

United States Department of Agriculture Natural Resources Conservation Service

Ecological Site Description

Site Type: Rangeland

Site Name: Sands

Site ID: R055CY008SD

Major Land Resource Area (MLRA): 55C – Southern Black Glaciated Plains



Physiographic Features

This site occurs on undulating, gently sloping uplands.

Landform: plain, flood plain

Aspect: N/A

	<u>Minimum</u>	<u>Maximum</u>
Elevation (feet):	1,300	2,000
Slope (percent):	1	9
Water Table Depth (inches):	80	80
Flooding:		
Frequency:	None	Frequent
Duration:	None	Brief
Ponding:		
Depth (inches):	None	None
Frequency:	None	None
Duration:	None	None
Runoff Class:	Negligible	Low

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. Greenup of cool-season plants may occur in September and October when adequate soil moisture is present.

	<u>Minimum</u>	<u>Maximum</u>
Frost-free period (days):	137	159
Freeze-free period (days):	156	180
Mean Annual Precipitation (inches):	19	25

Average Monthly Precipitation (inches) and Temperature (°F):

	Precip. Min.	Precip. Max	Temp. Min.	Temp. Max.
January	0.42	0.54	3.4	31.0
February	0.51	0.81	8.1	36.3
March	1.00	1.61	20.5	47.7
April	2.05	2.50	33.6	62.7
May	2.85	3.47	44.8	74.6
June	3.35	4.15	54.9	84.1
July	2.38	2.97	59.9	91.1
August	2.23	2.87	57.7	88.8
September	1.61	2.71	48.2	79.4
October	1.39	1.76	36.1	65.9
November	0.62	1.09	21.7	47.4
December	0.42	0.65	9.4	34.8

Climate Stations		Period	
Station ID	Location or Name	From	To
SD4037	Howard	1893	2008
SD5228	Marion	1901	2008
SD5561	Miller	1902	2008
SD8767	Wagner	1916	2008

For local climate stations that may be more representative, refer to <http://www.wcc.nrcs.usda.gov>.

Riparian and Wetland Features

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

Representative Soil Features

The soils in this site are excessively well-drained and formed in alluvium or in eolian deposits. The surface layer is three to five 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 one to nine 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/or production.

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

Parent Material Kind: alluvium, eolian deposits

Parent Material Origin:

Surface Texture: fine sand, loamy fine sand

Surface Texture Modifier: none

Subsurface Texture Group: sandy

Surface Fragments ≤3” (% Cover): 0-3

Surface Fragments >3” (%Cover): 0

Subsurface Fragments ≤3” (% Volume): 0

Subsurface Fragments >3” (% Volume): 0

	<u>Minimum</u>	<u>Maximum</u>
Drainage Class:	excessively well	excessively well
Permeability Class:	moderately rapid	moderately rapid
Depth (inches):	80	80
Electrical Conductivity (mmhos/cm)*:	0	0
Sodium Absorption Ratio*:	0	0
Soil Reaction (1:1 Water)*:	5.6	8.4
Soil Reaction (0.1M CaCl₂)*:	NA	NA
Available Water Capacity (inches)*:	2	3
Calcium Carbonate Equivalent (percent)*:	0	5

*These attributes represent from 0-40 inches or to the first restrictive layer.

Plant Communities

Ecological Dynamics of the Site:

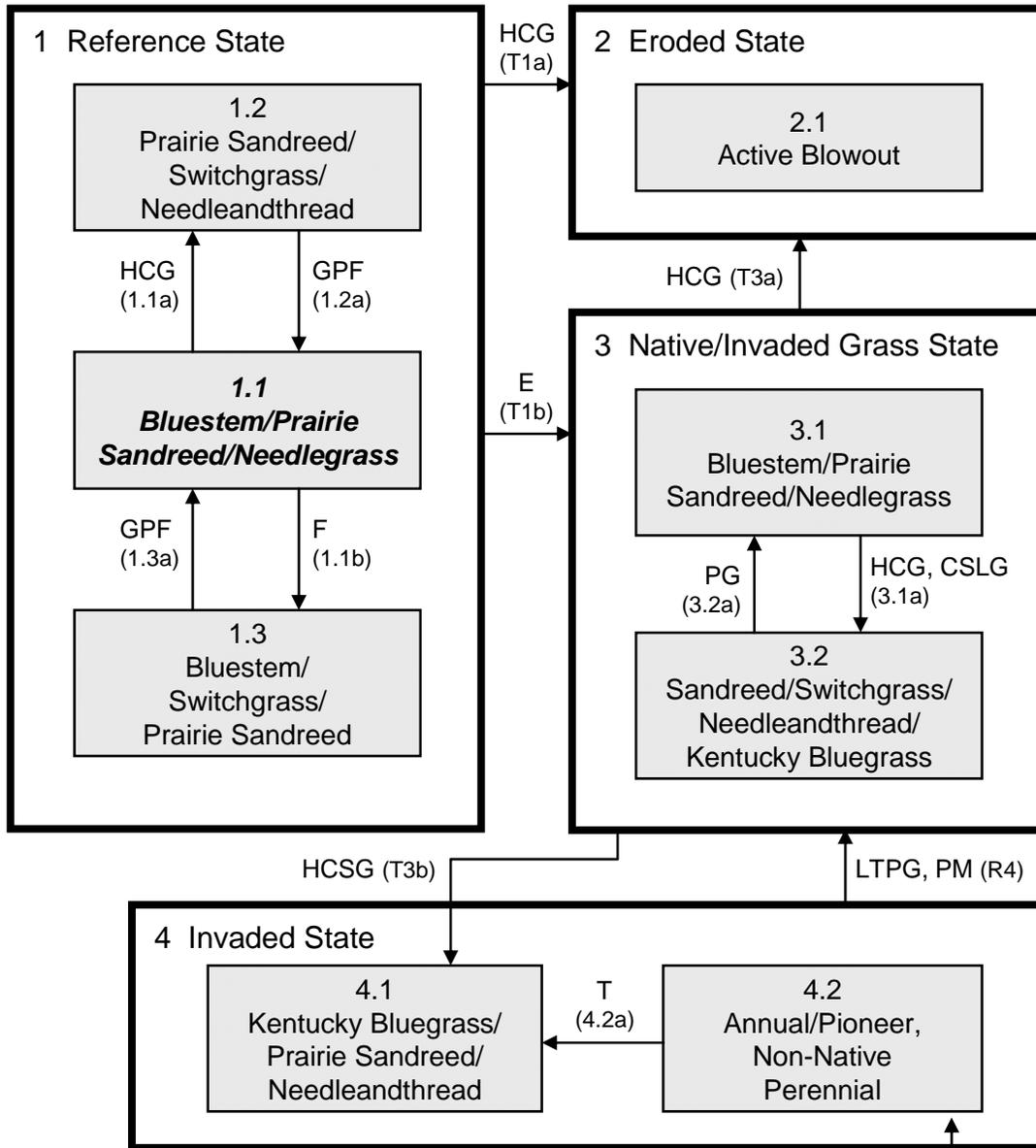
This site developed under Northern Great Plains climatic conditions, light to severe grazing by bison and other large herbivores, sporadic natural or man-caused wildfire (often of light intensities), and other biotic and abiotic factors that typically influence soil/site development. Changes will occur in the plant communities due to short-term weather variations, impacts of native and/or exotic plant and animal species, and management actions. While the following plant community descriptions describe more typical transitions that will occur, severe disturbances, such as periods of well below average precipitation, can cause significant shifts in plant communities and/or species composition.

Heavy continuous grazing (season-long grazing during the typical growing season of April through October and/or repeated seasonal grazing during the same time of year each year) without adequate recovery periods following grazing events causes departure from the Bluestem/Needlegrass/Prairie Sandreed Plant Community Phase (3.1). Sedge and blue grama will increase and eventually develop into a sod. Western wheatgrass will increase initially and then begin to decrease. Needleandthread, porcupine grass, sideoats grama, big bluestem, and little bluestem will decrease in frequency and production. Extended periods of nonuse and/or lack of fire will result in excessive litter and a plant community dominated by cool-season grasses such as Kentucky bluegrass, smooth brome grass, and cheatgrass.

