USDA Natural Resources Conservation Service

Ecological site R061XS044SD
Rocky Hills-South (16-18" PZ)

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General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

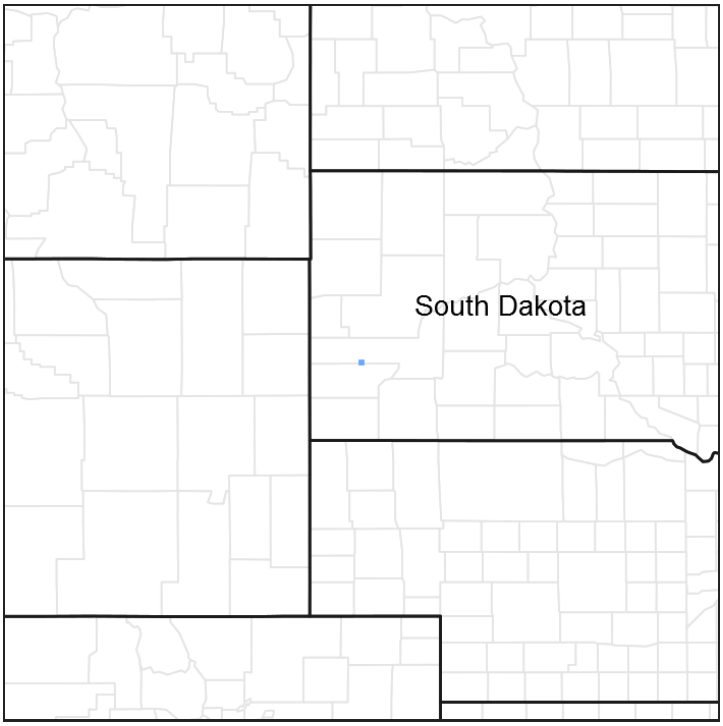


Figure 1. Mapped extent

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

MLRA notes

Major Land Resource Area (MLRA): 061X–Black Hills Foot Slopes

The Black Hills Foot Slopes (MLRA 61) is shared between Wyoming (WY) (58 percent) and South Dakota (SD) (42 percent). The MLRA is approximately 1,865 square miles. The

towns of Spearfish, Sturgis, and Hot Springs, South Dakota, and Newcastle and Sundance, Wyoming, are all in this MLRA. Rapid City, South Dakota, is on the eastern edge of the MLRA. Wind Cave National Park, Devils Tower National Monument, and parts of Thunder Basin National Grassland and the Black Hills National Forest are also in MLRA 61. Devils Tower was the nation's first National Monument, designated by President Theodore Roosevelt in 1906.

The Black Hills Foot Slopes consists of steeply dipping rocks circling the domed mountains of the Black Hills. As the mountains were uplifted, older sediments were tipped up and dipped away from the core of the mountains. The Lower Cretaceous Fall River and Lakota (Inyan Kara Group) sandstones, which are on the outside edge of the area, are referred to as the Dakota Hogback. The next geologic formation is the Triassic-aged red beds of the Spearfish shale. It forms a low valley. This "red valley" surrounds the Black Hills between the two ridges formed by the Inyan Kara (hogback) and Minnekahta Formations associated with the Black Hills (MLRA 62). The Lakota called the red beds the "Race Track." The red beds have gypsum and anhydrous layers. Ground water seepage can dissolve these layers, creating sinkholes on the surface.

The average elevation of MLRA 61 ranges from 2,950 to 3,940 feet with extremes to 5,580 feet. Slopes are generally hilly; however, the interior red beds are nearly level to moderately sloping. The exterior hogback is steep, erosion-resistant rock. The Belle Fourche River is the only river flowing through MLRA 61. It passes through Hulett, Wyoming.

The dominant soil orders in this MLRA are Alfisols, Entisols, and Mollisols. The soils in the area predominantly have frigid or mesic soil temperature regimes and aridic or ustic soil moisture regimes. The soils are shallow to very deep, generally well drained, and loamy.

Average annual precipitation is 16 to 22 inches. The majority of rainfall occurs early in the growing season. Some high-intensity thunderstorms occur in mid-late summer. This MLRA supports open grassland, open ponderosa forest, and savanna-like vegetation. The grassland is characterized by native grasses, such as big bluestem, little bluestem, western wheatgrass, needle and thread, prairie dropseed, and green needlegrass. Bur oak grows throughout the northern area and can develop into nearly pure stands.

The major resource concerns are urban expansion, wind erosion, water erosion, and water quality.

MLRA 61 is 54 percent privately owned rangeland and 19 percent forest land. Federal lands make up 7 percent of the rangeland and 5 percent of the forest land. The remaining 15 percent of the MLRA is privately owned cropland and urban development (USDA-NRCS, 2006: Ag Handbook 296).

LRU notes

For development of ecological sites, MLRA 61 is divided into three precipitation zones (PZ).

The northern area (18–22” PZ) extends from just south of Rapid City, South Dakota, north to the Wyoming border.

The southern area (16–18” PZ) extends from Newcastle, Wyoming, south to Hot Springs, South Dakota, then north to just south of Rapid City.

The western area (16–20” PZ) is primarily located in Wyoming, extending from Newcastle in the south, to north of the Bear Lodge Mountains, then south through the gap between the Bear Lodge Mountains and the Black Hills.

One additional grouping of ecological sites represents sites that are common for the entire MLRA and do not have a precipitation zone designation.

The forest lands in MLRA 61 are represented by three forest ecological sites, which are currently correlated to MLRA 62 Black Hills.

Classification relationships

USDA Land Resource Region G—Western Great Plains Range and Irrigated Region:
Major Land Resource Area (MLRA) 61—Black Hills Foot Slopes

US Environmental Protection Agency (EPA)
Level IV Ecoregions of the Conterminous United States:
Black Hills Foothills—17a

USDA Forest Service
Ecological Subregions: Sections and Subsections of Conterminous United States:
Black Hills Coniferous Forest Province—M334:
Black Hills Foothills Subsection—M334Aa

Ecological site concept

The Rocky Hills 16-18” PZ ecological site occurs throughout the southern portion of MLRA 61. It is located on moderate to steeply sloping uplands. Slopes range from 15 to 70 percent. This site is considered a run-off site and does not receive additional moisture from run-in or overflow. Soil surface and subsurface textures are extremely stony fine sandy loam. The surface layer is 6 to 10 inches thick. Soils typically do not have carbonates in the soil profile. The high amount of rock in the surface and subsurface soil profiles (up to 70 percent by volume), limits the available water holding capacity and vegetative productivity. The subsurface soil layers are nonrestrictive to water movement or root penetration.

