Ecological site EX044B01A165
Thin Claypan (TCp)
10-14" PZ Frigid

Last updated: 2/11/2025
Accessed: 07/20/2026

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 and borders two MLRAs: 43B Central Rocky Mountains and Foothills and 46 Northern and Central Rocky Mountain Foothills. The major watersheds of this MLRA are those of the Missouri and Yellowstone Rivers and their associated headwaters such as the Beaverhead, Big Hole, Jefferson, Ruby, Madison, Gallatin, and Shields Rivers. These waters allow for extensive irrigation for crop production in an area that would generally only be compatible with rangeland and grazing. The Missouri River and its headwaters are behind several reservoirs that supply irrigation water, hydroelectric power, and municipal water. Limited portions of the MLRA are west of the Continental Divide along the Clark Fork River. The primary land use of this MLRA is production agriculture (grazing, small grain production, and hay), but there is some limited mining. Urban development is high with large expanses of rangeland converted to subdivisions for a rapidly growing population. The MLRA consists of one Land Resource Unit (LRU) and seven climate based LRU subsets. These subsets are based on a combination of Relative Effective Annual Precipitation (REAP) and frost free days. Each subset expresses a distinct set of plants that differentiate it from other LRU subsets. Annual precipitation ranges from a low of 9 inches to a high 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 edge of the MLRA at the border with MLRA 43B. Frost free days also vary widely from less than 30 days in the Big Hole Valley to around 110 days in the warm valleys along the Yellowstone and Missouri Rivers. The plant communities of the MRLA are highly variable, but the dominant community is a cool-season grass and shrub-steppe community. Warm-season grasses have an extremely limited extent in this MLRA. Most subspecies of big sagebrush are present, to some degree, across the MLRA.

LRU notes

MLRA 44B has one LRU that covers the entire MLRA. The LRU has been broken into seven climate subsets based on a combination of Relative Effective Annual Precipitation (REAP) and frost free days. Each combination of REAP and frost free days results in a common plant community that is shared across the subset. Each subset is giving a letter designation of A through F for sites that do not receive additional water and Y for sites that receive additional water. LRU 01 Subset A has a REAP of nine to 14 inches (228.6-355.6mm) with a frost free days range of 70 to 110 days. This combination of REAP and frost free days results in a nearly treeless sagebrush steppe landscape. The soil moisture regime is Ustic, dry that borders on Aridic and has a Frigid soil temperature regime.

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

The Thin Claypan ecological site is an upland site formed from alluvium and is on slopes less than 15 percent. The site does not receive additional moisture from a water table or flooding. The Thin Claypan site has less than four (4) inches of the mineral surface over a heavy clay layer. This clay layer has greater than 35 percent clay. The site is moderately deep to very deep and has no root-restrictive layers within 20 inches (50cm). The site has a natric or relic natric horizons and is not strongly or violently effervescent within four inches of the mineral surface. This natric or relic natric horizon has a columnar structure, abrupt water restrictive clay layer present within 8" of soil surface. The surface of the site has less than five percent stone and is not skeletal, with less than 35 percent rock fragments in the 10 to 20-inch depth. Calcium carbonates may increase with depth.

Associated sites

EX044B01A001	**Clayey (Cy) 10-14" PZ Frigid** The clayey ecological site occupies adjacent sites, often the hills above the Thin Claypan site.
EX044B01A006	**Claypan (Cp) 10-14" PZ Frigid** The Claypan ecological site occupies the same landscape as the Thin Claypan and is frequently adjacent to or intermixed with Thin Claypan sites. Plant communities are very similar and will share similar state and transition models.

Similar sites

EX044B01A006	**Claypan (Cp) 10-14" PZ Frigid** The Claypan ecological occupies the same landscape as the Thin Claypan and is frequently adjacent to or intermixed with Thin Claypan sites. Plant communities are very similar and will share similar state and transition models. Claypan differs from other ecological sites in that it has higher plant productivity and deeper soil over the natric horizon.

Table 1. Dominant plant species

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

Legacy ID

R044BA165MT

Physiographic features

The Thin Claypan site exists on gently sloping (less than 15 percent slope) low hills near the valley bottom or on fan remnants.

Table 2. Representative physiographic features

Landforms	(1) Intermontane basin > Hill (2) Intermontane basin > Fan remnant
Flooding frequency	None

Ponding frequency	None
Elevation	1,370 – 1,980 m
Slope	0 – 20 %
Water table depth	100 cm
Aspect	Aspect is not a significant factor

Climatic features

The Central Rocky Mountain Valleys MLRA has a continental climate. Fifty to sixty percent of the annual long-term average precipitation falls between May and August. Average precipitation for LRU 01 Subset A is 12 inches (305mm), and the frost-free period averages 78 days. Precipitation is highest in May and June.

