USDA Natural Resources Conservation Service

Ecological site R032XY154WY
Shale (Sh) 5-9” Big Horn Basin Precipitation Zone

Accessed: 05/20/2025

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.

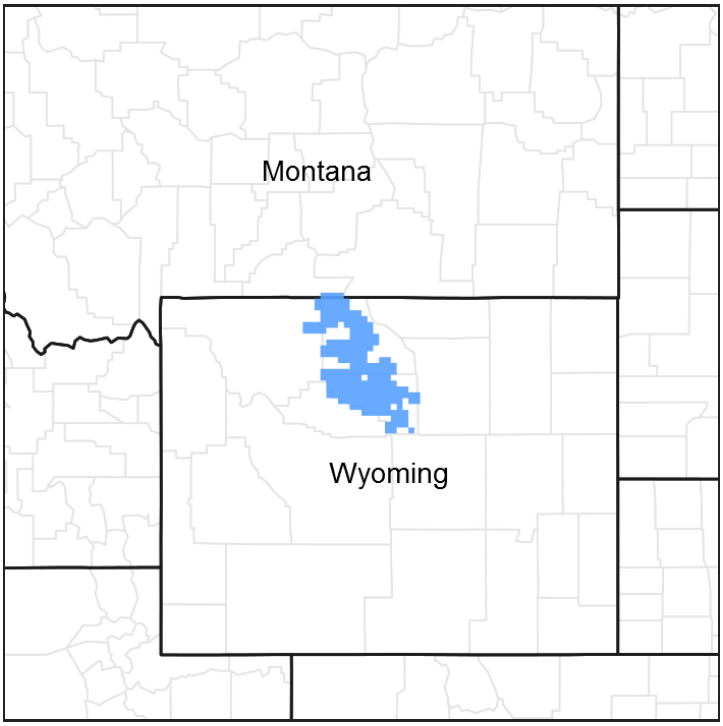


Figure 1. Mapped extent

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

R032XY158WY	**Shallow Clayey (SwCy) 5-9” Big Horn Basin Precipitation Zone**
R032XY176WY	**Very Shallow (VS) 5-9” Big Horn Basin Precipitation Zone**

Similar sites

R032XY354WY	**Shale (Sh) 10-14" East Precipitation Zone** Shale 10-14” Foothills and Basins East P.Z., 032XY354WY, has higher production.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

This site occurs on moderate to steep slopes and ridge tops.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Ridge (3) Escarpment
Flooding frequency	None
Ponding frequency	None
Elevation	3,700–6,000 ft
Slope	0–60%
Ponding depth	0 in
Aspect	Aspect is not a significant factor

Climatic features

Annual precipitation ranges from 5-9 inches per year. The normal precipitation pattern shows peaks in May and June and a secondary peak in September. This amounts to about 50% of the mean annual precipitation. Much of the moisture that falls in the latter part of the summer is lost by evaporation and much of the moisture that falls during the winter is lost by sublimation. Average snowfall is about 20 inches annually. 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, due to the high elevation and dry air, which permits rapid incoming and outgoing radiation. Cold air outbreaks from Canada in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Chinook winds may occur in winter and bring rapid rises in temperature. Extreme storms may occur during the winter, but most severely affect ranch operations during late winter and spring.

High winds are generally blocked from the basin by high mountains, but can occur in conjunction with an occasional thunderstorm.

Growth of native cool-season plants begins about April 1 and continues to about July 1. Cool weather and moisture in September may produce some green up of cool season plants that will continue to late October.

The following information is from the “Emblem” climate station:
Minimum Maximum 5 yrs. out of 10 between
Frost-free period (days): 98 171 May 13 – September 19
Freeze-free period (days): 120 184 May 1 – October 5
Mean Annual Precipitation (inches): 3.22 10.97

Mean annual precipitation: 7.42 inches
Mean annual air temperature: 45.01 F (31.2 F Avg. Min. to 58.7 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” Basin”, “Deaver”,”Lovell” and “Worland”.

