USDA Natural Resources Conservation Service

Ecological site R064XY012NE
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.

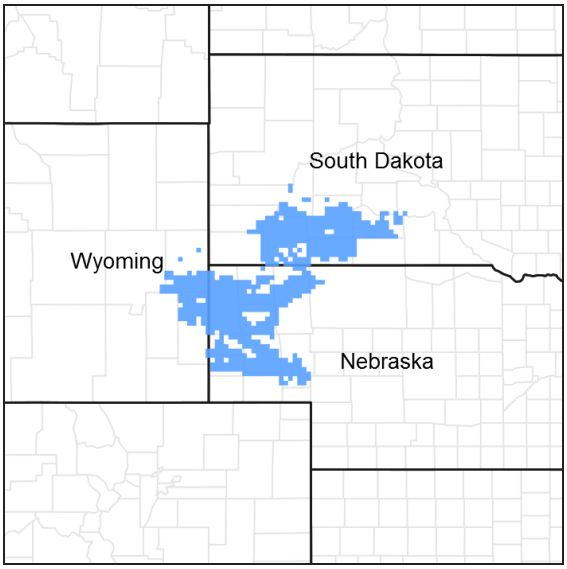


Figure 1. Mapped extent

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): 064X–Mixed Sandy and Silty Tableland and Badlands

The Mixed Sandy and Silty Tableland and Badlands (MLRA 64) is shared almost equally between South Dakota (42 percent) and Nebraska (41 percent). A small portion is in Wyoming (17 percent). The MLRA consists of 11,895 square miles. The towns of Kadoka and Pine Ridge, South Dakota; Chadron and Alliance, Nebraska; and Lusk, Wyoming, are all within the boundaries of this MLRA.

The following areas of special interest are in this MLRA: Agate Fossil Beds National Monument, Chadron State Park, Fort Robinson State Park, and the Pine Ridge Indian Reservation; parts of the Oglala and Buffalo Gap National Grasslands, which are in the Nebraska National Forest; and nearly all of Badlands National Park. The Badlands are internationally renowned for their Oligocene vertebrate fossils.

The northern section of the MLRA consists of old plateaus and terraces that have been deeply eroded by wind, water, and time. The southern section consists of nearly level to broad intervalley remnants of smooth fluvial plains. These two sections are separated by the Pine Ridge escarpment. Elevations gradually increase from 2,950 to 5,073 feet from east to west. The main drainageway through Badlands National Park is the White River. The headwaters of both the White and Niobrara Rivers are in MLRA 64. The Pine Ridge escarpment is at the northernmost extent of the Ogallala Aquifer.

Tertiary continental sediments consisting of sandstone, siltstone, and claystone underlie most of the area. Many of the bedrock units in the southern third of the MLRA are covered by loess. Soils range from shallow to very deep and from generally well drained to excessively drained. They are loamy or sandy. The Badlands consist of stream-laid layers of silt, clay, and sand mixed with layers of volcanic ash.

Average annual precipitation for the area is 14 to 20 inches. Most of the rainfall occurs as frontal storms in the spring and early summer. This area supports a mixture of short-, mid-, and tall-statured warm- and cool-season grasses. On the Pine Ridge Escarpment, these plants grow in association with ponderosa pine, Rocky Mountain juniper, western snowberry, skunkbush sumac, common chokecherry, and rose. Wyoming big sagebrush grows in minor amounts in the drier, far western portion of the MLRA; however, small remnant stands can be found in the eastern portion of the Oglala National Grassland in Nebraska.

Sixty percent of the MLRA is grassland, 11 percent of which is under Federal management. Twenty-two percent of the area is used as cropland, and 4 percent is forested. Major resource concerns include wind erosion, water erosion, and surface water quality (USDA-NRCS, 2006, Ag Handbook 296).

For development of ecological sites, MLRA 64 is divided into two precipitation zones (PZ): 14 to 17 inches per year and 17 to 20 inches per year. The wetter zone extends from the western end of the Pine Ridge Escarpment near Lusk, Wyoming, eastward along the escarpment through Nebraska and into the Big Badlands area of South Dakota. The drier zone extends from Wyoming eastward to Alliance and Oshkosh, Nebraska, south of the Pine Ridge Escarpment. MLRA 64 stops at the western edge of the Nebraska Sand Hills (MLRA 65).

A unique geologic area known as the Hartville Uplift is in the far southwest corner of the 14 to 17 inch precipitation zone. The Hartville Uplift is an elongated, north-northwest-oriented, broad domal arch of Laramide age (70-50 million years ago). It extends approximately 45 miles between Guernsey and Lusk, Wyoming, and is 15 miles wide at its widest point. Erosion has exposed a core of granite and Precambrian metasedimentary and metavolcanic rocks (Steele et al., 2018). In addition to the ecological sites in the 14 to 17 inch precipitation zone of MLRA 64, three unique ecological site descriptions were developed to describe the soils and plant community dynamics in the Hartville Uplift.

Classification relationships

USDA Land Resource Region G—Western Great Plains Range and Irrigated Region:
Major Land Resource Area (MLRA) 64—Mixed Sandy and Silty Tableland and Badlands

U.S. Environmental Protection Agency (EPA)
Level IV Ecoregions of the Conterminous United States:
High Plains—25:
Pine Ridge Escarpment—25a.
Flat to Rolling Plains—25d.
Pine Bluffs and Hills—25f.
Sandy and Silty Tablelands—25g.
Northwestern Great Plains—43:
White River Badlands—43h.
Keya Paha Tablelands—43i.

USDA Forest Service
Ecological Subregions: Sections and Subsections of Conterminous United States:
Great Plains and Palouse Dry Steppe Province—331:
Western Great Plains Section—331F:
Subsections:
Shale Scablands—331Fb.
White River Badlands—331Fh.
Pine Ridge Escarpment—331Fj.
High Plains—331Fk.
Hartville Uplift—331Fm.
Western Nebraska Sandy and Silty Tablelands—331Fn.
Keye Paha Tablelands—331Ft.

Powder River Basin Section—331G:
Subsection: Powder River Basin—331Ge.

Ecological site concept

The Sands Ecological Site occurs throughout MLRA 64. 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 3 to 30 percent but can be as steep as 40 percent. Soils are deep, excessively drained, and formed in eolian sand or sandy alluvium. The surface layer is 3 to 18 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 Plant Community consists of a mix of cool- and warm-season grasses, however, tall- and mid-statured warm-season grasses tend to be the dominant group. Prairie sandreed, sand or big bluestem, and little bluestem are dominant warm-season grasses, needle and thread and western wheatgrass are dominant cool-season grasses. Forbs are common and diverse. Common shrubs include leadplant, silver or sand sagebrush, rose, and small soapweed (yucca). In the drier western portion of MLRA 64, silver sagebrush will tend to occur on this site, whereas sand sagebrush will be most likely to occur on the eastern side.

