USDA Natural Resources
Conservation Service

Ecological site R043BY170WY
Steep Stony High Mountains

Accessed: 05/21/2025

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.

Associated sites

R043BY162WY	**Shallow Loamy High Mountains** Shallow Loamy
R043BY172WY	**Stony High Mountains** Stony

Similar sites

R043BY172WY	**Stony High Mountains** Stony (St) 20+M has lower production and different shrub species.
R043BY108WY	**Coarse Upland High Mountains** Coarse Upland (CU) 20+M has higher production, larger coarse fragments (boulders), and different shrub species.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

This site occurs on steep mountain slopes and fans.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Alluvial fan (3) Ridge
Flooding frequency	None
Ponding frequency	None
Elevation	1,981–3,658 m
Slope	15–70%
Ponding depth	0 cm

Climatic features

Annual precipitation is fairly evenly distributed through the year and averages over 20 inches. Snows are heavy and usually remain in place during the winter. Annual snowfall averages 150 to 200 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.

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 June 1 at lower elevations, as late as July 15 at higher elevations, and continues until the beginning of September.

The following information is from the “Moran 5 WNW” climate station:

Minimum Maximum 5 yrs. out of 10 between
Frost-free period (days): 31 78 June 30 – August 24
Freeze-free period (days): 65 118 June 5 – September 9

Annual Precipitation (inches): <20.78 >29.35 (2 years in 10)

Mean annual precipitation: 25.23 inches

Mean annual air temperature: 36.5?F (22.1?F Avg. Min. to 50.9?F Avg. Max.)

For detailed information visit the Natural Resources Conservation Service National Water and Climate Center at http://www.wcc.nrcs.usda.gov/cgibin/state.pl?state=wy website. Other climate station representative of this precipitation zone include ”Alta 1 NW”, “Lake

Yellowstone”, “Moose”, “Old Faithful”, and “Snake River” in Teton County; “Bedford 3 SE” in Lincoln County; and “Bondurant” in Sublette County.

Table 3. Representative climatic features

Frost-free period (average)	78 days
Freeze-free period (average)	118 days
Precipitation total (average)	737 mm

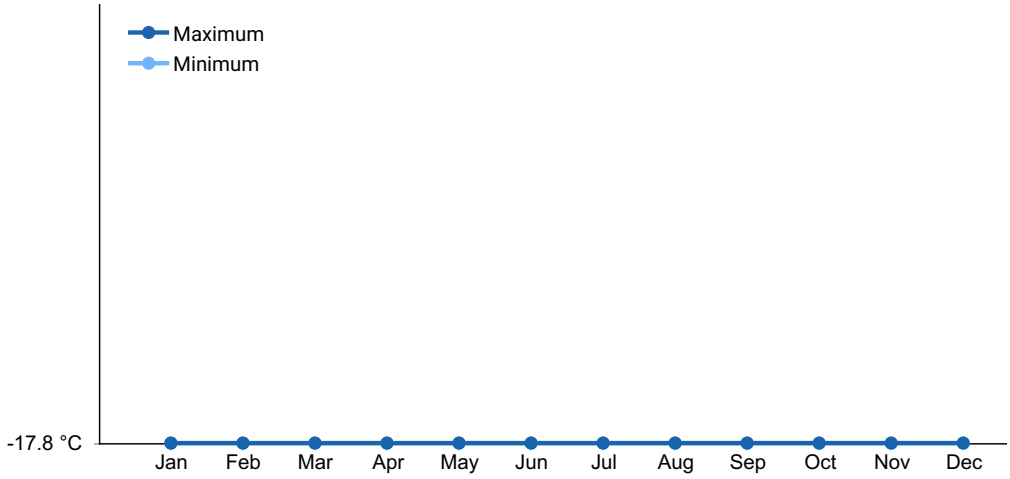


Figure 1. Monthly average minimum and maximum temperature

Influencing water features

Soil features

The soils of this site are moderately deep to deep (greater than 20 inches), well-drained, dark colored, and stony and/or bouldery. They occur as steep mountain foot slopes with gradients usually greater than 30%. Coarse fragments are greater than 35 percent, by volume, within the first 20 inches of soil, usually increasing with depth. Roots penetrate the soil material readily, but are forced to detour around coarse fragments.

