USDA Natural Resources
Conservation Service

Ecological site R058DY030SD
Choppy 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:
Northwestern Great Plains—43:
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 Choppy Sands ecological site is found throughout MLRA 58D. It is located on upland landscapes and does not receive additional moisture from runoff or overflow. The landforms are hummocks and dunes with typical slopes ranging from 15 to 30 percent, but can be as steep as 50 percent. Soils are deep, (greater than 20 inches) with a surface texture of loamy fine sand. Subsurface textures are fine sand to loamy fine sand.

The vegetation in the Reference State (1.0) is dominated by warm-season grasses, with cool-season grasses being sub-dominant. Prairie sandreed, little bluestem, needle and thread, and western wheatgrass. Other grasses and grass-likes include sand bluestem, blue grama, sand dropseed, and sun sedge.

Associated sites

R058DY008SD	**Sands** The Choppy Sands ecological site is found on moderately to steeply sloping hummocks and dunes adjacent to the Sands ecological site.
R058DY009SD	**Sandy** The Sandy ecological site is found adjacent to the Choppy Sands ecological site on slopes ranging from 0 to 6 percent.

Similar sites

R058DY008SD	**Sands** The Sands ecological site will have more prairie sandreed and less bare ground than the Choppy Sands ecological site.
R058DY009SD	**Sandy** The Sandy ecological site will have more western wheatgrass, and more vegetative production than the Choppy Sands ecological site.

Table 1. Dominant plant species

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

Physiographic features

The Choppy Sands ecological site occurs on moderately to steeply sloping uplands.

Table 2. Representative physiographic features

Landforms	(1) Upland > Dune
Runoff class	Very low to medium
Flooding frequency	None
Ponding frequency	None
Elevation	701–1,219 m
Slope	15–30%
Water table depth	203 cm
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 to 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)	381-432 mm
Frost-free period (actual range)	93-115 days
Freeze-free period (actual range)	120-132 days
Precipitation total (actual range)	356-432 mm
Frost-free period (average)	104 days
Freeze-free period (average)	125 days
Precipitation total (average)	406 mm

Climate stations used

- (1) CAMP CROOK [USC00391294], Camp Crook, SD
- (2) BAKER 1 E [USC00240412], Baker, MT
- (3) LADNER 9SW [USC00394671], 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 Choppy Sands ecological site.

Soil features

Soils common to this site have a loamy fine sand textured surface layer which is 2 to 5 inches thick. Slopes range from 15 to 30 percent. The soils are excessively drained and formed in eolian sand or residuum formed in sandstone. The texture of the subsurface layer’s ranges from loamy fine sand to fine sand. 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 Soil correlated to the Choppy Sands ecological site include Trey and Zeona.

Trey and Zeona are also correlated to the Sands (R058DY008SD) ecological site when slopes are less than 15 percent.

These soils are susceptible to wind erosion. The hazard of wind erosion increases when vegetation cover is reduced. 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 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 information 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	Excessively drained
Permeability class	Moderately rapid to rapid
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	7.62 cm
Calcium carbonate equivalent (0-101.6cm)	0–5%
Electrical conductivity (0-101.6cm)	0 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	5.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The Choppy Sands ecological site developed under 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.

As this site deteriorates, sand dropseed, blue grama, and sedges will increase. Species such as needle and thread, and prairie sandreed will decrease in frequency and production. The site is resilient and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allows for high drought resistance.

Interpretations are primarily based is the Bluestem-Prairie Sandreed-Needle and thread Plant Community (1.1). 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 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