Associated sites

R064XY011NE	**Sandy 14-17" PZ** The Sandy 14-17” PZ ecological site can be found on less sloping landscapes adjacent to or intermixed with the Sands site.
R064XY024NE	**Subirrigated** The Subirrigated ecological site can be found on lowland landscape positions downslope of the Sand site.
R064XY032NE	**Sandy 17-20" PZ** The Sandy 17-20” PZ ecological site can be found on less sloping landscapes adjacent to or intermixed with the Sands site.

Similar sites

R064XY032NE	**Sandy 17-20" PZ** The Sandy 17-20“ PZ ecological site will occur on more level landscapes, have more prairie sandreed, and will have higher forage production than the Sands site.
R064XY011NE	**Sandy 14-17" PZ** The Sandy 14-17 “ PZ ecological site will occur on more level landscapes, have more prairie sandreed, and will have higher forage production than the Sands site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Andropogon hallii* (2) *Calamovilfa longifolia*

Physiographic features

The Sands ecological site typically occurs on gently to more steeply sloping to rolling dunes.

Table 2. Representative physiographic features

Landforms	(1) Sandhills > Dune (2) Sandhills > Hill
Runoff class	Negligible to low
Flooding frequency	None
Ponding frequency	None

Elevation	2,900–5,000 ft
Slope	3–30%
Aspect	Aspect is not a significant factor

Climatic features

MLRA 64 has a continental climate consisting of cold winters and hot summers, low humidity, light rainfall, and ample sunshine. Extremes in temperature are common in some years. The climate results from MLRA 64 being near the geographic center of North America. There are few natural barriers on the Northern Great Plains. Air masses move freely across the plains and account for rapid changes in temperature.

Average annual precipitation ranges from 14 to 20 inches per year. The normal average annual temperature is about 47 °F. January is the coldest month with average temperatures ranging from about 21 °F (Wood, SD) to about 25 °F (Hemingford, NE). July is the warmest month with average temperatures ranging from about 70 °F (Keeline 3 W, WY: 1953–1986) to about 76 °F (Wood, SD). The range of normal average monthly temperatures between the coldest and warmest months is about 55 °F. This large annual range attests to the continental nature of the climate of this area. Wind speeds average about 11 miles per hour annually, ranging from about 13 miles per hour during the spring to about 10 miles per hour during the summer. Daytime winds are generally stronger than nighttime winds. Occasionally, strong storms bring brief periods of high winds with gusts to more than 50 miles per hour.

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

Table 3. Representative climatic features

Frost-free period (characteristic range)	92-120 days
Freeze-free period (characteristic range)	119-139 days
Precipitation total (characteristic range)	16-19 in
Frost-free period (actual range)	87-122 days
Freeze-free period (actual range)	110-149 days
Precipitation total (actual range)	15-20 in
Frost-free period (average)	107 days
Freeze-free period (average)	130 days
Precipitation total (average)	17 in

Climate stations used

- (1) LUSK 2 SW [USC00485830], Lusk, WY
- (2) HARRISON 20 SSE [USW00094077], Harrison, NE
- (3) ALLIANCE 1WNW [USC00250130], Alliance, NE
- (4) HARRISON [USC00253615], Harrison, NE
- (5) HEMINGFORD [USC00253755], Hemingford, NE
- (6) INTERIOR 3 NE [USC00394184], Interior, SD
- (7) MARTIN [USC00395281], Martin, SD
- (8) WOOD [USC00399442], Wood, SD
- (9) CHADRON 3NE [USC00251578], Chadron, NE
- (10) TORRINGTON 29N [USC00488997], Jay Em, WY

Influencing water features

No riparian or wetland features are directly associated with the Sands ecological site.

Wetland description

Not Applicable.

Soil features

The features common to soils in this site are the loamy fine sand to sand textures of the surface layers and slopes of 3 to 30 percent. The soils in this site are somewhat excessively to excessively drained and formed in eolian sand or sandy alluvium. The surface layer is 3 to 18 inches thick. The textures of the subsurface layers range from loamy fine sand to 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 soils correlated to the Sands ecological site: Dunday, Dwyer, Orpha, Valent, and Valentine.

These soils are susceptible to the hazards of 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 production.

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

Table 4. Representative soil features

Parent material	(1) Eolian sands–sandstone and siltstone (2) Alluvium–sandstone and siltstone
Surface texture	(1) Loamy fine sand (2) Fine sand (3) Sand
Family particle size	(1) Sandy
Drainage class	Somewhat excessively drained to excessively drained
Permeability class	Rapid to very rapid
Soil depth	80 in
Available water capacity (0-40in)	3–4 in
Calcium carbonate equivalent (0-40in)	0–10%
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

Ecological dynamics

This 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.