Table 4. Representative soil features

Surface texture	(1) Gravelly loam
Family particle size	(1) Loamy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderately slow to moderately rapid
Soil depth	51–152 cm
Surface fragment cover <=3"	0–20%
Surface fragment cover >3"	0–5%

Available water capacity (0-101.6cm)	5.08–10.16 cm
Calcium carbonate equivalent (0-101.6cm)	0–15%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	10–30%
Subsurface fragment volume >3" (Depth not specified)	0–15%

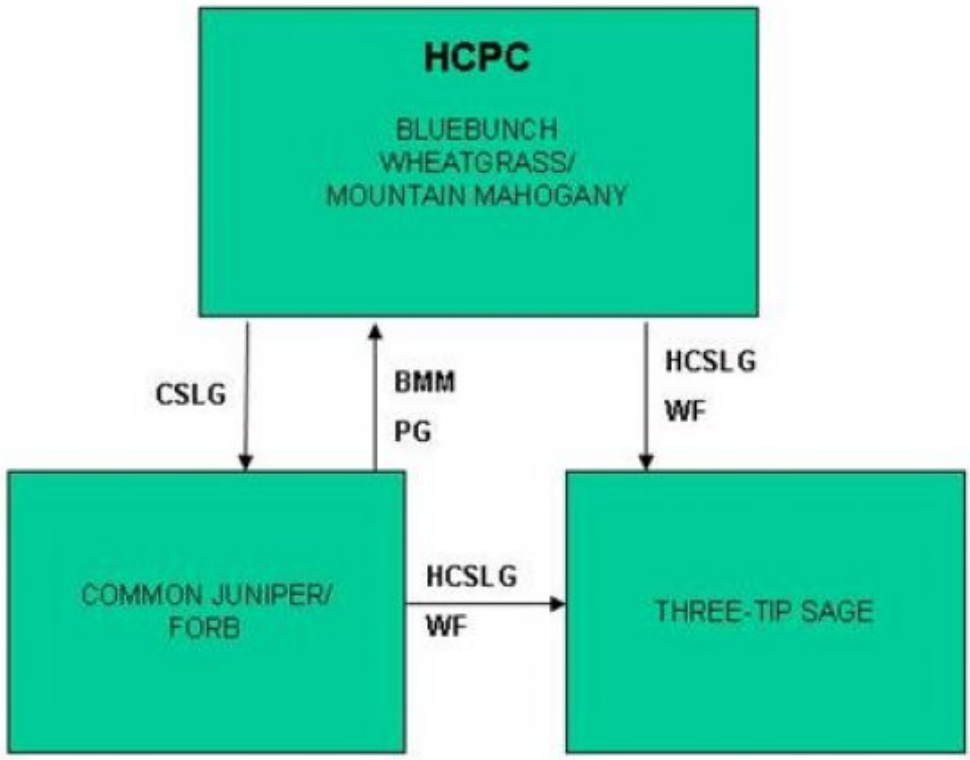
Ecological dynamics

As this site deteriorates, species such as rhizomatous wheatgrass, mountain big sagebrush, snowberry, and rabbitbrush increase. Mountain mahogany and serviceberry as well as cool season bunchgrasses such as bluebunch wheatgrass 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
Bluebunch Wheatgrass/Mountain Mahogany Plant Community (HCPC)