Choppy Sands – R058DY030SD 11/7/19

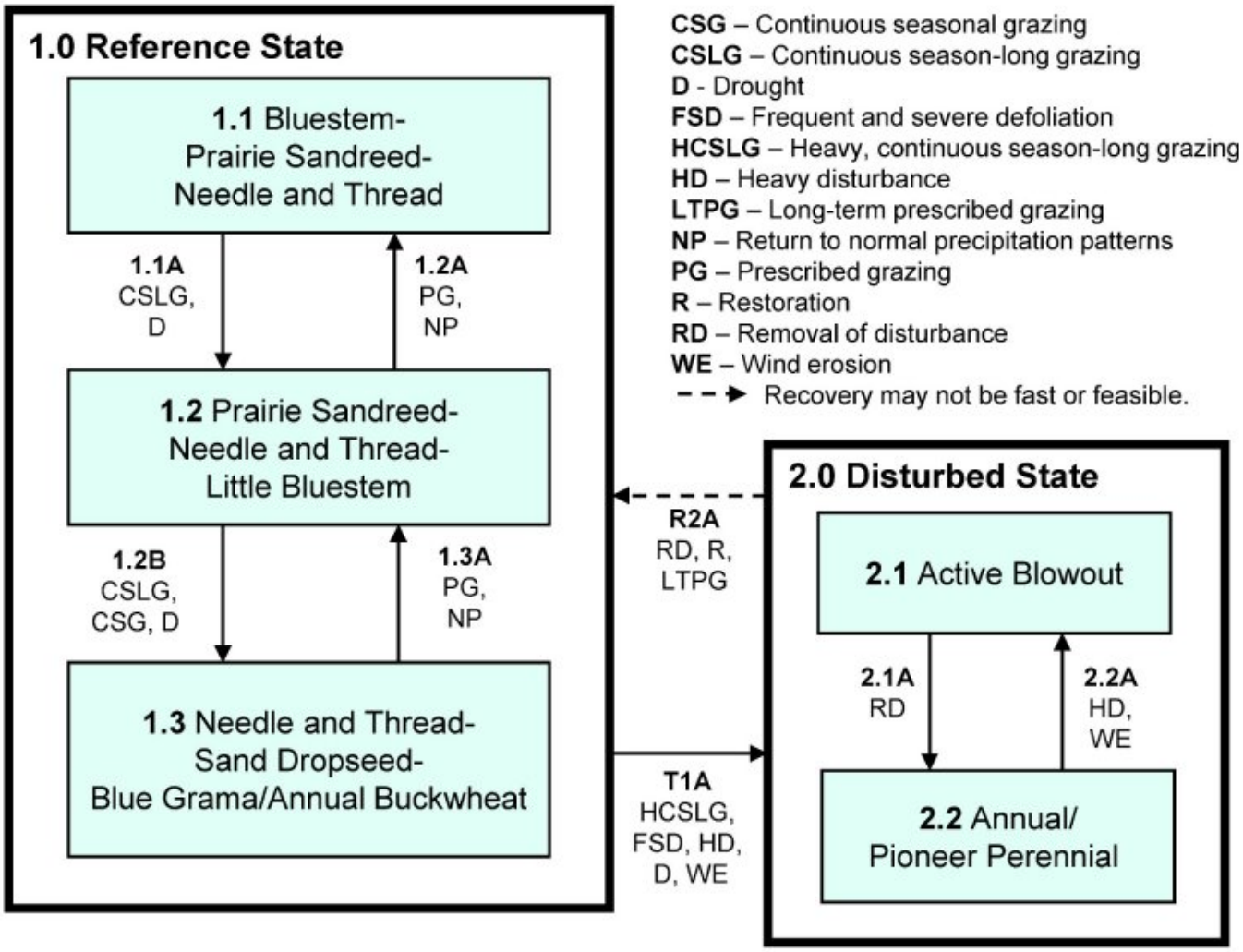

Diagram Legend: Choppy Sands - R058DY030SD

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 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 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 on areas receiving occasional periods of deferment or rest.

Dominant plant species

- western sandcherry (*Prunus pumila var. besseyi*), shrub
- prairie sagewort (*Artemisia frigida*), shrub
- leadplant (*Amorpha canescens*), shrub
- rose (*Rosa*), shrub
- yucca (*Yucca*), shrub
- prairie sandreed (*Calamovilfa longifolia*), grass
- little bluestem (*Schizachyrium scoparium*), grass
- needle and thread (*Hesperostipa comata ssp. comata*), grass
- sand bluestem (*Andropogon hallii*), grass
- ricegrass (*Oryzopsis*), grass
- blue grama (*Bouteloua gracilis*), grass
- hairy grama (*Bouteloua hirsuta*), grass
- western wheatgrass (*Pascopyrum smithii*), grass
- sedge (*Carex*), grass
- stiff sunflower (*Helianthus pauciflorus*), other herbaceous
- longbract spiderwort (*Tradescantia bracteata*), other herbaceous
- purple prairie clover (*Dalea purpurea*), other herbaceous
- dotted blazing star (*Liatris punctata*), other herbaceous
- tarragon (*Artemisia dracunculus*), other herbaceous
- hairy false goldenaster (*Heterotheca villosa*), other herbaceous
- beardtongue (*Penstemon*), other herbaceous
- scurfpea (*Psoralidium*), other herbaceous