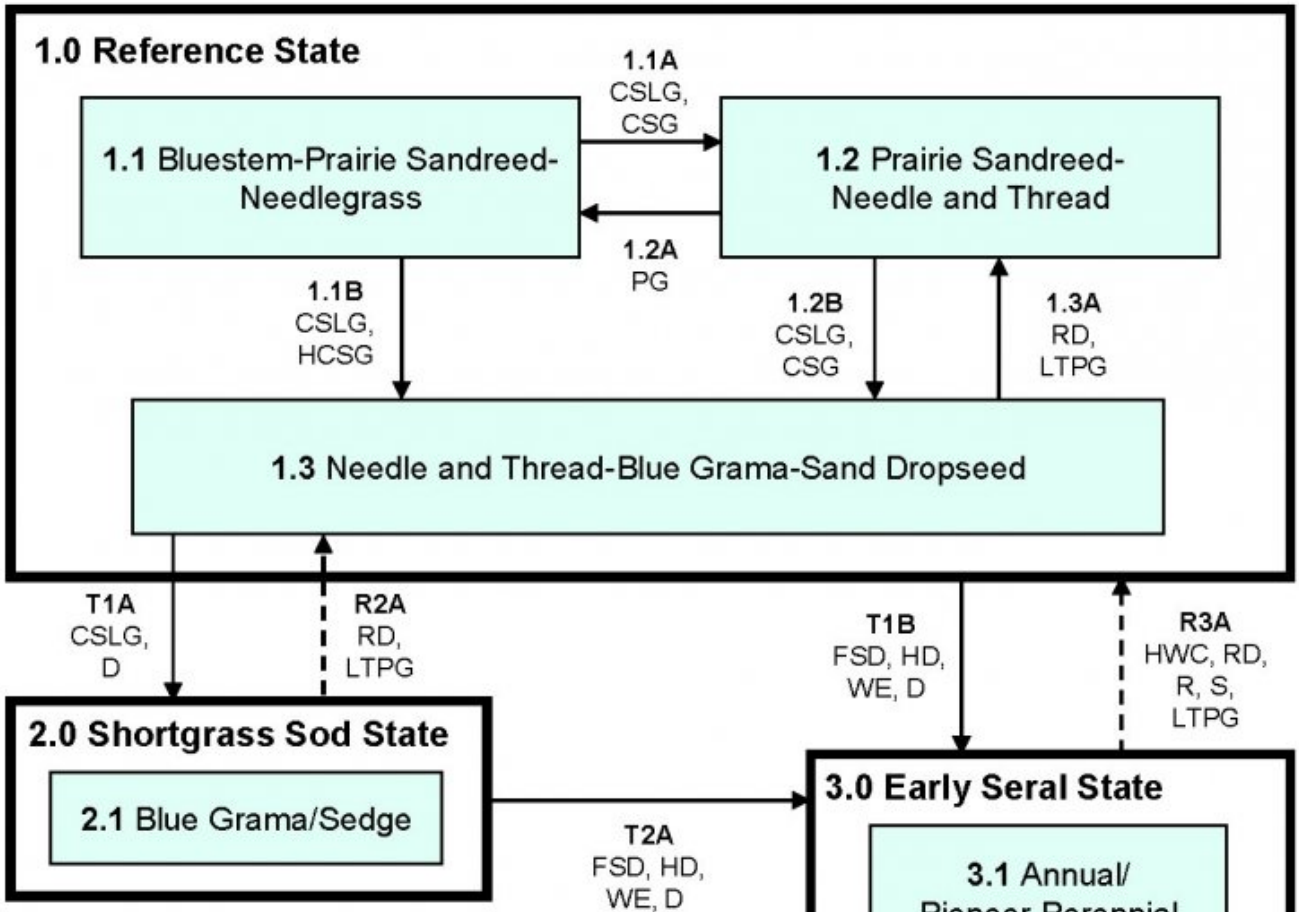
Continuous season-long grazing (during the typical growing season of May through October) or repeated seasonal grazing (e.g., every spring, every summer) without adequate recovery periods following each grazing occurrence causes this site to depart from the Bluestem-Prairie Sandreed-Needlegrass Plant Community (1.1). Species such as sand dropseed and blue grama will increase, while sand bluestem and little bluestem will decrease. Sand sagebrush or sliver sagebrush occurs primarily in the drier (14-17”) portion of this MLRA. With no fire, there is a potential for this site to be invaded by eastern redcedar if this species is found adjacent to the site.

Interpretations are primarily based on the Bluestem-Prairie Sandreed-Needlegrass Plant Community. It has been determined by study of rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. Trends in plant community dynamics ranging from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts also have been used. Plant 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

Sands – R064XY012NE 6/13/18



CSG – Continuous seasonal grazing
CSLG – Continuous season-long grazing
D – Drought
FSD – Frequent and severe defoliation
HCSLG – Heavy, continuous season-long grazing
HD – Heavy disturbance
HWC – Herbaceous weed control
LTPG – Long-term prescribed grazing
PG – Prescribed grazing
R – Restoration
RD – Removal of disturbance
S – Seeding
St – Site stabilization
WE – Wind Erosion
– – ➤ Recovery may not be fast or feasible

Diagram Legend - Sands - R064XY012NE

T1A	Continuous season-long grazing, in combination with drought.
T1B	Frequent and severe defoliation, heavy disturbance, drought, wild fire, and wind erosion.
T2A	Frequent and severe defoliation, heavy disturbance, drought, and wind erosion.

R2A	Removal of human-caused disturbance, in combination with long-term prescribed grazing, including change in season of use, and adequate time for recovery. This transition may take an extended period of time and in the end not meet management objectives.
R3A	Herbaceous weed control, if needed, removal of human-caused disturbance, restoration of blowout, including site stabilization, shaping, mulching, seeding followed by long-term prescribed grazing with change in season of use, and time for adequate recovery. This transition may take an extended period of time and in the end not meet management objectives.

1.1A	1.1 - 1.2	Continuous season-long grazing or continuous seasonal grazing.
1.1B	1.1 - 1.3	Continuous season-long grazing or heavy, continuous seasonal grazing.
1.2A	1.2 - 1.1	Prescribed grazing with proper stocking, change in season of use, and adequate time for recovery.
1.2B	1.2 - 1.3	Continuous season-long grazing, or continuous seasonal grazing.
1.3A	1.3 - 1.2	Removal of management-induced disturbance followed by long-term prescribed grazing with proper stocking rates, change in season of use, and adequate time for recovery.
3.1A	3.1 - 3.2	Heavy disturbance and wind erosion.
3.2A	3.2 - 3.1	Removal of management-induced disturbance, stabilization of blow-out, followed by prescribed grazing with proper stocking, change in season of use and adequate time for recovery.

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, is dominated by warm-season grasses and subdominant cool-season grass. Grazing or the lack of grazing, fire, and wind erosion are the major drivers between plant communities.

Community 1.1
Bluestem-Prairie Sandreed-Needlegrass

Interpretations are based primarily on the Bluestem-Prairie Sandreed-Needlegrass Plant Community. This plant community is also considered the Reference Plant Community (1.1). This site can be found on areas that are properly managed with grazing and prescribed burning, and on areas that receive occasional short periods of rest. The potential vegetation consists of about 85 percent grasses or grass-likes, 10 percent forbs, and 5 percent shrubs. The site is dominated by tall- and mid-statured grasses. The major grasses include sand or big bluestem, prairie sandreed, little bluestem, and needle and thread. Other species occurring on the site include sand dropseed, hairy grama, blue grama, western wheatgrass, switchgrass, and sedge. Forbs and shrubs such as penstemon, gayfeather, rose, leadplant, and sand or silver sagebrush are significant. This plant community is well adapted to the Northern Great Plains climatic conditions. Community dynamics, nutrient and water cycles, and energy flow are functioning at the potential of the site. Plant litter is properly distributed with some movement off-site and natural plant mortality is low. The high plant diversity allows for high tolerance to drought.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1450	1729	2205
Forb	35	114	195
Shrub/Vine	15	57	100
Total	**1500**	**1900**	**2500**

Figure 9. Plant community growth curve (percent production by month). NE6405, Pine Ridge/Badlands, warm-season dominant. Warm-season dominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		3	7	15	20	30	15	5	5		