Vegetation in the Reference State consists primarily of cool- and warm-season grass and sedges. Perennial forbs are common and diverse. Alder-leaf mountain mahogany, rose, and skunkbush sumac are almost always present. Scattered juniper and ponderosa pine may also occur.

Associated sites

R061XS012SD	**Thin Upland-South (16-18" PZ)** The Thin Upland 16-18” PZ ecological site is found on similar landscapes, adjacent to the Rocky Hills 16-18” PZ ecological site. Soils will not be skeletal.
R061XY016SD	**Very Shallow** The Very Shallow ecological site is found on similar landscapes adjacent to the Rocky Hills 16-18” PZ ecological site. Soils will be gravelly verses channery.
R061XS024SD	**Shallow Loamy-South (16-18" PZ)** The Loamy 16-18” PZ ecological site is found on similar landscapes, adjacent to the Rocky Hills 16-18” PZ ecological site. Soils will be shallow will be shallow (10 to 20 inches in depth).

Similar sites

R061XY016SD	**Very Shallow** The Very Shallow ecological site has more little bluestem, no alderleaf mountain mahogany and slightly less vegetative production than the Rocky Hills 16-18” PZ ecological site. Soils on the Very Shallow ecological site will be gravelly verses channery.
R061XY029SD	**Stony Hills** The Stony Hills ecological site will be found on similar soils and landscape position; will have more tall and mid-stature warm-season grasses, and greater vegetative production than the Rocky Hills 16-18” PZ ecological site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Cercocarpus montanus var. montanus*
Herbaceous	(1) *Hesperostipa comata ssp. comata* (2) *Bouteloua gracilis*

Physiographic features

The Rocky Hills 16-18” PZ ecological site occurs on hilly to very steeply sloping uplands.

Table 2. Representative physiographic features

Landforms	(1) Upland > Hill (2) Upland > Paleoterrace
Runoff class	High to very high
Flooding frequency	None
Ponding frequency	None
Elevation	2,900–5,000 ft
Slope	15–70%
Aspect	Aspect is not a significant factor

Climatic features

The climate in the southern LRU of MLRA 61 is typical of the drier portions of the Northern Great Plains where sagebrush steppes to the west yield to grassland steppes to the east. Average annual precipitation ranges from 16 to 18 inches with most falling during the growing season. Temperatures show a wide range between summer and winter and between daily maximums and minimums. The wide range is due to the high elevation and dry air, which permit rapidly incoming and outgoing radiation. In winter, cold air outbreaks from Canada move rapidly from northwest to southeast and account for extreme minimum temperatures. Chinook winds may occur in the winter and bring rapid rises in temperature. Extreme storms may occur during the winter. They most severely affect ranch operations during late winter and spring.

The average annual temperature is about 48 °F. January is the coldest month with average temperatures ranging from about 24 °F (Newcastle, WY) to about 27 °F (Hot Springs, SD). July is the warmest month with average temperatures ranging from about 72 °F (Rapid City, SD) to about 74 °F (Newcastle, WY). The range of average monthly temperatures between the coldest and warmest months is about 49 °F. Wind speeds are estimated to average about 11 miles per hour annually, ranging from about 13 miles per hour during the spring to about 10 miles per hour during the summer. Daytime winds are generally stronger than nighttime winds. Occasionally, storms bring brief periods of high winds with gusts to more than 50 miles per hour.

Growth of cool-season plants begins in early to mid-March, slowing or ceasing in late June. Warm-season plants begin growth about mid-May and continue to early or mid-September. Cool-season plants may green-up in September and October if adequate soil moisture is present.

Table 3. Representative climatic features

Frost-free period (characteristic range)	109-113 days
Freeze-free period (characteristic range)	127-131 days
Precipitation total (characteristic range)	16-18 in

Frost-free period (actual range)	107-117 days
Freeze-free period (actual range)	125-136 days
Precipitation total (actual range)	16-18 in
Frost-free period (average)	111 days
Freeze-free period (average)	130 days
Precipitation total (average)	17 in

Climate stations used

- (1) EDGEMONT [USC00392557], Edgemont, SD
- (2) EDGEMONT 23 NNW [USC00392565], Custer, SD
- (3) HOT SPRINGS [USC00394007], Hot Springs, SD
- (4) NEWCASTLE [USC00486660], Newcastle, WY
- (5) RAPID CITY 4NW [USC00396947], Rapid City, SD

Influencing water features

No riparian areas or wetland features are directly associated with the Rocky Hills 16-18” PZ ecological site.

Wetland description

Not Applicable.

Soil features

Soils common to the Rocky Hills 16-18” PZ ecological site are formed in deep residuum of metamorphic and granitic rocks. The surface layer textures are sandy loam or loam about 6 to 10 inches thick. The surface layers is channery and will have approximately 20 percent rock fragments. It is typically non-calcareous. Subsurface soils are very channery loam to clay loam with 35 to 70 percent rock fragments. The amount of rock in the soil profile limits the available water holding capacity and strongly influences the soil-water-plant relationship, and plant productivity. The soils have a moderate infiltration rate, and is well-drained. Subsurface soil layers are nonrestrictive to water movement and root penetration.

This site typically should show slight to no evidence of rills, wind-scoured areas, or pedestalled plants. If present, water flow paths are broken, irregular in appearance, or discontinuous. The soil surface is stable and intact.

Major soil correlated to the Rocky Hills 16-18” PZ ecological site is Shirttail.

This soil is mainly susceptible to water erosion. The hazard of water erosion increases on slopes greater than about 20 percent. Loss of 50 percent or more of the surface layer of the soils on this site can result in a shift in species composition and/or production.

More information regarding the soil is available in soil survey reports. Contact the local USDA Service Center for details specific to your area of interest or go online to access USDA's Web Soil Survey.

