

Ecological site R043BY476WY **Very Shallow (VS) 15-19" Northern Plains Precipitation Zone**

Accessed: 05/13/2025

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.

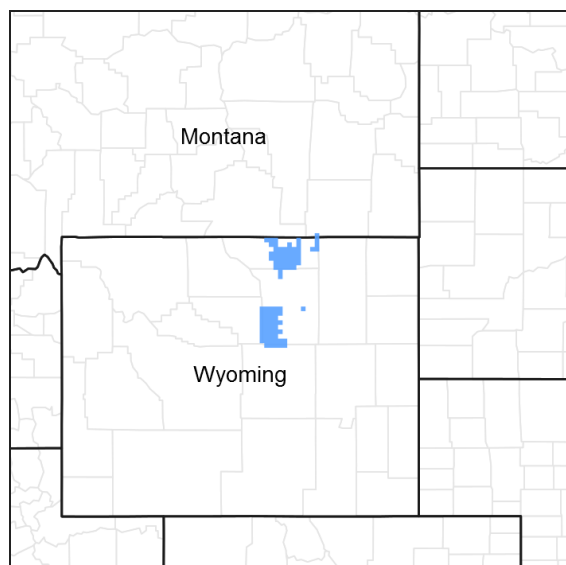


Figure 1. Mapped extent

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

R043BY408WY	Coarse Upland (CU) 15-19" Northern Plains Precipitation Zone
R043BY458WY	Shallow Clayey (SwCy) 15-19" Northern Plains Precipitation Zone
R043BY462WY	Shallow Loamy (SwLy) 15-19" Northern Plains Precipitation Zone
R043BY466WY	Shallow Sandy (SwSy) 15-19" Northern Plains Precipitation Zone

Similar sites

R058BY176WY	Very Shallow (VS) 10-17" PZ Very Shallow 10-14" Northern Plains P.Z., has lower production.
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Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

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

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Alluvial fan (3) Ridge
Flooding frequency	None
Ponding frequency	None
Elevation	1,128–2,286 m
Slope	20–60%
Ponding depth	0 cm
Aspect	Aspect is not a significant factor

Climatic features

Annual precipitation ranges from 15" to 19" per year. May is generally the wettest month. July, August and September are somewhat drier with daily amounts rarely exceeding one inch. Snowfall is quite heavy in the mountainous area. Annual snowfall averages close to 70 inches.

Sunshine is abundant in the latter part of the summer, the greatest amount being in July and August. Sunshine possibility during these two months averages 70 to 75% possibility with only a 65% possibility for June and September. Winter averages about 40% sunshine.

Because of the varied topography, the wind will vary considerably for different parts of the area. The wind is usually much lighter at the lower elevations and in the valleys as compared with the higher terrain. The average winter wind velocity is 8.5 mph, while the summer wind velocity averages 7.5 mph. Winds during storms and on ridges may exceed 45 mph.

Temperatures show a wide range between summer and winter, and between daily maximums and minimums. Summer nights are cool and temperatures drop into the forties at most places before sunrise. Summer daytime temperatures are usually in the seventies and occasionally reach eighty, but rarely reach the mid nineties. Winters are cold with daily lows below freezing most of the time. January has the coldest temperatures with a range of near 10 deg. F at night to the mid thirties in the afternoon. Temperatures of well below zero to –30 deg. F are not uncommon in the winter months.

The growing season for the cool season plants will generally start about April 15 to May 1 and continue to about October 10.

The following information is from the "Sheridan Airport" climate station:

Frost-free period (32 °F): 95-156 days; (5 yrs. out of 10, these days will occur between May 21 – September 19)

Freeze-free period 28 °F): 116-187 days; (5 yrs. out of 10, these days will occur between May 4 – September 29)

Mean annual precipitation: 14.7 inches

Mean annual air temperature: 45.0 °F (31.2 °F Avg. Min. – 58.8 °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: "Parkman 5 WNW"

Table 3. Representative climatic features

Frost-free period (average)	156 days
Freeze-free period (average)	187 days
Precipitation total (average)	483 mm

Influencing water features

Stream type: None

Soil features

The soils of this site are very shallow (less than 10" to bedrock), well-drained, rapidly to slowly permeable and can be of any texture. This site usually occurs on steep slopes, but may be on any slope. The bedrock will include all kinds except soft clay shales, igneous and some volcanic.