Table 3. Representative climatic features

Frost-free period (average)	171 days
Freeze-free period (average)	184 days
Precipitation total (average)	9 in

Influencing water features

Soil features

The soils of this site are very shallow (less than 8 inches to bedrock) well-drained soils formed from residuum. These soils have rapid to slow permeability and can be of any texture. This site usually occurs on steep slopes with many outcrops of shale bedrock. These clay shales are usually saline or alkaline in various degrees, and normally produce sparse stands of halophytes and saline tolerant grasses. The soil characteristics having the most influence on the plant community are the very shallow soils, which drastically reduces the amount of available moisture and potential quantities of soluble salts.

Table 4. Representative soil features

Surface texture	(1) Clay loam (2) Loam (3) Silt loam

Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Slow to moderate
Soil depth	1–8 in
Surface fragment cover <=3"	0–10%
Surface fragment cover >3"	0–10%
Available water capacity (0-40in)	0.6–2 in
Calcium carbonate equivalent (0-40in)	0–5%
Electrical conductivity (0-40in)	4–16 mmhos/cm
Sodium adsorption ratio (0-40in)	0–13
Soil reaction (1:1 water) (0-40in)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	5–20%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

Potential vegetation on this site is dominated by salt tolerant plants and drought resistant mid cool-season perennial grasses. The expected potential composition for this site is about 60% grasses, 15% forbs and 25% woody plants. The composition and production will vary naturally due to historical use, fluctuating precipitation and fire frequency.

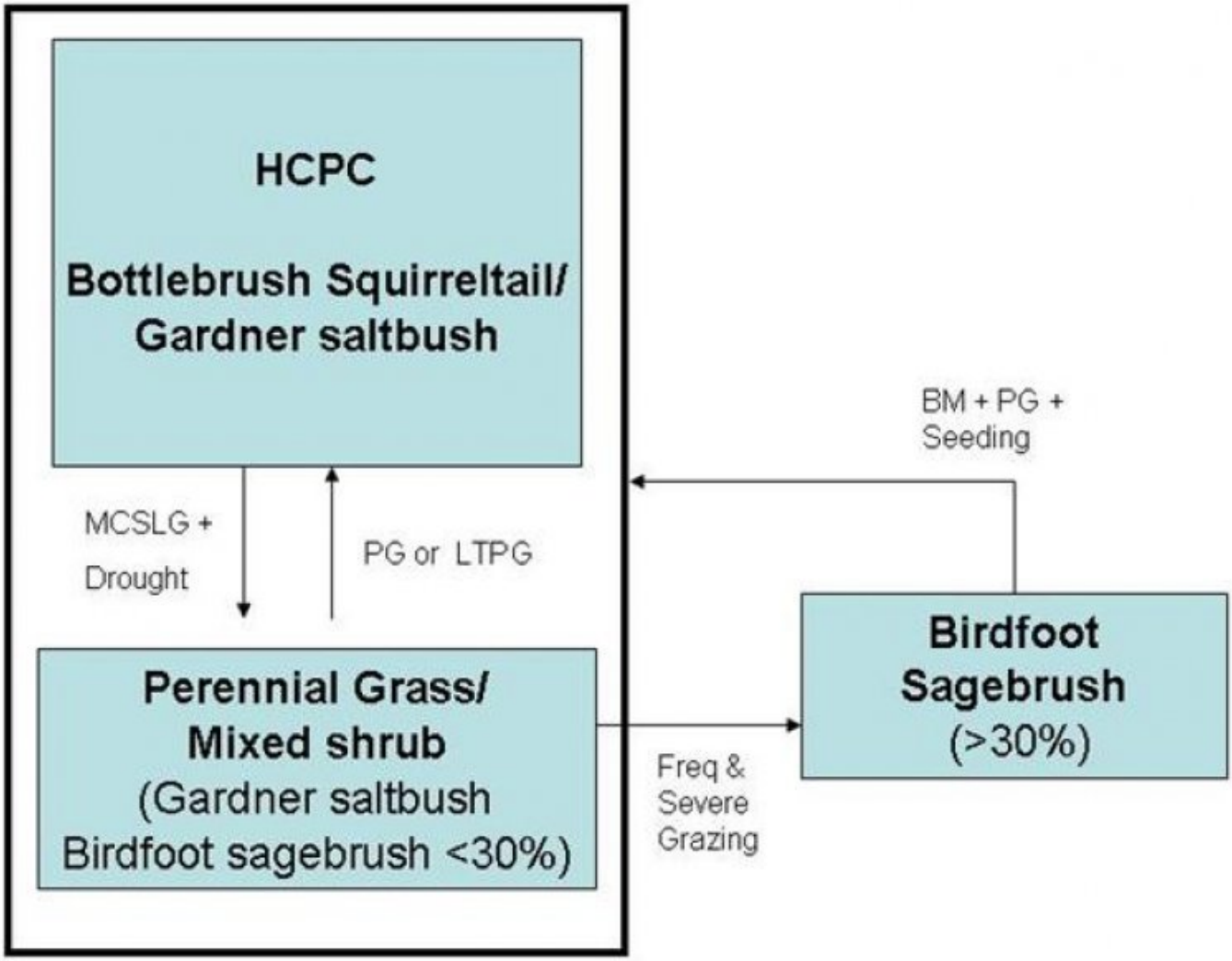
As this site deteriorates, species such as short warm-season grasses, birdfoot sagebrush and woodyaster will increase. Plains pricklypear and weedy annuals will invade. Cool season grasses such as bluebunch wheatgrass, Indian ricegrass and western wheatgrass will decrease in frequency and production.