Community 1.1
Bluestem-Prairie Sandreed-Needle and Thread

Interpretations are based primarily on the Bluestem-Prairie Sandreed-Needle and Thread 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. The potential vegetation is about 85 percent grasses or grass-like plants, 10 percent forbs, and 5 percent shrubs. Warm- and cool-season grasses are co-dominate on this plant community. The major grasses include prairie sandreed, little bluestem, and needle and by thread. Other grass or grass-like species occurring on the site include sand bluestem, Indian ricegrass, blue grama, hairy grama, western wheatgrass, and sedges. Significant forbs include stiff sunflower, bracted spiderwort, purple prairie clover, dotted gayfeather, green sagewort, hairy goldaster, penstemon, and scurfpea. The significant shrubs that occur include western sandcherry, fringed sagewort, leadplant, 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 (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1177	1524	1872
Forb	84	135	185
Shrub/Vine	84	135	185
Total	**1345**	**1794**	**2242**

Figure 9. Plant community growth curve (percent production by month). SD5804, Northern Rolling High Plains, warm-season dominant, cool-season sub-dominant.. Warm-season dominant, cool-season sub-dominant, uplands..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	7	18	24	25	15	7	1	0	0

Community 1.2
Prairie Sandreed-Needle and Thread-Little Bluestem

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 85 percent grasses and grass-like species, 10 percent forbs, and 5 percent shrubs. The dominant grasses include prairie sandreed, needle and thread, and little bluestem. Other grasses or grass-like species may include blowout grass, hairy grama, blue grama, and sedge. Significant forbs include green sagewort, scurfpea, Cuman ragweed, and annual buckwheat. The dominant shrubs that occur include cactus, yucca, and fringed sagewort. Compared to the Bluestem-Prairie Sandreed-Needle and thread Plant Community (1.1), sand bluestem had decreased and prairie sandreed, needle and thread, little bluestem, hairy grama, blue grama, and threadleaf sedge have increased. 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 (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	706	1079	1451
Forb	56	92	129
Shrub/Vine	22	62	101
Total	**784**	**1233**	**1681**

Figure 11. Plant community growth curve (percent production by month). SD5804, Northern Rolling High Plains, warm-season dominant, cool-season sub-dominant.. Warm-season dominant, cool-season sub-dominant, uplands..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	7	18	24	25	15	7	1	0	0

Community 1.3
Needle and Thread-Sand Dropseed-Blue Grama/Annual Buckwheat

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, and 5 percent

shrubs. The dominant grasses are needle and thread, blowout grass, blue grama, hairy grama, sand dropseed, and sedge. Significant forbs include Cuman ragweed, green sagewort, scurfpea, goldenrod, and annual eriogonum. Dominant shrubs in this community include fringed sagewort, yucca, and cactus. Compared to the Bluestem-Prairie Sandreed-Needle and thread Plant Community (1.1), blowout grass, sand dropseed, hairy grama, blue grama, and sedge have increased. Prairie sandreed is greatly diminished. Little bluestem is essentially absent. Desirable plant species have decreased. 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 (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	404	686	1082
Forb	34	59	84
Shrub/Vine	11	39	67
Total	**449**	**784**	**1233**

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 Bluestem-Prairie Sandreed-Needle and Thread Plant Community (1.1) to the Prairie Sandreed-Needle and Thread-Little Bluestem 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 this plant community to the Bluestem-Prairie Sandreed-Needle and Thread 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 this plant community to the Needle and Thread-Sand Dropseed-Blue Grama/Annual Buckwheat 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 this plant community to the Prairie Sandreed-Needle and Thread-Little Bluestem 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, feeding areas, 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. The State will also include cropland abandonment.