Table 4. Representative soil features

Parent material	(1) Residuum–igneous and metamorphic rock (2) Not specified
Surface texture	(1) Channery sandy loam (2) Channery loam
Family particle size	(1) Loamy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderate to moderately rapid
Soil depth	6–10 in
Surface fragment cover <=3"	15–40%
Surface fragment cover >3"	2–15%
Available water capacity (0-40in)	1–4 in
Calcium carbonate equivalent (0-40in)	0–8%
Electrical conductivity (0-40in)	0–1 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	35–70%
Subsurface fragment volume >3" (Depth not specified)	2–35%

Ecological dynamics

The Rocky Hills 16-18" PZ ecological site developed under the Northern Great Plains climatic conditions; light to severe grazing by bison and other large herbivores; sporadic, natural or human-caused wildfire (often of light intensities); and other biotic and abiotic factors that typically influence soil and site development. Changes occur in the plant

communities due to short-term weather variations, effects of native and exotic plant and animal species, and management actions. Although the following plant community descriptions are typical of the transitions between communities, severe disturbances, such as periods of well below average precipitation and the introduction of non-native cool-season grasses, can cause significant shifts in plant communities and species composition.

The Rocky Hills 16-18” PZ ecological site is naturally resilient, and quite resistant to change. Due to the steep slopes this site generally avoids more intensive grazing disturbances, however wildlife browse can be extensive, especially following fire. Continuous season-long grazing (grazing at moderate to heavy stocking levels for the full growing season each year) without adequate recovery periods following each grazing occurrence can cause a departure from the Needle and Thread-Little Bluestem-Grama/Alderleaf Mountain Mahogany Plant Community (1.1). Sedges and blue grama can increase, while many of the tall and mid-statured grasses will decrease (e.g., needle and thread, sideoats grama, bluebunch wheatgrass, and western wheatgrass). Even with these disturbances, many of the mid-statured grasses will remain in the community at reduced levels, allowing recovery after removal of disturbances.

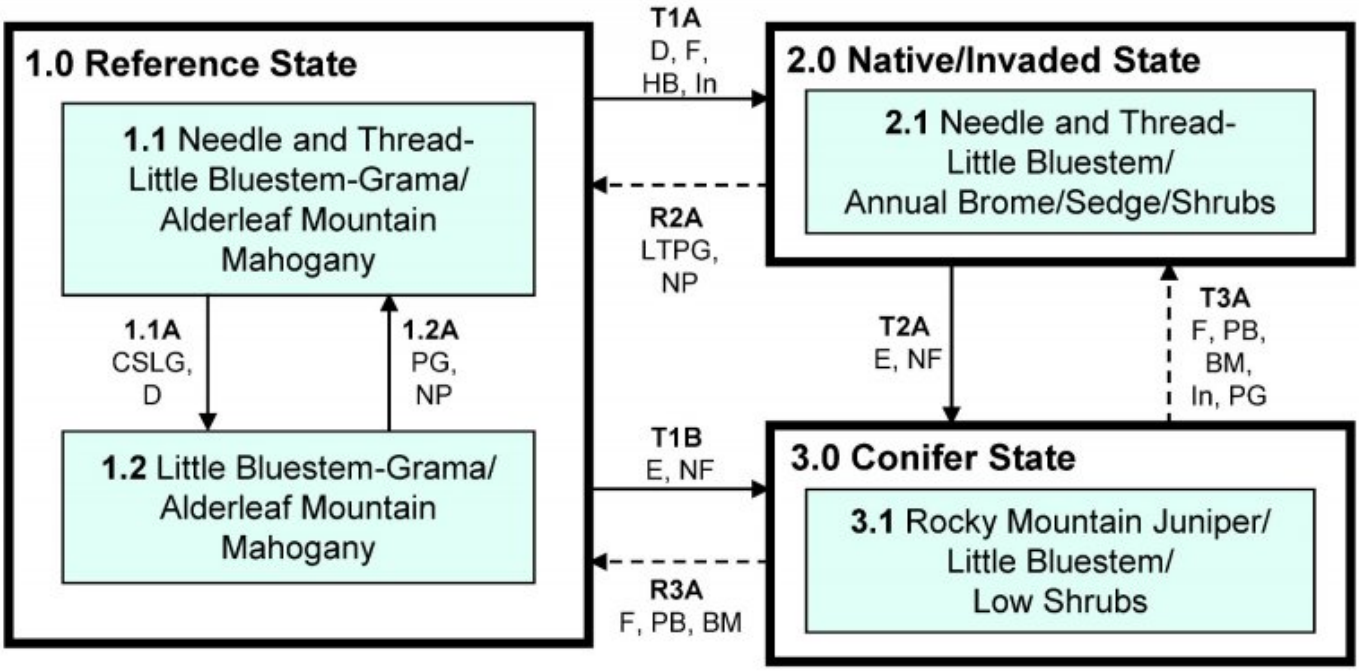
Interpretations are primarily based on the Needle and Thread-Little Bluestem-Grama/Alderleaf Mountain Mahogany Plant Community (1.1). It has been determined by study of rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. Trends in plant community dynamics ranging from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts also have been used. Plant community phases, states, transitional pathways, and thresholds have been determined through similar studies and experience.

Alderleaf mountain mahogany is not common in the Black Hills and is generally limited to the southern extent of MLRA 61.

The following state-and-transition diagram illustrates the common plant communities on the site and the transition pathways between communities. The ecological processes are discussed in more detail in the plant community descriptions following the diagram.

State and transition model

Rocky Hills 16-18” PZ – R061XS044SD 9/30/19



BM – Brush management
CSLG – Continuous season-long grazing
D – Drought
E – Encroachment of conifers
F – Fire
HB – Heavy browse
In – Invasion of non-native cool-season grasses
NP – normal precipitation patterns
PB – Prescribed burning
PG – Prescribed grazing
LTPG – Long-term prescribed grazing
- - → Transition may not be fast or feasible

Diagram Legend: Rocky Hills 16-18" PZ - R061XS044SD

T1A	1.0 to 2.0	Extended period of drought; fire; heavy wildlife browse on shrubs; the invasion of non-native annual cool-season grasses.
T1B	1.0 to 3.0	Encroachment of conifers and no fire.
T2A	2.0 to 3.0	Encroachment of conifers and no fire.
T3A	3.0 to 2.0	Fire, prescribed burning, or brush management to remove conifer encroachment; prescribed grazing; invasion of non-native annual cool-season grasses.
R2A	2.0 to 1.0	Long-term prescribed grazing including proper stocking rates, change in season of use, and adequate time for rest and recovery; a return to normal precipitation following drought. This transition may not be fast or feasible.
R3A	3.0 to 1.0	Fire, prescribed burning, or brush management to remove conifer encroachment. This transition may not be fast or feasible.
1.1A	1.1 to 1.2	Continuous season-long grazing, with above recommended stocking rates, and inadequate time for rest and recovery following grazing; or continuous seasonal grazing; or heavy grazing in combination with drought.
1.2A	1.2 to 1.1	Prescribed grazing including proper stocking rates, change in season of use, and adequate time for rest and recovery; return to normal precipitation following drought.