Community 1.2
Prairie Sandreed-Needle and Thread

This plant community typically develops under continuous season-long grazing or continuous seasonal grazing. The plant community has a reduced component of mid-grasses with an understory of short sod-forming grasses. The potential vegetation is about 85 percent grasses or grass-likes, 10 percent forbs, and 5 percent shrubs. Dominant grasses include prairie sandreed, needle and thread, hairy grama, and blue grama. Other species may include sand dropseed and sedge. Forbs commonly found in this plant community include dotted gayfeather, white sagebrush (cudweed sagewort), scurfpeas, and Cuman ragweed. Shrubs in the community include small soapweed (yucca), sand or silver sagebrush, cactus, and rose. Compared to the Sand Bluestem-Prairie Sandreed-Needlegrass Plant Community (1.1), hairy grama, blue grama, sand dropseed, and annual forbs have increased. Sand bluestem and little bluestem have decreased. Plant diversity remains high, despite the decrease in sand bluestem and little bluestem. 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. The hazard of 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	750	1232	1410
Forb	25	84	145
Shrub/Vine	25	84	145
Total	**800**	**1400**	**1700**

Figure 11. Plant community growth curve (percent production by month). NE6404, Pine Ridge/Badlands, warm-season dominant, cool-season sub-dominant. Warm-season dominant, cool-season sub-dominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		5	8	15	24	23	15	5	5		

Community 1.3
Needle and Thread-Blue Grama-Sand Dropseed

This plant community typically develops under continuous season-long or continuous seasonal grazing during the warm-season grass growing period. The potential vegetation is about 85 percent grasses or grass-likes, 10 percent forbs, and 5 percent shrubs. The dominant grasses are needle and thread, sand dropseed, hairy grama, and blue grama. Significant forbs include Cuman ragweed, annual sunflower, tenpetal blazingstar, and annual eriogonum. Dominant shrubs in this community include sand or silver sagebrush, small soapweed (yucca), and cactus.

Compared to the Sand Bluestem-Prairie Sandreed-Needlegrass Plant Community (1.1), sand dropseed, sandhill muhly, blue grama, and hairy grama have greatly increased. Prairie sandreed are limited to areas in the sagebrush. Sand bluestem and little bluestem are absent. Shortgrass plant species have increased. This community is fairly resilient following normal disturbances. The water cycle is impaired due to the increase in shortgrasses, increased potential for higher runoff, and decreased infiltration. The risk for soil erosion has increased.

Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	560	850	940
Shrub/Vine	25	90	155
Forb	15	60	105
Total	**600**	**1000**	**1200**

Figure 13. Plant community growth curve (percent production by month). NE6404, Pine Ridge/Badlands, warm-season dominant, cool-season sub-dominant. Warm-season dominant, cool-season sub-dominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		5	8	15	24	23	15	5	5		

Pathway 1.1A
Community 1.1 to 1.2

Continuous season-long grazing or continuous seasonal grazing where livestock can target the more palatable warm-season tallgrasses every year will lead to the Prairie Sandreed-Needle and Thread Plant Community (1.2).

Pathway 1.1B
Community 1.1 to 1.3

Continuous season-long grazing or heavy, continuous seasonal grazing where livestock can target the warm-season tallgrasses every year will lead to the Needle and Thread-Blue Grama-Sand Dropseed Plant Community (1.3).

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing at proper stocking rates and adequate plant recovery periods will move this plant community to the Bluestem-Prairies Sandreed-Needlegrass (1.1). Periods of non-use or deferment may be a management option to reach this plant community phase.

Pathway 1.2B
Community 1.2 to 1.3

Continuous season-long grazing or continuous seasonal grazing where livestock can target the more palatable tall- and mid-statured warm-season grasses every year will lead to the Needle and Thread-Blue Grama-Sand Dropseed Plant Community (1.3).

Pathway 1.3A
Community 1.3 to 1.2

Removal of heavy grazing disturbance coupled with long-term prescribed grazing, including proper stocking rates, change in season of use, and adequate time for recovery, will move this plant community to the Prairie Sandreed-Needle and Thread Plant Community (1.2).

State 2
Shortgrass Sod State

The Shortgrass State is dominated by shortgrass species and upland sedges. The State is the result of grazing management that did not provide adequate recovery time for mid- and tall-statured warm-season grasses and mid-statured cool-season grasses. The hydrologic function of this state is altered. Runoff is higher and infiltration is lower than the Reference State (1.0). This State is resistant to change through grazing management alone.

Community 2.1
Blue Grama/Sedge

This plant community typically develops under continuous season-long grazing over a period of many years. It is made up of short, grazing-tolerant species. The potential vegetation is about 80 percent grasses or grass-likes, 10 percent forbs, and 10 percent shrubs. The dominant species are blue grama, sand dropseed, and threadleaf sedge. Some needle and thread and western wheatgrass may be present in the plant community. Dominant forbs include Cuman ragweed, scurfpea, annual eriogonum, and white sagebrush. Dominant shrubs are fringed sagewort, broom snakeweed, tarragon (green sagewort), and cactus. Compared to the Reference Plant Community (1.1), blue grama sand dropseed, and threadleaf sedge have increased, creating sod-bound conditions. Little bluestem and sand bluestem are absent. Prairie sandreed is limited to a few sparse colonies. Sand and silver sagebrush may have also increased. This plant community is resistant to change. Soil erosion is low. The water cycle is reduced because of the lack of surface litter. Infiltration is moderate due to soil texture, which can help to reduce runoff, but offsite gully erosion can be a concern. Forage production, species diversity, and ground cover are declining.

Table 8. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	340	560	680
Forb	30	70	110
Shrub/Vine	30	70	110
Total	**400**	**700**	**900**

Figure 15. Plant community growth curve (percent production by month). NE6404, Pine Ridge/Badlands, warm-season dominant, cool-season sub-dominant. Warm-season dominant, cool-season sub-dominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		5	8	15	24	23	15	5	5		

State 3
Early Seral State

The Early Seral State is dominated by weedy annuals and biennials, sand dropseed, threeawn, and a variety of forbs, and shrubs. This State is the result of heavy disturbance such as frequent and severe defoliation or heavy livestock concentrations coupled with grazing management that does not provide adequate time for recovery. The hydrologic function is also likely to be dramatically altered. Runoff is high and infiltration is low. The Early Seral State is very resistant to change through grazing management alone.

Community 3.1
Annual/Pioneer Perennial

This plant community develops under frequent and severe defoliation or excessive disturbance. This can result from heavy livestock concentration (i.e. watering locations, bedding or loafing grounds, feeding areas, rodent activity, etc.). 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 tarragon (green sagewort), Cuman ragweed, annual sunflower, and annual eriogonum. Shrubs that may be present include cactus, small soapweed (yucca), and sand or silver sagebrush. This plant

community is resistant to change while soil disturbance or severe vegetation defoliation persist, thus holding back secondary plant succession. The potential of soil erosion is 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 percentage of bare ground. Reduced surface cover, low plant density and 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 required to maintain the new plant community.