Dominant plant species

- rose (*Rosa*), shrub
- ricegrass (*Oryzopsis*), grass
- prairie sandreed (*Calamovilfa longifolia*), grass
- hairy grama (*Bouteloua hirsuta*), grass
- sand dropseed (*Sporobolus cryptandrus*), grass
- sixweeks fescue (*Vulpia octoflora*), grass
- cheatgrass (*Bromus tectorum*), grass
- scurfpea (*Psoralidium*), other herbaceous
- sandbur (*Cenchrus*), other herbaceous
- common sunflower (*Helianthus annuus*), other herbaceous
- tarragon (*Artemisia dracunculus*), other herbaceous
- Cuman ragweed (*Ambrosia psilostachya*), other herbaceous
- annual buckwheat (*Eriogonum annuum*), other herbaceous
- pricklypear (*Opuntia*), 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. As succession progresses, blowout grass, and Indian ricegrass begin to colonize. Scurfpea, sandbur, and annual sunflower begin to come in with prairie sandreed, hairy grama, and rose slowly become evident on this plant community.

Community 2.2
Annual/Pioneer Perennial

This plant community develops under frequent and severe defoliation and/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, Cuman 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.

Pathway 2.1A

Community 2.1 to 2.2

Removal of disturbances will allow bare ground and blowouts the ability to stabilize through plant community successional processes may result in a shift from the Active Blowout Plant Community (2.1) 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 bare ground and wind erosion will result in a shift from the Annual/Pioneer Perennials Plant Community (2.1) to the Active Blowout Plant Community (2.1)

Transition T1A
State 1 to 2

Excessive disturbance including heavy grazing without adequate time for plant recovery, which results in a decline in plant health and vigor and an increase in plant mortality. Soil erosions increase and species composition shift from tall- and mid-stature warm-season grasses and needlegrasses to a plant community dominated by pioneer perennial species. Heavy, continuous season-long stocking: repeated grazing at moderately heavy to heavy stocking levels, during the typical growing season (May through October), without change in season of use or adequate recovery periods following grazing evens. Frequent and severe defoliation: continuous year-long heavy grazing, or heavy concentrated disturbance such as intense rodent activity, or livestock concentration areas. Extended periods of drought in combination with heavy stocking that is above available levels of plant vegetative production. Heavy disturbance: Soil and site stability is compromised from one, or a combination of, excessive grazing or defoliation, heavy livestock or vehicle traffic, wildfire, drought, severe hail events, wind erosion.

Constraints to recovery. Disturbance regime results in active soil erosion, active blowouts, and reference plant communities shift to plant communities dominated by pioneer perennial species.

Context dependence. Heavy defoliation in combination with drought which contributes to increased wind erosion, soil loss, and soil deposition, and a dramatic shift the soil site stability and biotic integrate and structural fictional groups. The Reference State (1.0) transitions from tall- and mid-stature warm-season grasses and needle grass plant communities to a Disturbed State (2.0) with soil erosion, active blowouts, and plant communities dominated by pioneer perennial species.

Restoration pathway R2A
State 2 to 1

Removing disturbances that led to this plant community and critical area treatment or restoration (i.e., use of mulch and seeding) followed by long-term prescribed grazing, which may require extended periods of deferment or non-use, may eventually 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

Critical Area Planting
Mulching
Prescribed Grazing
Range Planting

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall Warm-Season Grasses**			359–717	

	prairie sandreed	CALO	*Calamovilfa longifolia*	269–538	–
	sand bluestem	ANHA	*Andropogon hallii*	90–179	–
	big bluestem	ANGE	*Andropogon gerardii*	0–179	–
	switchgrass	PAVI2	*Panicum virgatum*	0–90	–
2	**Cool Season Bunchgrass**			179–359	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	179–359	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–90	–
3	**Mid- Warm-Season Grasses**			179–258	
	little bluestem	SCSC	*Schizachyrium scoparium*	179–269	–
	blowout grass	REFL	*Redfieldia flexuosa*	0–90	–
4	**Short-Warm Season Grasses**			90–179	
	blue grama	BOGR2	*Bouteloua gracilis*	18–90	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	18–90	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	18–36	–
5	**Other Native Grasses**			36–143	
	Grass, perennial	2GP	*Grass, perennial*	0–90	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	18–54	–
	western wheatgrass	PASM	*Pascopyrum smithii*	18–54	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	18–36	–
	fall rosette grass	DIWI5	*Dichanthelium wilcoxianum*	0–36	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–18	–
6	**Grass-Likes**			36–126	
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–90	–
	threadleaf sedge	CAFI	*Carex filifolia*	18–90	–
7	**Non-Native Cool-Season Grasses**			–	
Forb					
8	**Forbs**			90–179	
	Forb, native	2FN	*Forb, native*	18–90	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	18–54	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	18–36	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	18–36	–
	scurfpea	PSORA2	*Psoralidium*	18–36	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–36	–
	purple prairie clover	DAPU5	*Dalea purpurea*	18–36	–
	annual buckwheat	ERAN4	*Eriogonum annuum*	0–36	–
	longbract spiderwort	TRBR	*Tradescantia bracteata*	18–36	–
	dotted blazing star	LIPU	*Liatris punctata*	18–36	–
	western marbleseed	ONBEO	*Onosmodium bejariense var. occidentale*	0–36	–
	goldenrod	SOLID	*Solidago*	18–36	–
	field sagewort	ARCA12	*Artemisia campestris*	18–36	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	18–36	–