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)
WF - Wildfire

State 1
Bottlebrush Squirreltail/Gardner’s Saltbush Plant Community

Community 1.1
Bottlebrush Squirreltail/Gardner’s Saltbush Plant Community

The interpretive plant community for this site is the Historic Climax Plant Community. This state evolved with grazing by large herbivores and droughty soils due to the shallow depth to undeveloped salty weathered shale material. Historically, fire has not played an important role in this state due to the naturally sparse vegetation, which prohibits the spread of fire. Potential vegetation is about 60% grasses, 15% forbs, and 25% woody plants. Cool season midgrasses dominate the state. The major grasses include bluebunch wheatgrass, Indian ricegrass, bottlebrush squirreltail, and rhizomatous wheatgrasses. Other grasses occurring in this state include alkali sacaton, blue grama, and Sandberg bluegrass. Gardner’s saltbush and winterfat are conspicuous elements of this state. A variety of forbs also occur in this state and plant diversity is high (see Plant Composition Table). The total annual production (air-dry weight) of this state is about 150 pounds per acre, but it can range from about 85 lbs. /acre in unfavorable years to about 250 lbs. /acre in above average years. The state is fragile and adapted to the Northern Intermountain Desertic Basins climatic conditions. The diversity in plant species allows for some drought resistance. This is a sustainable plant community, but is difficult to reestablish when damaged. (Site/soil stability, watershed function, and biologic integrity). Transitions or pathways leading to other plant communities are as follows: • Moderate, Continuous Season-Long grazing will convert this plant community to the Perennial Grass/Mixed Shrub Plant Community. Prolonged Drought will exacerbate this transition.

Figure 3. Plant community growth curve (percent production by month). WY0501, 5-9BH Upland sites. Monthly percentages of total annual growth for all upland sites with dominantly C3 Cool season plants..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
			15	50	20	5		10			

State 2
Perennial Grass/Mixed Shrub Plant Community

Community 2.1
Perennial Grass/Mixed Shrub Plant Community

Historically, this plant community evolved under grazing and a low fire frequency. Currently, it is found under moderate, season-long grazing by livestock and will be exacerbated by prolonged drought conditions. This plant community is still dominated by cool-season midgrasses, while short warm-season grasses and miscellaneous forbs account for the balance of the understory. A variety of shrubs makes up the overstory. Dominant grasses include bottlebrush squirreltail, and rhizomatous wheatgrasses.