Table 3 Representative climatic features

Frost-free period (characteristic range)	70-110 days
Freeze-free period (characteristic range)	110-140 days
Precipitation total (characteristic range)	230-360 mm
Frost-free period (actual range)	70-110 days
Freeze-free period (actual range)	110-140 days
Precipitation total (actual range)	230-360 mm
Frost-free period (average)	80 days
Freeze-free period (average)	130 days
Precipitation total (average)	310 mm

- (1) HELENA RGNL AP [USW00024144], Helena, MT
- (2) GARDINER [USC00243378], Gardiner, MT
- (3) DILLON AP [USW00024138], Dillon, MT
- (4) DEER LODGE 3 W [USC00242275], Deer Lodge, MT
- (5) TRIDENT [USC00248363], Three Forks, MT
- (6) BOULDER [USC00241008], Boulder, MT

- (7) DILLION U OF MONTANA WESTERN [USC00242409], Dillon, MT
- (8) ENNIS [USC00242793], Ennis, MT
- (9) TWIN BRIDGES [USC00248430], Sheridan, MT
- (10) TOWNSEND [USC00248324], Townsend, MT

Influencing water features

The site has a clay layer near the surface which slows infiltration. Runoff is high.

Wetland description

This site is not associated with wetland characteristics.

Soil features

This site exists on sedimentary-originated soil with a high sodium (natric or relic natric) horizon that has a columnar structure (within 20 inches of the soil surface) and an abrupt root or water-restrictive clay layer within 4 inches of the surface. As a result of this high clay layer, infiltration rates are slow. Clay content in the top four inches of soil is variable; however, an argillic horizon will have a significant increase in clay over the surface. Surface soil structure will range from fine granular to subangular blocky. An E horizon may be present, and if so, it will have a weak, platy structure. The structure of the clay layer will be columnar.

Common soil series include Dyce and Doolittle. As these soils may express a range of characteristics, it is necessary to use the most current ecological site key with an onsite soil pit to determine the correct ecological site.

Table 4. Representative soil features

Parent material	(1) Alluvium – sedimentary rock
Surface texture	(1) Clay loam (2) Loam
Family particle size	(1) Fine
Drainage class	Well drained
Permeability class	Moderately slow to slow
Surface fragment cover <=3"	0 – 10 %
Surface fragment cover >3"	Not specified
Calcium carbonate equivalent (5.1-25.4cm)	10 – 20 %
Clay content (0-5.1cm)	20 – 30 %

Soil reaction (1:1 water) (5.1-25.4cm)	7.4 – 8.6

Ecological dynamics

The Thin Claypan Ecological Site occurs in a relatively small landscape; however, slight variations within the plant community may exist due to elevation, frost-free days, and relative effective annual precipitation.

The reference plant community is dominated by bluebunch wheatgrass (Pseudoroegneria spicata) and needle and thread. Subdominant species may include western wheatgrass, Wyoming big sagebrush (Artemisia tridentata ssp. wyomingensis), winterfat (Krascheninnikovia lanata), and dotted gayfeather (Liatris punctata). This potential is suggested by investigations showing a predominance of perennial grasses on near-pristine range sites (Ross et al., 1973). In the reference plant community, shrubs comprise 10 to 15 percent of the community, which tends to be higher than many other ecological sites in this MLRA.

The natural fire return interval of the area is highly variable, ranging up to 100 years, but due to the sparse vegetation and low production, natural fire is exceedingly rare.

A shift to the dominance of shrubs may occur in response to improper grazing management, drought, or where big sagebrush occurs due to a lack of fire. As the mid-stature bunchgrasses decrease, shrub encroachment by a variety of species, including broom snakeweed (Gutierrezia sarothrae), prairie sagewort (Artemisia frigida), Wyoming big sagebrush, yellow rabbitbrush (Chrysothamnus viscidiflorus), rubber rabbitbrush (Ericameria nauseosa), and plains prickly pear (Opuntia polyacantha), occurs within this site. 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 Shortgrass 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. Grazed areas received periodic high intensity, short duration grazing pressure due to bison's nomadic nature and herd structure. Livestock forage was noted as being minimal in areas recently grazed by bison (Lesica and Cooper 1997). Meriwether Lewis documented that he was met by 60 Shoshone warriors on horseback in August 1805, and the Corps of Discovery was later supplied with horses by the same band of Shoshone. This suggests that the areas near the modern-day Montana towns of Twin Bridges, Dillon, Grant, and Dell were grazed by an untold number of horses for nearly 50 years prior to the large introduction of cattle and sheep. The gold boom of 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, sheep production increased by more than 400 percent and dominated the livestock industry until the 1930s. Since then, cattle production has dominated the region's livestock industry (Wyckoff and Hansen 2001).