	beardtongue	PENST	*Penstemon*	0–18	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–18	–
	yellow sundrops	CASE12	*Calylophus serrulatus*	0–18	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–18	–
Shrub/Vine					
9	**Shrubs**			90–179	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–72	–
	leadplant	AMCA6	*Amorpha canescens*	18–54	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	18–36	–
	western poison ivy	TORY	*Toxicodendron rydbergii*	0–36	–
	rose	ROSA5	*Rosa*	18–36	–
	western sandcherry	PRPUB	*Prunus pumila var. besseyi*	18–36	–
	soapweed yucca	YUGL	*Yucca glauca*	18–36	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–36	–

Table 9. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall Warm-Season Grasses**			185–370	
	prairie sandreed	CALO	*Calamovilfa longifolia*	185–370	–
	sand bluestem	ANHA	*Andropogon hallii*	0–62	–
	big bluestem	ANGE	*Andropogon gerardii*	0–62	–
2	**Cool Season Bunchgrass**			123–308	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	123–308	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–25	–
3	**Mid- Warm-Season Grasses**			123–308	
	little bluestem	SCSC	*Schizachyrium scoparium*	62–185	–
	blowout grass	REFL	*Redfieldia flexuosa*	0–123	–
4	**Short Warm Season Grasses**			62–185	
	blue grama	BOGR2	*Bouteloua gracilis*	25–123	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	25–123	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	12–62	–
5	**Other Native Grasses**			25–62	
	western wheatgrass	PASM	*Pascopyrum smithii*	12–62	–
	Grass, perennial	2GP	*Grass, perennial*	0–49	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	12–37	–
	fall rosette grass	DIWI5	*Dichanthelium wilcoxianum*	0–37	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–25	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	12–25	–
6	**Grass-Likes**			37–123	
	threadleaf sedge	CAFI	*Carex filifolia*	25–123	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	12–99	–

7	**Non-Native Cool-Season Grasses**			–	
Forb					
8	**Forbs**			62–123	
	annual buckwheat	ERAN4	*Eriogonum annuum*	0–62	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	12–62	–
	Forb, native	2FN	*Forb, native*	12–62	–
	scurfpea	PSORA2	*Psoralidium*	12–37	–
	field sagewort	ARCA12	*Artemisia campestris*	12–37	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–12	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–12	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–12	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	0–12	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–12	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–12	–
	longbract spiderwort	TRBR	*Tradescantia bracteata*	0–12	–
	dotted blazing star	LIPU	*Liatris punctata*	0–12	–
	goldenrod	SOLID	*Solidago*	0–12	–
Shrub/Vine					
9	**Shrubs**			25–99	
	soapweed yucca	YUGL	*Yucca glauca*	12–49	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–37	–
	prairie sagewort	ARFR4	*Artemisia frigida*	12–37	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	12–25	–
	western poison ivy	TORY	*Toxicodendron rydbergii*	0–12	–
	rose	ROSA5	*Rosa*	0–12	–
	western sandcherry	PRPUB	*Prunus pumila var. besseyi*	0–12	–
	leadplant	AMCA6	*Amorpha canescens*	0–12	–

