USDA Natural Resources Conservation Service

Ecological site R058DY008SD
Sands

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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): 058D–Northern Rolling High Plains, Eastern Part

The Northern Rolling High Plains, Eastern Part (MLRA 58D) is shared between South Dakota (65 percent), Montana (21 percent), and North Dakota (14 percent). The MLRA is approximately 2,755 square miles. The small towns of Buffalo and Camp Crook, South Dakota, and Marmarth, North Dakota, are all within the boundary of this MLRA, and Baker, Montana, is on the northern most edge. Portions of the Little Missouri National Grassland and Custer National Forest are also in the MLRA. Portions of the Little Missouri River and the headwaters of major tributaries that eventually form the Grand and Moreau Rivers in South Dakota are also in this area.

The Northern Rolling High Plains, Eastern Part consists of Cretaceous marine and continental sediments of shale, siltstone, and sandstone. The continental and marine Hell Creek Formation is under approximately 85 percent of the MLRA, and the Fox Hills Sandstone forms the southern boundary of the MLRA. Tertiary deposits are in scattered areas throughout the MLRA. These deposits consist of the Paleocene Ludlow and Tongue River Formations, the Oligocene White River Group, and the Miocene Arikaree Group. These Tertiary deposits are resistant and positioned above the Cretaceous beds. Ponderosa pine growing in areas of these Tertiary formations further distinguishes these formations from the other formations in the MLRA. Pleistocene and Holocene river sand and gravel deposits are also on the valley floors and on the terraces along the larger rivers in the area. A large Quaternary eolian deposit is directly south of the town of Buffalo.

The average elevation of MLRA 58D ranges from 2,300 feet to 4,000 feet, increasing gradually from east to west. Harding Peak is the highest point at 4,019 feet. In places, flat-topped, steep-sided buttes rise sharply above the gently rolling plains below.

The dominant soil orders in this MLRA are Alfisols, Entisols, Inceptisols, and Mollisols. The soils in the area dominantly have a frigid soil temperature regime, an ustic soil moisture regime that borders on aridic, and mixed mineralogy. They are shallow to very deep, generally well drained, and loamy or clayey.

Annual precipitation is 14 to 17 inches and can fluctuate widely from year to year. The majority of rainfall occurs early in the growing season. Some high-intensity thunderstorms occur mid to late summer. The native vegetation in this MLRA consists primarily of grasses and forbs with a small component of trees and shrubs along streams. Ponderosa pine grow on the upper slopes and on the top of some of the higher buttes. Open grasslands are characterized by western wheatgrass, green needlegrass, blue grama, and buffalograss. Wyoming big sagebrush grows on clayey soils in the western part of the MLRA.

More than four-fifths of the MLRA is privately owned ranches running cattle, sheep, or both. Less than 5 percent of the area is federally owned. The major resource concerns are water quality, wind erosion, and water erosion (USDA, NRCS. 2006. Ag Handbook 296).

Classification relationships

USDA
Land Resource Region G—Western Great Plains Range and Irrigated Region:
Major Land Resource Area (MLRA) 58D— Northern Rolling High Plains, Eastern Part

US Environmental Protection Agency (EPA)
Level IV Ecoregions of the Conterminous United States:
Forested Buttes—43d
Sagebrush Steppe—43e

USDA Forest Service
Ecological Subregions: Sections and Subsections of Conterminous United States:
Great Plains - Palouse Dry Steppe Province—331:
Missouri Plateau Section—331M
Sagebrush Steppe Subsection—334Mi

Ecological site concept

The Sands Ecological Site is found throughout MLRA 58D. It is located on upland landscapes and does not receive additional moisture from runoff or overflow. This site can have very complex slopes that typically range from 5 to 15 percent. Soils are deep (greater than 20 inches), excessively drained, and formed in eolian sand or sandy alluvium. The surface layer is 3 to 6 inches thick with a texture range of loamy fine sand to sand. The subsurface textures are also loamy fine sand to sand.

The vegetation in the Reference State (1.0) consists of a mix of warm- and cool-season grasses, however, tall- and mid-statured warm-season grasses tend to be the dominant group. Prairie sandreed, sand bluestem, big bluestem, little bluestem, and blue grama are dominant warm-season grasses. Needle and thread is the dominant cool-season grass. Forbs are common and diverse. Common shrubs include fringed sagewort, rose, silver sagebrush, and small soapweed (yucca).

Associated sites

R058DY009SD	**Sandy** The Sandy ecological site is found adjacent to the Sands ecological site on slopes ranging from zero to six percent.

R058DY010SD	**Loamy** The Loamy ecological site is found adjacent to the Sands ecological site on slopes ranging from zero to six percent.
R058DY028SD	**Shallow Sandy** The Shallow Sandy ecological site is found in shallow soils adjacent to the Sands ecological site with slopes greater than nine percent.
R058DY030SD	**Choppy Sands** The Choppy Sands ecological site is found on moderately to steeply sloping hummocks and dunes adjacent to the Sands ecological site.

Similar sites

R058DY010SD	**Loamy** The Loamy ecological site will have more western wheatgrass, less needle and thread, and higher vegetative production than the Sands ecological site.
R058DY009SD	**Sandy** The Sandy ecological site will have more western wheatgrass, and more vegetative production than the Sands ecological site.
R058DY030SD	**Choppy Sands** The Choppy Sands ecological site will have more prairie sandreed and little bluestems, and less vegetative production than the Sands ecological site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Calamovilfa longifolia* (2) *Hesperostipa comata ssp. comata*

Physiographic features

The Sands ecological site occurs on nearly level to moderately steep uplands.

