USDA Natural Resources Conservation Service

Ecological site R055CY008SD
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): 055C–Southern Black Glaciated Plains

The Southern Black Glaciated Plains (55C) is located within the Northern Great Plains Region. It is entirely within South Dakota encompassing about 10,835 square miles (Figure 1). The elevation ranges from 1,310 to 1,970 square feet. The MLRA is on nearly level to undulating glacial till plains interrupted by steeper slopes adjacent to streams and moraines. The James River is an under-fit stream. Its valley was carved by floodwaters draining glacial Lake Dakota and is filled with glacial outwash and alluvial deposits. (USDA-NRCS, 2006).

The dominant soil order in this MLRA is Mollisols. The soils in the area dominantly have a mesic soil temperature regime, an ustic soil moisture regime, and mixed or smectitic mineralogy. They generally are very deep, well drained to very poorly drained, and clayey or loamy. This area supports natural prairie vegetation characterized by western wheatgrass (Pascopyrum smithii), green needlegrass (Nassella viridula), needle and thread (Hesperostipa comata), and porcupinegrass (Hesperostipa spartea) with Prairie cordgrass (Spartina pectinata), and reed canarygrass (Phalaris arundinacea) as the dominant vegetation on the poorly drained soils. (USDA-NRCS, 2006).

Classification relationships

Major Land Resource Area (MLRA): Southern Black Glaciated Plains (55C) (USDA-NRCS, 2006)

USFS Subregions: North Central Glaciated Plains Section (251B); Yankton Hills and Valleys Subsection (251Bf); Western Glaciated Plains Section (332B); James River Lowland Subsection (332Bb); North Central Great Plains Section (332D); Southern Missouri Coteau Slope Subsection (332Dd); Southern Missouri Coteau Subsection (332De) - (Cleland et al., 2007).

US EPA Level IV Ecoregion: Southern Missouri Coteau (42e); Southern Missouri Coteau Slope (42f); James River Lowland (46n) - (USEPA, 2013)

Ecological site concept

The Sands ecological site typically occurs in an upland area. Soils vary from moderately well drained to excessively drained. The surface and subsoil textures are sand, loamy sand, loamy fine sand. Slopes can range from 0 to 40 percent. Vegetation in the Reference State is dominated by warm-season grasses such as sand bluestem and prairie sandreed, and cool-season needlegrasses. Forbs include sageworts, ragweed, and scurfpea. Non-native grasses such as Kentucky bluegrass and smooth bromegrass or native conifers such as eastern redcedar may invade due to shifts in disturbance regime.

Associated sites

R055CY010SD	**Loamy** These sites occur on upland areas. Soils are well drained. The surface and subsoil textures are loam, silt loam, silty clay loam, clay loam, sandy clay loam, and very fine sandy loam. The central concept soil series are Houdek, Clarno, and Hand, but other series are included.
R055CY012SD	**Thin Upland** These sites occur on uplands. Soils are well drained and will effervesce with acid at or near the surface. The central concept soil series are Ethan and Betts, but other series are included.
R055CY009SD	**Sandy** These sites occur on upland areas. Soils vary from moderately well drained to somewhat excessively well drained. The surface and subsoil textures are sandy loam, fine sandy loam, and loamy very fine sand. The central concept soil series are Henkin, Blendon, and Carthage, but other series are included.

Similar sites

R055CY009SD	**Sandy** The Sandy site is in a similar landscape position, but the surface and subsoil textures are sandy loam, fine sandy loam, and loamy very fine sand. The Sandy site will have more needlegrass, less prairie sandreed, and higher production than the Sands site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Andropogon hallii* (2) *Schizachyrium scoparium*

Physiographic features

This site occurs on undulating, gently sloping uplands.

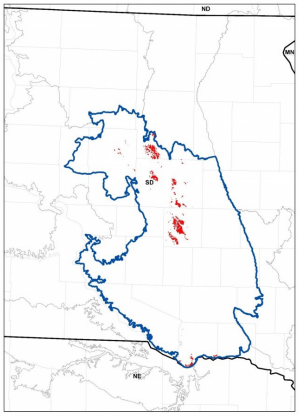

Figure 2. Distribution of Sands sites in MLRA 55C. In many cases, data is not spatially consistent across political boundaries due to the method with which soils were mapped; e. g. county subsets.

Table 2. Representative physiographic features

Landforms	(1) Plain (2) Flood plain
Flooding duration	Brief (2 to 7 days)
Flooding frequency	None to frequent
Ponding frequency	None
Elevation	396–610 m
Slope	1–9%
Water table depth	203 cm
Aspect	Aspect is not a significant factor

Climatic features

MLRA 55C is considered to have a continental climate: Cold winters and hot summers, low humidity, light rainfall, and much sunshine. Extremes in temperature may also abound. The climate is the result of this MLRA's location near the geographic center of North America. There are few natural barriers on the Northern Great Plains, and air masses move freely across the plains and account for rapid changes in temperature.

Annual precipitation typically ranges from 19 to 25 inches per year. The average annual temperature is about 47°F. January is the coldest month with average temperatures ranging from about 15°F (Howard, South Dakota [SD]), to about 20°F (Wagner, SD). July is the warmest month with temperatures averaging from about 73°F (Howard, SD), to about 77°F (Wagner, SD). The range of normal average monthly temperatures between the coldest and warmest months is about 58°F. This large annual range attests to the continental nature of this area's climate. Hourly winds are estimated to average about 12 miles per hour (mph) annually, ranging from about 13 mph during the spring to about 11 mph during the summer. Daytime winds are generally stronger than nighttime, and occasional 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. Green-up of cool-season plants may occur in September and October when adequate soil moisture is present.

Table 3. Representative climatic features

Frost-free period (characteristic range)	122-129 days
Freeze-free period (characteristic range)	137-151 days
Precipitation total (characteristic range)	559-660 mm

Frost-free period (actual range)	114-131 days
Freeze-free period (actual range)	133-155 days
Precipitation total (actual range)	533-686 mm
Frost-free period (average)	125 days
Freeze-free period (average)	144 days
Precipitation total (average)	610 mm

Climate stations used

- (1) FAULKTON 1 NW [USC00392927], Faulkton, SD
- (2) REDFIELD [USC00397052], Redfield, SD
- (3) MILLER [USC00395561], Miller, SD
- (4) HURON RGNL AP [USW00014936], Huron, SD
- (5) DE SMET [USC00392302], De Smet, SD
- (6) FORESTBURG 4 NNE [USC00393029], Artesian, SD
- (7) HOWARD [USC00394037], Howard, SD
- (8) SALEM 5NE [USC00395360], Salem, SD
- (9) ALEXANDRIA [USC00390128], Alexandria, SD
- (10) MITCHELL MUNI AP [USW00094950], Mitchell, SD
- (11) MITCHELL 2 N [USC00395671], Mitchell, SD
- (12) MITCHELL [USC00395669], Mitchell, SD
- (13) CHAMBERLAIN MUNI AP [USW00094943], Chamberlain, SD
- (14) CHAMBERLAIN 5 S [USC00391621], Chamberlain, SD
- (15) ACADEMY 2NE [USC00390043], Platte, SD
- (16) MARION [USC00395228], Marion, SD
- (17) MENNO [USC00395481], Menno, SD
- (18) TYNDALL [USC00398472], Tyndall, SD
- (19) WAGNER [USC00398767], Wagner, SD

Influencing water features

No riparian areas or wetland features are directly associated with this site.

