USDA Natural Resources Conservation Service

Ecological site R043BY210WY
Dense Clay Foothills and Mountains West

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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.

Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

Associated sites

R043BY204WY	**Clayey Foothills and Mountains West**

Similar sites

R034AY210WY	**Dense Clay Foothills and Basins West (DC)** Dense Clay (DC), 10-14W has lower production and no spike fescue.
R043BY204WY	**Clayey Foothills and Mountains West** Clayey (Cy), 15-19W has higher production, less evident soil cracking, and mountain big sagebrush instead of low sage.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

This site can be found in a lowland or upland position, on flat to moderately sloping land.

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan (2) Stream terrace
Flooding frequency	None
Ponding frequency	None
Elevation	1,707–2,530 m
Slope	0–60%
Ponding depth	0 cm

Climatic features

Annual precipitation ranges from 15-19 inches per year. Wide fluctuations may occur in yearly precipitation and result in more dry years than those with more than normal 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. Extreme storms may occur during the winter, but most severely affect ranch operations during late winter and spring.

Prevailing winds are from the southwest, and strong winds are less frequent than over other areas of Wyoming. Occasional storms, however, can bring brief periods of high winds with gusts exceeding 50 mph.

Growth of native cool season plants begins about May 15 and continues to about August 15.

The following information is from the “Jackson” climate station:

Table 3. Representative climatic features

Frost-free period (average)	60 days
Freeze-free period (average)	100 days
Precipitation total (average)	483 mm

Influencing water features

Soil features

The soils of this site are moderately deep to very deep (greater than 20” to bedrock), well to poorly drained soils formed in alluvium. These soils have slow to very slow permeability. The topsoil, except for thin ineffectual layers, will be heavy clays and/or soils that develop large cracks when dry and are very sticky when wet. These soils are not high in salinity and /or alkalinity.

Table 4. Representative soil features

Surface texture	(1) Clay loam (2) Clay (3) Sandy clay loam
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Very slow to slow
Soil depth	51–152 cm

Surface fragment cover <=3"	0–5%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	7.11–15.24 cm
Calcium carbonate equivalent (0-101.6cm)	5–15%
Electrical conductivity (0-101.6cm)	4–16 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–10
Soil reaction (1:1 water) (0-101.6cm)	7.4–9
Subsurface fragment volume <=3" (Depth not specified)	0–15%
Subsurface fragment volume >3" (Depth not specified)	0%