Grasses of secondary importance include Sandberg bluegrass, blue grama, and alkali sacaton. Forbs commonly found in this plant community include smooth woodyaster, stemless mock goldenweed, Hood's phlox, sulfur flower buckwheat, Cous biscuitroot, and scarlet globemallow. Shrubs such as Gardner saltbush, winterfat, birdfoot sagebrush and bud sagebrush account for 20% to 30% of the total production. Plains pricklypear can also occur. When compared to the Historical Climax Plant Community, birdfoot sagebrush and smooth woody aster has increased. Indian ricegrass and bluebunch wheatgrass have decreased as the production of cool-season grasses has been reduced. Indian ricegrass may occur in only trace amounts under the sagebrush canopy or within the patches of pricklypear. Blue grama has increased. In addition, the amount of winterfat may or may not have changed depending on the season of use. The total annual production (air-dry weight) of this state is about 70 pounds per acre, but it can range from about 25 lbs. /acre in unfavorable years to about 150 lbs. /acre in above average years. This plant community is resistant to change. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term overgrazing. The herbaceous component is mostly intact and plant vigor and replacement capabilities are sufficient. Water flow patterns and litter movement may be occurring but only on steeper slopes. Incidence of pedestalling is minimal. Soils are mostly stable and the surface shows minimum soil loss. The watershed is functioning and the biotic community is intact. Transitional pathways leading to other plant communities are as follows: • Prescribed grazing or possibly long-term prescribed grazing will convert this plant community to the HCPC. The probability of this occurring is high especially if rotational grazing along with short deferred grazing is implemented as part of the prescribed method of use. • Frequent and severe grazing over the long-term will convert this plant community to the Birdfoot Sagebrush/Woodyaster vegetative state.

Figure 4. Plant community growth curve (percent production by month). WY0501, 5-9BH Upland sites. Monthly percentages of total annual growth for all upland sites with dominantly C3 Cool season plants..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
			15	50	20	5		10			

State 3
Birdfoot Sagebrush Plant Community

Community 3.1
Birdfoot Sagebrush Plant Community

This vegetation state currently is found under heavy, season-long grazing by livestock in the absence of fire. Birdfoot sagebrush is a significant component of this plant community. Other plants, which may be of importance, include Gardner's saltbush, and bud sagebrush. Cool-season grasses have been reduced. Bare ground, warm season grasses, and annual plants are also prominent. The dominant grasses are blue grama and Sandberg bluegrass. Cool-season grasses have been eliminated or significantly reduced.

Weedy annual species such as cheatgrass and Russian thistle may occur if a seed source is available. Cactus often increases. The interspaces between plants have expanded significantly leaving the amount of bare ground more prevalent. As a result, the herbaceous production has been significantly reduced. When compared with the Perennial Grass/Mixed Shrub Plant Community the total annual production however, does not differ significantly as the shrub production off sets the decline in the herbaceous production. The shift in production will affect the type and availability of forage. The total annual production (air-dry weight) of this state is about 50 pounds per acre, but it can range from about 15 lbs. /acre in unfavorable years to about 150 lbs. /acre in above average years. This plant community is resistant to change. These areas are actually more resistant to fire as less fine fuels are available and the bare ground between the shrubs has increased. Continued frequent and severe grazing or the removal of grazing does not seem to affect the composition or structure of the plant community. Plant diversity is moderate to poor. The plant vigor is diminished and replacement capabilities are limited due to the reduced number of cool-season grasses. Plant litter is noticeably less when compared to the HCPC. Soil erosion is accelerated because of increased bare ground. Water flow patterns and pedestalling are obvious. Infiltration is reduced and runoff has increased. Rill channels may be noticeable in the interspaces and gullies may be establishing where rills have concentrated down slope. Transitional pathways leading to other plant communities are as follows: • Brush management (fire) and prescribed grazing will return this state to near Historic Climax Plant Community. Seeding native perennials may be necessary to hasten establishment of these species.