State 1
Reference State

The Reference State represents the best estimate of the natural range of variability that dominated the dynamics of the Rocky Hills 16-18” PZ ecological site prior to European settlement. This state is dominated by cool- and warm-season grasses. In pre-European times, the primary disturbance mechanisms included occasional fire and grazing by large herding ungulates and browsers. Timing of fires and grazing coupled with weather events dictated the dynamics that occurred within the natural range of variability. Taller cool- and warm-season grasses would have declined and a corresponding increase in short statured grass and grass-like species would have occurred. Today, a similar state can be found on areas that are properly managed with grazing and prescribed burning and sometimes on areas receiving occasional short periods of rest. The Reference State (1.0) is susceptible to invasion of non-native cool-season grasses and the encroachment of conifers.

Community 1.1
Needle and Thread-Little Bluestem-Grama/Alderleaf Mountain Mahogany

Interpretations are based primarily on the Needle and Thread-Little Bluestem-Grama/Alderleaf Mountain Mahogany Plant Community. This plant community is also considered to be the Reference Plant Community (1.1). This plant community evolved with grazing and browsing by large herbivores and occasional fire. It can be found on areas that are properly managed with prescribed grazing that allows for proper utilization, changes in season of use, and adequate recovery periods following each grazing event. The potential vegetation is about 50 percent grasses or grass-like plants, 15 percent forbs, and 35 percent shrubs and trees. Cool- and warm-season grass and grass-likes dominate this plant community. The major grasses or grass-likes include needle and thread, little bluestem, threadleaf sedge, blue and hairy grama, western wheatgrass and sideoats grama. Other grasses occurring on the site include threeawn, plains muhly, bluebunch wheatgrass, and prairie Junegrass. The significant forbs include dotted gayfeather, hairy goldaster, purple coneflower, prairie clover, and stemless hymenoxys. Significant shrubs are alderleaf mountain mahogany, rose, skunkbush sumac, and creaping juniper. 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 or browsing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term. This plant community is stable and protected from excessive erosion.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	530	903	1120
Shrub/Vine	205	350	550
Forb	65	140	215
Tree	0	7	15
Total	**800**	**1400**	**1900**

Figure 9. Plant community growth curve (percent production by month). SD6102, Black Hills Foot Slopes, cool-season dominant, warm-season sub-dominant. Cool-season dominant, warm-season sub-dominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		3	10	23	34	15	6	5	4		

Community 1.2
Little Bluestem-Grama/Alderleaf Mountain Mahogany

This plant community can develop from continuous season-long grazing (grazing at moderate to heavy stocking levels for the full growing season each year); annual, spring seasonal grazing; or heavy grazing in combination with drought. Warm-season mid- and shortgrass, and grass-like species increase on the site and annual production decreases. Cool-season needlegrasses and wheatgrass decreases. The potential vegetation is about 55 percent grasses or grass-like plants, 15 percent forbs, and 30 percent shrubs and trees. Little bluestem, blue grama, and threadleaf sedge are the dominant grass and grass-like species. Other grasses may include western wheatgrass, needle and thread, prairie Junegrass, and threeawn. Significant forbs include green sagewort, cutleaf ironplant, silverleaf scurfpea, white prairie aster, milkvetch, and spiny phlox. Common shrubs include true mountain mahogany and fringed sagewort. At times, true mountain mahogany will be severely browsed (hedged) and may be present at the lower range of total annual production. This plant community is relatively stable. The competitive advantage of blue grama and threadleaf sedge prevents other species from establishing. This plant community is less productive than the Needle and Thread-Little Bluestem-Grama/Alderleaf Mountain Mahogany Plant Community (1.1). Runoff has increased and infiltration has decreased. Soil erosion does not increase substantially.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	545	759	955
Shrub/Vine	105	220	350
Forb	50	110	170
Tree	0	11	25
Total	**700**	**1100**	**1500**

Figure 11. Plant community growth curve (percent production by month). SD6102, Black Hills Foot Slopes, cool-season dominant, warm-season sub-dominant. Cool-season dominant, warm-season sub-dominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		3	10	23	34	15	6	5	4		

Pathway 1.1A
Community 1.1 to 1.2

Continuous season-long grazing (stocking levels above carrying capacity for extended portions of the growing season); or heavy grazing in combination with drought will lead the Needle and Thread-Little Bluestem-Grama/Alderleaf Mountain Mahogany Plant Community (1.1) to the Little Bluestem-Grama/Alderleaf Mountain Mahogany Plant Community (1.2).

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing that includes proper stocking rates, change in season of use, and adequate time for plant recovery following grazing event, and a return to normal precipitation patterns following drought will convert the Little Bluestem-Grama/Alderleaf Mountain Mahogany (1.2) plant community to the Needle and Thread-Little Bluestem-Grama/Alderleaf Mountain Mahogany (1.1) plant community.

Conservation practices

Prescribed Grazing

State 2
Native/Invaded State

The Native/Invaded State is dominated by native cool-season grasses and grass-likes and, and subdominant non-native cool-season grasses. If the native cool-season grasses decline rapidly, exposing bare ground, a corresponding increase of non-native cool-season grasses can occur. The non-native cool-season grasses will include cheatgrass, field brome, and possible Kentucky bluegrass.