Figure 16. Plant community growth curve (percent production by month). NE6403, Pine Ridge/Badlands, cool-season/warm-season co-dominant. Cool-season, warm-season co-dominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		5	10	20	25	20	10	5	5		

Community 3.2
Blowout

This condition can be reached from any other plant community with significant disturbances such as heavy grazing, livestock trailing, vehicle activity, and repeated wildfire. Large areas of blowing sand result in movement and possible enlargement of the blowout. Evaporation and transpiration of the few existing plants are extremely high due to bare ground, lack of litter, fire, and few plants. The plant community is in a low successional stage from poor soil development, fire occurrence, and sporadic herbivore use. Sandhill muhly and blowout grass are present due to their tolerance to drought.

Pathway 3.1A
Community 3.1 to 3.2

Continued heavy disturbance, including grazing, livestock trailing, vehicle activity, etc., resulting in bare ground susceptible to wind erosion will lead to the Blowout Plant Community (3.2).

Pathway 3.2A
Community 3.2 to 3.1

In order to reestablish an early successional plant community, this site will need to be protected from heavy disturbance and the blowout stabilized. Once stabilized, prescribed grazing must be incorporated in the management. This will include change in season of use and adequate time for plant recovery following the grazing event.

Transition T1A
State 1 to 2

Continuous season-long grazing as well as heavy grazing in combination with expended periods of drought will transition the Needle and Thread-Blue Grama-Sand Dropseed Plant Community toward the Shortgrass Sod State (2.0). This transition will result in decreases in both forage production and plant species diversity. This would also be typical of calving/lambing pastures where the unit is continuously utilized during the late winter through spring.

Transition T1B
State 1 to 3

Frequent and severe defoliation, heavy disturbance including animal feeding areas, small horse pastures, rodent activity, watering sites, wildfire, heavy grazing in combination with drought, and wind erosion will transition any plant community in the Reference State (1.0) to the Early Seral State (3.0).

Restoration pathway R2A
State 2 to 1

Removal of human-caused disturbance coupled with long-term prescribed grazing, including proper stocking rates, change in season of use, and adequate time for recovery, may move this shortgrass plant community back to the Needle and Thread-Blue Grama-Sand Dropseed Plant Community (1.3). This transition will take an extended period of time and may not meet management objectives.

Transition T2A
State 2 to 3

Frequent and severe defoliation, heavy disturbance including animal feeding areas, small horse pastures, rodent activity, watering sites, wind erosion, and heavy grazing in combination with drought, will transition the shortgrass plant community to the Early Seral State (3.0).

Restoration pathway R3A
State 3 to 1

In order to move either of these plant communities to the Reference State (1.0) the heavy disturbance must be removed, and blowout has to be restored. The restoration will include site stabilization, shaping, mulching, and seeding followed by long-term prescribed grazing with change in season of use, and time for adequate recovery. This transition may take an extended period of time and in the end not meet management objectives. Herbaceous weed control may be an option to help in this transition.

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall and Mid- Warm-Season Grasses**			570–1235	
	prairie sandreed	CALO	*Calamovilfa longifolia*	285–760	–
	sand bluestem	ANHA	*Andropogon hallii*	285–475	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–285	–
	big bluestem	ANGE	*Andropogon gerardii*	0–95	–
2	**Mid- Cool-Season Grasses**			95–380	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	95–190	–
	western wheatgrass	PASM	*Pascopyrum smithii*	0–190	–
3	**Short- Warm-Season Grasses**			38–190	
	blue grama	BOGR2	*Bouteloua gracilis*	19–190	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	19–95	–
4	**Other Native Grasses and Grass-Likes**			95–285	
	sedge	CAREX	*Carex*	19–190	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–190	–
	threeawn	ARIST	*Aristida*	0–95	–
	switchgrass	PAVI2	*Panicum virgatum*	0–95	–
	sandhill muhly	MUPU2	*Muhlenbergia pungens*	0–95	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–38	–
	sand lovegrass	ERTR3	*Eragrostis trichodes*	0–38	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–38	–

	thin paspalum	PASE5	*Paspalum setaceum*	0–19	–
5	**Non-Native Cool-Season Grasses**			0	
Forb					
6	**Forbs**			38–190	
	Forb, perennial	2FP	*Forb, perennial*	0–38	–
	common sunflower	HEAN3	*Helianthus annuus*	0–19	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–19	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	0–19	–
	false boneset	BREU	*Brickellia eupatorioides*	0–19	–
	dotted blazing star	LIPU	*Liatris punctata*	0–19	–
	goldenrod	SOLID	*Solidago*	0–19	–
	tarragon	ARDR4	*Artemisia dracunculus*	0–19	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–19	–
	beardtongue	PENST	*Penstemon*	0–19	–
	scurfpea	PSORA2	*Psoralidium*	0–19	–
	spiderwort	TRADE	*Tradescantia*	0–19	–
	tenpetal blazingstar	MEDE2	*Mentzelia decapetala*	0–19	–
	thistle	CIRSI	*Cirsium*	0–19	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–19	–
	annual buckwheat	ERAN4	*Eriogonum annuum*	0–5	–
Shrub/Vine					
7	**Shrubs**			19–95	
	pricklypear	OPUNT	*Opuntia*	0–19	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–19	–
	leadplant	AMCA6	*Amorpha canescens*	0–19	–
	western poison ivy	TORY	*Toxicodendron rydbergii*	0–19	–
	rose	ROSA5	*Rosa*	0–19	–
	sand sagebrush	ARFI2	*Artemisia filifolia*	0–19	–
	sandcherry	PRPU3	*Prunus pumila*	0–19	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–19	–
	soapweed yucca	YUGL	*Yucca glauca*	0–19	–

Table 10. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall and Mid- Warm-Season Grasses**			210–560	
	prairie sandreed	CALO	*Calamovilfa longifolia*	210–420	–
	sand bluestem	ANHA	*Andropogon hallii*	14–140	–
	big bluestem	ANGE	*Andropogon gerardii*	0–70	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–70	–
2	**Mid- Cool-Season Grasses**			70–210	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	70–210	–
	western wheatgrass	PASM	*Pascopyrum smithii*	0–140	–
3	**Short Warm-Season Grasses**			70–210	

