USDA Natural Resources Conservation Service

Ecological site R061XY158WY
Shallow Clayey (SwCy) 15-19" Precipitation Zone, Black Hills

Accessed: 05/03/2024

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.

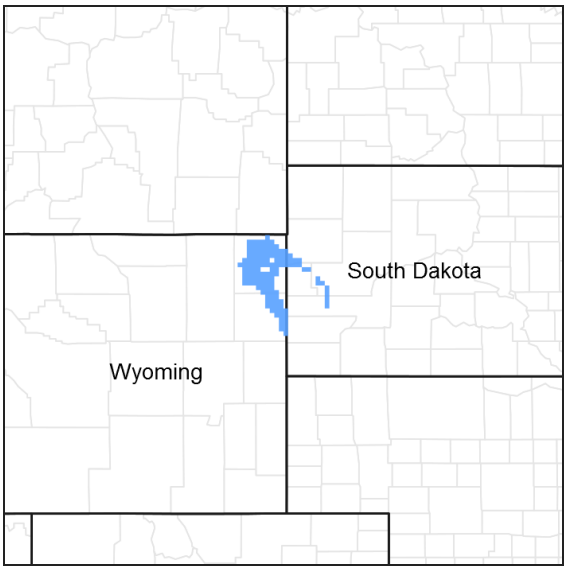


Figure 1. Mapped extent

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

R061XY104WY	**Clayey-West (16-20" PZ)**
R061XY162WY	**Shallow Loamy-West (16-20" PZ)**

Similar sites

R058BY258WY	**Shallow Clayey (SwCy) 15-17” PZ** Shallow Clayey 15-17" Northern Plains P.Z. has lower production.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

This site occurs on slopes and ridge tops, but may occur on all slopes.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Ridge (3) Escarpment
Flooding frequency	None
Ponding frequency	None
Elevation	1,067–1,524 m
Slope	0–60%
Ponding depth	0 cm
Water table depth	152 cm
Aspect	Aspect is not a significant factor

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.

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 April 1 and continues to about July 1. Native warm season plants begin about May 15 and continue to about August 15. Fall green-up may occur in September and last through October.

The following information is from the “Devils Tower 2” climate station:

Mean annual precipitation: 17.66 inches
Mean annual air temperature: 44.4 F (28.6 F Avg. Min. to 60.1 F Avg. Max.)
For detailed information visit the Natural Resources Conservation Service National Water and Climate Center at http://www.wcc.nrcs.usda.gov/ website. Other climate station(s) representative of this precipitation zone include ”Hulett” and “Sundance”.

Table 3. Representative climatic features

Frost-free period (average)	93 days
Freeze-free period (average)	125 days
Precipitation total (average)	508 mm

Influencing water features

Stream Type: None

Soil features

Representative Soil Features
The soils of this site are shallow (less than 20”to bedrock) well-drained soils formed in alluvium or residuum. These soils have moderate to slow permeability and may occur on all slopes. The bedrock is clay shale which is virtually impenetrable to plant roots. The soil textures included in this site are silty clay, clay, and the finer portions of sandy clay loam, clay loam, or silty clay loam. Thin ineffectual layers of other soil textures are disregarded. Layers of the

soil most influential to the plant community vary from 3 to 6 inches thick.

Table 4. Representative soil features

Surface texture	(1) Clay loam (2) Clay (3) Silty clay loam
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Very slow to moderately slow
Soil depth	25–51 cm
Surface fragment cover <=3"	0–25%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	3.56–10.67 cm
Calcium carbonate equivalent (0-101.6cm)	0–10%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–5
Soil reaction (1:1 water) (0-101.6cm)	6.1–8.4
Subsurface fragment volume <=3" (Depth not specified)	5–15%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

Ecological Dynamics of the Site:

As this site deteriorates, species such as blue grama and big sagebrush will increase. Cool season grasses such as green needlegrass, little bluestem, bluebunch wheatgrass, and rhizomatous wheatgrasses will decrease in frequency and production.