Community 2.1
Needle and Thread-Little Bluestem/Annual Brome/Sedge/Shrubs

This plant community can develop from the adverse effects of heavy, continuous grazing or browsing in conjunction with extended periods of below-average precipitation. This plant community phase is further impacted by the invasion of non-native cool-season grasses such as cheatgrass, field brome, and possibly Kentucky bluegrass. Needle and thread and little bluestem will be evident on the aspect of this phase but will be reduced in vigor and production. Annual bromegrass and sedge will make up a bulk of the composition on this plant community phase. The potential vegetation is about 60 percent grasses or grass-like plants, 15 percent forbs, and 25 percent shrubs and trees. The dominant grass and grass-like species will include needle and thread, little bluestem, threadleaf sedge, blue grama, and cheatgrass and field brome. Other grasses present include western wheatgrass, threeawn, Kentucky bluegrass, hairy grama, and prairie

Junegrass. Significant forbs include cudweed sagewort, green sagewort, milkvetch, white prairie aster, and spiny phlox. Common shrubs include alderleaf mountain mahogany, creeping juniper, and fringed sagewort. At times, true mountain mahogany will be severely browsed (hedged) and may be present at the lower range of total annual production. Lack of litter and short plant heights result in higher soil temperatures, poor water infiltration rates, and higher evaporation, which gives sedges and annual bromegrass a competitive advantage over cool-and warm-season mid-grasses. This plant community is relatively stable. The competitive advantage of blue grama and threadleaf sedge prevents other species from establishing. This plant community is less productive than the Needle and Thread-Little Bluestem-Grama/Alderleaf Mountain Mahogany Plant Community (1.1). Runoff has increased and infiltration has decreased. Soil erosion will not increase substantially.

Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	390	572	750
Shrub/Vine	75	140	205
Forb	35	80	125
Tree	0	8	20
Total	**500**	**800**	**1100**

Figure 13. Plant community growth curve (percent production by month). SD6102, Black Hills Foot Slopes, cool-season dominant, warm-season sub-dominant. Cool-season dominant, warm-season sub-dominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		3	10	23	34	15	6	5	4		

State 3
Conifer State

This state consists of areas where tree canopy increases to a level that impedes the reproductive capability of the major native perennial grass species. The increase in tree canopy is a result of a disruption of the natural historic fire regime that kept the trees at an immature stage. This state is reached when mature tree canopy reaches approximately 25 percent or more. Tree canopy typically is dominated by Rocky Mountain juniper, but ponderosa pine may also be present in varying amounts.

Community 3.1
Rocky Mountain Juniper/Little Bluestem/Shrubs

This plant community develops where trees from adjacent sites encroach or trees naturally

occurring on the site increase and begin to shade out the herbaceous and shrub components. Rocky Mountain juniper is the most common species to occupy the site, but ponderosa pine can also occur. These species expand on this site due to suppression of fire. The tree canopy is 25 percent or greater. The potential plant community is made up of approximately 50 percent grasses and grass-like species, 10 percent forbs, 15 percent shrubs, and 25 percent trees. Dominant grass and grass-like species include little bluestem, needle and thread, blue grama, and threadleaf sedge. Forbs commonly found in this community include white sagebrush (cudweed sagewort), field sagewort, and white prairie aster. Alderleaf mountain mahogany will typically decrease and low shrubs including broom snakeweed, fringed sagewort, and creeping juniper will increase. Non-native species such as cheatgrass, field brome and Kentucky bluegrass will tend to invade. Compared to the Needle and Thread-Little Bluestem-Grama/Alderleaf Mountaikn Mahogany Plant Community (1.1), tree canopy increases significantly. The grass component decreases dramatically with increased shading and the buildup of duff. Annual herbaceous production also decreases as will the preferred browse species. While the tree canopy can provide excellent protection from the weather for both livestock and wildlife, it is not capable of supporting large numbers of wildlife and livestock due to decreased herbaceous and shrub production. A significant reduction of tree canopy can be accomplished through fire, mechanical brush management, or prescribed burning. The vegetation in the understory is capable of enduring fire; however, very hot crown fires will have a detrimental effect to the plant community.

Figure 14. Plant community growth curve (percent production by month). SD6111, Black Hills Foot Slopes, heavy conifer canopy. Mature ponderosa pine/juniper overstory.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	3	7	11	24	27	12	5	4	3	2	1

Transition T1A
State 1 to 2

Extended periods of drought; fire; heavy wildlife browse; and the invasion of non-native cool-season grasses and will cause a transition from the Reference State (1.0) to the Native/Invaded State (2.0).

Transition T1B
State 1 to 3

The encroachment of conifers, primarily Rocky Mountain juniper, and no fire will transition the Reference State (1.0) to the Conifer State (3.0).

Restoration pathway R2A
State 2 to 1

Long-term prescribed grazing (moderate stocking levels coupled with adequate recovery periods; grazing systems intended to treat specific species dominance; or periodic light to moderate stocking levels possibly including periodic rest), coupled with a return to more normal precipitation cycles may lead the Native/Invaded State (2.0) over a threshold to the Reference State (1.0). This will likely take a long period of time, possibly up to 10 years or more, and recovery may not be attainable.

Conservation practices

Prescribed Grazing

Transition T2A
State 2 to 3

The encroachment of conifers, primarily Rocky Mountain juniper, and no fire will transition the Native/Invaded State (2.0) to the Conifer State (3.0).

Restoration pathway R3A
State 3 to 1

Fire, prescribed burning, or mechanical brush management to remove conifer encroachment, and prescribed grazing, may lead this plant community across a threshold back to the Reference State (1.0). This would have to take place before the conifers reach maturity and are still susceptible to fire, and reproductive propagules of the perennial grasses and shrubs are still present. After trees reach maturity, a stand replacing fire or brush management would be needed to move this plant community over the threshold back to the Reference State (1.0). This recovery may take a long period of time, possibly up to 10 years or more, and may not meet management objectives.

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing

Transition T3A
State 3 to 2

Invasion of non-native cool-season grasses; fire, mechanical brush management, or prescribed burning to remove conifers; will transition the Conifer State (3.0) to the Native/Invaded State (2.0).