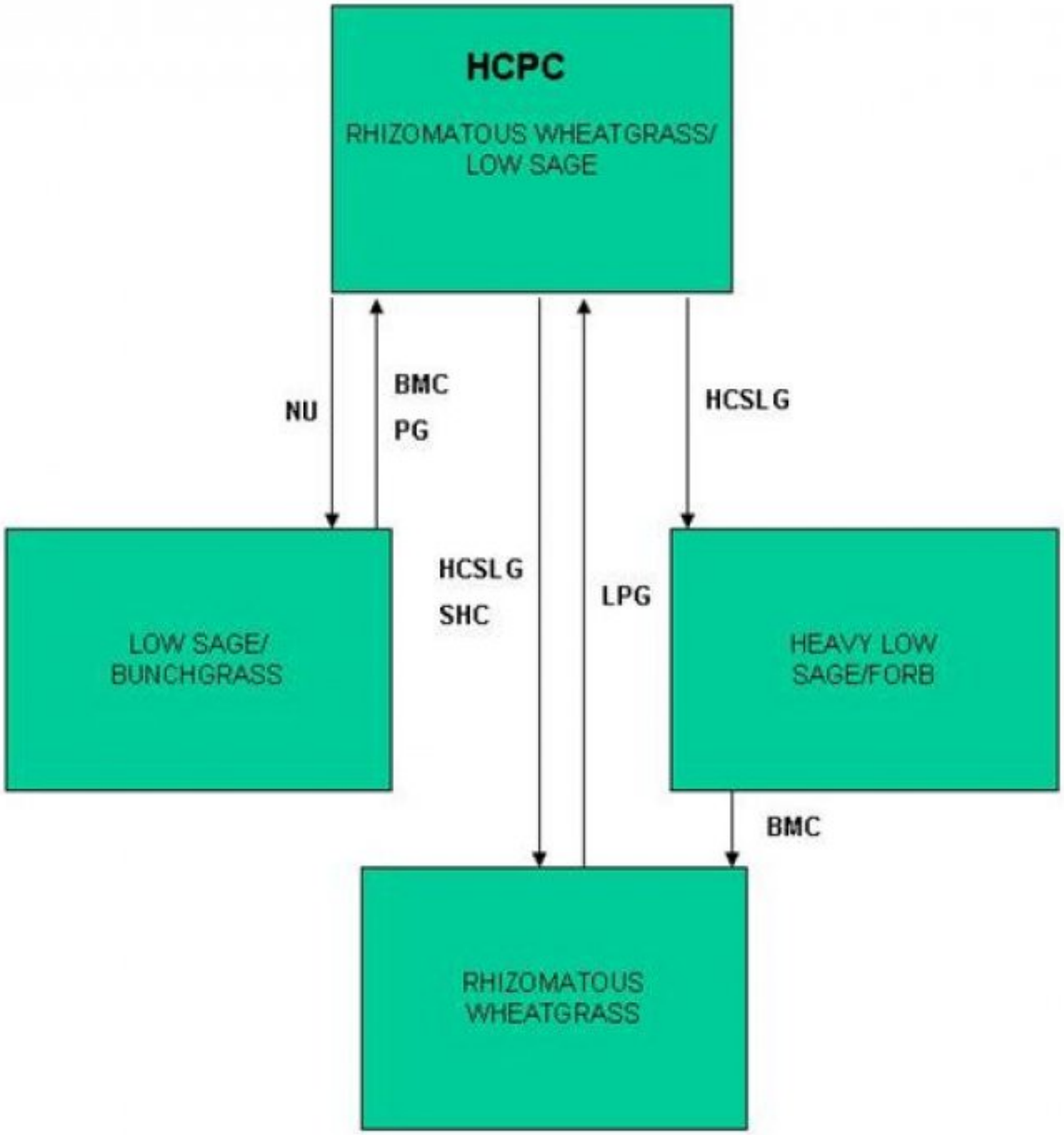
Ecological dynamics

As this site deteriorates from improper grazing management, rhizomatous wheatgrass, early or low sagebrush, and green rabbitbrush will increase. Basin wildrye, mountain brome, and spike fescue will decrease in frequency and production.

The Historic Climax Plant Community (description follows the plant community diagram) has been determined by study of rangeland relic areas, or areas protected from excessive disturbance. Trends in plant communities going from heavily grazed areas to lightly grazed areas, seasonal use pastures, and historical accounts have also been used.

The following is a State and Transition Model Diagram that illustrates the common plant communities (states) that can occur on the site and the transitions between these communities. The ecological processes will be discussed in more detail in the plant community narratives following the diagram.

State and transition model



BMA – Brush Management (all methods)
BMC – Brush Management (chemical)
BMF – Brush Management (fire)
BMM – Brush Management (mechanical)
CSP – Chemical Seedbed Preparation
CSLG – Continuous Season-long Grazing
DR – Drainage
CSG – Continuous Spring Grazing
HB – Heavy Browse
HCSLG – Heavy Continuous Season-long Grazing
HI – Heavy Inundation
LPG – Long-term Prescribed Grazing
MT – Mechanical Treatment (chiseling, ripping, pitting)
NF – No Fire
NS – Natural Succession
NWC – Noxious Weed Control
NWI – Noxious Weed Invasion
NU – Nonuse
P&C – Plow & Crop (including hay)
PG – Prescribed Grazing
RPT – Re-plant Trees
RS – Re-seed
SGD – Severe Ground Disturbance
SHC – Severe Hoof Compaction
WD – Wildlife Damage (Beaver)
WF - Wildfire

State 1
Rhizomatous Wheatgrass/Low Sage Plant Community (HCPC)

Community 1.1
Rhizomatous Wheatgrass/Low Sage Plant Community (HCPC)

