion and sedimentation transport low. Water leaving the site will have a 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 Mid-Statured Bunchgrass Community 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 nonexistent. 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. This plant community has a similar canopy cover, but the bare ground will be less than 15 percent. Therefore, the hydrologic cycle is functioning at a level similar to the water cycle in the Mid-Statured Bunchgrass Community . When compared to the Mid-Statured Bunchgrass Community, infiltration rates are slightly reduced and surface runoff is slightly higher. In the Shortgrass Community, Degraded State, and the Invaded State, canopy and ground cover are greatly reduced compared to the Reference State, which impedes the hydrologic cycle. Infiltration will decrease and runoff will increase due to reduced ground cover, the 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 the frequency and severity of flooding within a watershed. Soil erosion is accelerated, the quality of surface runoff is poor, and sedimentation increases.

Recreational uses

This site provides some limited recreational opportunities for hiking, horseback riding, big game hunting, and upland bird hunting. The forbs have flowers that appeal to photographers. This site provides valuable open space.

Wood products

This site is not suitable for wood products.

Inventory data references

Information presented was derived from the site’s Range Site Description (Limy Droughty 15-19 inch P.Z. Northern Rocky Mountain Valleys, South, East of Continental Divide), NRCS clipping data, National Resource Inventory (NRI) 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).

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Approval

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Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

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Date	03/01/2020
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** **Rills are not present in the reference condition on slopes less than 20 percent. Slopes greater than 20 percent rills may exist but will be extremely rare and less than one (1) foot.**

2. **Presence of water flow patterns:** **Water flow patterns are rare in the reference condition. If present, they are most likely to occur on steeper slopes (20 percent) and are inconspicuous, disconnected, and very short in length.**

3. **Number and height of erosional pedestals or terracettes:** Pedestals are not evident in the reference condition.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground is seven (7) to 15 percent. Bare ground refers to exposed mineral soil not covered by litter, rock, basal cover, plant cover, standing dead, lichen and/or moss.

5. **Number of gullies and erosion associated with gullies:** Gullies are not present in the reference condition.

6. **Extent of wind scoured, blowouts and/or depositional areas:** Wind scoured, or depositional areas are not evident in the reference condition.

7. **Amount of litter movement (describe size and distance expected to travel):** Movement of fine herbaceous litter may occur within less than a foot from where it originated.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil Surface Stable with Stability Ratings of 4-6 under canopy and 3-5 under canopy gaps. Biotic crusts and or root mats may be present.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil structure is weak fine to moderately fine granular. A horizon three (3) to five (5) inches thick, light to dark grey-brown color (Value of 4 or less, Chroma 3 or less) Official Series Description (OSD) for characteristic range.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Evenly distributed across the site, bunchgrasses improve infiltration while rhizomatous grass protects the surface from runoff forces. The Limy Droughty ecological site is well drained and has a high infiltration rate. An even distribution of mid stature bunchgrasses (70-75 percent), cool season rhizomatous grasses (5-10 percent), shortgrass (10-15 percent), forbs (1-10 percent), shrubs (5-10 percent), and subshrubs (0-5 percent)

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** Not Present

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: Dominant: Mid-statured, cool season, perennial bunchgrasses

    Sub-dominant: perennial shortgrasses and grasslikes > rhizomatous grasses > shrubs ? forbs > subshrubs

Other:

Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** **Mortality in herbaceous species is not evident. Species with bunch growth forms may have some natural mortality in centers.**

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14. **Average percent litter cover (%) and depth (in):** **Total litter cover ranges from 20 to 30 percent. Most litter is irregularly distributed on the soil surface and is not at a measurable depth.**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** **Average annual production is 1200. Low: 900 High 1400 lbs per acre. Production varies based on effective precipitation and natural variability of soil properties for this ecological site.**

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** **Potential invasive (including noxious) species (native and non-native). Invasive species on this ecological site include (but not limited to) annual bromes., spotted knapweed, yellow toadflax, leafy spurge, ventenata, crested wheatgrass, etc. Native species such as Rocky Mountain juniper, ponderosa pine, Douglas fir, broom snakeweed, rabbitbrush species., blue grama, Sandberg bluegrass, etc. when their populations are significant enough to affect ecological function, indicate site condition departure.**

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17. **Perennial plant reproductive capability:** **In the reference condition, all plants are vigorous enough for reproduction either by seed or rhizomes in order to balance natural mortality with species recruitment. Density of plants indicates that plants reproduce at level sufficient to fill available resource.**