Conservation practices

Brush Management
Prescribed Burning

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Cool-Season Bunchgrass**			210–350	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	210–350	–
	green needlegrass	NAVI4	*Nassella viridula*	0–70	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–70	–
2	**Mid- Warm-Season Grasses**			28–140	
	little bluestem	SCSC	*Schizachyrium scoparium*	14–140	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	14–70	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–42	–
3	**Short Warm-Season Grasses**			140–210	
	blue grama	BOGR2	*Bouteloua gracilis*	140–210	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	14–70	–
	threeawn	ARIST	*Aristida*	14–42	–
4	**Rhizomatous Wheatgrass**			70–210	
	western wheatgrass	PASM	*Pascopyrum smithii*	70–210	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–140	–
5	**Other Native Grasses**			28–70	
	prairie Junegrass	KOMA	*Koeleria macrantha*	14–42	–
	Sandberg bluegrass	POSE	*Poa secunda*	14–28	–
	squirreltail	ELEL5	*Elymus elymoides*	0–28	–
	Grass, perennial	2GP	*Grass, perennial*	0–28	–
6	**Grass-Likes**			28–140	
	threadleaf sedge	CAFI	*Carex filifolia*	28–140	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–70	–
7	**Non-Native Cool-Season Grasses**			0	

7	**Non-Native Cool-Season Grasses**			0	
Forb					
8	**Forbs**			70–210	
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	14–42	–
	milkvetch	ASTRA	*Astragalus*	14–42	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	14–42	–
	Forb, perennial	2FP	*Forb, perennial*	14–42	–
	field locoweed	OXCAS3	*Oxytropis campestris var. spicata*	14–28	–
	spiny phlox	PHHO	*Phlox hoodii*	14–28	–
	stemless four-nerve daisy	TEACA2	*Tetraneuris acaulis var. acaulis*	14–28	–
	white prairie aster	SYFA	*Symphyotrichum falcatum*	14–28	–
	purple prairie clover	DAPU5	*Dalea purpurea*	14–28	–
	pussytoes	ANTEN	*Antennaria*	14–28	–
	rayless tansyaster	MAGR2	*Machaeranthera grindelioides*	14–28	–
	Indian paintbrush	CASTI2	*Castilleja*	14–28	–
	buckwheat	ERIOG	*Eriogonum*	14–28	–
	American vetch	VIAM	*Vicia americana*	14–28	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	14–28	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	14–28	–
	dotted blazing star	LIPU	*Liatris punctata*	0–14	–
	field sagewort	ARCA12	*Artemisia campestris*	0–14	–
	little larkspur	DEBI	*Delphinium bicolor*	0–14	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–14	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	0–14	–
	white prairie clover	DACA7	*Dalea candida*	0–14	–
Shrub/Vine					
9	**Shrubs**			210–490	
	alderleaf mountain mahogany	CEMO2	*Cercocarpus montanus*	210–420	–
	skunkbush sumac	RHTR	*Rhus trilobata*	14–70	–

	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–28	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–28	–
	creeping juniper	JUHO2	*Juniperus horizontalis*	0–28	–
	prairie sagewort	ARFR4	*Artemisia frigida*	14–28	–
	rose	ROSA5	*Rosa*	0–28	–
	pricklypear	OPUNT	*Opuntia*	0–14	–
Tree					
10	**Trees**			0–14	
	ponderosa pine	PIPO	*Pinus ponderosa*	0–14	–
	Rocky Mountain juniper	JUSC2	*Juniperus scopulorum*	0–14	–

Table 9. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Cool-Season Bunchgrass**			55–110	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	55–110	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–22	–
	green needlegrass	NAVI4	*Nassella viridula*	0–11	–
2	**Mid- Warm-Season Grasses**			55–110	
	little bluestem	SCSC	*Schizachyrium scoparium*	55–110	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–55	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–33	–
3	**Short Warm-Season Grasses**			165–220	
	blue grama	BOGR2	*Bouteloua gracilis*	110–220	–
	threeawn	ARIST	*Aristida*	22–88	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	11–55	–
4	**Rhizomatous Wheatgrass**			11–110	
	western wheatgrass	PASM	*Pascopyrum smithii*	11–110	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–55	–
5	**Other Native Grasses**			11–44	
	prairie Junegrass	KOMA	*Koeleria macrantha*	11–33	–

	Sandberg bluegrass	POSE	*Poa secunda*	0–22	–
	squirreltail	ELEL5	*Elymus elymoides*	0–22	–
	Grass, perennial	2GP	*Grass, perennial*	0–22	–
6	**Grass-Likes**			165–275	
	threadleaf sedge	CAFI	*Carex filifolia*	55–110	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–55	–
7	**Non-Native Cool-Season Grasses**			0	
Forb					
8	**Forbs**			55–165	
	white sagebrush	ARLU	*Artemisia ludoviciana*	11–55	–
	field sagewort	ARCA12	*Artemisia campestris*	11–44	–
	white prairie aster	SYFA	*Symphyotrichum falcatum*	11–33	–
	Forb, perennial	2FP	*Forb, perennial*	11–33	–
	spiny phlox	PHHO	*Phlox hoodii*	11–22	–
	milkvetch	ASTRA	*Astragalus*	11–22	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–22	–
	Indian paintbrush	CASTI2	*Castilleja*	0–11	–
	little larkspur	DEBI	*Delphinium bicolor*	0–11	–
	American vetch	VIAM	*Vicia americana*	0–11	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–11	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–11	–
	pussytoes	ANTEN	*Antennaria*	0–11	–
	rayless tansyaster	MAGR2	*Machaeranthera grindelioides*	0–11	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	0–11	–
	field locoweed	OXCAS3	*Oxytropis campestris var. spicata*	0–11	–
	stemless four-nerve daisy	TEACA2	*Tetraneuris acaulis var. acaulis*	0–11	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	0–11	–
	buckwheat	ERIOG	*Eriogonum*	0–11	–
Shrub/Vine					

Shrub/Vine					
9	**Shrubs**			110–330	
	alderleaf mountain mahogany	CEMO2	*Cercocarpus montanus*	110–220	–
	skunkbush sumac	RHTR	*Rhus trilobata*	22–110	–
	prairie sagewort	ARFR4	*Artemisia frigida*	11–33	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–22	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–22	–
	pricklypear	OPUNT	*Opuntia*	0–22	–
	creeping juniper	JUHO2	*Juniperus horizontalis*	0–22	–
	rose	ROSA5	*Rosa*	0–11	–
Tree					
10	**Trees**			0–22	
	ponderosa pine	PIPO	*Pinus ponderosa*	0–22	–
	Rocky Mountain juniper	JUSC2	*Juniperus scopulorum*	0–22	–