Table 4. Representative soil features

Surface texture	(1) Loam (2) Clay loam (3) Clay
Family particle size	(1) Loamy
Drainage class	Well drained to excessively drained
Permeability class	Slow to very rapid
Soil depth	3–25 cm
Surface fragment cover ≤3"	0–20%
Surface fragment cover >3"	0–29%
Available water capacity (0-101.6cm)	3.56–4.06 cm
Calcium carbonate equivalent (0-101.6cm)	0–5%
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)	6.6–8.4
Subsurface fragment volume ≤3" (Depth not specified)	0–15%
Subsurface fragment volume >3" (Depth not specified)	0–25%

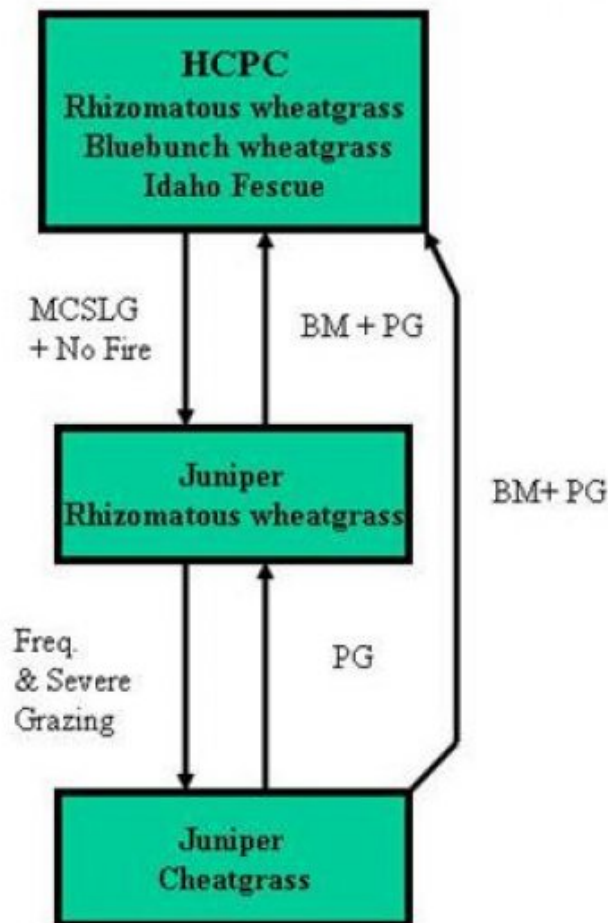
Ecological dynamics

As this site deteriorates from improper grazing management, species such as blue grama, juniper, and big sagebrush will increase. Species such as cheatgrass will invade. Cool season grasses such as bluebunch wheatgrass, spike fescue, Idaho fescue 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.

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-term 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 - found adjacent to a saline site

Rhizomatous Wheatgrasses, Bluebunch Wheatgrass, Idaho Fescue Plant Community

Community 1.1

Rhizomatous Wheatgrasses, Bluebunch Wheatgrass, Idaho Fescue Plant Community

The interpretive plant community for this site is the Historic Climax Plant Community. This site 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, 10% forbs, and 15% woody plants. The state is dominated by cool season midgrasses. The major grasses include bluebunch wheatgrass, rhizomatous wheatgrasses, needleandthread, spike fescue, and little bluestem. Other grasses occurring on the state include Idaho fescue, Cusick and Sandberg bluegrass, big bluegrass, sideoats grama, and prairie junegrass. Big sagebrush is a conspicuous element of this state, occurs in a mosaic pattern, and makes up 5 to 10% of the annual production. Big sagebrush, juniper and conifers may become dominant on some areas with absence of fire. Natural fire occurred frequently in this community and prevented sagebrush, junipers and conifers from being the dominant landscape. Annual production on this state ranges from 400 to 900 pounds depending on climatic conditions. This plant community is extremely stable and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allows for high drought tolerance. 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: • Improper grazing and lack of fire, will convert this plant community to the Juniper/Rhizomatous wheatgrass Plant Community. • Heavy, continuous season-long grazing and lack of fire will convert the plant community to the Juniper/Cheatgrass Vegetation State.