Soil features

The soils in this site are excessively well-drained and formed in alluvium or in eolian deposits. The surface layer is 3 to 5 inches thick. The surface texture is typically loamy fine sand or fine sand, while the texture of the subsurface ranges from loamy fine sand to sand. Slopes range from 1 to 9 percent. This site should show slight to no evidence of rills, wind scoured areas, or pedestalled plants. Water flow paths will typically not be present. The soil surface is stable and intact.

These soils are mainly susceptible to wind erosion. The hazard of erosion increases where vegetative cover is low or in poor condition. Occasional erosion may occur with flooding events. Low available water capacity influences the soil-water-plant relationship. Loss of the soil surface layer can result in a shift in species composition and production.

Soil series are Forestburg and Doger

Access Web Soil Survey (http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm) for specific local soils information.

Table 4. Representative soil features

Surface texture	(1) Fine sand (2) Loamy fine sand

Family particle size	(1) Sandy
Drainage class	Excessively drained
Permeability class	Moderately rapid
Soil depth	203 cm
Surface fragment cover <=3"	0–3%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	5.08–7.62 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

State and Community Phases
The information in this Ecological Site Description, including the state-and-transition model (STM), was developed based on historical data, current field data, professional experience, and a review of the scientific literature. As a result, all possible scenarios or plant species may not be included. Key indicator plant species, disturbances, and ecological processes are described to inform land management decisions.

The site which is located in the Southern Black Glaciated Plains Region developed under Northern Great Plains climatic conditions and included natural influence of large herding herbivores and occasional fire. Changes will occur in the plant communities due to weather fluctuations and management actions. Under adverse impacts, a relatively rapid decline in vegetative vigor and composition can occur. Under favorable conditions the site has the potential to resemble the Reference State. Interpretations are primarily based on the 1.1 Sand Bluestem-Prairie Sandreed-Needle and thread Plant Community Phase. It has been determined by study of rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. Trends in plant community dynamics ranging from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts also have been used. Plant community phases, states, transitional pathways, and thresholds have been determined through similar studies and experience.

This ecological site (ES) has been grazed by domestic livestock since they were introduced into the area. The introduction of domestic livestock and the use of fencing and reliable water sources have changed the ecological dynamics of this site. Heavy, continuous grazing without adequate recovery periods following each grazing occurrence causes this site to depart from the Reference State due to the compaction and overgrazing. Sedge (Cyperaceae) and blue grama (*Bouteloua gracilis*) will increase and eventually develop into a sod. Western wheatgrass will increase initially and then begin to decrease. Needle and thread, porcupinegrass, sideoats grama (*Bouteloua curtipendula*), big bluestem (*Andropogon gerardii*), and little bluestem (*Schizachyrium scoparium*) will decrease in frequency and production. Extended periods of non-use and/or lack of fire will result in excessive litter and a plant community dominated by cool-season grasses such as Kentucky bluegrass (Poa partensis), smooth bromegrass (*Bromus inermis*), and cheatgrass (*Bromus tectorum*). Extended periods of no surface fire could result in the invasion of conifers in which eastern redcedar (*Juniperus virginiana*) and Rocky Mountain juniper (*Juniperus scopulorum*) will increase and could eventually dominate the site.

Following the state-and-transition diagram are narratives for each of the described states and community phases.

These may not represent every possibility, but they are the most prevalent and repeatable states and community phases. The associated plant composition tables have been developed from the best available knowledge at the time of this revision. As more data are collected, some of these community phases and states may be revised or removed, and new ones may be added. The main purpose for including the descriptions here is to capture the current knowledge and experience at the time of this revision.