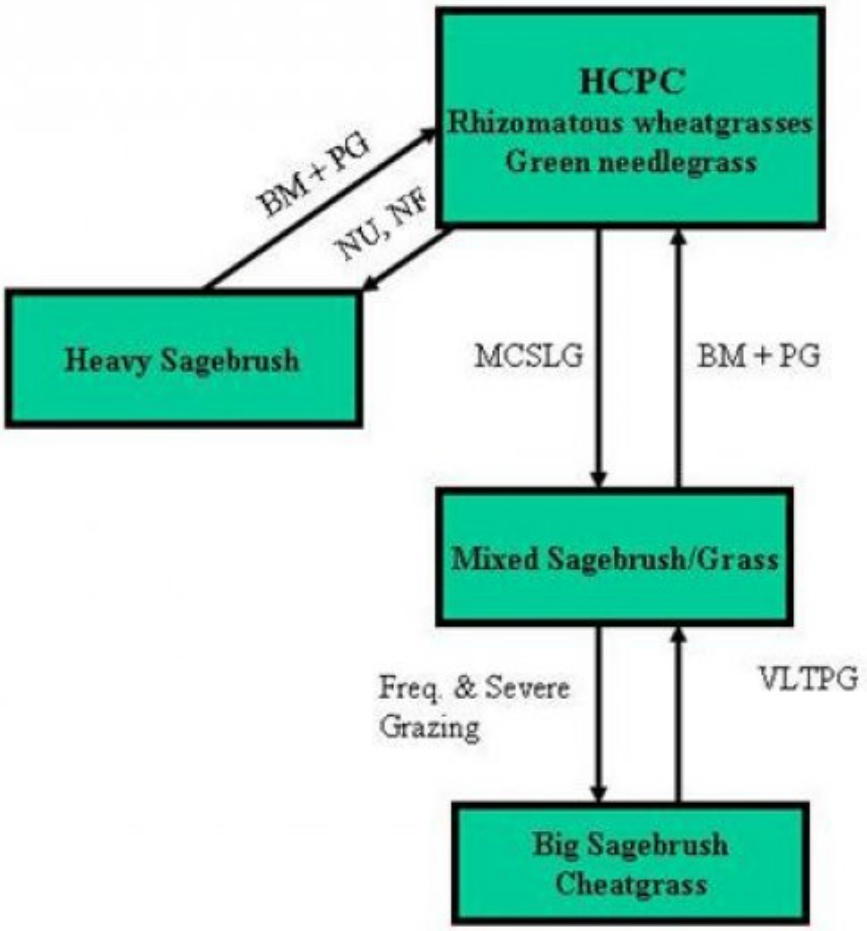
The Historic Climax Plant Community (description follows the plant community diagram) has been determined by study of rangeland relic areas, or areas protected from excessive disturbance. Trends in plant communities going from heavily grazed areas to lightly grazed areas, seasonal use pastures, and historical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

Plant Community Narratives
Following are the narratives for each of the described plant communities. These plant communities may not represent every possibility, but they probably are the most prevalent and repeatable plant communities. The plant composition tables shown above have been developed from the best available knowledge at the time of this revision. As more data is collected, some of these plant communities may be revised or removed, and new ones may be added. None of these plant communities should necessarily be thought of as “Desired Plant Communities”. According to the USDA NRCS National Range and Pasture Handbook, Desired Plant Communities (DPC’s) will be determined by the decision-makers and will meet minimum quality criteria established by the NRCS. The main purpose for including any description of a plant community here is to capture the current knowledge and experience

at the time of this revision.

State and transition model



BM - Brush Management (fire, chemical, mechanical)
Freq. & Severe Grazing - Frequent and Severe Utilization of the Cool-season Mid-grasses during the Growing Season
GLMT - Grazing Land Mechanical Treatment
LTPG - Long-tem Prescribed Grazing
MCSLG - Moderate, Continuous Season-long Grazing
NU, NF - No Use and No Fire
PG - Prescribed Grazing (proper stocking rates with adequate recovery periods during the growing season)
VLTPG - Very Long-term Prescribed Grazing (could possibly take generations)
Na - Moderate Sodium in Soil