Due to the alkaline pH and high clay content of the soils on this site, the potential for dryland farming is low, and it is rarely successful over the long term.

Dense clubmoss (Selaginella densa), in general, is a minor component of the reference plant community of this ecological site. The conditions that created large cover classes of clubmoss on this site point to a history of continuous (year-long) or moderate spring grazing use (Sturm 1954). In some situations, the site could be old crop fields that have reverted back to rangeland. In this case, clubmoss is helping reduce erosion and increase site stability, especially where livestock use is restricted (such as in CRP). While dense clubmoss provides soil stability on sites where it exists, anecdotal observations by some suggest that it competes for the limited water resources in the upper soil profile, which restricts plant available water; however, a study from Canada (Colberg and Romo 2003) in a similar climate on similar soils indicates that the correlation between reduced plant available water and clubmoss cover is negligible. Although quantitative evidence is currently unavailable, the correlation between reduced plant production and competition for space may simply be the cause. Dense patches of clubmoss may inhibit seed contact with the soil, reducing seedling recruitment.

Invasive weeds are beginning to have a high impact on this ecological site, particularly cheatgrass and field brome. These plants are typically associated with nearby human impacts (roads and construction activities).

Plant Communities and Transitions
A state and transition model 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.

Both percent species composition by weight and percent canopy cover are referenced in this document. Canopy cover drives the transitions between communities and states because of the influence of shade, the interception of rainfall, and the competition for available water. Species composition by dry weight remains an important descriptor of the herbaceous community and of the community as a whole. Woody species are included in the species composition for the site. Calculating the similarity index requires species composition by dry weight.

Although there is considerable qualitative experience supporting the pathways and transitions within the state and transition model (STM), no quantitative information exists that specifically identifies threshold parameters between grassland types and invaded types in this ecological site.

State and transition model

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Grass/Grasslike					
1	**Deep rooted bunchgrasses**			168-224	
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	140-168	25-40
	needle and thread	HECO26	*Hesperostipa comata*	56-84	5-10
	green needlegrass	NAVI4	*Nassella viridula*	11-73	5-10
	squirreltail	ELEL5	*Elymus elymoides*	0-22	0-1
2	**Rhizomatous grasses**			168-224	
	western wheatgrass	PASM	*Pascopyrum smithii*	146-202	5-10
	thickspike wheatgrass	ELLA3	*Elymus lanceolatus*	56-90	3-5
	plains reedgrass	CAMO	*Calamagrostis montanensis*	0-22	0-1
3	**Increaser Bunchgrass/Shortgrasses**			45-67	
	Sandberg bluegrass	POSE	*Poa secunda*	50-62	3-5
	prairie Junegrass	KOMA	*Koeleria macrantha*	22-45	0-5
	blue grama	BOGR2	*Bouteloua gracilis*	11-22	0-3
	saltgrass	DISP	*Distichlis spicata*	0-17	0-2
	needleleaf sedge	CADU6	*Carex duriuscula*	6-11	0-1
Shrub/Vine					
4	**Shrubs**			67-101	
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	45-90	10-15
	greasewood	SAVE4	*Sarcobatus vermiculatus*	0-22	0-5
	little sagebrush	ARAR8	*Artemisia arbuscula*	0-22	0-5
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0-11	0-1
	prairie sagewort	ARFR4	*Artemisia frigida*	0-11	0-1
	Gardner's saltbush	ATGA	*Atriplex gardneri*	0-6	0-1
	slender buckwheat	ERMI4	*Eriogonum microthecum*	0-6	0-1
	plains pricklypear	OPPO	*Opuntia polyacantha*	0-1	0
Forb					
5	**Forbs**			22-34	
	American vetch	VIAM	*Vicia americana*	11-22	1-3
	desertparsley	LOMAT	*Lomatium*	6-11	1-2
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	6-11	1-2
	bastard toadflax	COUM	*Comandra umbellata*	6-11	1-2
	pussytoes	ANTEN	*Antennaria*	6-11	1-2
	spiny phlox	PHHO	*Phlox hoodii*	6-11	0-2
	milkvetch	ASTRA	*Astragalus*	0-11	0-2