State and transition model

Sands – R055CY008SD

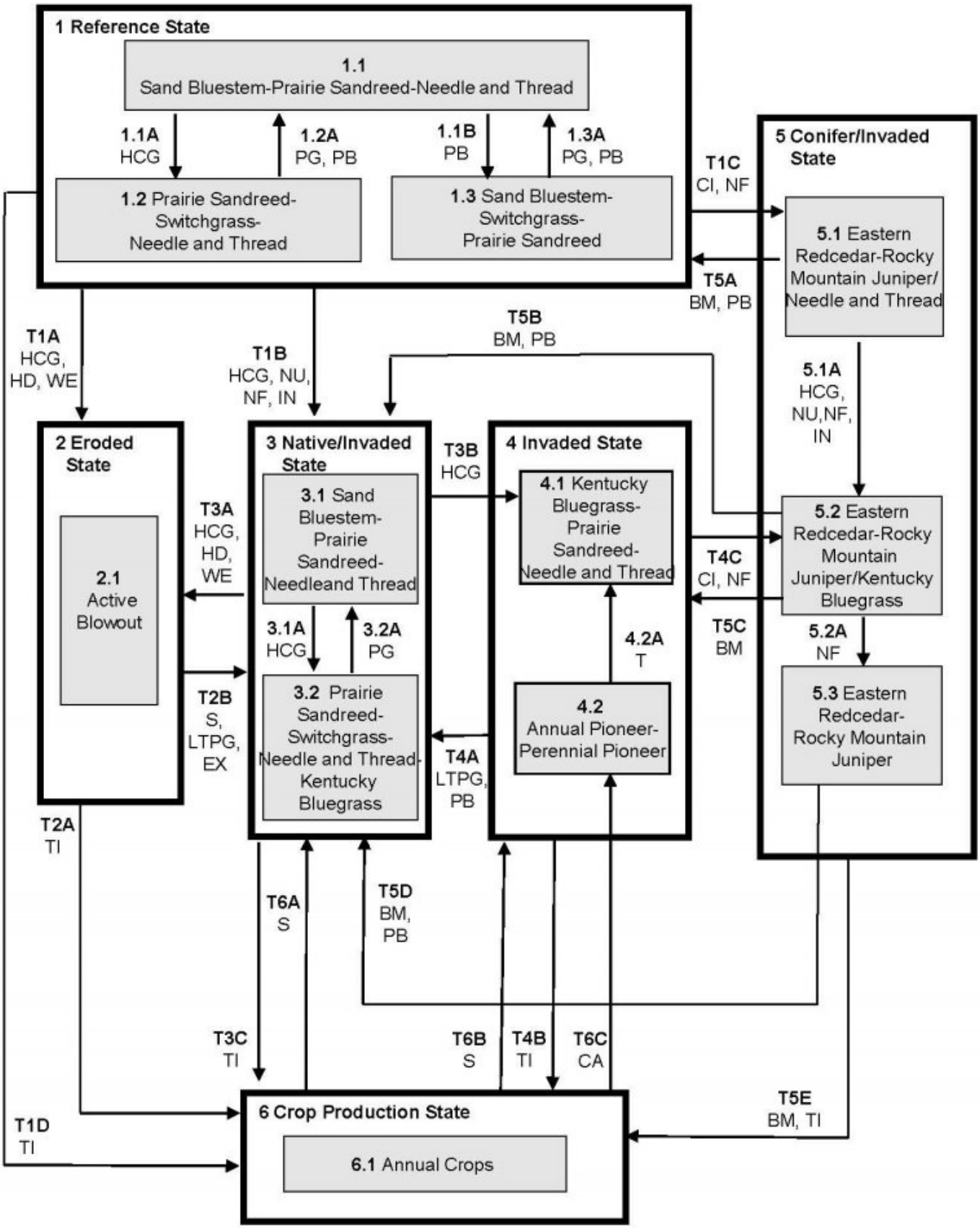

Figure 9. State-and-Transition Model for the Sands site in MLRA 55C.

Figure 10. Legend for the Sands site in MLRA 55C.

Code	Process
T1A	Heavy, continuous grazing, heavy soil disturbance, wind erosion
T1B	Heavy, continuous grazing, non-use, no fire, invasion
T1C	Conifer invasion, no fire
T1D	Tillage
T2A	Tillage
T2B	Seeding, long term prescribed grazing, exclusion of use
T3A	Heavy, continuous grazing, heavy soil disturbance, wind erosion
T3B	Heavy, continuous grazing
T3C	Tillage
T4A	Long term prescribed grazing, prescribed burning
T4B	Tillage
T4C	Conifer invasion, no fire
T5A	Brush management, prescribed burning
T5B	Brush management, prescribed burning
T5C	Brush management
T5D	Brush management, prescribed burning
T5E	Brush management, tillage
T6A	Seeding
T6B	Seeding
T6C	Cropped and abandoned
1.1A	Heavy, continuous grazing
1.1B	Prescribed burning
1.2A	Prescribed grazing with recovery periods, prescribed burning
1.3A	Prescribed grazing with recovery periods, prescribed burning
3.1A	Heavy, continuous grazing
3.2A	Prescribed grazing with recovery periods
4.2A	Time w/wo disturbances
5.1A	Heavy, continuous grazing, non-use, no fire, invasion
5.2A	No fire

Figure 11. Matrix for the Sands site in MLRA 55C.

State 1
Reference State

The Reference State represents the natural range of variability that dominated the dynamics of this ecological site (ES). This state was dominated by warm-season grasses with cool-season grasses being subdominant. Before Europeans settled in North America, the primary disturbance mechanisms for this site in the reference condition included periods of below and above average precipitation, sporadic fire, and herbivory by insects and large ungulates. Frequent surface fires (every 3 to 5 years), grazing, and weather events dictated the dynamics that occurred within the natural range of variability. The less grazing tolerant tall warm-season grasses and cool-season grasses would have declined. Prairie sandreed would have increased with ongoing disturbance. With severe, prolonged disturbance, plant vigor can rapidly decline and this state can move towards an active blowout. Today, a similar state can be found on areas that are properly managed with grazing and/or prescribed burning, and sometimes on areas receiving occasional short periods of rest.

Community 1.1
Sand Bluestem-Prairie Sandreed-Needle and Thread

Interpretations are based primarily on the 1.1 Sand Bluestem-Prairie Sandreed-Needleandthead Plant Community Phase (this is also considered to be the Reference Community). The potential vegetation was about 85 percent grasses or grass-like plants, 10 percent forbs, and 5 percent shrubs. The community was dominated by warm-season grasses, with cool-season grasses subdominant. The major grasses included sand bluestem, big bluestem, prairie sandreed, switchgrass (*Panicum virgatum*), little bluestem, needle and thread, and porcupinegrass. Other grass or grass-like species included sideoats grama, western wheatgrass, blue grama, hairy grama (*Bouteloua hirsuta*), threadleaf sedge (*Carex filifolia*), Indiangrass (*Sorghastrum nutans*), and sand dropseed (*Sporobolus cryptandrus*). This plant community was resilient and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allowed for high tolerance to drought. This was a sustainable plant community in regards to site and soil stability, watershed function, and biologic integrity.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	2040	2793	3503
Forb	140	235	359
Shrub/Vine	62	110	174
Total	**2242**	**3138**	**4036**

Figure 13. Plant community growth curve (percent production by month). SD5504, Southern Black Glaciated Plains, warm-season dominant, cool-season . Warm-season dominant, cool-season subdominant..

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-Switchgrass-Needle and Thread

This plant community evolved under heavy, continuous grazing or from over utilization during extended drought periods. The potential plant community was made up of approximately 85 percent grasses and grass-like species, 10 percent forbs, and 5 percent shrubs. Dominant grasses included prairie sandreed, switchgrass, needle and thread, blue grama, sand dropseed, and threadleaf sedge. Grasses of secondary importance included little bluestem, purple lovegrass (*Eragrostis spectabilis*), hairy grama, western wheatgrass, sand bluestem, big bluestem, and porcupinegrass. Forbs commonly found in this plant community include cudweed sagewort (*Artemisia ludoviciana*), green sagewort (Artemisia dramunculus), Cuman ragweed (*Ambrosia psilostachya*), and scurfpea (Psoralidium). This plant community had similar plant composition to the 3.2 Prairie Sandreed-Switchgrass-Needleandthread-Kentucky Bluegrass Plant Community Phase. The main difference is that this plant community phase did not have the presence of non-native invasive species such as Kentucky bluegrass. When compared to the 1.1 Sand Bluestem-Prairie Sandreed-Needleandthread Plant Community Phase, prairie sandreed, needle and thread, sand dropseed, threadleaf sedge, and blue grama increased. Bluestems and porcupinegrass decrease and production was reduced. This plant community was moderately resistant to change. The herbaceous

species present were well adapted to grazing; however, species composition could be altered through long-term overgrazing. If the herbaceous component was intact, it tended to be resilient if the disturbance was not long-term.

Figure 14. Plant community growth curve (percent production by month). SD5504, Southern Black Glaciated Plains, warm-season dominant, cool-season . Warm-season dominant, cool-season subdominant..