Table 10. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Cool-Season Bunchgrass**			80–120	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	80–120	–
	green needlegrass	NAVI4	*Nassella viridula*	0–16	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–16	–
2	**Mid- Warm-Season Grasses**			40–20	
	little bluestem	SCSC	*Schizachyrium scoparium*	40–120	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–16	–
3	**Short Warm-Season Grasses**			16–80	
	blue grama	BOGR2	*Bouteloua gracilis*	16–80	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	8–40	–
	threeawn	ARIST	*Aristida*	8–24	–
4	**Rhizomatous Wheatgrass**			0–40	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–40	–
	thickspike	ELLAL	*Elymus lanceolatus ssp.*	0–8	–

	wheatgrass		*lanceolatus*		
5	**Other Native Grasses**			0–32	
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–16	–
	Grass, perennial	2GP	*Grass, perennial*	0–16	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–16	–
	squirreltail	ELEL5	*Elymus elymoides*	0–8	–
6	**Grass-Likes**			40–80	
	threadleaf sedge	CAFI	*Carex filifolia*	40–80	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–40	–
7	**Non-Native Cool-Season Grasses**			80–160	
	cheatgrass	BRTE	*Bromus tectorum*	40–160	–
	field brome	BRAR5	*Bromus arvensis*	16–80	–
	Kentucky bluegrass	POPR	*Poa pratensis*	0–8	–
Forb					
8	**Forbs**			40–120	
	white sagebrush	ARLU	*Artemisia ludoviciana*	8–56	–
	field sagewort	ARCA12	*Artemisia campestris*	8–48	–
	Forb, introduced	2FI	*Forb, introduced*	8–48	–
	white prairie aster	SYFA	*Symphyotrichum falcatum*	8–24	–
	Forb, perennial	2FP	*Forb, perennial*	0–16	–
	spiny phlox	PHHO	*Phlox hoodii*	8–16	–
	milkvetch	ASTRA	*Astragalus*	8–16	–
	rayless tansyaster	MAGR2	*Machaeranthera grindelioides*	8–16	–
	field locoweed	OXCAS3	*Oxytropis campestris var. spicata*	0–8	–
	pussytoes	ANTEN	*Antennaria*	0–8	–
	little larkspur	DEBI	*Delphinium bicolor*	0–8	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	0–8	–
	buckwheat	ERIOG	*Eriogonum*	0–8	–
Shrub/Vine					
9	**Shrubs**			80–200	
	alderleaf mountain mahogany	CEMO2	*Cercocarpus montanus*	40–160	–

	mahogany				
	skunkbush sumac	RHTR	*Rhus trilobata*	16–80	–
	prairie sagewort	ARFR4	*Artemisia frigida*	16–64	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–40	–
	creeping juniper	JUHO2	*Juniperus horizontalis*	8–24	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	8–24	–
	pricklypear	OPUNT	*Opuntia*	0–16	–
	rose	ROSA5	*Rosa*	0–8	–
Tree					
10	**Trees**			0–16	
	ponderosa pine	PIPO	*Pinus ponderosa*	0–16	–
	Rocky Mountain juniper	JUSC2	*Juniperus scopulorum*	0–16	–

Animal community

Wildlife Interpretations:
MLRA 61 lies within the drier portion of the northern mixed-grass prairie ecosystem where sagebrush steppes to the west yield to grassland steppes to the east. Prior to European settlement, this area consisted of diverse grass- and shrubland habitats interspersed with varying densities of depressional instream wetlands and woody riparian corridors. These habitats provided critical life cycle components for many users. Many species of grassland birds, small mammals, reptiles, amphibians, and herds of roaming bison, elk, and pronghorn were among the inhabitants adapted to this semi-arid region. Roaming herbivores, as well as several small mammal and insect species, were the primary consumers linking the grassland resources to predators such as the gray wolf, mountain lion, and grizzly bear, and smaller carnivores such as the coyote, bobcat, fox, and raptors. The prairie dog was once abundant; however, the species remains a keystone species within its range. The black-footed ferret, burrowing owl, ferruginous hawk, mountain plover, and swift fox were associated with prairie dog complexes.

Historically, the northern mixed-grass prairie was a disturbance-driven ecosystem with fire, herbivory, and climate functioning as the primary disturbance factors either singly or in combination. Following European settlement, livestock grazing, cropland conversion, elimination of fire, energy development, and other anthropogenic factors influenced species composition and abundance. Introduced and invasive species further impacted plant and animal communities. The bison was a historical keystone species but had been extirpated in this area as a free-ranging herbivore. The loss of the bison and reduction of prairie dog populations and fire as ecological drivers greatly influenced the character of the remaining native plant communities and altered wildlife habitats. Human development has reduced habitat quality for area-sensitive species.

Within MLRA 61, the Rocky Hills 16-18” PZ ecological site provides upland grassland cover with an associated forb, shrub, and tree component. It was typically part of an expansive grassland landscape that included combinations of Clayey, Loamy, Sandy, Overflow, Subirrigated, and Terrace ecological sites. This site provided habitat for species requiring unfragmented grassland. Important habitat features, and components found commonly or exclusively on this site may include sharp-tailed grouse leks; upland nesting habitat for grassland birds, forbs, and insects for brood habitat; and a forage source for small and large herbivores. Many grassland- and shrub steppe-nesting bird populations are declining. Extirpated species include free-ranging American bison, grizzly bear, gray wolf, black-footed ferret, mountain plover, Rocky Mountain locust, and swift fox.

The majority of the Rocky Hills 16-18” PZ ecological site remains intact and provides increasingly important habitat for grassland- and shrub nesting birds, small rodents, coyote, and a variety of reptiles, amphibians, and insects. Invasive species such as cheatgrass and field brome have impacted the biological integrity of the site for some grassland birds. Changes in historic fire regime and domestic grazing have impacted the forb/shrub/grass percentages.

Grazing Interpretations:
A significant amount of the Rocky Hills 16-18” PZ ecological site will be inaccessible to cattle due to steep slopes and rocky terrain. Sheep and goats, as well as elk and deer, can and will access this site.

The following list suggests annual, initial stocking rates for average growing conditions. These estimates are conservative and should be used only as guidelines in the initial stages of conservation planning. Commonly, the current plant composition does not entirely match any particular plant community (as described in this ecological site description). Therefore, a resource inventory is necessary to document plant composition and production. More accurate estimates of carrying capacity should eventually be calculated using the following stocking rate information along with animal preference data and actual stocking records, particularly when grazers other than cattle are involved. In consultation with the land manager, a more intensive grazing management program that results in improved harvest efficiencies and increased carrying capacity may be developed.

The following suggested initial stocking rates are based on 912 lb/acre (air-dry weight) per animal-unit-month (AUM) with a 25 percent harvest efficiency of preferred and desirable forage species (refer to USDA-NRCS, National Range and Pasture Handbook). An AUM is defined as the equivalent amount of forage required by a 1,000-pound cow, with or without calf, for one month.