Interpretations are primarily based on the 1.1 Bluestem/Needlegrass/Prairie Sandreed 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.

The following is a diagram that illustrates the common plant community phases that can occur on the site and the transition pathways between communities. These are the most common plant community phases based on current knowledge and experience and changes may be made as more data is collected. Narratives following the diagram contain more detail pertaining to the ecological processes.

Plant Communities and Transitional Pathways



Refer to narrative for details on pathways: **C** – Cropped, abandoned; **CSLG** – Continuous season-long grazing; **E** – Encroachment of introduced species; **F** – Fire; **GPF** – Grazing, precipitation, and/or fire returning to more normal disturbance regime levels and frequencies; **HCG** – Heavy continuous grazing; **HCSG** – Heavy continuous seasonal grazing; **LTPG** – Long-term prescribed grazing; **PG** – Prescribed grazing; **T** – Time, w/wo disturbances; **S** – Seeding.

Any Plant Community

Plant Community Composition and Group Annual Production

COMMON/GROUP NAME	SCIENTIFIC NAME	SYMBOL	1.1 Bluestem/Prairie Sandreed/ Needlegrass		
			Group	lbs./acre	% Comp
GRASSES & GRASS-LIKES				2380 - 2660	85 - 95
TALL WARM-SEASON GRASSES			1	700 - 1260	25 - 45
sand bluestem	Andropogon hallii	ANHA	1	140 - 840	5 - 30
big bluestem	Andropogon gerardii	ANGE	1	140 - 840	5 - 30
prairie sandreed	Calamovilfa longifolia	CALO	1	280 - 840	10 - 30
switchgrass	Panicum virgatum	PAVI2	1	140 - 560	5 - 20
Indiangrass	Sorghastrum nutans	SONU2	1	0 - 140	0 - 5
MID WARM-SEASON GRASSES			2	280 - 560	10 - 20
little bluestem	Schizachyrium scoparium	SCSC	2	280 - 560	10 - 20
sideoats grama	Bouteloua curtipendula	BOCU	2	0 - 84	0 - 3
purple lovegrass	Eragrostis spectabilis	ERSP	2	0 - 84	0 - 3
NEEDLEGRASS			3	280 - 420	10 - 15
porcupine grass	Hesperostipa spartea	HESP11	3	140 - 420	5 - 15
needleandthread	Hesperostipa comata ssp. comata	HECOC8	3	140 - 420	5 - 15
SHORT WARM-SEASON GRASSES			4	84 - 280	3 - 10
blue grama	Bouteloua gracilis	BOGR2	4	28 - 140	1 - 5
hairy grama	Bouteloua hirsuta	BOHI2	4	28 - 140	1 - 5
sand dropseed	Sporobolus cryptandrus	SPCR	4	28 - 140	1 - 5
sand paspalum	Paspalum setaceum	PASE5	4	0 - 84	0 - 3
OTHER NATIVE GRASSES			5	84 - 280	3 - 10
western wheatgrass	Pascopyrum smithii	PASM	5	28 - 140	1 - 5
prairie junegrass	Koeleria macrantha	KOMA	5	28 - 84	1 - 3
Scribner panicum	Dichanthelium oligosanthes var. scribnerianum	DIOLS	5	28 - 84	1 - 3
Wilcox panicum	Dichanthelium wilcoxianum	DIWI5	5	0 - 56	0 - 2
other grasses		2GRAM	5	0 - 140	0 - 5
GRASS-LIKES			6	28 - 140	1 - 5
threadleaf sedge	Carex filifolia	CAFI	6	28 - 140	1 - 5
other grass-like		2GL	6	0 - 84	0 - 3
FORBS			8	140 - 280	5 - 10
Carolina puccoon	Lithospermum carolinense	LICA13	8	0 - 56	0 - 2
cudweed sagewort	Artemisia ludoviciana	ARLU	8	28 - 56	1 - 2
cutleaf ironplant	Machaeranthera pinnatifida	MAPI	8	0 - 28	0 - 1
erigonum	Eriogonum spp.	ERIOG	8	0 - 56	0 - 2
false boneset	Brickellia eupatorioides	BREU	8	28 - 56	1 - 2
Flodman's thistle	Cirsium flodmanii	CIFL	8	0 - 28	0 - 1
gayfeather	Liatris spp.	LIATR	8	28 - 56	1 - 2
goldenrod	Solidago spp.	SOLID	8	28 - 56	1 - 2
green sagewort	Artemisia campestris	ARCA12	8	28 - 56	1 - 2
groundplum milkvetch	Astragalus crassicaupus	ASCR2	8	0 - 28	0 - 1
heath aster	Symphotrichum ericoides	SYER	8	28 - 56	1 - 2
hoary puccoon	Lithospermum canescens	LICA12	8	28 - 56	1 - 2
horsetail	Equisetum laevigatum	EQLA	8	0 - 28	0 - 1
penstemon	Penstemon spp.	PENST	8	28 - 56	1 - 2
plains larkspur	Delphinium carolinianum ssp. virescens	DECAV2	8	0 - 28	0 - 1
prairie coneflower	Ratibida columnifera	RACO3	8	28 - 56	1 - 2
prairie groundsel	Packera plattensis	PAPL12	8	0 - 28	0 - 1
bracted spiderwort	Tradescantia bracteata	TRBR	8	28 - 56	1 - 2
purple prairie clover	Dalea purpurea	DAPU5	8	28 - 56	1 - 2
scurfpea	Psoralegium spp.	PSORA2	8	28 - 56	1 - 2
serrateleaf eveningprimrose	Calylophus serrulatus	CASE12	8	0 - 28	0 - 1
stiff sunflower	Helianthus pauciflorus	HEPA19	8	28 - 56	1 - 2
western ragweed	Ambrosia psilostachya	AMPS	8	0 - 28	0 - 1
woolly verbena	Verbena stricta	VEST	8	0 - 28	0 - 1
native forbs		2FN	8	28 - 84	1 - 3
SHRUBS			9	56 - 140	2 - 5
leadplant	Amorpha canescens	AMCA6	9	28 - 84	1 - 3
rose	Rosa spp.	ROSA5	9	28 - 56	1 - 2
snowberry	Symphoricarpos spp.	SYMPH	9	0 - 28	0 - 1
western sandcherry	Prunus pumila var. besseyi	PRPUB	9	0 - 28	0 - 1
yucca	Yucca glauca	YUGL	9	0 - 28	0 - 1
other shrubs		2SHRUB	9	0 - 56	0 - 2