The interpretive plant community for this site is the Historic Climax Plant Community. This state evolved with grazing by large herbivores and is suited for grazing by domestic livestock. Potential vegetation is estimated at 75% grasses or grass-like plants, 15% forbs and 10% woody plants. The major grasses include rhizomatous wheatgrass, basin wildrye, mountain brome, slender wheatgrass, and spike fescue. Other grasses and grass-like plants may include Columbia and Letterman needlegrass, prairie junegrass, Idaho fescue, sun sedge, and mutton and Sandberg bluegrass. Low sagebrush is the major woody plant. Other woody plants that may occur include early sagebrush, and green rabbitbrush. A typical plant composition for this state consists of rhizomatous wheatgrass 10-25%, basin wildrye 5-15%, mountain brome 1-15%, slender wheatgrass 1-15%, spike fescue 1-15%, other grasses and grass-like plants 10-25%, perennial forbs 5-15%, low sagebrush 1-10%, and up to 5% other woody species. Ground cover, by ocular estimate, varies from 60-65%. The total annual production (air-dry weight) of this state is about 1200 pounds per acre, but it can range from about 800 lbs./acre in unfavorable years to about 1500 lbs./acre in above average years. The following is the growth curve of this plant community expected during a normal year: Growth curve number: WY0201 Growth curve name: 15-19W, UPLAND SITES Growth curve description: ALL UPLAND SITES JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC 0 0 0 0 10 35 30 20 5 0 0 0 (Monthly percentages of total annual growth) This state is extremely stable and well adapted to the Central Rocky Mountains climatic conditions. The diversity in plant species allows for high drought resistance. This is a sustainable plant community (site/soil stability, watershed function, and biologic integrity). Transitions or pathways leading to other plant communities are as follows: • Nonuse will convert this plant community to the Low Sage/Bunchgrass State. • Heavy Continuous Season-long Grazing and Severe Hoof Compaction will convert this plant community to the Rhizomatous Wheatgrass State. • Heavy Continuous Season-long Grazing will convert this plant community to the Heavy Low Sage/Forb State.

Figure 4. Plant community growth curve (percent production by month). WY0201, 15-19W Upland sites.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
				10	35	30	20	5			

State 2
Low Sage/Bunchgrass Plant Community

Community 2.1
Low Sage/Bunchgrass Plant Community

This plant community is the result of protection from grazing. Low sagebrush, and sometimes early sage, dominates with annual production often exceeding 20%, and herbaceous forage production is decreased. The understory of grass includes rhizomatous wheatgrass, bottlebrush squirreltail, and mutton bluegrass. The total annual production (air-dry weight) of this state is about 1000 pounds per acre, but it can range from about 600 lbs./acre in unfavorable years to about 1300 lbs./acre in above average years. The following is the growth curve of this plant community expected during a normal year: Growth curve number: WY0201 Growth curve name: 15-19W, UPLAND SITES Growth curve description: ALL UPLAND SITES JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC 0 0 0 0 10 35 30 20 5 0 0 0 (Monthly percentages of total annual growth) The state is stable and protected from excessive erosion. The biotic integrity of this plant community is usually intact, however forage value will decrease and wildlife values will shift toward different species. The watershed is functioning. Transitional pathways leading to other plant communities are as follows: • Chemical Brush Management followed by 1 to 2 years deferment as part of a Prescribed Grazing plan will result in a plant community very similar to the Historic Climax Plant Community (Rhizomatous Wheatgrass/Low Sage State).

Figure 5. Plant community growth curve (percent production by month). WY0201, 15-19W Upland sites.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
				10	35	30	20	5			

State 3
Rhizomatous Wheatgrass Plant Community

Community 3.1
Rhizomatous Wheatgrass Plant Community

This plant community is the result of improper grazing techniques, with sheep in particular, and involving severe hoof compaction of heavy clay soils. Shrubs have been removed, and rhizomatous wheatgrass is the dominant and sometime the only species present. There is a substantial amount of bare ground. Phlox is a common forb on this site. The total annual production (air-dry weight) of this state is about 500 pounds per acre, but it can range from about 300 lbs./acre in unfavorable years to about 700 lbs./acre in above average years. The following is the growth curve of this plant community expected during a normal year: Growth curve number: WY0201 Growth curve name: 15-19W, UPLAND SITES Growth curve description: ALL UPLAND SITES JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC 0 0 0 0 10 35 30 20 5 0 0 0 (Monthly percentages of total annual growth) The soil is not protected and erosion will increase if management is not changed. The biotic integrity may be reduced due to low vegetative production and plant diversity. The watershed is functioning at risk. Transitional pathways leading to other plant communities are as follows: • Long-term Prescribed Grazing will result in a plant community very similar to the Historic Climax Plant Community (Rhizomatous Wheatgrass/Low Sage State).