3	**Short Warm-Season Grasses**			70–210	
	blue grama	BOGR2	*Bouteloua gracilis*	14–210	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	14–70	–
4	**Other Native Grasses and Grass-Likes**			70–210	
	sedge	CAREX	*Carex*	14–140	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	14–140	–
	threeawn	ARIST	*Aristida*	0–70	–
	sandhill muhly	MUPU2	*Muhlenbergia pungens*	0–70	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–28	–
	switchgrass	PAVI2	*Panicum virgatum*	0–28	–
	sand lovegrass	ERTR3	*Eragrostis trichodes*	0–14	–
	thin paspalum	PASE5	*Paspalum setaceum*	0–14	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–14	–
5	**Non-Native Cool-Season Grasses**			0	
Forb					
6	**Forbs**			28–140	
	Forb, perennial	2FP	*Forb, perennial*	0–28	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–14	–
	tarragon	ARDR4	*Artemisia dracunculus*	0–14	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–14	–
	false boneset	BREU	*Brickellia eupatorioides*	0–14	–
	thistle	CIRSI	*Cirsium*	0–14	–
	common sunflower	HEAN3	*Helianthus annuus*	0–14	–
	blazing star	LIATR	*Liatris*	0–14	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	0–14	–
	tenpetal blazingstar	MEDE2	*Mentzelia decapetala*	0–14	–
	beardtongue	PENST	*Penstemon*	0–14	–
	scurfpea	PSORA2	*Psoralidium*	0–14	–
	goldenrod	SOLID	*Solidago*	0–14	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–14	–
	spiderwort	TRADE	*Tradescantia*	0–14	–
	annual buckwheat	ERAN4	*Eriogonum annuum*	0–14	–
Shrub/Vine					
7	**Shrubs**			28–140	
	silver sagebrush	ARCA13	*Artemisia cana*	0–28	–
	sand sagebrush	ARFI2	*Artemisia filifolia*	0–28	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–28	–
	pricklypear	OPUNT	*Opuntia*	0–28	–
	soapweed yucca	YUGL	*Yucca glauca*	0–28	–
	sandcherry	PRPU3	*Prunus pumila*	0–14	–
	rose	ROSA5	*Rosa*	0–14	–
	western poison ivy	TORY	*Toxicodendron rydbergii*	0–14	–
	leadplant	AMCA6	*Amorpha canescens*	0–14	–

Table 11. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall and Mid-Warm- Season Grasses**			10–100	
	prairie sandreed	CALO	*Calamovilfa longifolia*	10–100	–
2	**Mid- Cool-Season Grasses**			100–200	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	100–200	–
	western wheatgrass	PASM	*Pascopyrum smithii*	0–100	–
3	**Short Warm-Season Grasses**			100–300	
	blue grama	BOGR2	*Bouteloua gracilis*	100–300	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–50	–
4	**Other Native Grasses and Grass-Likes**			50–200	
	sand dropseed	SPCR	*Sporobolus cryptandrus*	10–150	–
	sedge	CAREX	*Carex*	50–100	–
	threeawn	ARIST	*Aristida*	0–50	–
5	**Non-Native Cool-Season Grasses**			0–50	
	cheatgrass	BRTE	*Bromus tectorum*	0–50	–
	field brome	BRAR5	*Bromus arvensis*	0–20	–
	crested wheatgrass	AGCR	*Agropyron cristatum*	0–10	–
Forb					
6	**Forbs**			20–100	
	scurfpea	PSORA2	*Psoralidium*	0–20	–
	Forb, perennial	2FP	*Forb, perennial*	0–20	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–20	–
	annual buckwheat	ERAN4	*Eriogonum annuum*	0–20	–
	common sunflower	HEAN3	*Helianthus annuus*	0–20	–
	blazing star	LIATR	*Liatris*	0–10	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	0–10	–
	tenpetal blazingstar	MEDE2	*Mentzelia decapetala*	0–10	–
	beardtongue	PENST	*Penstemon*	0–10	–
	tarragon	ARDR4	*Artemisia dracunculus*	0–10	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–10	–
	false boneset	BREU	*Brickellia eupatorioides*	0–10	–
	thistle	CIRSI	*Cirsium*	0–10	–
	goldenrod	SOLID	*Solidago*	0–10	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–10	–
	spiderwort	TRADE	*Tradescantia*	0–10	–
Shrub/Vine					
7	**Shrubs**			30–150	
	sand sagebrush	ARFI2	*Artemisia filifolia*	0–90	–
	prairie sagewort	ARFR4	*Artemisia frigida*	10–50	–
	pricklypear	OPUNT	*Opuntia*	0–50	–
	soapweed yucca	YUGL	*Yucca glauca*	0–50	–

	silver sagebrush	ARCAC5	*Artemisia cana ssp. cana*	0–50	–
	sandcherry	PRPU3	*Prunus pumila*	0–10	–
	western poison ivy	TORY	*Toxicodendron rydbergii*	0–10	–
	leadplant	AMCA6	*Amorpha canescens*	0–10	–

Table 12. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall and Mid- Warm-Season Grasses**			0–70	
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–70	–
2	**Mid- Cool-Season Grasses**			35–70	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	35–70	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–35	–
3	**Short Warm-Season Grasses**			105–245	
	blue grama	BOGR2	*Bouteloua gracilis*	105–245	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–35	–
4	**Other Native Grasses and Grass-Likes**			50–140	
	sand dropseed	SPCR	*Sporobolus cryptandrus*	7–105	–
	sedge	CAREX	*Carex*	35–70	–
	threeawn	ARIST	*Aristida*	0–35	–
5	**Non-Native Cool-Season Grasses**			0–70	
	cheatgrass	BRTE	*Bromus tectorum*	0–70	–
	field brome	BRAR5	*Bromus arvensis*	0–14	–
	crested wheatgrass	AGCR	*Agropyron cristatum*	0–7	–
Forb					
6	**Forbs**			35–105	
	common sunflower	HEAN3	*Helianthus annuus*	0–56	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–35	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–35	–
	annual buckwheat	ERAN4	*Eriogonum annuum*	0–21	–
	Forb, perennial	2FP	*Forb, perennial*	0–14	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	0–7	–
	false boneset	BREU	*Brickellia eupatorioides*	0–7	–
	blazing star	LIATR	*Liatris*	0–7	–
	goldenrod	SOLID	*Solidago*	0–7	–
	tarragon	ARDR4	*Artemisia dracunculus*	0–7	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–7	–
	beardtongue	PENST	*Penstemon*	0–7	–
	spiderwort	TRADE	*Tradescantia*	0–7	–
	tenpetal blazingstar	MEDE2	*Mentzelia decapetala*	0–7	–
	thistle	CIRSI	*Cirsium*	0–7	–
Shrub/Vine					
7	**Shrubs**			35–105	
	prairie sagewort	ARFR4	*Artemisia frigida*	7–70	–

	sand sagebrush	ARFI2	*Artemisia filifolia*	0–70	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–70	–
	soapweed yucca	YUGL	*Yucca glauca*	0–35	–
	pricklypear	OPUNT	*Opuntia*	0–35	–
	western poison ivy	TORY	*Toxicodendron rydbergii*	0–7	–
	rose	ROSA5	*Rosa*	0–7	–

Table 13. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)

Animal community

Wildlife Interpretations:
MLRA 64 is in the drier areas of a northern mixed-grass prairie ecosystem in which sagebrush steppes to the west yield to grassland steppes to the east. Prior to European settlement, this MLRA consisted of diverse grassland 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, and 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 species of small mammals and insects, were the primary consumers linking the grassland resources to large predators, such as the wolf, mountain lion, and grizzly bear, and to smaller carnivores, such as the coyote, bobcat, fox, and raptors. The prairie dog was once abundant and remains a keystone species within its range. The black-footed ferret, burrowing owl, ferruginous hawk, mountain plover, and swift fox are associated with prairie dog complexes.