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
Sand Bluestem-Switchgrass-Prairie Sandreed

This plant community was a result of fire occurring at relatively frequent intervals (every 3 to 5 years). This phase could have also resulted from a combination of grazing events immediately following early season fire (i.e., large ungulates attracted to highly nutritious vegetative growth following a fire). These events would have caused a reduction in cool-season grasses and an increase in warm-season grasses. The warm-season grasses were more tolerant of shorter return intervals of fire and would have increased in vigor and production leading to a temporary shift to this phase. Needlegrasses would have decreased most significantly amongst the cool-season grasses. The potential vegetation was about 80 percent grasses or grass-like plants, 15 percent forbs, and 5 percent shrubs. The community was dominated by warm-season grasses. The major grasses included sand bluestem, big bluestem, switchgrass, prairie sandreed, Indiangrass, little bluestem, and sideoats grama. Other grass or grass-like species included blue grama, hairy grama, sand dropseed, needle and thread, porcupinegrass, and threadleaf sedge. This plant community was not resistant to change and would have readily shifted back to the 1.1 Sand Bluestem-Prairie Sandreed-Needlegrass Plant Community Phase with a return of more normal fire return intervals.

Figure 15. Plant community growth curve (percent production by month). SD5505, Southern Black Glaciated Plains, warm-season dominant.. Warm-season dominant..

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

Pathway 1.1A
Community 1.1 to 1.2

Heavy, continuous grazing which includes herbivory at moderate to heavy levels at the same time of year each year without adequate recovery periods, or during periods of below normal precipitation when grazing frequency and intensity increases on these sites due to limited forage availability on adjacent upland sites, will shift this community to the 1.2 Prairie Sandreed-Switchgrass-Needle and Thread Plant Community Phase.

Pathway 1.1B
Community 1.1 to 1.3

Prescribed burning occurring at relatively frequent intervals (every 3 to 5 years), a return to normal disturbance regime levels and frequencies, periodic light to moderate grazing possibly including periodic rest, occasional grazing events immediately following early season fire that caused a reduction in cool-season grasses and an increase in warm-season grasses. The warm-season grasses were more tolerant of shorter return intervals of fire and would increase in vigor and production leading to a temporary shift to the 1.3 Sand Bluestem-Switchgrass-Prairie Sandreed Plant Community Phase.

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing, and/or prescribed burning occurring at relatively frequent intervals (every 3 to 5 years) and a return to normal disturbance regime levels and frequencies, or periodic light to moderate grazing possibly including periodic rest, will convert this plant community to the 1.1 Sand Bluestem-Prairie Sandreed-Needle and Thread Plant Community Phase.

Pathway 1.3A
Community 1.3 to 1.1

Prescribed grazing (alternating season of use and providing adequate recovery periods), periodic light to moderate grazing possibly including periodic rest, prescribed burning occurring at relatively frequent intervals (every 3 to 5 years), and a return to normal disturbance regime levels will convert this plant community to the 1.1 Sand Bluestem-Prairie Sandreed-Needleand thread Plant Community Phase.

State 2
Eroded State

The Eroded State is a result of heavy, continuous grazing or from over utilization during extended periods of drought. These soils are very susceptible to wind erosion. A soil disturbance from livestock or from some mechanical means combined with wind will initiate the eroded state. Continuous wind erosion will bury existing vegetation and create a blowout situation. Extended periods of drought will enhance this process. The blowout area will become very sparsely vegetated with remaining area bare soil. An active blowout area will be mostly bare soil.

Community 2.1
Active Blowout

This plant community evolved under heavy, continuous season grazing or from over utilization during extended drought periods. The potential plant community is variable, sometimes nearly devoid of vegetation, and at other times having a considerable cover of grasses. The grasses that make up this plant community phase are those that have developed adaptations to withstand or avoid damage due to blowing sand and can withstand being buried. Typical species may include species such as sand bluestem, prairie sandreed, blowout grass (Redfieldia flexousa), and other early pioneer species. This plant community phase is susceptible to wind erosion and the blowing and shifting sand may keep this community in an early seral phase.

Figure 16. Plant community growth curve (percent production by month). SD5505, Southern Black Glaciated Plains, warm-season dominant.. Warm-season dominant..

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

State 3
Native/Invaded State

The Native/Invaded State represents the more common range of variability that exists with higher levels of grazing management, but in the absence of periodic fire due to fire suppression. This state is dominated by warm-season grasses with cool-season grasses being subdominant. It can be found on areas that are properly managed with grazing and/or prescribed burning and sometimes on areas receiving occasional short periods of rest. Grazing tolerant will increase with disturbance.

Community 3.1
Sand Bluestem-Prairie Sandreed-Needle and Thread

This plant community phase is similar to the 1.1 Bluestem/Prairie Sandreed/Needlegrass Plant Community Phase but it also contains minor amounts of non-native invasive grass species such as Kentucky bluegrass and smooth bromegrass (up to about 15 percent by air-dry weight). The potential vegetation is about 85 percent grasses or grass-like plants, 10 percent forbs, and 5 percent shrubs. The community is dominated by warm-season grasses with cool-season grasses subdominant. The major grasses include sand and big bluestem, prairie sandreed, switchgrass, little bluestem, needle and thread, and porcupinegrass. Other grass or grass-like species include sideoats grama, western wheatgrass, blue grama, hairy grama, threadleaf sedge, Indiangrass, and sand dropseed. This plant community is resilient and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allows for high tolerance to drought. This is a sustainable plant community in regards to site and soil stability, watershed function, and biologic integrity.

Figure 17. Plant community growth curve (percent production by month). SD5504, Southern Black Glaciated Plains, warm-season dominant, cool-season . Warm-season dominant, cool-season subdominant..

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 3.2
Prairie Sandreed-Switchgrass/Needle and Thread-Kentucky Bluegrass

This plant community is a result of heavy, continuous grazing, continuous season-long grazing, or from over utilization during extended drought periods. The potential plant community is made up of approximately 85 percent grasses and grass-like species, 15 percent forbs, and 5 percent shrubs. Dominant grasses include prairie sandreed, switchgrass, needle and thread, blue grama, sand dropseed, and threadleaf sedge. Grasses of secondary importance include little bluestem, purple lovegrass, hairy grama, western wheatgrass, sand and bluestem, and porcupinegrass. Forbs commonly found in this plant community include cudweed sagewort, green sagewort, Cuman ragweed, and scurfpea. When compared to the Bluestem/Prairie Sandreed/Needlegrass Plant Community Phase (1.1), prairie sandreed, needle and thread, sand dropseed, threadleaf sedge, and blue grama increase. Bluestems and porcupinegrass decrease and production is reduced. This plant community is moderately resistant to change. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term overgrazing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1552	2107	2516
Forb	106	177	269
Shrub/Vine	22	69	129
Total	**1680**	**2353**	**2914**

Figure 19. Plant community growth curve (percent production by month). SD5504, Southern Black Glaciated Plains, warm-season dominant, cool-season . Warm-season dominant, cool-season subdominant..