State 1
Rhizomatous wheatgrasses/ Green needlegrass

Community 1.1
Rhizomatous wheatgrasses/ Green needlegrass

Rhizomatous Wheatgrasses, Green Needlegrass Plant Community The interpretive plant community for this site is the Historic Climax Plant Community (HCPC). This state evolved with grazing by large herbivores and is well suited for grazing by domestic livestock. Potential vegetation is about 75% grasses or grass-like plants, 15% forbs, and 10% woody plants. The state is dominated by cool season midgrasses. The major grasses include rhizomatous wheatgrasses, green needlegrass, little bluestem, and bluebunch wheatgrass. Other grasses include Sandberg bluegrass, blue grama, prairie junegrass, and plains reedgrass. Big sagebrush and winterfat are conspicuous elements of this state, occur in a mosaic pattern, and make up 5 to 10% of the annual production. Big sagebrush may become dominant on some areas with absence of fire. Natural fire occurred frequently in this community and prevented sagebrush from being the dominant landscape. Wildfires are actively controlled in recent times so chemical control using herbicides has replaced the historic role of fire on this state. Recently, controlled burning has regained some popularity. The total annual production (air-dry weight) of this state is about 1400 pounds per acre, but it can range from about 900 lbs/acre in unfavorable years to about 1800 lbs/acre in above average years. The state is extremely stable and well adapted to the Black Hills Foot Slopes 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: • Protection from grazing and fire will convert this plant community to the Heavy Sagebrush Plant Community. • Moderate, continuous season-long grazing will convert the plant community to the Mixed Sagebrush/Grass Plant Community. • Frequent & Severe season-long grazing will convert the plant community to the Big sagebrush/Cheatgrass Plant Community.

Figure 4. Plant community growth curve (percent production by month). WY1601, 15-19BL Upland sites.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
			5	20	40	15	5	10	5		

State 2
Heavy Sagebrush

Community 2.1
Heavy Sagebrush

Heavy Sagebrush Plant Community This plant community is the result of protection from grazing and fire. Big Sagebrush dominates this plant community with canopy cover often exceeding 50%. The understory of grass includes rhizomatous wheatgrasses, green needlegrass, little bluestem, bluebunch wheatgrass, and prairie junegrass. With complete protection from grazing and fire, the state will become dominated by big sagebrush. The sagebrush canopy protects the cool season grasses, but this protection makes them unavailable for grazing. Big sagebrush is long-lived and will persist for a long period. This plant community can provide valuable winter feed for both livestock (especially sheep) and wildlife (such as mule deer and antelope). The total annual production (air-dry weight) of this state is about 1000 pounds per acre, but it can range from about 800 lbs/acre in unfavorable years to about 1200 lbs/acre in above average years. The soil is protected from erosion. The watershed is functioning. The biotic integrity is maintained except that grass production has decreased. Transitional pathways leading to other plant communities are as follows: • Brush control followed by deferment for 1 to 2 years and prescribed grazing management thereafter will return this state to near Historic Climax Plant Community. Care should be taken when planning brush control to exclude critical winter ranges.

Figure 5. Plant community growth curve (percent production by month). WY1601, 15-19BL Upland sites.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
			5	20	40	15	5	10	5		

State 3
Mixed Sagebrush/Grass

Community 3.1
Mixed Sagebrush/Grass

Mixed Sagebrush/Grass Plant Community Historically, this plant community evolved under grazing by bison and a low fire frequency. Currently, it is found under moderate, season-long grazing by livestock in the absence of fire or brush control. Big sagebrush is a significant component of this plant community. Cool-season grasses make up the majority of the understory with the balance made up of short warm-season grasses, annual cool-season grass, and miscellaneous forbs. Dominant grasses include rhizomatous wheatgrasses, little bluestem, and green needlegrass. Grasses of secondary importance include blue grama, prairie junegrass, and Sandberg bluegrass. Forbs, commonly found in this plant community, include Louisiana sagewort (cudweed), plains wallflower, hairy goldaster, slimflower scurfpea, and scarlet globemallow. Sagebrush canopy ranges from 20% to 30%. Fringed sagewort is commonly found. Plains pricklypear and winterfat can also occur. When compared to the Historical Climax Plant Community, big sagebrush and blue grama have increased. Green needlegrass, little bluestem, and bluebunch wheatgrass have decreased, often occurring only where protected from grazing by the big sagebrush canopy. Production of cool-season grasses has also been reduced. Cheatgrass (downy brome) has invaded the state. The overstory of big sagebrush and understory of grass and forbs provide a diverse plant community that will support domestic livestock and wildlife such as mule deer and antelope. The total annual production (air-dry weight) of this state is about 900 pounds per acre, but it can range from about 600 lbs/acre in unfavorable years to about 1200 lbs/acre in above average years. The state is stable and protected from excessive erosion. The biotic integrity of this plant community is usually intact. However, it can be at risk depending on how far a shift has occurred in plant composition toward blue grama, sagebrush, and/or cheatgrass. The watershed is usually functioning. However, it can become at risk when canopy cover of big sagebrush, blue grama sod, and/or bare ground increases. Transitional pathways leading to other plant communities are as follows: • Brush control followed by prescribed grazing, will result in a plant community very similar to the Historic Climax Plant Community. • Frequent and severe grazing, will result in a Big sagebrush/ Cheatgrass Plant Community.