Figure 5. Plant community growth curve (percent production by month). WY0501, 5-9BH Upland sites. Monthly percentages of total annual growth for all upland sites with dominantly C3 Cool season plants..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
			15	50	20	5		10			

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1				23–45	
	squirreltail	ELELE	*Elymus elymoides ssp. elymoides*	23–45	–
2				15–30	
	western wheatgrass	PASM	*Pascopyrum smithii*	15–30	–
3				8–23	
	Indian ricegrass	ACHY	*Achnatherum*	8–23	–

			hymenoides		
4				0–15	
	Grass, perennial	2GP	*Grass, perennial*	0–8	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–8	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–8	–
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	0–8	–
	alkali sacaton	SPAI	*Sporobolus airoides*	0–8	–
Forb					
5				0–8	
	Forb, perennial	2FP	*Forb, perennial*	0–8	–
	milkvetch	ASTRA	*Astragalus*	0–8	–
	princesplume	STANL	*Stanleya*	0–8	–
	woodyaster	XYLOR	*Xylorhiza*	0–8	–
Shrub/Vine					
6				23–45	
	Gardner's saltbush	ATGA	*Atriplex gardneri*	23–45	–
7				0–15	
	birdfoot sagebrush	ARPE6	*Artemisia pedatifida*	0–15	–
8				0–8	
	bud sagebrush	PICRO	*Picrothamnus*	0–8	–
9				0–8	
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–8	–
10				0–8	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–8	–

Animal community

Animal Community – Wildlife Interpretations
Historic Climax Plant Community: 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. Due to the sparseness of the vegetation, this community does not provide escape and thermal cover for large ungulates or nesting habitat for sage grouse.

Perennial Grass/Mixed Shrub: 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. Due to the sparseness of the vegetation, this community does not provide escape and thermal cover for large ungulates or nesting habitat for sage grouse.

Birdfoot Sagebrush: This plant community can provide winter foraging for mule deer and antelope. Due to the sparseness of the vegetation, this community does not provide escape and thermal cover for large ungulates or for nesting 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*
(lb. /ac) (AUM/ac)
Historic Climax Plant Community 85-250 .07
Perennial Grass/Mixed Shrub 25-150 .05
Birdfoot Sagebrush 15-150 .01

* - 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 ranges from slow to moderate. Runoff potential for this site varies from moderate to very 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 will be continuous on slopes > 9% and gullies may be present on steeper slopes. Water flow paths will be obvious, regular and continuous with debris dams occuring only on lesser slopes. Erosional pedestals present with terracettes present at debris dams in association with bunchgrasses such as bluebunch wheatgrass. Plant litter movement is expected on steeper slopes but typically falls in place and signs of movement are not common on slopes of < 9%. 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 varieties 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 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 19 1965-1986 WY Park & others

Contributors

Ray Gullion

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)	Ray Gullion
Contact for lead author	ray.gullion@wy.usda.gov
Date	05/02/2008
Approved by	E. Bainter
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills will be continuous.

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2. **Presence of water flow patterns:** Water flow paths will be obvious, regular and continuous with debris dams occurring only on lesser slopes.

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3. **Number and height of erosional pedestals or terracettes:** Erosional pedestals present with terracettes present at debris dams.

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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 75 to 85%.

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5. **Number of gullies and erosion associated with gullies:** Active gullies may be present on steeper slopes.

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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):** Plant litter movement is expected.

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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 15% or greater of soil surface. Stability class anticipated to be 3 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:** Sparse plant canopy, slow infiltration rates, and the high amount of bare ground contribute to a naturally high runoff rate 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 but soil surface is typically crusted and hard to very hard when dry.

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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 stature grasses >> shrubs > forbs > short stature grasses/grasslikes

    Sub-dominant:

    Other:

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Some plant mortality and decadence (10 to

15%) is expected on this site.

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14. **Average percent litter cover (%) and depth (in):** Average litter cover is 5-10% with depths of 0.1 to 0.2 inches. Litter cover is in contact with soil surface with little evidence of biological activity.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 100 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:** Birdfoot sagebrush, Woodyaster, Short warm-season grasses, Annuals, Exotics, and Species found on Noxious Weed List.

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17. **Perennial plant reproductive capability:** Limited ability to reproduce.