Table 2. Representative physiographic features

Landforms	(1) Upland > Dune (2) Upland > Hill
Runoff class	Very low to low
Flooding frequency	None
Ponding frequency	None
Elevation	2,300–4,000 ft
Slope	2–15%
Water table depth	80 in
Aspect	Aspect is not a significant factor

Climatic features

The climate in MLRA 58D is typical of the drier portions of the Northern Great Plains where sagebrush steppes to the west yield to grassland to the east. Average annual precipitation ranges from 14 to 17 inches with most falling in the early growing season. Some high intensity, convective thunderstorms occur in the summer. Precipitation in winter occurs as snow. Temperatures show a wide range between summer and winter and between daily maximums and minimums. This wide range is due to the high elevation and dry air, which permit rapid incoming and outgoing radiation. Outbreaks of cold air from Canada in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Extreme storms may occur during the winter but have the most severe

effect on ranching operations during late winter and in spring.

The normal average annual temperature is about 44 °F. January is the coldest month with average temperatures ranging from about 12 °F (Marmarth, North Dakota) to about 20 °F (Baker, Montana). July is the warmest month with temperatures averaging from about 70 °F (Marmarth, North Dakota) to about 76 °F (Baker, Montana). The range of normal average monthly temperatures between the coldest and warmest months is about 55 °F. Wind speeds are estimated to average about 11 miles per hour (mph) annually, ranging from about 13 mph during the spring to about 10 mph during the summer. Daytime winds are generally stronger than nighttime winds. Strong storms may bring brief periods of high winds with gusts of more than 50 mph.

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)	97-111 days
Freeze-free period (characteristic range)	121-129 days
Precipitation total (characteristic range)	15-17 in
Frost-free period (actual range)	93-115 days
Freeze-free period (actual range)	120-132 days
Precipitation total (actual range)	14-17 in
Frost-free period (average)	104 days
Freeze-free period (average)	125 days
Precipitation total (average)	16 in

Climate stations used

- (1) BAKER 1 E [USC00240412], Baker, MT
- (2) LADNER 9SW [USC00394671], Camp Crook, SD
- (3) CAMP CROOK [USC00391294], Camp Crook, SD
- (4) BUFFALO ASOS [USW00094037], Buffalo, SD
- (5) BUFFALO 13 ESE [USW00094081], Reva, SD
- (6) REDIG 11 NE [USC00397062], Buffalo, SD
- (7) HOOVER [USC00393945], Newell, SD

Influencing water features

No significant water features influence the Sands ecological site.

Soil features

Soils common to the Sands ecological site have loamy fine sand textured surface layers that are 3 to 6 inches thick. Slopes range from 2 to 15 percent. The soils in this site are well to excessively drained and formed in eolian sand or residuum formed in sandstone. The textures of the subsurface layers range from loamy fine sand to fine sand. Subsurface soil layers are nonrestrictive to water movement and root penetration.

This site should show slight to no evidence of rills, wind-scoured areas, or pedestalled plants. Water flow paths are broken, irregular in appearance, or discontinuous with numerous vegetative barriers. The soil surface is stable and intact.

Major Soils correlated to the Sands ecological site include, Hanly, Telfer, Trey, and Zeona.

Trey and Zeona are correlated to the Choppy Sands (R058DY030SD) ecological site when the slopes are greater

than 15 percent.

These soils are susceptible to wind and water erosion. The hazard of water erosion increases on slopes greater than about 15 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 can be found in the various soil survey reports. Contact the local USDA Service Center for soil survey reports that include more detail specific to your area of interest, or use the internet to access USDA's Web Soil Survey.

Table 4. Representative soil features

Parent material	(1) Eolian sands–sandstone (2) Residuum–sandstone
Surface texture	(1) Loamy fine sand
Family particle size	(1) Sandy
Drainage class	Well drained to excessively drained
Permeability class	Moderately rapid to rapid
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	3 in
Calcium carbonate equivalent (0-40in)	0–5%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	5.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The Sands 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 will occur in the plant communities due to short-term weather variations, impacts of native and exotic plant and animal species, and management actions. While the following plant community descriptions specify more typical transitions between communities that will occur, 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.

Blue grama, needle and thread, and upland sedges increase as this site deteriorates from improper management. Species such as sand bluestem, little bluestem, and prairie sandreed will decrease in frequency and production.

The plant community upon which interpretations are primarily based is the Prairie Sandreed-Needle and thread-Bluestem Plant Community. This plant community has been determined by studying 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 communities, states, transitional pathways, and thresholds have been determined through similar studies and experience.

The following is a State-and-Transition diagram that illustrates the common plant communities that can occur on the site and the transition pathways between communities. The ecological processes will be discussed in more detail in the plant community descriptions following the diagram.