Figure 6. Plant community growth curve (percent production by month). WY1601, 15-19BL Upland sites.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
			5	20	40	15	5	10	5		

State 4
Big Sagebrush/ Cheatgrass

Community 4.1
Big Sagebrush/ Cheatgrass

Big sagebrush/Cheatgrass Plant Community This plant community is the result of frequent and severe grazing. Big sagebrush, fringed sagewort and cheatgrass dominate. When compared to the historic climax plant community there are hardly any perennial grasses left and the dominant shrubs are big sagebrush. The total annual production (air-dry weight) of this state is about 450 pounds per acre, but it can range from about 300 lbs/acre in unfavorable years to about 600 lbs/acre in above average years. Much bare ground is present. This community has lost some of its value for grazing wildlife and livestock. It is susceptible to erosion and increased runoff due to the bare ground. Transitional pathways leading to other plant communities are as follows: • Prescribed grazing management is the only improvement practice that can be used on this state due to steep slopes. Long-term prescribed grazing may return this state to the Mixed sagebrush/Grass Plant Community.

Figure 7. Plant community growth curve (percent production by month). WY1601, 15-19BL Upland sites.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
			5	20	40	15	5	10	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				314–471	
	western wheatgrass	PASM	*Pascopyrum smithii*	314–471	–
2				78–235	
	sideoats grama	BOCU	*Bouteloua curtipendula*	78–235	–
3				78–157	
	little bluestem	SCSC	*Schizachyrium scoparium*	78–157	–
4				78–157	
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	78–157	–
5				78–157	
	green needlegrass	NAVI4	*Nassella viridula*	78–157	–
6				78–157	
	prairie dropseed	SPHE	*Sporobolus heterolepis*	78–157	–
7				78–157	
	prairie Junegrass	KOMA	*Koeleria macrantha*	78–157	–
8				78–314	
	Grass, perennial	2GP	*Grass, perennial*	0–78	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–78	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–78	–
	plains reedgrass	CAMO	*Calamagrostis montanensis*	0–78	–
	timber oatgrass	DAIN	*Danthonia intermedia*	0–78	–
	onespike danthonia	DAUN	*Danthonia unispicata*	0–78	–
	blue wildrye	ELGL	*Elymus glaucus*	0–78	–
	fowl bluegrass	POPA2	*Poa palustris*	0–78	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–78	–
Forb					
9				78–235	
	Forb, perennial	2FP	*Forb, perennial*	0–78	–
	bastard toadflax	COMAN	*Comandra*	0–78	–
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	0–78	–
	prairie clover	DALEA	*Dalea*	0–78	–
	fleabane	ERIGE2	*Erigeron*	0–78	–
	desertparsley	LOMAT	*Lomatium*	0–78	–
	bluebells	MERTE	*Mertensia*	0–78	–
	beardtongue	PENST	*Penstemon*	0–78	–
	mountain goldenbanner	THMOM3	*Thermopsis montana var. montana*	0–78	–
	American vetch	VIAM	*Vicia americana*	0–78	–
Shrub/Vine					
10				0–78	

	winterfat	KRASC	*Krascheninnikovia*	0–78	–
11				0–78	
	big sagebrush	ARTR2	*Artemisia tridentata*	0–78	–
12				0–78	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–78	–

Animal community

Animal Community – Wildlife Interpretations
Historic Climax Plant Community: The predominance of grasses in this plant community favors grazers and mixed-feeders, such as bison, elk, and antelope. Suitable thermal and escape cover for deer may be limited due to the low quantities of woody plants. However, topographical variations could provide some escape cover. When found adjacent to sagebrush dominated states, this plant community may provide brood rearing/foraging areas for sage grouse, as well as lek sites. Other birds that would frequent this plant community include western meadowlarks, horned larks, and golden eagles. Many grassland obligate small mammals would occur here.