**Figure 4. Plant community growth curve (percent production by month).
WY1301, 15-19NP Upland sites.**

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	45	35	10	0	5	0	0	0

State 2

Juniper/Rhizomatous wheatgrass Plant Community

Community 2.1

Juniper/Rhizomatous wheatgrass Plant Community

Historically, this plant community evolved under grazing by bison and a high fire frequency. Currently, it is found under moderate, season-long grazing by livestock in the absence of fire or brush control. Big sagebrush, junipers and conifers are significant components 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 grasses, and miscellaneous forbs. Dominant grasses include rhizomatous wheatgrasses, spike fescue, little bluestem, and bluebunch wheatgrass. Grasses of secondary importance include Idaho fescue, prairie junegrass, Sandberg bluegrass, green needlegrass and one-spike oatgrass. Forbs, commonly found in this plant community, include Louisiana sagewort (cudweed), yarrow, field chickweed, prairie thermopsis and scarlet globemallow. Sagebrush canopy ranges from 20% to 30%. Juniper and conifer canopy ranges up to 20%. Fringed sagewort is commonly found. Plains pricklypear and winterfat can also occur. When compared to the Historical Climax Plant Community, sagebrush, junipers and conifers have increased. Bluebunch wheatgrass has decreased, often occurring only where protected from grazing by the sagebrush canopy. Production of cool-season grasses has also been reduced. Cheatgrass (downy brome) has invaded the site. The overstory of sagebrush, juniper, conifers and understory of grass and forbs provide a diverse plant community which will support domestic livestock and wildlife such as mule deer and antelope. Annual production ranges from 300 to 800 pounds. The site is at risk for 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 juniper, sagebrush, and/or cheatgrass. The watershed is usually functioning. However, it can become at risk when canopy cover of juniper, sagebrush, cheatgrass, and/or bare ground increases. Transitions or pathways leading to other plant communities are as follows: • Brush management (fire) followed by 1 or 2 years deferment and proper grazing use will return this state to near Historic Climax Plant Community. • Heavy Improper grazing management over the long-term will convert this state to the Juniper/Cheatgrass Vegetation State.

**Figure 5. Plant community growth curve (percent production by month).
WY1301, 15-19NP Upland sites.**

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	45	35	10	0	5	0	0	0

State 3

Juniper/Cheatgrass Plant Community

Community 3.1

Juniper/Cheatgrass Plant Community

This vegetation state currently is found under heavy, season-long grazing by livestock in the absence of fire or brush control. Wyoming big sagebrush, junipers and conifers are significant components of this plant community. Cool-season grasses have been reduced. Bare ground and cool-season annual plants dominate the understory. Perennial grasses are sparse, and include rhizomatous wheatgrasses, bluebunch wheatgrass, red threeawn, and blue grama. Grasses of secondary importance include little bluestem, prairie junegrass, and Sandberg bluegrass. Cheatgrass is the dominant grass. Forbs, commonly found in this plant community, include American vetch, cudweed sagewort, hairy goldaster, prairie thermopsis and scarlet globemallow. Big sagebrush canopy ranges from 20% to 30%. Juniper and conifer canopy ranges up to 50%. Fringed sagewort is commonly found. Plains pricklypear and winterfat can also occur. Annual production ranges from 250 to 500 pounds Soil erosion is accelerated because of increased bare ground. Water flow patterns and pedestaling are obvious. Infiltration is reduced and runoff is increased. Transitions or pathways leading to other plant communities are as follows: • Brush control followed by deferment for 1 to 2 years and proper 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. • Prescribed Grazing for the long term may eventually return this state to the Juniper/Rhizomatous wheatgrass Plant Community.

Figure 6. Plant community growth curve (percent production by month). WY1301, 15-19NP Upland sites.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	45	35	10	0	5	0	0	0

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				196–392	
	bluebunch wheatgrass	PSSP6	<i>Pseudoroegneria spicata</i>	196–392	–
2				78–196	
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	78–196	–
3				39–78	
	spike fescue	LEKI2	<i>Leucopoa kingii</i>	39–78	–
4				39–78	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	39–78	–
5				39–157	
	Grass, perennial	2GP	<i>Grass, perennial</i>	0–39	–
	Fendler threeawn	ARPUL	<i>Aristida purpurea</i> var. <i>longiseta</i>	0–39	–
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	0–39	–
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	0–39	–
	threadleaf sedge	CAFI	<i>Carex filifolia</i>	0–39	–
	creospike danthonia	DAUNI	<i>Danthonia unispicata</i>	0–39	