State and transition model

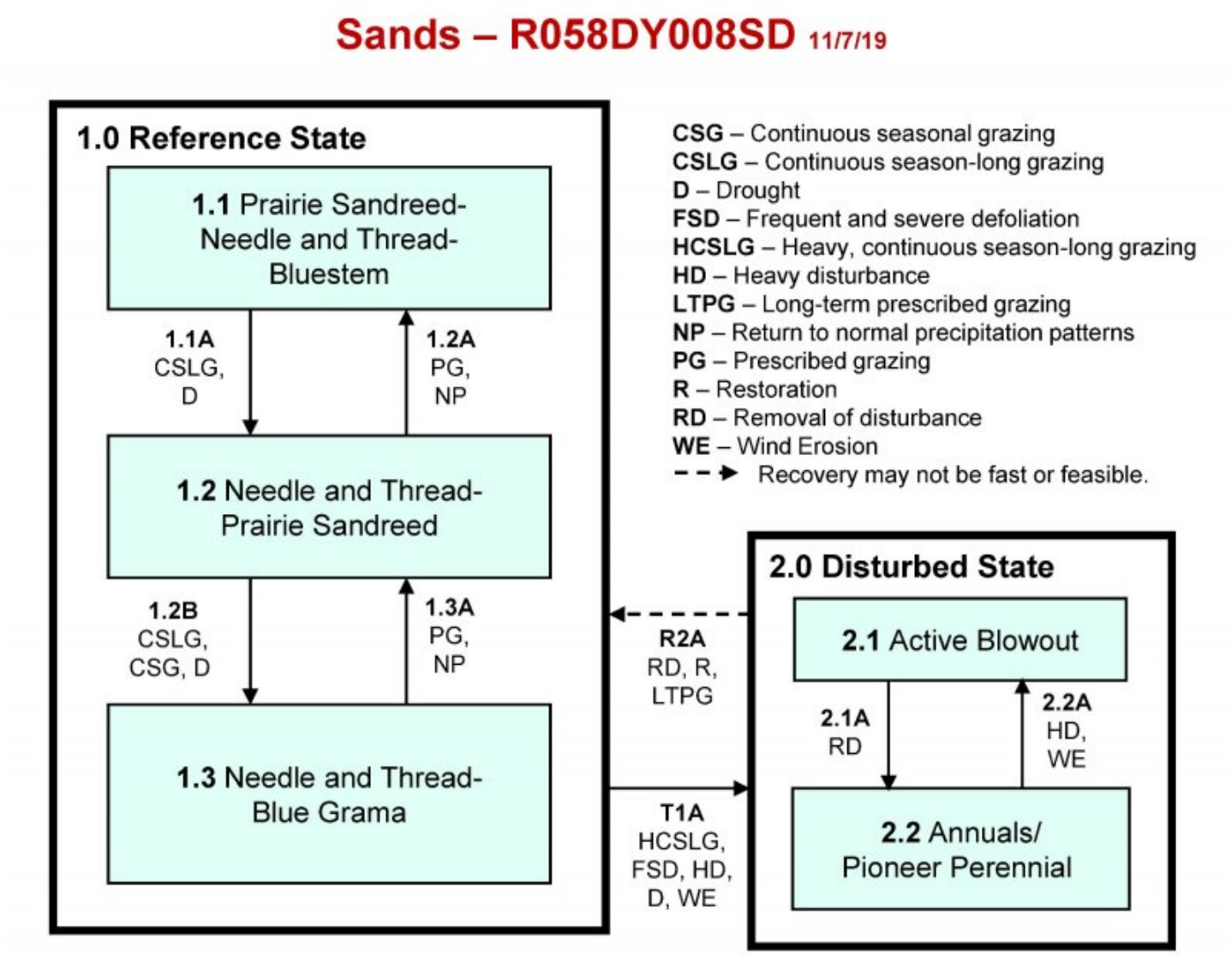

Diagram Legend: Sands - R058DY008SD

T1A	1.0 to 2.0	Heavy, continuous season-long grazing; frequent and severe defoliation: heavy disturbance; heavy grazing in combination with drought; wind erosion.
R2A	2.0 to 1.0	Removal of management-induced disturbance; restoration of site, including site stabilization, shaping, mulching, seeding; long-term prescribed grazing with proper stocking rates, change is season of use, and time for adequate recovery. This transition may not be fast or in the end meet management goals.
1.1A	1.1 to 1.2	Continuous season-long grazing; or heavy grazing in combination with drought.
1.2A	1.2 to 1.1	Prescribed grazing with proper stocking, change is season of use, and adequate time for recovery; a return to normal precipitation patterns.
1.2B	1.2 to 1.3	Continuous season-long grazing; continuous seasonal grazing; heavy grazing in combination with drought.
1.3A	1.3 to 1.2	Prescribed grazing with proper stocking, change is season of use, and adequate time for recovery; a return to normal precipitation patterns.
2.1A	2.1 to 2.2	Removal of management-induced disturbances.
2.2A	2.2 to 2.1	Heavy disturbance, and wind erosion.

State 1
Reference State

The Reference State represents what is believed to show the natural range of variability that dominated the dynamics of the Sands ecological site prior to European settlement. This site in the Reference State (1.0) is dominated by warm-season grasses. In pre-European times, the primary disturbance mechanisms included frequent fire and grazing by large herding ungulates. Timing of fires and grazing coupled with weather events dictated the dynamics that occurred within the natural range of variability. Taller warm- and cool-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.