Community 1.1
Bluebunch Wheatgrass/Mountain Mahogany 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 about 55% grasses or grass-like plants, 10% forbs, and 35% woody plants. The major grasses include bluebunch wheatgrass, big bluegrass, thickspike wheatgrass, Idaho fescue, and spike fescue. Other grasses include blue wildrye, Indian ricegrass, Canby and mutton bluegrass, prairie junegrass, Letterman, Richardson, western, and Columbia needlegrass, bottlebrush squirreltail, one-spike and timber oatgrass, mountain brome, oniongrass, mountain muhly, bentgrass, spike trisetum, and slender wheatgrass. Mountain mahogany, bitterbrush, and serviceberry are the dominant woody plants. Other woody plants may include low, three-tip, and mountain big sagebrush, snowberry, honeysuckle, mountain ash, common juniper, and green rabbitbrush. A typical plant composition for this state consists of bluebunch wheatgrass 25-35%, Idaho fescue 5-10%, spike fescue 5-10%, big bluegrass 5-10%, thickspike wheatgrass 5-10%, other grasses and grass-like plants 10-20%, perennial forbs 5-10%, true mountain mahogany 5-15%, up to 5% serviceberry, up to 5% bitterbrush, and 5-15% other woody species. Ground cover, by ocular estimate, varies from 40-45%. The total annual production (air-dry weight) of this state is about 1800 pounds per acre, but it can range from about 1400 lbs./acre in unfavorable years to about 2200 lbs./acre in above average years. The following is the growth curve of this plant community expected during a normal year: Growth curve number: WY0101 Growth curve name: 20+M, UPLAND SITES Growth curve description: ALL UPLAND SITES JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC 0 0 0 0 5 30 40 20 5 0 0 0 (Monthly percentages of total annual growth) The state is 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: • Continuous Season-Long Grazing will convert this plant community to the Common Juniper/Forb State. • Wildfire followed by Heavy, Continuous Season-long Grazing will convert this plant community to the Three-tip Sage State.

State 2
Common Juniper/Forb Plant Community

Community 2.1
Common Juniper/Forb Plant Community

This plant community is a result of improper grazing management practices. Common juniper, snowberry, mountain big sagebrush, limber pine, and other woody species

dominate this community, often exceeding 60% of the annual production. Rhizomatous wheatgrass and annual forbs make up the majority of the understory. The total annual production (air-dry weight) of this state is about 1400 pounds per acre, but it can range from about 1000 lbs./acre in unfavorable years to about 1800 lbs./acre in above average years. The following is the growth curve of this plant community expected during a normal year: Growth curve number: WY0101 Growth curve name: 20+M, UPLAND SITES Growth curve description: ALL UPLAND SITES JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC 0 0 0 0 5 30 40 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: • Mechanical Brush Management followed by deferment for 1 to 2 years as part of a Prescribed Grazing plan will return this state to near Historic Climax Plant Community (Bluebunch Wheatgrass/Mountain Mahogany State). Care should be taken when planning brush management to consider wildlife habitat and critical winter ranges. • Wildfire followed by Heavy, Continuous Season-long Grazing will convert this plant community to the Three-tip Sage State.

State 3
Three-tip Sage Plant Community

Community 3.1
Three-tip Sage Plant Community

This plant community is the result of hot wildfire followed by improper grazing techniques. Dominant species include three-tip sagebrush and green rabbitbrush. The total annual production (air-dry weight) of this state is about 1000 pounds per acre, but it can range from about 500 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: WY0101 Growth curve name: 20+M, UPLAND SITES Growth curve description: ALL UPLAND SITES JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC 0 0 0 0 5 30 40 20 5 0 0 0 (Monthly percentages of total annual growth) The state is vulnerable to excessive erosion. The biotic integrity of this plant community is at risk depending on how far a shift has occurred in plant composition toward green rabbitbrush, three-tip sagebrush, and annual forbs. The watershed is at risk as bare ground increases. Transitional pathways leading to other plant communities are as follows: It is not often practicable or economically feasible to convert this plant community.