Figure 6. Plant community growth curve (percent production by month). WY0201, 15-19W Upland sites.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
				10	35	30	20	5			

State 4
Heavy Low Sage/Forb Plant Community

Community 4.1
Heavy Low Sage/Forb Plant Community

This plant community is the result of long-term, improper cattle grazing. Low sagebrush, and sometimes early sage, dominates with annual production often exceeding 30-60%. There is mostly bare ground between sagebrush plants with an understory of grass and forbs limited to the protected areas under shrubs. The major grasses include Sandberg bluegrass and rhizomatous wheatgrass. The total annual production (air-dry weight) of this state is about 400 pounds per acre, but it can range from about 200 lbs./acre in unfavorable years to about 600 lbs./acre in above average years. The following is the growth curve of this plant community expected during a normal year: Growth curve number: WY0201 Growth curve name: 15-19W, UPLAND SITES Growth curve description: ALL UPLAND SITES JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC 0 0 0 0 10 35 30 20 5 0 0 0 (Monthly percentages of total annual growth) Soil erosion is accelerated because of increased bare ground. The biotic community has been compromised, but is relatively stable. The watershed is functioning, but is at risk of further degradation. Water flow patterns and pedestals are obvious. Infiltration is reduced and runoff is increased. Transitional pathways leading to other plant communities are as follows: • Chemical Brush Management will convert this plant community to the Rhizomatous Wheatgrass State.

Figure 7. Plant community growth curve (percent production by month). WY0201, 15-19W Upland sites.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
				10	35	30	20	5			

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1				135–336	
	western wheatgrass	PASM	*Pascopyrum smithii*	135–336	–
2				67–202	
	basin wildrye	LECI4	*Leymus cinereus*	67–202	–
3				13–202	
	mountain brome	BRMA4	*Bromus marginatus*	13–202	–
4				13–202	
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	13–202	–
5				13–202	
	spike fescue	LEKI2	*Leucopoa kingii*	13–202	–
6				135–336	
	Grass, perennial	2GP	*Grass, perennial*	0–67	–
	Letterman's needlegrass	ACLE9	*Achnatherum lettermanii*	0–67	–
	Columbia needlegrass	ACNE9	*Achnatherum nelsonii*	0–67	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	0–67	–
	squirreltail	ELEL5	*Elymus elymoides*	0–67	–
	Idaho fescue	FEID	*Festuca idahoensis*	0–67	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–67	–
	muttongrass	POFE	*Poa fendleriana*	0–67	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–67	–
Forb					
7				67–202	
	Forb, perennial	2FP	*Forb, perennial*	0–67	–
	common yarrow	ACMI2	*Achillea millefolium*	0–67	–
	rosy pussytoes	ANRO2	*Antennaria rosea*	0–67	–
	milkvetch	ASTRA	*Astragalus*	0–67	–
	hawksbeard	CREPI	*Crepis*	0–67	–
	larkspur	DELPH	*Delphinium*	0–67	–
	fleabane	ERIGE2	*Erigeron*	0–67	–
	buckwheat	ERIOG	*Eriogonum*	0–67	–
	aster	EUCEP2	*Eucephalus*	0–67	–
	sneezeweed	HELEN	*Helenium*	0–67	–
	little sunflower	HEPU3	*Helianthus pumilus*	0–67	–
	desertparsley	LOMAT	*Lomatium*	0–67	–
	bluebells	MERTE	*Mertensia*	0–67	–
	locoweed	OXYTR	*Oxytropis*	0–67	–
	ragwort	PACKE	*Packera*	0–67	–
	phlox	PHLOX	*Phlox*	0–67	–
	American vetch	VIAM	*Vicia americana*	0–67	–

	mule-ears	WYAM	*Wyethia amplexicaulis*	0–67	–
Shrub/Vine					
8				13–135	
	little sagebrush	ARAR8	*Artemisia arbuscula*	13–135	–
	little sagebrush	ARARL	*Artemisia arbuscula ssp. longiloba*	13–135	–
9				0–67	
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–67	–

Animal community

Animal Community – Wildlife Interpretations
Rhizomatous Wheatgrass/Low Sage Plant Community (HCPC): Suitable thermal and escape cover for mule deer and elk may be limited due to the low height and density of woody plants. Year-round habitat is provided for many sagebrush obligate species such as the sage sparrow, sage thrasher, pygmy rabbit, sagebrush vole, horned lizard, and pronghorn antelope. Other birds that would frequent this plant community include horned larks and golden eagles.