Historically, the northern mixed-grass prairie was a disturbance-driven ecosystem in which fire, herbivory, and climate functioned 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 affected plant and animal communities. The bison was a historical keystone species but has been extirpated in this area as a free-ranging herbivore. The loss of the bison and the 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 reduced habitat quality for area-sensitive species.

Within MLRA 64, the Sands Ecological Site (ES) provides upland grassland cover with an associated forb and shrub component. It was typically part of an expansive grassland landscape that included combinations of Badlands, Thin Breaks, Clayey, Claypan, Dense Clay, Loamy, Saline, Sandy, Shallow, Overflow, Subirrigated, and Terrace ESs. This Sands 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 in this ES include free-ranging American bison, grizzly bear, gray wolf, black-footed ferret, mountain plover, Rocky Mountain locust, and swift fox.

The majority of this ES remains 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 cheatgrass have impacted the biological integrity of the site for some grassland birds. Changes in historic fire regime and domestic grazing have impacted the percentages of forbs, shrubs, and grasses. 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,

Bluestem-Prairie Sandreed-Needlegrass (1.1) and Prairie Sandreed-Needle and Thread (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, spotted ground squirrel, white-tailed and black-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 limited habitat for amphibians, mostly toads (i.e., Great Plains, Woodhouse's, and plains spade-foot). Prey abundance and shade opportunities may attract multiple reptile species such as gopher snake, milk snake, prairie rattlesnake, and western ornate box turtle to this site. Several species of sand-loving lizards such as the lesser earless lizard, prairie lizard, many-lined skink, and six-lined racerunner utilize this site. Resulting from continuous season-long grazing, the shift to a community of needle and thread and prairie sandreed occurs. The forb and shrub diversity has not substantially decreased. The shift from the Reference Plant Community (1.1) to the Prairie Sandreed-Needle and Thread Community (1.2) does not result in a significant change to the wildlife community.

Needle and Thread-Blue Grama-Sand Dropseed (1.3) and Blue Grama-Sedge (2.1): Needle and thread and blue grama will dominate. Forb and shrub abundance increases. This increase along with the abundance of Cuman ragweed and dropseed provide a substantial high-quality seed source for small herbivores including voles, mice, and spotted ground squirrels.

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 and black-tailed jackrabbit will increase due to the loss of the tall grass component. Reptile species such as gopher snake, milk snake, prairie rattlesnake, western ornate box turtle, lesser earless lizard, prairie lizard, many-lined skink, and six-lined racerunner will continue to utilize this site.
The short stature of these plant communities 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 (3.1): This plant community develops under severe disturbance or excessive defoliation. This can result from heavy livestock or prairie dog concentration or via crop abandonment (go-back land). 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 cheatgrass or field brome, crested wheatgrass, and other non-native species due to severe soil disturbances and relatively high percentage of bare ground.

The potential for soil erosion is high, impacting offsite aquatic habitats through increased runoff, nutrient, and sediment loads. Reduced surface cover, low plant density and 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-Needlegrass (1.1)

Average Production (lb/acre, air-dry): 1,900
Stocking Rate (AUM/acre): 0.52

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

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

Plant Community: Blue Grama/Sedge (2.1)
Average Production (lb/acre, air-dry): 700
Stocking Rate (AUM/acre): 0.19

*Plant Community: Annual/Pioneer Perennial (3.1)
Average Production (lb/acre, air-dry): Variable
Stocking Rate (AUM/acre): Variable

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

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

** Total onsite annual production may contain vegetation deemed undesirable or untargeted by the grazing animal. Therefore, AUM values may have been 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 have insufficient protein to meet livestock requirements. Added protein allows ruminants to better utilize the energy stored in grazed plant materials. A forage quality test (either directly or through fecal sampling) should be used to determine the level of supplementation needed.

Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group A. Infiltration ranges from high to very high. Runoff potential for this site varies from very low to low depending upon 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. Areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff. Refer to the USDA-NRCS National Engineering Handbook, Part 630, for hydrologic soil groups, runoff quantities, and hydrologic curves.

Recreational uses

This site provides hunting opportunities for 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 present on the site.

Other products

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

Other information

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

This ESD is an updated “Previously Approved” ESD that represented a first-generation tier of documentation that, prior to the release of the 2014 National Ecological Site Handbook (NESH), met all requirements as an “Approved” ESD as laid out in the 1997 National Range and Pasture Handbook (NRPH). The document fully described the Reference State and Community Phase in the State-and-Transition model. All other alternative states are 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 that it will continue refinement toward an “Approved” status.

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

Inventory data references

Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range-trained personnel were also used. Those involved in developing this site include: Stan Boltz, range management specialist (RMS), NRCS; Jill Epley, RMS, NRCS; Rick Peterson, RMS, NRCS; David Steffen, RMS, NRCS; Jeff Vander Wilt; RMS, NRCS; Phil Young, soil scientist, NRCS; and George Gamblin, RMS, NRCS.

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Approval

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This ecological site was reviewed and approved at the Approved Level by David Kraft, Regional ESS, Salina, KS on 6/06/2019.

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

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Date	12/16/2024
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None. Rills should not be present.

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2. **Presence of water flow patterns:** Typically, none. Water flow patterns may be present on slopes of 15% or greater. When present, they will be no longer than 2 to 4 inches (5 to 10 cm), less than 3 inches (7.5 cm) wide, and discontinuous. Water flow patterns, when present, are often associated with animal activity.

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3. **Number and height of erosional pedestals or terracettes:** Bunch grasses may be slightly pedestalled (0.5 inch or 1.25 cm) with no exposed roots; occurrence of pedestalled plants will average less than one per square meter. This typically will occur on north and west aspects of slopes exceeding 10 percent and where bunchgrasses are more common. Drought or wildfire can contribute to increased incidences of 1 to 3 pedestalled plants per square meter.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground is typically less than 15 percent, and bare ground patches are less than 2 to 3 inches (5 to 7.5 cm) in diameter.