	woolly plantain	PLPA2	*Plantago patagonica*	0-1	0-1

Table 6. Community 1.2 plant community composition

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

Table 7. Community 2.1 plant community composition

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

Table 8. Community 3.1 plant community composition

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

Table 9. Community 4.1 plant community composition

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

Animal community

The Claypan ecological site provides a variety of wildlife habitats 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 Bunchgrass Community (1.1) will likely have the minimum sagebrush canopy cover present. The potential for a diverse forb component in the Reference State may provide important early-season (spring) foraging habitat for the greater sage grouse and their broods. Other communities on the site with sufficient sagebrush cover may harbor sage grouse populations, specifically Community 2.1 (Rhizomatous Grass-Shrub), where big sagebrush populations are under a reduced fire regime. Also, as the canopy cover of sagebrush increases in State 2 and, to a lesser extent, in Degraded State 3, pygmy rabbit, Brewer's sparrow, and mule deer use may increase. Managed livestock grazing is suitable on this site; however, this site can be easily damaged by overgrazing due to its lower production and high bare ground percentage. In order to maintain the productivity of the site, grazing on adjoining sites with less production must be managed carefully to make sure 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. According to McLean et al., early-season defoliation of bluebunch wheatgrass can result in high mortality and reduced vigor in plants. They also suggest, based on prior studies, that regrowth is necessary before dormancy to reduce injury of bluebunch wheatgrass.

The grazing season has a greater impact 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 Rhizomatous Grass State is subject to further degradation into the Shortgrass-Shrub 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 an increased risk of further degradation. 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 the species composition of invasive species. In the Shortgrass-Shrub State, grazing may be possible but is generally not economically or environmentally sustainable.

Hydrological functions

The hydrologic cycle functions best in the Reference State (1) with good infiltration and deep percolation of rainfall; however, the cycle degrades as the vegetation community declines. Rapid rainfall infiltration, high soil organic matter, good soil structure, and good porosity accompany high bunchgrass canopy cover (Thurow et al. 1986). 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 Bunchgrass-Shrub 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 nonexistent. Plant litter remains in place and is not moved by wind or water. In the Shortgrass Shrub State (3) and the Invaded State (4), canopy and ground cover are greatly reduced compared to the Reference State (1), which impedes the hydrologic cycle. Infiltration will decrease and runoff will increase due to reduced ground cover, 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. (McCalla et al., 1984)

Recreational uses

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

Wood products

none

Other products

none

Inventory data references

The information contained within this Ecological Site Description has been obtained from field observations, historic data, and professional judgement. Inventory sites are located across Southwest Montana.

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Approval

Kirt Walstad, 2/11/2025

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	05/10/2020
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.

2. **Presence of water flow patterns:** Water flow patterns are rarely present except after heavy rainfall events. If present, flow patterns will be short (less than 2 feet 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 20-25%. It consists of small, randomly scattered patches.

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):** Litter movement is not evident in the reference condition.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** The average soil stability rating is 4-5 under plant canopies and 3 in plant interspaces. The A horizon thickness is highly variable and is 1-4 inches thick.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil Structure at the surface is medium granular. A Horizon should be 1-4 inches thick with color, when wet, typically ranging in Value of 4 or less and Chroma of 3 or less. Local geology may affect color, it is important to reference the Official Series Description (OSD) for characteristic range. https://soilseries.sc.egov.usda.gov/osdname.aspx

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Infiltration of the Thin Clay Pan ecological site is slow to very slow. The site is well drained. An even distribution of mid stature bunchgrasses (40 percent), rhizomatous grass (35 percent), cool season shortgrasses (10-15 percent), forbs (1-5 percent), and shrubs (5-15 percent) optimizes infiltration and reduces runoff under normal moisture events.

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** A compaction layer is not present in the reference condition. Soil profile will contain an abrupt transition to an argillic horizon which can be misinterpreted as compaction, however, the soil structure will be strong medium subangular blocky, where a compaction layer will be platy or structureless (massive).

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant: Mid-statured, cool season, perennial bunchgrasses (Bluebunch wheatgrass) = rhizomatous grasses

    Sub-dominant: shrubs > shortgrass grasses/grasslikes (blue grama, Junegrass) > forbs

    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 is 3 percent or less.

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14. **Average percent litter cover (%) and depth (in):** Total litter cover ranges from 25-30%. 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 500lbs/acre. Low: 300lbs/acre High 700lbs/acre. Production varies based on effective precipitation and natural variability of soil properties for this ecological site. Metric: Low: 336 kg/ha Average (RV): 560 kg/ha High: 785 kg/ha

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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 brome spp., spotted knapweed, crested wheatgrass, pale alyssum, field pennycress (fanweed) Native species such as broom snakeweed, Sandberg's bluegrass, blue grama, pricklypear cactus, greasewood, 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.**