Dominant plant species

- soapweed yucca (*Yucca glauca*), shrub
- rose (*Rosa*), shrub
- prairie sandreed (*Calamovilfa longifolia*), grass
- needle and thread (*Hesperostipa comata ssp. comata*), grass
- sand bluestem (*Andropogon hallii*), grass
- blue grama (*Bouteloua gracilis*), grass
- little bluestem (*Schizachyrium scoparium*), grass
- prairie Junegrass (*Koeleria macrantha*), grass
- western wheatgrass (*Pascopyrum smithii*), grass
- sedge (*Carex*), grass
- dotted blazing star (*Liatris punctata*), other herbaceous
- prairie sagewort (*Artemisia frigida*), other herbaceous
- hairy false goldenaster (*Heterotheca villosa*), other herbaceous
- beardtongue (*Penstemon*), other herbaceous
- scurfpea (*Psoralidium*), other herbaceous

Community 1.1
Prairie Sandreed-Needle and Thread-Bluestem

Interpretations are based primarily on the Prairie Sandreed-Needle and Thread-Bluestem Plant Community, which is also considered to be the Reference Plant Community (1.1). This plant community can be found on areas that are properly managed with grazing, and sometimes on areas receiving occasional short periods of deferment. Warm-season grasses dominate this plant community. The potential vegetation is about 85 percent grasses or grass-like plants, 10 percent forbs, 5 percent shrubs, and 0 to 1 percent mat-forming forbs. The major grasses include prairie sandreed, needle and thread, sand bluestem, and little bluestem. Other grasses or grass-like species occurring on

the site include prairie Junegrass, western wheatgrass, and upland sedges. Significant forbs include dotted gayfeather, green sagewort, hairy goldaster, penstemon, and scurfpea. The significant shrubs that occur include, fringed sagewort, rose, and yucca. This plant community is well adapted to the Northern Great Plains climatic conditions. Individual species can vary greatly in production depending on growing conditions (timing and amount of precipitation and temperature). The diversity in plant species allows for high drought tolerance. This is a healthy and sustainable plant community. Moderate or high available water capacity provides a favorable soil-water-plant relationship. Overall, the interpretive plant community has the appearance of being stable, diverse, and productive. Plant litter is properly distributed with very little movement offsite and natural plant mortality is very low.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1020	1558	2085
Forb	90	190	300
Shrub/Vine	90	142	195
Moss	0	10	20
Total	**1200**	**1900**	**2600**

Figure 9. Plant community growth curve (percent production by month). SD5805, Northern Rolling High Plains, warm-season dominant.. Warm-season dominant, uplands..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	2	5	15	25	30	15	7	1	0	0

Community 1.2
Needle and Thread-Prairie Sandreed

This plant community develops under continuous season-long grazing or from over utilization during extended drought periods. The potential vegetation is made up of approximately 80 percent grasses and grass-like species, 10 percent forbs, 8 percent shrubs, and 2 percent mat-forming forbs. The dominant grasses include needle and thread and prairie sandreed. Other grasses or grass-like species may include blue grama, upland sedges, and little bluestem. Significant forbs include cudweed sagewort, green sagewort, scurfpea, and western ragweed. The dominant shrubs that occur include cactus, yucca, and fringed sagewort. Compared to the Prairie Sandreed-Needle and thread-Bluestem Plant Community (1.1), the shortgrass species including blue grama and threadleaf sedge have increased. The warm-season species including prairie sandreed, sand bluestem, and little bluestem have decreased in composition. Annual bromes, bluegrass, sweetclover, and other annual grasses and forbs can invade the site. This plant community can occur in a mosaic with patchy, slightly used areas occurring adjacent to and intermingled with this plant community. This plant community is not resistant to change. Changes in grazing management can result in a shift to another plant community. This community is fairly resilient following normal disturbances because of the high diversity of plant species and the high amount of litter. Soil erosion is low. The water cycle is functioning due to the litter cover on the soil surface. Infiltration is high because of the soil texture and surface litter.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	755	1092	1525
Shrub/Vine	80	147	215
Forb	65	140	215
Tree	0	21	45
Total	**900**	**1400**	**2000**

Figure 11. Plant community growth curve (percent production by month). SD5803, Northern Rolling High Plains, cool-season/warm-season co-

dominant.. Cool-season, warm-season co-dominant, uplands..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	10	20	28	21	10	5	3	0	0

Community 1.3
Needle and Thread-Blue Grama

This plant community typically develops over a period of several years with continuous season-long grazing or continuous seasonal grazing (grazing at the same time of year every year for extended periods during the growing season). It is made up of approximately 80 percent grasses and grass-like species, 10 percent forbs, 5 percent shrubs, and up to 5 percent mat-forming forbs. The dominant grasses and grass-likes are blue grama, needle and thread, sand dropseed, and threadleaf sedge. Significant forbs include western ragweed, green sagewort, scurfpea, goldenrod, and annual eriogonum. Dominant shrubs in this community include fringed sagewort, yucca, and cactus. Compared to the Prairie Sandreed-Needle and thread-Bluestem Plant Community (1.1), blue grama, sand dropseed, and threadleaf sedge have greatly increased. Prairie sandreed is greatly diminished. Sand bluestem and little bluestem are essentially absent. This plant community is not resistant to change due to the higher percentage of bare ground. The water cycle is impaired due to a reduction in litter and the potential for higher runoff and decreased infiltration. The risk for soil erosion increases.

Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	505	770	1135
Shrub/Vine	45	100	155
Forb	45	100	155
Tree	5	30	55
Total	**600**	**1000**	**1500**

Figure 13. Plant community growth curve (percent production by month). SD5803, Northern Rolling High Plains, cool-season/warm-season co-dominant.. Cool-season, warm-season co-dominant, uplands..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	10	20	28	21	10	5	3	0	0

Pathway 1.1A
Community 1.1 to 1.2

Continuous season-long grazing or grazing for extended periods during the actively growing period of the dominant grasses without adequate recovery periods; or heavy grazing in combination with drought will lead to the Prairie Sandreed-Needle and Thread-Bluestem Plant Community (1.1) to the Needle and Thread-Prairie Sandreed Plant Community (1.2).

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing with proper stocking rate, change in season of use, and adequate time for plant recovery; and a return to normal precipitation patterns following drought will convert the Needle and Thread-Prairie Sandreed Plant Community (1.2) to the Prairie Sandreed-Needle and Thread-Bluestem Plant Community (1.1).

Conservation practices

Prescribed Grazing

Pathway 1.2B
Community 1.2 to 1.3

Continuous season-long grazing; or continuous seasonal grazing (grazing at moderate rates at the same time every year); or heavy grazing in combination with drought will move the Needle and Thread-Prairie Sandreed Plant Community (1.2) to the Needle and Thread-Blue Grama Plant Community (1.3).

Pathway 1.3A
Community 1.3 to 1.2

Prescribed grazing with proper stocking rate, change in season of use, and adequate time for plant recovery; and a return to normal precipitation patterns following drought will convert the Needle and Thread-Blue Grama Plant Community (1.3) to the Needle and Thread-Prairie Sandreed Plant Community (1.2).

Conservation practices

Prescribed Grazing

State 2
Disturbed State

The Disturbed State (2.0) can be reached from any plant community through heavy disturbance. This can result from heavy livestock or wildlife concentration (i.e., water locations, bedding or loafing grounds, etc.,). With significant disturbances, large areas of blowing sand can result in large blowouts. Evaporation and transpiration rates of the few existing plants are extremely high due to bare ground and lack of litter.

Dominant plant species

- soapweed yucca (*Yucca glauca*), shrub
- blue grama (*Bouteloua gracilis*), grass
- sand dropseed (*Sporobolus cryptandrus*), grass
- sedge (*Carex*), grass
- sixweeks fescue (*Vulpia octoflora*), grass
- cheatgrass (*Bromus tectorum*), grass
- prairie sagewort (*Artemisia frigida*), other herbaceous
- Cuman ragweed (*Ambrosia psilostachya*), other herbaceous
- common sunflower (*Helianthus annuus*), other herbaceous
- annual buckwheat (*Eriogonum annuum*), other herbaceous

Community 2.1
Active Blowout

This condition can be reached from any other plant community. Large areas of blowing sand result in movement and possible enlargement of blowouts. Evaporation is extremely high, and transpiration of the few existing plants is also high due to bare ground, lack of litter, and low plant density. The plant community is in a low successional stage due to steep slopes and poor soil development.

Community 2.2
Annual/Pioneer Perennials

The Annual/Pioneer Perennial Plant Community develops under frequent and severe defoliation or excessive disturbance. This can result from heavy livestock or wildlife concentration (i.e., water locations, bedding or loafing grounds, feeding areas, etc.,) or cropping abandonment. The dominant vegetation includes pioneer annual grasses and forbs and early successional biennial and perennial species. Grasses may include blue grama, sand dropseed, sedge, sixweeks fescue, and cheatgrass. The dominant forbs may include green sagewort, western ragweed, annual sunflower, and annual buckwheat. Shrubs that may be present include cactus and small soapweed. This plant community is resistant to change as long as soil disturbance or severe vegetation defoliation persists, thus holding back secondary plant succession. Soil erosion is potentially high in this plant community. The community

also is susceptible to invasion of non-native annual and perennial forbs due to severe soil disturbances and relatively high percent of bare ground. Reduced surface cover, low plant density, low plant vigor, and loss of root biomass, all contribute to decreased water infiltration, increased runoff, and accelerated erosion rates. If left without management, blowouts may occur. Significant economic inputs and time would be required to move this plant community toward a higher successional stage and a more productive plant community. Secondary succession is highly variable, depending upon availability and diversity of a viable seed bank of higher successional species within the existing plant community and neighboring plant communities. This plant community can be renovated to improve the production capability, but management changes would be needed to maintain the new plant community.

Pathway 2.1A
Community 2.1 to 2.2

The removal of disturbances may allow the blowouts to stabilize through plant succession and facilitate the Active Blowout Plant Community (2.1) to transition to the Annual/Pioneer Perennial Plant Community (2.2).

Pathway 2.2A
Community 2.2 to 2.1

Continued heavy disturbance resulting in an increase of wind erosion and bare ground will result in a shift from the Annual/Pioneer Perennials Plant Community (2.2) to the Active Blowout Plant Community (2.1)

Transition T1A
State 1 to 2

Heavy, continuous season-long grazing; frequent and severe defoliation; heavy disturbances; or heavy grazing in combination with drought; and wind erosion; will transition any plant community in the Reference State (1.0) to the Disturbed State (2.0).