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

Pathway 3.1A
Community 3.1 to 3.2

Heavy, continuous grazing which includes herbivory at moderate to heavy levels at the same time of year each year without adequate recovery periods, or during periods of below normal precipitation when grazing frequency and intensity increases on these sites due to limited forage availability on adjacent upland sites, will shift this community to the 3.2 Prairie Sandreed-Switchgrass-Needle and Thread-Kentucky Bluegrass Plant Community Phase.

Pathway 3.2A
Community 3.2 to 3.1

Prescribed grazing (alternating season of use and providing adequate recovery periods) or periodic light to moderate grazing possibly including periodic rest will convert this plant community to the 3.1 Sand Bluestem-Prairie Sandreed-Needleandthread Plant Community Phase.

Conservation practices

Prescribed Grazing

State 4
Invaded State

The Invaded State is a result of encroachment mainly by invasive introduced cool-season grasses. The ecological processes are not functioning, especially the biotic processes and the hydrologic functions. The introduced cool-season grasses cause reduced infiltration and increased runoff. Preliminary studies indicate this threshold may exist when Kentucky bluegrass exceeds 30 percent of the plant community and native grasses represent less than 40 percent of the plant community composition. The opportunity for high intensity spring burns is severely reduced by early green-up and increased moisture and humidity at the soil surface, and grazing pressure cannot cause a reduction in sod-grass dominance. Production is limited to the sod-forming species. Infiltration continues to decrease and runoff increases, energy capture into the system is restricted to early season low producing species. Nutrient cycling is limited by root depth of the dominate species.

Community 4.1
Kentucky Bluegrass-Prairie Sandreed-Needle and Thread

This plant community phase is a result of heavy, continuous seasonal grazing or heavy, continuous season-long grazing. It is characterized by a dominance of Kentucky bluegrass, prairie sandreed, needle and thread, sedge, and blue grama. The dominance of Kentucky bluegrass is at times so complete that other species are difficult to find on the site. A relatively thick duff layer can sometimes accumulate at or above the soil surface and eventually a thatch-mat layer may develop at the surface as well.. Nutrient cycling is greatly reduced and native plants have great difficulty becoming established. Infiltration is greatly reduced and runoff is high. Production will be significantly reduced when compared to the interpretive plant community. The period that palatability is high is relatively short as Kentucky bluegrass matures rapidly. Energy capture is also reduced. Biological activity in the soil is likely reduced significantly in this phase.

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1250	1836	2404
Forb	95	151	224
Shrub/Vine	–	30	62
Total	**1345**	**2017**	**2690**

Figure 21. Plant community growth curve (percent production by month). SD5502, Southern Black Glaciated Plains, cool-season dominant, warm-season . Cool-season dominant, warm-season subdominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	10	23	34	15	6	5	4	0	0

Community 4.2
Annual Pioneer-Perennial Pioneer

This plant community developed under continuous, heavy grazing or other excessive disturbances (e.g., heavy use areas, defoliation by rodents, etc.). The potential plant community is made up of approximately 40 to 80 percent grasses and grass-like species, 20 to 60 percent forbs, and 0 to 5 percent shrubs. The species present in this phase are highly variable but often include non-native invasive and early seral species. Plant diversity is low (plant richness may be high but areas are often dominated by a few species). The ecological processes are difficult to restore because of the loss of plant diversity and overall soil disturbance. Soil erosion is potentially very high because of the bare ground and shallow-rooted herbaceous plant community. Water runoff will increase and infiltration will decrease due to animal related soil compaction and loss of root mass due to low plant diversity and vigor. This plant community will require significant economic inputs and time to move towards another plant community. This movement is highly variable in its succession. This is due to the loss of diversity (including the loss of the seed bank) within the existing plant community and the plant communities on adjacent sites. This community can be renovated to improve the production capability; however, if management changes are not made the

vegetation could revert back to a threeawn/annual community.

Pathway 4.2A
Community 4.2 to 4.1

This community pathway occurs with the passage of time as successional processes take place and perennial plants gradually begin to establish on the site again. This pathway will lead to the 4.1 Kentucky Bluegrass-Prairie Sandreed-Needleandthread Plant Community Phase.

State 5
Conifer/Invaded State

The Conifer/Invaded State is dominated (canopy exceeds 20 percent of total surface area) by areas where trees have become established or have encroached onto the site due to the absence of periodic fire. This state is dominated by eastern redcedar and Rocky Mountain juniper with cool-season grasses being subdominant. The plant community can develop into a closed canopy that impedes the reproductive capability of the major native perennial grass species. A single eastern redcedar tree with a 7 foot crown diameter eliminates the equivalent of 3 pounds of forage. Further, the forage potential of a pasture with 250 mature eastern redcedar trees per acre (or one tree every thirteen feet) is reduced by 50 percent. It is suggested that reducing stocking rates by 10 percent for every 50 trees per acre. The increase in tree canopy which is a result of a disruption of the natural and human related fire regimes that occurred prior to European settlement of North America, which kept trees from encroaching much of the grasslands.

Community 5.1
Eastern Red Cedar-Rocky Mountain Juniper/Needle and Thread

This plant community evolved due to the invasion of conifers, such as eastern redcedar and Rocky Mountain juniper. This phase was a result of the absence of periodic fire. These events may cause a reduction in warm-season grasses and an increase in cool-season grasses and allow for the encroachment of conifers. The potential plant community is made up of approximately 50 percent grasses and grass-like species, 10 percent forbs, 10 percent shrubs, and 30 percent trees. Dominant grasses and grass-likes include needle and thread, sand bluestem, prairie sandreed, and switchgrass. As the canopy increases, warm-season grasses tend to decrease as the cool-season grasses increase. Forbs will be diverse.

Community 5.2
Eastern Redcedar-Rocky Mountain Juniper/Kentucky Bluegrass

This plant community phase is a result of heavy, continuous seasonal grazing or heavy, continuous season-long grazing or non-use and/or no surface fire for extended periods of time (typically for 10 or more years). When compared to the 5.1 Eastern Redcedar-Rocky Mountain Juniper/Needle and Thread Plant Community, the amount of non-native invasive cool-season grasses such as Kentucky bluegrass and smooth bromegrass have increased significantly. It is characterized by a dominance of Kentucky bluegrass, prairie sandreed, needle and thread, sedge, and blue grama. The dominance of Kentucky bluegrass is at times so complete that other species are difficult to find on the site. A relatively thick duff layer can sometimes accumulate at or above the soil surface and eventually a thatch-mat layer may develop at the surface as well. Production is limited to the sod forming species. The period that palatability is high is relatively short, as Kentucky bluegrass matures rapidly. Infiltration continues to decrease and runoff increases, energy capture into the system is restricted to early season low producing species. Nutrient cycling is limited by root depth of the dominate species. Biological activity in the soil is likely reduced significantly in this phase.