Table 10. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall Warm-Season Grasses**			0–39	
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–39	–
	sand bluestem	ANHA	*Andropogon hallii*	0–16	–
	big bluestem	ANGE	*Andropogon gerardii*	0–16	–
2	**Cool Season Bunchgrass**			118–235	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	118–235	–
3	**Mid- Warm-Season Grasses**			16–78	
	blowout grass	REFL	*Redfieldia flexuosa*	16–78	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–39	–
4	**Short-Warm Season Grasses**			78–157	
	blue grama	BOGR2	*Bouteloua gracilis*	16–118	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	39–118	–

	hairy grama	BOHI2	*Bouteloua hirsuta*	8–78	–
5	**Other Native Grasses**			24–55	
	western wheatgrass	PASM	*Pascopyrum smithii*	8–39	–
	Grass, perennial	2GP	*Grass, perennial*	0–24	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	8–24	–
	fall rosette grass	DIWI5	*Dichanthelium wilcoxianum*	0–24	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	8–24	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	8–16	–
6	**Grass-Likes**			39–118	
	threadleaf sedge	CAFI	*Carex filifolia*	39–118	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	8–63	–
7	**Non-Native Cool-Season Grasses**			8–39	
	Kentucky bluegrass	POPR	*Poa pratensis*	0–39	–
	cheatgrass	BRTE	*Bromus tectorum*	8–39	–
Forb					
8	**Forbs**			39–78	
	annual buckwheat	ERAN4	*Eriogonum annuum*	16–78	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	16–63	–
	Forb, native	2FN	*Forb, native*	8–39	–
	field sagewort	ARCA12	*Artemisia campestris*	8–31	–
	Forb, introduced	2FI	*Forb, introduced*	0–24	–
	scurfpea	PSORA2	*Psoralidium*	8–24	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–8	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–8	–
Shrub/Vine					
9	**Shrubs**			16–63	
	soapweed yucca	YUGL	*Yucca glauca*	16–47	–
	prairie sagewort	ARFR4	*Artemisia frigida*	8–24	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	8–16	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–16	–

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 have 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 Choppy 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, Sands, 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 Choppy Sands ecological site has remained relatively intact and provides increasingly important habitat for grassland and shrub steppe nesting birds, small rodents, coyote, and a variety of reptiles, amphibians, and insects. Invasive species such as annual brome grasses and crested wheatgrass 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.

Bluestem-Prairie Sandreed-Needle and Thread (1.1) and Prairie Sandreed-Needle and Thread-Bluestem (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-Sand Dropseed-Blue Grama/Annual Buckwheat (1.3): The predominance of grasses and the loss of forbs and shrubs in this community cause a reduction in the insect populations, such as pollinators, and reduce the value to most herbivores. Grasshopper sparrow, horned lark, lark bunting, 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 provides adequate nutrition levels for small and large herbivores including voles, mice, thirteen-lined ground squirrel, white-tailed jackrabbit, and deer. 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.

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, crested wheatgrass, and other nonnative 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: Bluestem-Prairie Sandreed-Needle and Thread (1.1)
Average Production (lb/acre, air-dry): 1,600
Stocking Rate (AUM/acre): 0.44

Plant Community: Prairie Sandreed-Needle and Thread-Little Bluestem (1.2)
Average Production (lb/acre, air-dry): 1,100
Stocking Rate (AUM/acre): 0.30

Plant Community: Needle and Thread-Sand Dropseed-Blue Grama/Annual Buckwheat (1.3)
Average Production (lb/acre, air-dry): 700
Stocking Rate (AUM/acre): 0.19

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; Stan Boltz, RMS, NRCS; Dave Dewald, Wildlife BIO, NRCS; Jody Forman, RMS, NRCS; Dennis Froemke, RMS, NRCS; Cheryl Nielsen, RMS, NRCS; Jeff Printz, RMS, NRCS; Mike Stirling, RMS, NRCS.

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Approval

Suzanne Mayne-Kinney, 7/18/2024

Acknowledgments

This ecological site description was updated by Rick L. Peterson on November 6, 2019.

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.

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	stanley.boltz@sd.usda.gov, 605-352-1236
Date	05/06/2010
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. “Cat-steps” on steeper slopes may be present on a limited basis, but these are not considered terracettes.

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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 25 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.

---

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** A-horizon should be 1 to 3 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 >>

Sub-dominant: Cool-season bunchgrass > Mid warm-season bunchgrass > forbs >

Other: Short warm-season grasses = shrubs > 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 1,200-2,000 lbs./acre (air-dry weight). Reference value production is 1,600 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.