Restoration pathway R2A
State 2 to 1

Removal of disturbances; restoration of the disturbed areas (i.e., use of mulch and seeding); and long-term prescribed grazing, which may require extended periods of deferment or non-use, may transition the Disturbed State (2.0) to the Reference State (1.0). This transition may not be fast or in the end meet management goals.

Conservation practices

Mulching
Range Planting
Prescribed Grazing

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	**Tall-Warmed Seasoned Grasses**			380–760	
	prairie sandreed	CALO	*Calamovilfa longifolia*	380–760	–
	sand bluestem	ANHA	*Andropogon hallii*	0–190	–
	big bluestem	ANGE	*Andropogon gerardii*	0–190	–
2	**Cool-Season Bunchgrass**			285–475	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	285–475	–

	Indian ricegrass	ACHY	*Achnatherum nymenoides*	0–38	–
3	**Mid Warm-Season Bunchgrass**			38–152	
	little bluestem	SCSC	*Schizachyrium scoparium*	38–152	–
4	**Short Warm-Season Grasses**			38–152	
	blue grama	BOGR2	*Bouteloua gracilis*	38–152	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–38	–
5	**Other Native Grasses**			95–285	
	western wheatgrass	PASM	*Pascopyrum smithii*	38–190	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	38–152	–
	Grass, perennial	2GP	*Grass, perennial*	0–95	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–57	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	19–38	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–19	–
6	**Grass-likes**			19–95	
	threadleaf sedge	CAFI	*Carex filifolia*	19–76	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	19–57	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–38	–
	needleleaf sedge	CADU6	*Carex duriuscula*	0–38	–
7	**Non-Native Cool-Season Grasses**			0	
Forb					
8	**Forbs**			95–285	
	goldenrod	SOLID	*Solidago*	19–57	–
	field sagewort	ARCA12	*Artemisia campestris*	19–57	–
	Forb, native	2FN	*Forb, native*	19–57	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	19–38	–
	bush morning-glory	IPLE	*Ipomoea leptophylla*	0–38	–
	dotted blazing star	LIPU	*Liatris punctata*	19–38	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	19–38	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	19–38	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	19–38	–
	beardtongue	PENST	*Penstemon*	19–38	–
	purple prairie clover	DAPU5	*Dalea purpurea*	19–38	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	19–38	–
	scurfpea	PSORA2	*Psoralidium*	19–38	–
	annual buckwheat	ERAN4	*Eriogonum annuum*	0–38	–
	longbract spiderwort	TRBR	*Tradescantia bracteata*	0–19	–
	yellow sundrops	CASE12	*Calylophus serrulatus*	0–19	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	0–19	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–19	–
	western wallflower	ERAS2	*Erysimum asperum*	0–19	–
	western marbleseed	ONBEO	*Onosmodium bejariense var. occidentale*	0–19	–
	whorled milkweed	ASVE	*Asclepias verticillata*	0–19	

	whorled milkweed	ASVE	*Asclepias verticillata*	0–19	–
Shrub/Vine					
9	**Shrubs**			95–190	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–57	–
	prairie sagewort	ARFR4	*Artemisia frigida*	19–57	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–57	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	19–38	–
	rose	ROSA5	*Rosa*	19–38	–
	soapweed yucca	YUGL	*Yucca glauca*	19–38	–
	brittle pricklypear	OPFR	*Opuntia fragilis*	19–38	–
	western sandcherry	PRPUB	*Prunus pumila var. besseyi*	0–19	–
Moss					
10	**Mat-Forming Forbs**			0–19	
	lesser spikemoss	SEDE2	*Selaginella densa*	0–19	–

Table 9. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall Warm-Season Grasses**			140–280	
	prairie sandreed	CALO	*Calamovilfa longifolia*	140–280	–
	sand bluestem	ANHA	*Andropogon hallii*	0–28	–
	big bluestem	ANGE	*Andropogon gerardii*	0–28	–
2	**Cool-Season Bunchgrass**			210–420	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	140–420	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–14	–
3	**Mid- Warm-Season Bunchgrass**			14–70	
	little bluestem	SCSC	*Schizachyrium scoparium*	14–70	–
4	**Short Warm-Season Grasses**			42–210	
	blue grama	BOGR2	*Bouteloua gracilis*	28–140	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	14–112	–
5	**Other Native Grasses**			28–70	
	western wheatgrass	PASM	*Pascopyrum smithii*	28–140	–
	Grass, perennial	2GP	*Grass, perennial*	0–70	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	14–42	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–42	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–28	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	14–28	–
6	**Grass-Likes**			70–210	
	threadleaf sedge	CAFI	*Carex filifolia*	28–140	–
	needleleaf sedge	CADU6	*Carex duriuscula*	14–56	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	14–56	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–28	–
7	**Non-Native Cool-Season Grasses**			14–70	