	Unispire Danthonia	DRON	<i>Danthonia unispicata</i>	0-39	-
	Idaho fescue	FEID	<i>Festuca idahoensis</i>	0-39	-
	needle and thread	HECO26	<i>Hesperostipa comata</i>	0-39	-
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	0-39	-
	green needlegrass	NAVI4	<i>Nassella viridula</i>	0-39	-
	Cusick's bluegrass	POCU3	<i>Poa cusickii</i>	0-39	-
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	0-39	-
Forb					
6				39-78	
	Forb, perennial	2FP	<i>Forb, perennial</i>	0-39	-
	yarrow	ACHIL	<i>Achillea</i>	0-39	-
	textile onion	ALTE	<i>Allium textile</i>	0-39	-
	rosy pussytoes	ANRO2	<i>Antennaria rosea</i>	0-39	-
	sandwort	ARENA	<i>Arenaria</i>	0-39	-
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	0-39	-
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	0-39	-
	balsamroot	BALSA	<i>Balsamorhiza</i>	0-39	-
	field chickweed	CEAR4	<i>Cerastium arvense</i>	0-39	-
	prairie clover	DALEA	<i>Dalea</i>	0-39	-
	fleabane	ERIGE2	<i>Erigeron</i>	0-39	-
	buckwheat	ERIOG	<i>Eriogonum</i>	0-39	-
	aster	EUCEP2	<i>Eucephalus</i>	0-39	-
	hairy false goldenaster	HEVI4	<i>Heterotheca villosa</i>	0-39	-
	flax	LINUM	<i>Linum</i>	0-39	-
	lupine	LUPIN	<i>Lupinus</i>	0-39	-
	locoweed	OXYTR	<i>Oxytropis</i>	0-39	-
	silverleaf Indian breadroot	PEAR6	<i>Pedimelum argophyllum</i>	0-39	-
	phlox	PHLOX	<i>Phlox</i>	0-39	-
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	0-39	-
	stonecrop	SEDUM	<i>Sedum</i>	0-39	-
	American vetch	VIAM	<i>Vicia americana</i>	0-39	-
Shrub/Vine					
7				39-118	
	Shrub (>.5m)	2SHRUB	<i>Shrub (>.5m)</i>	0-39	-
	silver sagebrush	ARCA13	<i>Artemisia cana</i>	0-39	-
	black sagebrush	ARNO4	<i>Artemisia nova</i>	0-39	-
	big sagebrush	ARTR2	<i>Artemisia tridentata</i>	0-39	-
	hawthorn	CRATA	<i>Crataegus</i>	0-39	-
	rubber rabbitbrush	ERNA10	<i>Ericameria nauseosa</i>	0-39	-
	common juniper	JUCO6	<i>Juniperus communis</i>	0-39	-
	Rocky Mountain juniper	JUSC2	<i>Juniperus scopulorum</i>	0-39	-
	ponderosa pine	PIPO	<i>Pinus ponderosa</i>	0-39	-
	chokecherry	PRVIV	<i>Prunus virginiana</i> var. <i>virginiana</i>	0-39	-

	skunkbush sumac	RHTR	<i>Rhus trilobata</i>	0–39	–
	Woods' rose	ROWOW	<i>Rosa woodsii</i> var. <i>woodsii</i>	0–39	–
	western snowberry	SYOC	<i>Symphoricarpos occidentalis</i>	0–39	–

Animal community

Animal Community – Wildlife Interpretations

Rhizomatous Wheatgrasses, Bluebunch Wheatgrass, Idaho Fescue Plant Community (HCPC): 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.

Juniper/ Rhizomatous wheatgrass 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.

Juniper/Cheatgrass Plant Community: This plant community may be useful for the same large grazers 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. It may provide some foraging opportunities for sage grouse when it occurs proximal to woody cover. Good grasshopper habitat equals good foraging for birds.

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 WG, Bluebunch WG, Idaho Fescue 400-900 .2

Juniper/ Rhizomatous wheatgrass 300-800 .15

Juniper/Cheatgrass 250-500 .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 highly variable and is dominated by soils in hydrologic group B and C, with localized areas in hydrologic group D. Infiltration ranges from slow to very rapid. Runoff potential for this site varies from moderate to high depending on soil hydrologic group, slope 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 may be present, but should be small. Water flow patterns should be barely distinguishable. 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

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. 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 1971-1994 WY

Ocular estimates 1990-1999 WY

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 slope < 9% to common on slopes > 25%

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

3. **Number and height of erosional pedestals or terracettes:** Not evident on slopes < 9% present on slopes > 9%

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground is 35-45%

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

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

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

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 55% or greater of soil surface and maintains soil surface integrity. Soil Stability class is anticipated to be 4 or greater.

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

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Grass canopy and basal cover should reduce raindrop impact and slow overland flow providing increased time for infiltration to occur. Infiltration varies with soil texture from slow to very rapid.

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 or soil surface crusting should be 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:

Sub-dominant:

Other:

Additional: Mid stature Cool Season Grasses >> Mid stature Warm Season Grasses > Short stature Grasses/Grasslikes
> Shrubs/Trees > Forbs

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Some plant mortality and decadence is expected
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14. **Average percent litter cover (%) and depth (in):** Average litter cover is 15-20% with depths of 0.10 to 0.25 inches
-

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 700 lbs/ac
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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, Cheatgrass, Threadleaf sedge, Threeawns, Junipers, Big sagebrush, Fringed sagewort, and Species found on Noxious Weed List
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17. **Perennial plant reproductive capability:** May be limited due to effective moisture and seed to soil contact
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