Community 5.3
Eastern Redcedar-Rocky Mountain Juniper

This plant community phase is a result of no surface fire for extended periods of time (typically for 10 or more years). Coniferous trees have increased significantly, and the herbaceous component has decreased. With the dominance of the coniferous trees such as eastern redcedar and Rocky Mountain juniper, the canopy covers the area and grass species are unable to survive. Grass production for livestock is severely limited. Prescribed burning

before the juniper species reach maturity and are still susceptible to fire (< 5 foot in height), or mechanical brush management can be used to maintain or recover 5.3 Eastern Redcedar-Rocky Mountain Juniper Plant Community Phase.

Pathway 5.1A
Community 5.1 to 5.2

Non-use and/or no surface fire for extended periods of time (typically for 10 or more years) causing litter levels to become high enough to reduce native grass vigor, diversity, and density, and/or heavy continuous grazing or invasion of non-native plant species will shift this plant community to the 5.2 Eastern Red Cedar-Rocky Mountain Juniper/Kentucky Bluegrass Plant Community Phase.

Pathway 5.2A
Community 5.2 to 5.3

No surface fire for extended periods of time (typically for 10 or more years) causing litter levels to become high enough to reduce native grass vigor, diversity, and density, will shift this plant community to the 5.3 Eastern Red Cedar-Rocky Mountain Juniper Plant Community Phase.

State 6
Crop Production State

The Crop Production State is characterized by the production of annual crops using a variety of tillage and cropping systems along with management practices.

Community 6.1
Annual Crops

This plant community developed with the use of a variety of tillage and cropping systems for the production of annual crops including corn, soybeans, wheat, and a variety of other crops.

Transition T1A
State 1 to 2

Heavy, continuous grazing (stocking levels well above carrying capacity for extended portions of the growing season and often at the same time of year each year) or with heavy soil surface disturbance (livestock or mechanical) and wind erosion will cause a shift over a threshold and convert this plant community to the 2.1 Active Blowout Plant Community Phase within the Eroded State (State 2).

Transition T1B
State 1 to 3

Non-use and/or no surface fire for extended periods of time (typically for 10 or more years) causing litter levels to become high enough to reduce native grass vigor, diversity, and density, heavy, continuous grazing, or the invasion of non-native plant species will likely lead this state over a threshold resulting in the Native-Invaded State (State 3).

Transition T1C
State 1 to 5

No surface fire for extended periods of time (typically for 10 or more years) causing litter levels to become high enough to reduce native grass vigor, diversity, and density, and invasion of conifer will likely lead this state over a threshold leading to the 5.1 Eastern Redcedar-Rocky Mountain Juniper/Needle and Thread Plant Community Phase within the Conifer/Invaded State (State 5).

Transition T1D
State 1 to 6

Tillage will cause a shift over a threshold leading to the 6.1 Annual Crops Plant Community Phase within the Crop Production State (State 6).

Transition T2B
State 2 to 3

Seeding coupled with long-term prescribed grazing (moderate stocking levels coupled with adequate recovery periods, or other grazing systems such as high-density, low-frequency intended to treat specific species dominance, or periodic light to moderate stocking levels possibly including periodic rest) and exclusion of use from livestock grazing may lead the Eroded State (State 2) over a threshold to the Native/Invaded State (State 3).

Transition T2A
State 2 to 6

Tillage will cause a shift over a threshold leading to the 6.1 Annual Crops Plant Community Phase within the Crop Production State (State 6).

Transition T3A
State 3 to 2

Heavy, continuous grazing (stocking levels well above carrying capacity for extended portions of the growing season and often at the same time of year each year) or with heavy soil disturbance (livestock or mechanical and wind erosion will cause a shift over a threshold and convert this plant community to the 2.1 Active Blowout Plant Community Phase and the Eroded State (State 2).

Transition T3B
State 3 to 4

Heavy, continuous grazing (stocking levels well above carrying capacity for extended portions of the growing season and often at the same time of year each year), will likely lead this state over a threshold leading to the 4.1 Kentucky Bluegrass-Prairie Sandreed-Needleandthread Community Phase within the Invaded State (State 4). Grazing repeatedly in the early growing season can expedite this shift by causing mechanical disturbance due to trampling.

Transition T3C
State 3 to 6

Tillage will cause a shift over a threshold leading to the 6.1 Annual Crops Plant Community Phase within the Crop Production State (State 6).

Restoration pathway T4A
State 4 to 3

Long-term prescribed grazing (moderate stocking levels coupled with adequate recovery periods, or other grazing systems such as high-density, low-frequency intended to treat specific species dominance, or periodic light to moderate stocking levels possibly including periodic rest) coupled with prescribed burning occurring at relatively frequent intervals (every 3 to 5 years) and a return to normal disturbance regime levels may lead the Invaded State (State 4) over a threshold to the Native/Invaded State (State 3).

Conservation practices

Prescribed Grazing
Integrated Pest Management (IPM)

Transition T4C
State 4 to 5

No surface fire for extended periods of time (typically for 10 or more years) causing litter levels to become high enough to reduce native grass vigor, diversity, and density, and invasion of conifer will likely lead this state over a threshold leading to the 5.2 Eastern Redcedar-Rocky Mountain Juniper/Kentucky Bluegrass Plant Community Phase within the Conifer/Invaded State (State 5).

Transition T4B
State 4 to 6

Tillage will cause a shift over a threshold leading to the 6.1 Annual Crops Plant Community Phase within the Crop Production State (State 6).

Restoration pathway T5A
State 5 to 1

Brush management which would include the mechanical removal of the conifers, coupled with prescribed burning occurring at relatively frequent intervals (3 to 5 years) and a return to normal disturbance regime levels may lead this 5.1 Eastern Redcedar-Rocky Mountain Juniper/Needle and Thread Plant Community Phase within the Conifer/Invaded State (State 5) over a threshold to the Reference State (State 1).

Restoration pathway T5B & T5D
State 5 to 3

Brush management, which would include the mechanical removal of the conifers, coupled with prescribed burning may lead this 5.2 Eastern Redcedar-Rocky Mountain Juniper/Kentucky Bluegrass Plant Community Phase within the Conifer/Invaded State (State 5) over a threshold to the Native/Invaded State (State 3). Brush management, which would include the mechanical removal of the conifers, coupled with prescribed burning prescribed burning occurring at relatively frequent intervals (every 3 to 5 years) and a return to normal disturbance regime levels may lead this 5.3 Eastern Redcedar-Rocky Mountain Juniper Plant Community Phase within the Conifer/Invaded State (State 5) over a threshold to the Native/Invaded State (State 3).