7	**Non-Native Cool Season Grasses**			14–70	
	Kentucky bluegrass	POPR	*Poa pratensis*	14–70	–
	cheatgrass	BRTE	*Bromus tectorum*	14–70	–
	field brome	BRAR5	*Bromus arvensis*	0–28	–
Forb					
8	**Forbs**			70–210	
	goldenrod	SOLID	*Solidago*	14–56	–
	field sagewort	ARCA12	*Artemisia campestris*	14–56	–
	scurfpea	PSORA2	*Psoralidium*	14–42	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	14–42	–
	Forb, native	2FN	*Forb, native*	14–42	–
	Forb, introduced	2FI	*Forb, introduced*	14–42	–
	annual buckwheat	ERAN4	*Eriogonum annuum*	0–42	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	14–28	–
	dotted blazing star	LIPU	*Liatris punctata*	14–28	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–28	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–14	–
	beardtongue	PENST	*Penstemon*	0–14	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–14	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–14	–
	whorled milkweed	ASVE	*Asclepias verticillata*	0–14	–
	yellow sundrops	CASE12	*Calylophus serrulatus*	0–14	–
	bush morning-glory	IPLE	*Ipomoea leptophylla*	0–14	–
Shrub/Vine					
9	**Shrubs**			84–210	
	prairie sagewort	ARFR4	*Artemisia frigida*	14–70	–
	silver sagebrush	ARCA13	*Artemisia cana*	14–70	–
	soapweed yucca	YUGL	*Yucca glauca*	14–56	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–42	–
	rose	ROSA5	*Rosa*	14–42	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	14–28	–
	brittle pricklypear	OPFR	*Opuntia fragilis*	14–28	–
Moss					
10	**Mat-Forming Forbs**			0–42	
	lesser spikemoss	SEDE2	*Selaginella densa*	0–42	–

Table 10. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall Warm-Season Grasses**			0–50	
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–50	–
2	**Cool Season Bunchgrass**			100–300	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	100–300	–
3	**Mid- Warm-Season Bunchgrass**			10–50	

	little bluestem	SCSC	*Schizachyrium scoparium*	10–50	–
4	**Short Warm-Season Grasses**			150–300	
	blue grama	BOGR2	*Bouteloua gracilis*	100–250	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	20–150	–
5	**Other Native Grasses**			20–100	
	western wheatgrass	PASM	*Pascopyrum smithii*	10–50	–
	Grass, perennial	2GP	*Grass, perennial*	0–50	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	10–30	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	10–20	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–20	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–20	–
6	**Grass-Likes**			100–200	
	threadleaf sedge	CAFI	*Carex filifolia*	50–150	–
	needleleaf sedge	CADU6	*Carex duriuscula*	10–50	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	10–50	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–20	–
7	**Non-Native Cool-Season Grasses**			20–50	
	Kentucky bluegrass	POPR	*Poa pratensis*	10–50	–
	cheatgrass	BRTE	*Bromus tectorum*	10–50	–
	field brome	BRAR5	*Bromus arvensis*	10–50	–
Forb					
8	**Forbs**			50–150	
	goldenrod	SOLID	*Solidago*	10–50	–
	field sagewort	ARCA12	*Artemisia campestris*	10–50	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	10–50	–
	Forb, introduced	2FI	*Forb, introduced*	10–50	–
	scurfpea	PSORA2	*Psoralidium*	10–40	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	10–30	–
	Forb, native	2FN	*Forb, native*	10–30	–
	annual buckwheat	ERAN4	*Eriogonum annuum*	0–30	–
	dotted blazing star	LIPU	*Liatris punctata*	0–10	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–10	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–10	–
Shrub/Vine					
9	**Shrubs**			50–150	
	prairie sagewort	ARFR4	*Artemisia frigida*	10–80	–
	soapweed yucca	YUGL	*Yucca glauca*	10–70	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–30	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–30	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	10–30	–
	brittle pricklypear	OPFR	*Opuntia fragilis*	10–30	–
	rose	ROSA5	*Rosa*	10–20	–

Moss					
10	**Mat-Forming Forbs**			10–50	
	lesser spikemoss	SEDE2	*Selaginella densa*	10–50	–

Animal community

Wildlife Interpretations
MLRA 58D 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 58D, the Sands ecological site provides upland grassland cover with an associated forb component. It was typically part of an expansive grassland landscape that included combinations of Loamy, Shallow Loamy, Shallow Clayey, Thin Loamy, Claypan, Sandy, Sandy Claypan, Clayey, and Thin Claypan 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 Sands ecological site remains intact and provides increasingly important habitat for grassland nesting birds, small rodents, coyotes, and a variety of reptiles, amphibians, and insects. Invasive species such as annual bromegrasses and crested wheat have impacted the biological integrity of the site for some grassland birds.

Prairie Sandreed-Needle and Thread-Bluestem (1.1) and
Needle and Thread-Prairie Sandreed (1.2): The predominance of grasses plus high diversity of forbs and shrubs in this community favors grazers and mixed-feeders, such as deer and pronghorn. Insects, such as pollinators, play a large role in maintaining the forb community and provide a forage base for grassland birds and other species. The complex plant structural diversity provides habitat for a wide array of migratory and resident birds. Grasshopper sparrow, lark bunting, western meadowlark, and sharp-tailed grouse are common and benefit from the structure and composition this plant community provides. Diverse prey populations are available for grassland raptors such as ferruginous hawk, Swainson’s hawk, golden eagle, and prairie falcon.

The diversity of grasses, forbs, and shrubs provide high nutrition levels for small and large herbivores including voles, mice, thirteen-lined ground squirrel, white-tailed jackrabbit, and deer. The higher stature of this plant community provides thermal, protective, and escape cover for herbivores and grassland birds. Predators utilizing this plant community include coyote, American badger, red fox, and long-tailed weasel. This plant community provides habitat for herptiles such as the spade foot toad, bull snake, and western rattlesnake.