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5. **Number of gullies and erosion associated with gullies:** None. Gullies should not 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 (3 m) in diameter. Small wind scoured areas may also occur immediately adjacent to areas receiving repeated disturbance.

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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 (less than 6 inches or 15 cm) of fine litter from water is possible, but not normal. Litter movement from wind is not expected.

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil stability ratings are typically 2 or 3. Some series on this site have little organic matter in the surface horizon, and the structure is single grain sand. Soil 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.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** A-horizon ranges from 1 to 6 inches (2.5 to 15.25 cm) thick. Dunday soils have an A-horizon ranging from 10 to 19 inches (25.4 to 48.25 cm). Some soils have little organic matter in the A-horizon. Colors are dark grayish brown, grayish brown, pale brown or light brownish gray (values of 4 to 6) when dry and very dark brown, very dark grayish brown, dark brown, or dark grayish brown (values of 2 to 4), when moist. 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 and tall rhizomatous and tufted perennial cool season grasses) with fine and coarse roots positively influences infiltration. Invasion of introduced cool-season grasses such as Kentucky bluegrass, annual brome, and crested wheatgrass may have an adverse impact infiltration and runoff.

    Relative composition is approximately 85 percent grasses or grass-like plants, 10 percent forbs, and 5 percent shrubs. The grass component is composed of C4 tallgrass (30-65%), C3 midgrass (10-20%), C4 midgrass (5-15), C4, short grasses (2-15%), and grass-likes (1-10%).

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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. A compaction layer should not occur on this site.

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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: Phase 1.1
    1. Native, perennial, C4 tallgrass, 570-1235 #/ac, 30-65% (2 species minimum): prairie sandreed, sand bluestem, big bluestem, switchgrass.

    Phase 1.2
    1. Native, perennial, C4 tallgrass, 210-490 #ac, 15-35% (2 species minimum): prairie sandreed, sand bluestem, big bluestem, switchgrass.

    Phase 1.3
    1. Native, perennial, C4, shortgrass, 100-300 #/ac, 10-30%: (1 species minimum): blue grama, hairy grama, threeawn.

    Sub-dominant: Phase 1.1
    1. Native, perennial, C3 midgrass, 190-380 #/ac, 10-20% (1 species minimum): needle and thread, prairie Junegrass, Indian ricegrass, green needlegrass, Scribner rosettegrass, western wheatgrass.

2. Native, perennial, C4, shortgrass, 35-285 #/ac, 2-15% (2 species minimum): blue grama, hairy grama, sandhill muhly.

Phase 1.2
1. Native perennial, C4, midgrass, 70-210 #/ac, 5-15% (1 species minimum): little bluestem, sand dropseed, sand lovegrass.
2. Native, perennial, C4, shortgrass, 70-210 #/ac, 5-15% (2 species minimum): blue grama, hairy grama, threeawn, sandhill muly, thin paspalum.
3. Native, perennial, C3 midgrass, 70-210 #/ac, 5-15% (1 species minimum): needle and thread, western wheatgrass, Scribner's rosette grass, Indian ricegrass.

Phase 1.3
1. Native, perennial, C3 grass, 100-200 #ac, 10-20% (1 species minimum): needle and thread, western wheatgrass.
2. Shrubs, 30-150 #/ac, 3-15% (1 species minimum): prairie sagewort and other shrubs that vary from location to location.
3. Native, perennial, C4 midgrass, 10-150 #/ac (1 species minimum): 1-15%: sand dropseed.

Other: Minor - Phase 1.1
1. Native, perennial, C4, midgrass, 95-285 #/ac, 0-15% : little bluestem, sand lovegrass, sand dropseed, thin paspalum.
2. Grass-likes, 19-190 #/ac: (1-10%): sedges.
3. Native forbs, 38-190 #/ac (2-10%): Species will vary from location to location.
4. Shrubs and vines, 19-95 #/ac (1-5%): Species will vary from location to location.

Minor - Phase 1.2
1. Native forbs, 28-140 #/ac, 2-10%: species vary from location to location.
2. Shrubs and vines, 28-140 #/ac, 2-10%: Species will vary from location to location.
3. Grass-likes, 14-140 #/ac, 1-10%: sedges.

Minor Phase 1.3
1. Grass-likes, 50-100 #/ac, 5-10%: sedge.
2. Native forbs: species present vary from location to location.
3. Native, perennial, C4, tallgrass, 10-100 #/ac, 1-10%: prairie sandreed.
4. Non-native C3 grass, 0-50 #/ac, 0-5%: cheatgrass, field brome, crested wheatgrass.

Additional: The Reference Community (1.1) or Bluestem-Prairie Sandreed-Needlegrass Community consists of seven F/S groups. These groups, in order of relative abundance, are native, perennial, C4, rhizomatous, tallgrass; native, perennial, C3 midgrass; native, perennial, C4 midgrass; native, perennial, C4 shortgrass; native forbs; grass-likes; and shrubs.

The Prairie Sandreed-Needle and Thread Community (1.2) consists of seven F/S groups. These groups in order of relative abundance are native, perennial, C4 tallgrass, native, perennial, C4 midgrass = native, perennial, C4 shortgrass = native, perennial, C3 midgrass; native forbs = shrubs = grass-likes.

The Needle and Thread-Blue Grama-Sand Dropseed Community consists of eight F/S groups. These groups are native, perennial, C4 shortgrass; native, perennial, C3 grass; shrubs; native, perennial, C4 midgrass; grass-likes; native forbs; native, perennial, C4 tallgrass, and non-native, C3 grass.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Bunchgrasses have strong, healthy centers with few (less than 3 percent) dead centers. Shrubs may show some dead branches (less than 5 percent) as plants age.

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14. **Average percent litter cover (%) and depth (in):** Plant litter cover is evenly distributed throughout the site and is expected to be 40 to 60 percent and at a depth of 0.25 to 0.50 inch (0.65 to 1.3 cm). Kentucky bluegrass excessive litter can negatively impact the functionality of this site.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** The representative value (RV) for annual production is 1,900 pounds per acre on an air dry weight basis. Low and High production years should yield 1,500 and 2,500 pounds respectively.

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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:** No non-native invasive species are present. Annual bromes, Kentucky bluegrass, crested wheatgrass, absinth wormwood, and eastern red cedar are known invasives that have the potential to become dominant or co-dominant on this site. Consult the state noxious weed and state watch lists for potential invasive species. Note: species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants.

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17. **Perennial plant reproductive capability:** All perennial species exhibit high vigor relative to recent weather conditions. Perennial grasses should have vigorous rhizomes or tillers; vegetative and reproductive structures are not stunted. All perennial species should be capable of reproducing annually.