Low Sage/Bunchgrass Plant Community: This plant community may be beneficial for the same wildlife that would use the Historic Climax Plant Community.

Rhizomatous Wheatgrass Plant Community: This plant community has a low level of diversity. Due to the dominance of grasses, feed for browsing animals is limited. Areas of bare ground may provide lek locations for sage grouse.

Heavy Low Sage/Forb Plant Community: This plant community may be beneficial for the same wildlife that would use the Historic Climax Plant Community. However, the plant community composition is less diverse, and thus, less apt to meet the seasonal needs of these animals.

Animal Community – Grazing Interpretations
The following table lists suggested stocking rates for cattle under continuous season-long grazing under normal growing conditions. 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). Because of this, a field visit is recommended, in all cases, to document plant composition and production. More precise carrying capacity estimates should eventually be calculated using this information along with animal preference data, particularly when grazers other than cattle are involved. Under more intensive grazing management, improved harvest efficiencies can result in an increased carrying capacity. If distribution problems occur, stocking rates must be reduced to maintain plant health and vigor.

Plant Community Production Carrying Capacity*
(lb./ac) (AUM/ac)
Rhizomatous Wheatgrass/Low Sage (HCPC) 800-1500 .35
Low Sage/Bunchgrass 600-1300 .3
Rhizomatous Wheatgrass 400-1000 .22
Heavy Low Sage/Forb 200-600 .12

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

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

Hydrological functions

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

Rills and gullies should not typically be present. Water flow patterns should be barely distinguishable if at all present. Pedestals are only slightly present in association with bunchgrasses. Litter typically falls in place, and signs of movement are not common. Chemical and physical crusts are rare to non-existent. Cryptogamic crusts are present, but only cover 1-2% of the soil surface.

Recreational uses

This site provides limited hunting opportunities.

Wood products

No appreciable wood products are present on the site.

Inventory data references

Inventory Data References (narrative)
Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range trained personnel were also used. Those involved in developing this site include: Bill Christensen, Range Management Specialist, NRCS; Karen Clause, Range Management Specialist, NRCS; and Everet Bainter, Range Management Specialist, NRCS. Other sources used as references include: USDA NRCS Water and Climate Center, USDA NRCS National Range and Pasture Handbook, and USDA NRCS Soil Surveys from various counties.

Inventory Data References
Data Source Number of Records Sample Period State County
SCS-RANGE-417 58 1966-1986 WY Lincoln & others

Contributors

K. Clause

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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Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rare to nonexistent. Where present, short and widely spaced.

2. **Presence of water flow patterns:** Barely observable.

3. **Number and height of erosional pedestals or terracettes:** Rare to nonexistent.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground can range from 0-20%.

5. **Number of gullies and erosion associated with gullies:** Active gullies should not be present.

6. **Extent of wind scoured, blowouts and/or depositional areas:** Rare to nonexistent.

7. **Amount of litter movement (describe size and distance expected to travel):** Herbaceous and large woody litter not expected to move.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil Stability Index ratings range from 3 (interspaces) to 6 (under plant canopy), but average values should be 4.5 or greater.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil data is limited for this site. Soil OM of 2 to 5% is expected.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Plant community consists of 70-80% grasses, 15% forbs, and 5-15% shrubs. Evenly distributed plant canopy (60-90%) and litter, despite slow infiltration rates, results in minimal runoff. Basal cover is typically 5-15% for this site and does affect runoff on this site.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None.

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: Mid-size, cool season bunchgrasses> cool season rhizomatous grasses>perennial forbs>perennial shrubs>short, cool season bunchgrasses

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Minimal decadence, typically associated with shrub component.

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14. **Average percent litter cover (%) and depth (in):** Litter ranges from 5-35% of total canopy measurement with total litter (including beneath the plant canopy) from 50-85% expected. Herbaceous litter depth typically ranges from 5-15mm. Woody litter can be up to a couple inches (4-6 cm).

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** English: 800-1500 lb/ac (1200 lb/ac average); Metric 896-1680 kg/ha (1344 kg/ha average).

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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:** Bare ground greater than 30% is the most common indicator of a threshold being crossed. Sandberg bluegrass, buckwheat, and phlox are common increasers. Kentucky bluegrass, common dandelion, thistles, and annual weeds are common invasive species in disturbed sites.

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17. **Perennial plant reproductive capability:** All species are capable of reproducing, except in extreme drought years.