Needle and Thread-Blue Grama (1.3): Resulting from continuous season-long grazing or continuous seasonal

grazing without adequate recovery periods between grazing events; needle and thread and blue grama will dominate. The decrease in diversity of grasses, forbs, and shrubs may result in less seed production or lower quality nutrition for small herbivores including voles, mice, and thirteen-lined ground squirrel. A shift to shorter plant structure will favor prairie dog expansion and associate species such as ferruginous hawk, burrowing owl, tiger salamander, and swift fox. Species such as horned lark, long-billed curlew, upland sandpiper, and white-tailed jackrabbit will increase due to the loss of the tall grass component. The short stature of this plant community limits thermal, protective, and escape cover. Predators utilizing this plant community include coyote, American badger, red fox, and long-tailed weasel.

Annual/Pioneer Perennial Plant Community (2.2): This plant community develops under severe disturbance and/or excessive defoliation. The dominant vegetation includes pioneer annual grasses, forbs, invaders, and early successional biennial and perennial species. Plant species from adjacent ecological sites may become minor components of this plant community. The community is susceptible to invasion of annual bromegrasses, bluegrass, and other non-native species due to severe soil disturbances and relatively high percent of bare ground.

Soil erosion is potentially high, impacting offsite aquatic habitats through increased runoff, nutrient, and sediment loads. Reduced surface cover, low plant density, low plant vigor, loss of root biomass, and soil compaction, all contribute to decreased wildlife abundance and diversity.

Since secondary succession is highly variable plant and wildlife species will vary. This plant community provides habitat for generalist or early successional species.

Grazing Interpretations
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: Prairie Sandreed-Needle and Thread-Bluestem (1.1)
Average Production (lb/acre, air-dry): 1,900
Stocking Rate (AUM/acre): 0.52

Plant Community: Needle and Thread-Prairie Sandreed (1.2)
Average Production (lb/acre, air-dry): 1,400
Stocking Rate (AUM/acre): 0.38

Plant Community: Needle and Thread-Blue Grama (1.3)
Average Production (lb/acre, air-dry): 1,000
Stocking Rate (AUM/acre): 0.27

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 groups A. 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. Normally 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 opportunities for hunting upland game species. 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 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 description include: Ryan Beer, Range Management Specialist (RMS), NRCS; Chuck Berdan, Biologist, Bureau of Land Management (BLM); Stan Boltz, RMS, NRCS; Dave Dewald, Wildlife BIO, NRCS; Mitch Faulkner, RMS, NRCS; Jody Forman, RMS, NRCS;

Dennis Froemke, RMS, NRCS; Tom Juntti, BIO, United States Forest Service (USFS); Cheryl Nielsen, RMS, NRCS; Jeff Printz, RMS, NRCS; Mike Stirling, RMS, NRCS; Dan Svingen, BIO, USFS; Darrell Vanderbusch, Soil Scientist, NRCS; Cindy Zachmeier, BIO, NRCS; and Tim Zachmeier, BIO, BLM.

There is 1 SCS-RANGE-417 collected in 2004 in Harding County, South Dakota.

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Approval

Suzanne Mayne-Kinney, 7/18/2024

Acknowledgments

This ecological site description was updated by Rick L. Peterson on January 6, 2020.

The ESDs were available for QC review by Mark Hayek, Emily Helms, Ryan Beer, and Mitch Faulkner.

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

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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, Thad Berrett, Cheryl Nielsen
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Date	05/07/2010
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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2. **Presence of water flow patterns:** None.

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3. **Number and height of erosional pedestals or terracettes:** Bunchgrasses may be pedestalled, but no exposed roots should be 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):** 5 to 15 percent is typical.

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5. **Number of gullies and erosion associated with gullies:** None should be present.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** Occasional areas associated with increased animal activity (e.g., rodent burrows, animal trailing) may exhibit small wind scoured areas, typically less than 10 feet in diameter.

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7. **Amount of litter movement (describe size and distance expected to travel):** Litter should fall in place. Slight amount of movement of smallest size class litter is possible, but not normal.

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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):** Some series on this site typically have little organic matter in the surface horizon, and the structure is single grain sand. Soil aggregate stability will be difficult to measure on these soils. Surface organic matter should still adhere to the soil surface. Surface erosion by water rarely occurs due to rapid infiltration, but surface is susceptible to wind erosion if vegetative cover is reduced due to drought or heavy grazing. Biological crusts are often present (up to 10% of the surface) and serve to provide resistance to erosion. The dominant rhizomatous warm-season species are adapted to these coarse soils and when vigorous are vital in preventing erosion by wind.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** A-horizon should be 2 to 4 inches thick. Some soils (e.g., Zeona) have little organic matter in the A-horizon and dark grayish brown colors when moist, but possibly not mollic. Structure can be single grain to fine granular parting to single grain in the 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:** 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. Infiltration is typically high due to the coarse nature of these soils.

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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):** None.

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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: Tall warm-season rhizomatous grasses >> Mid cool-season bunchgrasses >

    Sub-dominant: Forbs > Shrubs >

    Other: Mid warm-season bunchgrasses > Short warm-season grasses = Grass-likes

    Additional:

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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):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-**

production): Production ranges from 1,200-2,600 lbs./acre (air-dry weight). Reference value production is 1,900 lbs./acre (air-dry weight).

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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:** State and local noxious weeds

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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 should have vigorous rhizomes or tillers.