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				504–706	
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	504–706	–
2				101–202	
3				101–202	
	spike fescue	LEKI2	*Leucopoa kingii*	101–202	–
4				101–202	
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	101–202	–
5				101–202	
	Idaho fescue	FEID	*Festuca idahoensis*	101–202	–
6				202–404	
	Grass, perennial	2GP	*Grass, perennial*	0–101	–
	Columbia needlegrass	ACNE9	*Achnatherum nelsonii*	0–101	–
	western needlegrass	ACOC3	*Achnatherum occidentale*	0–101	–
	Richardson's needlegrass	ACRI8	*Achnatherum richardsonii*	0–101	–
	bentgrass	AGROS2	*Agrostis*	0–101	–
	mountain brome	BRMA4	*Bromus marginatus*	0–101	–
	California oatgrass	DACA3	*Danthonia californica*	0–101	–
	timber oatgrass	DAIN	*Danthonia intermedia*	0–101	–
	onespike danthonia	DAUN	*Danthonia unispicata*	0–101	–
	squirreltail	ELELE	*Elymus elymoides ssp. elymoides*	0–101	–
	blue wildrye	ELGL	*Elymus glaucus*	0–101	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–101	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–101	–
	oniongrass	MEBU	*Melica bulbosa*	0–101	–
	mountain muhly	MUMO	*Muhlenbergia montana*	0–101	–
	muttongrass	POFE	*Poa fendleriana*	0–101	–
	spike trisetum	TRSP2	*Trisetum spicatum*	0–101	–
Forb					
7				101–202	
	Forb, perennial	2FP	*Forb, perennial*	0–101	–

	common yarrow	ACMI2	*Achillea millefolium*	0–101	–
	agoseris	AGOSE	*Agoseris*	0–101	–
	pussytoes	ANTEN	*Antennaria*	0–101	–
	columbine	AQUIL	*Aquilegia*	0–101	–
	sandwort	ARENA	*Arenaria*	0–101	–
	milkvetch	ASTRA	*Astragalus*	0–101	–
	balsamroot	BALSA	*Balsamorhiza*	0–101	–
	bellflower	CAMPA	*Campanula*	0–101	–
	Indian paintbrush	CASTI2	*Castilleja*	0–101	–
	fireweed	CHAN9	*Chamerion angustifolium*	0–101	–
	hawksbeard	CREPI	*Crepis*	0–101	–
	draba	DRABA	*Draba*	0–101	–
	fleabane	ERIGE2	*Erigeron*	0–101	–
	buckwheat	ERIOG	*Eriogonum*	0–101	–
	geranium	GERAN	*Geranium*	0–101	–
	avens	GEUM	*Geum*	0–101	–
	little sunflower	HEPU3	*Helianthus pumilus*	0–101	–
	stoneseed	LITHO3	*Lithospermum*	0–101	–
	desertparsley	LOMAT	*Lomatium*	0–101	–
	lupine	LUPIN	*Lupinus*	0–101	–
	mayflower	MAIAN	*Maianthemum*	0–101	–
	creeping barberry	MARE11	*Mahonia repens*	0–101	–
	bluebells	MERTE	*Mertensia*	0–101	–
	ragwort	PACKE	*Packera*	0–101	–
	beardtongue	PENST	*Penstemon*	0–101	–
	phacelia	PHACE	*Phacelia*	0–101	–
	phlox	PHLOX	*Phlox*	0–101	–
	buttercup	RANUN	*Ranunculus*	0–101	–
	stonecrop	SEDUM	*Sedum*	0–101	–
	aster	SYMPH4	*Symphyotrichum*	0–101	–
	meadow-rue	THALI2	*Thalictrum*	0–101	–
	clover	TRIFO	*Trifolium*	0–101	–
	valerian	VALER	*Valeriana*	0–101	–
	American vetch	VIAM	*Vicia americana*	0–101	–