Restoration pathway T5C
State 5 to 4

Brush management, which would include the mechanical removal of the conifers, may lead this 5.2 Eastern Redcedar-Rocky Mountain Juniper/Kentucky Bluegrass Plant Community Phase within the Conifer/Invaded State (State 5) over a threshold to the Invaded State (State 4).

Transition T5E
State 5 to 6

Brush management, which would include the mechanical removal of the conifers, coupled with tillage will cause a shift over a threshold leading to the 6.1 Annual Crops Plant Community Phase within the Crop Production State (State 6).

Restoration pathway T6A
State 6 to 3

Seeding may lead this Crop Production State (State 6) over a threshold to the Native/Invaded State (State 3).

Restoration pathway T6B
State 6 to 4

Seeding may lead this Crop Production State (State 6) over a threshold to the Invaded State (State 4). Cropping followed by abandonment may lead this plant community phase over a threshold to the Invaded State (State 4) and more specifically to the 4.2 Annual Pioneer-Perennial Pioneer Plant Community Phase.

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**			785–1412	
	big bluestem	ANGE	*Andropogon gerardii*	157–942	–
	sand bluestem	ANHA	*Andropogon hallii*	157–942	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	314–942	–
	switchgrass	PAVI2	*Panicum virgatum*	157–628	–
	Indiangrass	SONU2	*Sorghastrum nutans*	0–157	–
2	**Mid Warm-Season Grasses**			314–628	
	little bluestem	SCSC	*Schizachyrium scoparium*	314–628	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–94	–
	purple lovegrass	ERSP	*Eragrostis spectabilis*	0–94	–
3	**Needlegrass**			314–471	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	157–471	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	157–471	–
4	**Short Warm-Season Grasses**			94–314	
	blue grama	BOGR2	*Bouteloua gracilis*	31–157	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	31–157	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	31–157	–
	thin paspalum	PASE5	*Paspalum setaceum*	0–94	–
5	**Other Native Grasses**			94–314	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–157	–
	western wheatgrass	PASM	*Pascopyrum smithii*	31–157	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	31–94	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	31–94	–
	fall rosette grass	DIWI5	*Dichanthelium wilcoxianum*	0–63	–
6	**Grass-likes**			31–157	
	threadleaf sedge	CAFI	*Carex filifolia*	31–157	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–94	–
Forb					
7	**Forbs**			157–314	
	Forb, native	2FN	*Forb, native*	31–94	–
	field sagewort	ARCA12	*Artemisia campestris*	31–63	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	31–63	–
	false boneset	BREU	*Brickellia eupatorioides*	31–63	–
	beardtongue	PENST	*Penstemon*	31–63	–
	scurfpea	PSORA2	*Psoralidium*	31–63	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	31–63	–
	goldenrod	SOLID	*Solidago*	31–63	–

	white heath aster	SYER	*Symphyotrichum ericoides*	31–63	–
	longbract spiderwort	TRBR	*Tradescantia bracteata*	31–63	–
	buckwheat	ERIOG	*Eriogonum*	0–63	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	33–63	–
	blazing star	LIATR	*Liatris*	31–63	–
	hoary puccoon	LICA12	*Lithospermum canescens*	31–63	–
	Carolina puccoon	LICA13	*Lithospermum caroliniense*	0–63	–
	purple prairie clover	DAPU5	*Dalea purpurea*	31–63	–
	Carolina larkspur	DECAV2	*Delphinium carolinianum ssp. virescens*	0–31	–
	smooth horsetail	EQLA	*Equisetum laevigatum*	0–31	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	0–31	–
	hoary verbena	VEST	*Verbena stricta*	0–31	–
	yellow sundrops	CASE12	*Calylophus serrulatus*	0–31	–
	Flodman's thistle	CIFL	*Cirsium flodmanii*	0–31	–
	groundplum milkvetch	ASCR2	*Astragalus crassicarpus*	0–31	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–31	–
	prairie groundsel	PAPL12	*Packera plattensis*	0–31	–
Shrub/Vine					
8	**Shrubs**			63–157	
	leadplant	AMCA6	*Amorpha canescens*	31–94	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–63	–
	rose	ROSA5	*Rosa*	31–63	–
	snowberry	SYMPH	*Symphoricarpos*	0–31	–
	soapweed yucca	YUGL	*Yucca glauca*	0–31	–
	western sandcherry	PRPUB	*Prunus pumila var. besseyi*	0–31	–

Table 9. Community 3.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall Warm-Season Grasses**			471–1059	
	prairie sandreed	CALO	*Calamovilfa longifolia*	353–942	–
	switchgrass	PAVI2	*Panicum virgatum*	118–471	–
	big bluestem	ANGE	*Andropogon gerardii*	0–71	–
	sand bluestem	ANHA	*Andropogon hallii*	0–71	–
2	**Mid Warm-Season Grasses**			0–118	
	purple lovegrass	ERSP	*Eragrostis spectabilis*	0–118	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–118	–
3	**Needlegrass**			235–471	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	235–471	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–71	–
4	**Short Warm-Season Grasses**			118–353	
	blue grama	BOGR2	*Bouteloua gracilis*	47–235	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	47–235	–

	sand dropseed	SPCR	*Sporobolus cryptandrus*	47–282	
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–188	–
5	**Other Native Grasses**			24–188	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–118	–
	western wheatgrass	PASM	*Pascopyrum smithii*	0–118	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	24–47	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–47	–
	fall rosette grass	DIWI5	*Dichanthelium wilcoxianum*	0–24	–
7	**Non-Native Grasses**			71–282	
	Kentucky bluegrass	POPR	*Poa pratensis*	47–282	–
	brome	BROMU	*Bromus*	24–188	–
Forb					
8	**Forbs**			118–235	
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	24–94	–
	field sagewort	ARCA12	*Artemisia campestris*	24–71	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	24–71	–
	smooth horsetail	EQLA	*Equisetum laevigatum*	0–71	–
	goldenrod	SOLID	*Solidago*	24–71	–
	white heath aster	SYER	*Symphyotrichum ericoides*	24–47	–
	hoary verbena	VEST	*Verbena stricta*	0–47	–
	Forb, introduced	2FI	*Forb, introduced*	0–47	–
	Forb, native	2FN	*Forb, native*	0–47	–
	scurfpea	PSORA2	*Psoralidium*	24–47	–
	buckwheat	ERIOG	*Eriogonum*	0–47	–
	blazing star	LIATR	*Liatris*	0–24	–
	prairie groundsel	PAPL12	*Packera plattensis*	0–24	–
	beardtongue	PENST	*Penstemon*	0–24	–
	Flodman's thistle	CIFL	*Cirsium flodmanii*	0–24	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–24	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–24	–
Shrub/Vine					
9	**Shrubs**			24–118	
	soapweed yucca	YUGL	*Yucca glauca*	0–71	–
	snowberry	SYMPH	*Symphoricarpos*	0–47	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–47	–
	leadplant	AMCA6	*Amorpha canescens*	0–24	–
	rose	ROSA5	*Rosa*	0–24	–