Heavy Sagebrush Plant Community: This plant community can provide important winter foraging for elk, mule deer and antelope, as sagebrush can approach 15% protein and 40-60% digestibility during that time. This community provides excellent escape and thermal cover for large ungulates, as well as nesting and brood rearing habitat for sage grouse.

Mixed Sagebrush/Grass Plant Community: The combination of an overstory of sagebrush and an understory of grasses and forbs provide a very diverse plant community for wildlife. The crowns of sagebrush tend to break up hard crusted snow on winter ranges, so mule deer and antelope may use this state for foraging and cover year-round, as would cottontail and jack rabbits. It provides important winter, nesting, brood-rearing, and foraging habitat for sage grouse. Brewer’s sparrows’ nest in big sagebrush plants, and hosts of other nesting birds utilize stands in the 20-30% cover range.

Big sagebrush/Cheatgrass Plant Community: This plant community can provide important winter foraging for elk, mule deer and antelope, as sagebrush can approach 15% protein and 40-60% digestibility during that time. Grazing during spring to fall may be restricted due to low grass production. This community provides nesting and brood rearing habitat for sage grouse.

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*
(Lbs/acre) (AUM/ac)
Historic Climax Plant Community 900-1800 .35
Heavy Sagebrush 800-1200 .3
Mixed Sagebrush/Grass 600-1200 .3
Big sagebrush/Cheatgrass 300-600 .1

* - 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 C and D. Infiltration ranges from very slow to moderately slow. 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% ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be where short-grasses form a strong sod and dominate the site. 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 such as bluebunch wheatgrass. 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 hunting opportunities for upland game species. The wide variety of plants which bloom from spring until fall have an esthetic value that appeals to visitors.

Wood products

No appreciable wood products are present on the site.

Other products

none noted

Inventory data references

Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range trained personnel were also used. 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.

Contributors

G. Mitchell

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	04/01/2005
Approved by	E. Bainter

Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Due to the wide slope range associated with this site, the number and extent of rills will vary from none on sites with slopes of < 9% to common on slopes > 25%.

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2. **Presence of water flow patterns:** Due to the wide slope range associated with this site, water flow patterns will vary from barely observable on sites with slopes of < 9% from broken and irregular in appearance to continuous on slopes > 25%..

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3. **Number and height of erosional pedestals or terracettes:** Not evident on slopes < 9%. Erosional pedestals will be present with terracettes present at debris dams on slopes >9%.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground is 20 to 35%.

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5. **Number of gullies and erosion associated with gullies:** Active gullies restricted to concentrated water flow patterns.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** None.

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7. **Amount of litter movement (describe size and distance expected to travel):** Little to no plant litter movement occurs on slopes < 9%. Litter movement does occur on slopes > 25%.

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Plant cover and litter is at 65% or greater of soil surface and maintains soil surface integrity. Stability class anticipated to be 5 or greater.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Use soil series description for depth and color of A-horizon.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Plant canopy, very slow to slow infiltration rates, the amount of bare ground, and steepness of slopes results in a naturally high runoff rate on slopes > 25%, even in HCPC.

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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):** No compaction layer would be expected except for the naturally occurring

rooting restriction (bedrock or decomposing shale) at 10 to 20 inches.

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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:

    Sub-dominant:

    Other:

    Additional: Mid-stature bunch grasses > mid-stature rhizomatous grasses > short stature grasses/grasslikes > forbs > shrubs

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very low.

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14. **Average percent litter cover (%) and depth (in):** Litter cover is in contact with soil surface.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 1400 lbs/acre

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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:** Blue grama, Big sagebrush, Cheatgrass, Fringed sagewort, Plains prickly pear and species found on noxious weed list.

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17. **Perennial plant reproductive capability:** No limitations.