	American vetch	VIAM	*Vicia americana*	0–101	–
	violet	VIOLA	*Viola*	0–101	–
	mule-ears	WYAM	*Wyethia amplexicaulis*	0–101	–
Shrub/Vine					
8				101–303	
	alderleaf mountain mahogany	CEMO2	*Cercocarpus montanus*	101–303	–
9				0–101	
	Saskatoon serviceberry	AMAL2	*Amelanchier alnifolia*	0–101	–
10				0–101	
	antelope bitterbrush	PUTR2	*Purshia tridentata*	0–101	–
11				101–303	
	Shrub, deciduous	2SD	*Shrub, deciduous*	0–101	–
	Shrub, evergreen	2SE	*Shrub, evergreen*	0–101	–
	Tree, deciduous	2TD	*Tree, deciduous*	0–101	–
	Tree, evergreen	2TE	*Tree, evergreen*	0–101	–
	little sagebrush	ARAR8	*Artemisia arbuscula*	0–101	–
	tarragon	ARDR4	*Artemisia dracunculus*	0–101	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–101	–
	threetip sagebrush	ARTR4	*Artemisia tripartita*	0–101	–
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	0–101	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–101	–
	common juniper	JUCOD	*Juniperus communis var. depressa*	0–101	–
	honeysuckle	LONIC	*Lonicera*	0–101	–
	Greene's mountain ash	SOSCS	*Sorbus scopulina var. scopulina*	0–101	–
	snowberry	SYMPH	*Symphoricarpos*	0–101	–

Animal community

Animal Community – Wildlife Interpretations
Bluebunch Wheatgrass/Mountain Mahogany Plant Community (HCPC): This plant community provides excellent thermal and escape cover for wintering mule deer and elk. Year-round habitat is provided for mule deer, elk, bobcat, mountain lion, cottontail rabbits,

jackrabbits, and many other birds such as the black-throated sparrow, lark sparrow, green-tailed towhee, and neo-tropical migrants. Mountain mahogany provides good thermal cover and nesting habitat for many bird species.

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

Three-tip Sage Plant Community: This plant community exhibits a low level of plant species diversity. In most cases it is not a desirable plant community to select as a wildlife habitat management objective.

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)
Bluebunch Wheatgrass/Mountain Mahogany (HCPC) 1400-2200 0.5
Common Juniper/Forb 1000-1800 0.3
Three-tip Sage 500-1500 0.1

* - 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 B and C, with localized areas in hydrologic group D. Infiltration ranges from moderately slow to moderate. Runoff potential for this site varies from low to

moderate depending on soil hydrologic group and ground cover (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 hunting opportunities for upland game species.

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

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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Date	03/16/2007
Approved by	E. Bainter
Approval date	
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.

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

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

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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 can range from 0-20%.

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

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

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

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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):** Soil Stability Index ratings range from 3 (interspaces) to 6 (under plant canopy), but average values should be 4.0 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 6-16% 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 50-75% grasses, 10% forbs, and 15-40% shrubs. Evenly distributed plant canopy (60-85%) and litter plus moderate infiltration rates result in minimal runoff. Basal cover is typically greater than 10% for this site and does affect runoff on this site. Surface rock fragments of 20-50% provide stability to the site, but reduce infiltration.

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>> perennial shrubs>perennial forbs=cool season rhizomatous grasses>short cool season bunchgrasses

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.

14. **Average percent litter cover (%) and depth (in):** Litter ranges from 5-30% of total canopy measurement with total litter (including beneath the plant canopy) from 50-80% expected.

Herbaceous litter depth typically ranges from 3-10mm. 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: 1400-2200 lb/ac (1800 lb/ac average); Metric 1568-2464 kg/ha (2016 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 35% is the most common indicator of a threshold being crossed. Rabbitbrush, Sandberg bluegrass, buckwheat, yarrow, and phlox are common increasers. Annual weeds such as cheatgrass and mustards 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.