Plant Community: Needle and Thread-Little Bluestem-Grama/Alderleaf Mountain Mahogany (1.1)
Average Production (lb/acre, air-dry): 1,400
Stocking Rate (AUM/acre): 0.38

Plant Community: Little Bluestem-Grama/Alderleaf Mountain Mahogany (1.2)
Average Production (lb/acre, air-dry): 1,100
Stocking Rate (AUM/acre): 0.30

Plant Community: Needle and Thread-Little Bluestem/Annual Brome/Sedge/Shrubs (2.1)
Average Production (lb/acre, air-dry): 800*
Stocking Rate (AUM/acre): 0.22*

Plant Community: Rocky Mountain Juniper/Little Bluestem/Low Shrubs (3.1)
Average Production (lb/acre, air-dry): Variable*
Stocking Rate (AUM/acre): Variable

Plant Community: All other plant communities identified in this document have variable annual production values and require onsite sampling to determine initial stocking rates.

* Total annual production and stocking rates are highly variable and require onsite sampling.

Total onsite annual production may contain vegetation deemed undesirable or untargeted by the grazing animal. Therefore, AUM values may need to be reduced to reflect only preferred or desirable forage species.

Grazing by domestic livestock is one of the major income-producing industries in the area. Rangeland in this area may provide yearlong forage for livestock. During the dormant period, the forage for livestock likely has insufficient protein to meet livestock requirements. Added protein allows ruminants to better utilize the energy stored in grazed plant materials. A forage quality test (either directly or through fecal sampling) should be used to determine the level of supplementation needed.

Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group B. Infiltration and 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 percent ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be where shortgrasses form a strong sod and dominate the site. Dominance by blue grama, buffalograss, bluegrass, and smooth bromegrass will result in reduced infiltration and increased runoff. Areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff. Refer to the USDA-NRCS National Engineering Handbook, Part 630, for hydrologic soil groups, runoff quantities, and hydrologic curves.

Recreational uses

This site provides hunting, hiking, photography, bird watching, and other opportunities. The wide variety of plants that bloom from spring until fall have aesthetic value that appeals to visitors.

Wood products

No appreciable wood products are typically present on this site.

Other products

Harvesting the seeds of native plants can provide additional income on this site.

Other information

Revision Notes: “Previously Approved” Provisional
This provisional ecological site description (ESD) has passed quality control (QC) and quality assurance (QA) to ensure the it meets the 2014 NESH standards for a “Provisional” ecological site description.

This ecological site description (ESD) is an updated “Previously Approved” ESD that represented a first-generation tier of documentation that met all requirements as an “Approved” ESD as laid out in the 1997 National Range and Pasture Handbook (NRPH). The requirements for approved status changed with the release of the 2014 National Ecological Site Handbook (NESH). The previously approved document fully described the reference state and community phase in the state-and-transition model. All other alternative states were at least described in narrative form. The “Previously Approved” ESD has been field-tested for a minimum of five years and is a proven functional document for conservation planning. The “Previously Approved” ESD may not contain all tabular and narrative entries as required in the current “Approved” level of documentation, but it is expected this ESD will continue refinement toward the current “Approved” status.

Site Development and Testing Plan
Future work, as described in an official project plan, is necessary to validate the information in this provisional ecological site description. The plan will include field activities for low-, medium-, and high-intensity sampling, soil correlations, and analysis of the data. Annual field reviews should be done by soil scientists and vegetation specialists. Final field review, peer review, quality control, and quality assurance reviews are required to produce the final document.

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. Those

involved in developing this site include: Stan Boltz, Range Management Specialist, NRCS; Cynthia Englebert, Range Management Specialist, Forest Service; George Gamblin, Range Management Specialist, NRCS; Ryan Murray, Range Management Specialist, NRCS; Cheryl Nielsen, Range Management Specialist, NRCS; L. Michael Stirling, Range Management Specialist, NRCS; Jim Westerman, Soil Scientist, NRCS.

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Rick L. Peterson

Approval

Suzanne Mayne-Kinney, 7/17/2024

Acknowledgments

All ecological sites were written to the Provisional Level by Rick L. Peterson, ESS, Rapid City, SSO in FY20.

The ESDs were reviewed for quality control by Emily Helms, John Hartung, Mitch Faulkner, and Ryan Murray.

All ecological sites were then reviewed and approved at the Provisional Level by David Kraft, Regional ESS, Salina, KS in September 2020.

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)	Stan Boltz
Contact for lead author	Stan Boltz, stanley.boltz@sd.usda.gov, 605-352-1236
Date	09/30/2009
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None usually present.

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2. **Presence of water flow patterns:** None, or barely visible and discontinuous with numerous debris dams when present.

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3. **Number and height of erosional pedestals or terracettes:** Few pedastalled plants typically on steeper slopes. Terracettes not present.

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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 roughly 5 to 15 percent, and patches are less than 2 inches in diameter.

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

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

7. **Amount of litter movement (describe size and distance expected to travel):** Small size litter classes will generally move short distances, some medium size class litter will move very short distances. Litter debris dams are occasionally present.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil aggregate stability ratings typically 5 to 6, normally 6. Surface organic matter adheres to the soil surface.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface structure is typically granular, and mollic (higher organic matter) colors of surface horizon about 4 to 6 inches deep. If conditions are other than this, refer to map unit component descriptions for component on which the site occurs.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Combination of shallow and deep rooted species (mid & tall rhizomatous and tufted perennial cool- and warm-season grasses) with fine and coarse roots positively influences 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: Mid and tall, cool-season bunchgrasses = shrubs >>

    Sub-dominant: Short, warm-season grasses = wheatgrass (mid, cool-season rhizomatous) = forbs >

Other: Mid, warm-season grasses > grass-like species

Additional: Other grasses occur in other functional groups in minor amounts.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very little evidence of decadence or mortality. Bunch grasses have strong, healthy centers and shrubs are vigorous.

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14. **Average percent litter cover (%) and depth (in):** 55 to 65 percent plant litter cover, roughly 0.25 to 0.5 inch depth. 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):** Ranges from 800 to 1,900 pounds/acre. Reference value is 1,400 pounds/acre (air-dry weight basis).

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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:** Refer to State and Local Noxious Weed List.

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17. **Perennial plant reproductive capability:** All species exhibit high vigor relative to climatic conditions. Do not rate based solely on seed production. Perennial grasses typically have vigorous rhizomes or tillers.