Table 10. Community 4.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall Warm-Season Grasses**			101–404	
	prairie sandreed	CALO	*Calamovilfa longifolia*	40–404	–
	switchgrass	PAVI2	*Panicum virgatum*	0–202	–
2	**Needlegrass**			0–303	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–303	–
3	**Short Warm-Season Grasses**			40–202	
	sand dropseed	SPCR	*Sporobolus cryptandrus*	20–161	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–101	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–40	–
4	**Other Native Grasses**			0–101	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–81	–
	fall rosette grass	DIWI5	*Dichanthelium wilcoxianum*	0–40	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–20	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–20	–
5	**Grass-likes**			20–141	
	threadleaf sedge	CAFI	*Carex filifolia*	20–141	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–40	–
6	**Non-Native Grasses**			504–1110	
	Kentucky bluegrass	POPR	*Poa pratensis*	404–1009	–
	brome	BROMU	*Bromus*	20–202	–
Forb					
7	**Forbs**			101–202	
	Forb, introduced	2FI	*Forb, introduced*	20–101	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	20–101	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	20–101	–
	field sagewort	ARCA12	*Artemisia campestris*	20–81	–
	Forb, native	2FN	*Forb, native*	0–61	–
	smooth horsetail	EQLA	*Equisetum laevigatum*	0–61	–
	buckwheat	ERIOG	*Eriogonum*	0–61	–
	scurfpea	PSORA2	*Psoralidium*	20–61	–
	goldenrod	SOLID	*Solidago*	0–61	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–40	–
	hoary verbena	VEST	*Verbena stricta*	0–40	–
Shrub/Vine					
8	**Shrubs**			0–61	
	soapweed yucca	YUGL	*Yucca glauca*	0–61	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–20	–

Animal community

The following table lists annual, suggested initial stocking rates with average growing conditions. These are conservative estimates that should be used only as guidelines in the initial stages of conservation planning. Often the current plant composition does not entirely match any particular plant community (as described in this ES description). Because of this, a resource inventory is necessary to document plant composition and production. More accurate carrying capacity estimates 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. With consultation of the land manager, more intensive grazing management may result in improved harvest efficiencies and increased carrying capacity. Stocking rates are calculated using Animal-Unit-Month (AUM), which is the amount of air-dry forage required to feed a cow, with or without calf, for one month.

Bluestem/Prairie Sandreed/Needlegrass (1.1 & 3.1)
Average Annual Production (lbs./acre, air-dry): 2,800
Stocking Rate* (AUM/acre): 0.77

Sandreed/Switchgrass/Needleandthread/Kentucky Bluegrass (3.2)
Average Annual Production (lbs./acre, air-dry): 2,100
Stocking Rate* (AUM/acre): 0.58

Kentucky Bluegrass/Prairie Sandreed/Needleandthread (4.1)
Average Annual Production (lbs./acre, air-dry): 1,800
Stocking Rate* (AUM/acre): 0.49

Annual/Pioneer, Non-Native Perennial (4.2)
Average Annual Production (lbs./acre, air-dry): 800
Stocking Rate* (AUM/acre): 0.22

*Based on 912 lbs./acre (air-dry weight) per Animal Unit Month (AUM) and on 25 percent harvest efficiency (refer to United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), National Range and Pasture Handbook).

Grazing by domestic livestock is one of the major income-producing industries in the area. Rangeland in this area may provide yearlong forage. During the dormant period, the forage for livestock will likely be lacking protein to meet livestock requirements and added protein will allow 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 is typically high and runoff low on this site high depending on 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 short-grasses form a strong sod and dominate the site. Dominance by blue grama, sedge, bluegrass, and smooth bromegrass will result in reduced infiltration and increased runoff. Areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff (refer to Section 4, NRCS National Engineering Handbook for runoff quantities and hydrologic curves).

Recreational uses

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

Wood products

No appreciable wood products are typically present on this site.

Other products

Seed harvest of native plant species can provide additional income on this site.

Other information

Ecological Site Correlation Issues and Questions:

• SD005 Beadle County, SD did not use the (Ff) Forestburg-Elsmere loamy sands, 0 to 2 percent slopes (national symbol cz2n) as used in the adjoining SD115 Spink County, SD.
• SD005 Beadle County, SD did not use the (Fh) Forestburg-Elsmere-Toko complex, 0 to 2 percent slopes (national symbol cz2p) as used in the adjoining SD115 Spink County, SD.
• Reference and alternative states within the state and transition model are may not be fully documented and may require additional field sampling for refinement.

Inventory data references

There is no NRCS clipping data and other inventory currently available for this site. Information presented here has been derived using field observations from range-trained personnel. Those involved in developing this site include: Stan Boltz, Range Management Specialist, NRCS; and Bruce Kunze, Soil Scientist, NRCS.

Data Source Sample Period State County
SCS-RANGE-417 (0018646111) 10/8/1986 SD Sanborn
SCS-RANGE-417 (0018546111) 10/8/1986 SD Sanborn

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Approval

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This Provisional Ecological Site concept has passed both Quality Control and Quality Assurance processes. Officially approved for publication by David Kraft as of 11/12/2020.

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.

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Date	12/07/2004
Approved by	Stan Boltz
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills should not be present.

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

3. **Number and height of erosional pedestals or terracettes:** Slight pedestalling on bunch grasses.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground less than 10 percent and less than 2 inches in diameter.

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

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

7. **Amount of litter movement (describe size and distance expected to travel):** Little to no plant litter movement. Plant litter remains in place and is not moved by erosional forces.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Stability class usually 4-6. Typical high root content protects soil surface from erosion.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Use soil series description for depth and color of A-horizon.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Healthy, deep rooted native grasses enhance infiltration and reduce runoff.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** No compaction layer should be evident.

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 grass >> mid warm-season bunch grass >

    Sub-dominant: Mid warm-season bunchgrasses > mid and tall cool-season bunch grass >

    Other: Short warm-season grasses = forb = shrub.

    Additional: Due to differing root structure and distribution, Kentucky bluegrass and smooth bromegrass do not fit into reference plant community F/S groups.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very little to no evidence of decadence or mortality.

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14. **Average percent litter cover (%) and depth (in):** Litter cover is in contact with soil surface.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 2,000–3,600 lbs./acre air-dry weight, average 2,800 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:** Refer to State and Local Noxious Weed List.

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17. **Perennial plant reproductive capability:** All species are capable of reproducing.