Annual Production lbs./acre		LOW	RV	HIGH
GRASSES & GRASS-LIKES		1820 -	2492	-3125
FORBS		125 -	210	-320
SHRUBS		55 -	98	-155
TOTAL		2000 -	2800	-3600

This list of plants and their relative proportions are based on near normal years. Fluctuations in species composition and relative production may change from year to year dependent upon precipitation or other climatic factors. RV = Representative value.

Plant Community Composition and Group Annual Production

COMMON/GROUP NAME	SYMBOL	1.1 Bluestem/Prairie Sandreed/ Needlegrass			3.2 Sandreed/Switchgrass/Needle- andthread/Kentucky Bluegrass			4.1 Kentucky Bluegrass/Prairie Sandreed/Needleandthread		
		Grp	lbs./acre	% Comp	Grp	lbs./acre	% Comp	Grp	lbs./acre	% Comp
GRASSES & GRASS-LIKES			2380 - 2660	85 - 95		1785 - 1995	85 - 95		1530 - 1710	85 - 95
TALL WARM-SEASON GRASSES		1	700 - 1260	25 - 45	1	420 - 945	20 - 45	1	90 - 360	5 - 20
sand bluestem	ANHA	1	140 - 840	5 - 30	1	0 - 63	0 - 3			
big bluestem	ANGE	1	140 - 840	5 - 30	1	0 - 63	0 - 3			
prairie sandreed	CALO	1	280 - 840	10 - 30	1	315 - 840	15 - 40	1	36 - 360	2 - 20
switchgrass	PAV12	1	140 - 560	5 - 20	1	105 - 420	5 - 20	1	0 - 180	0 - 10
Indiangrass	SONU2	1	0 - 140	0 - 5						
MID WARM-SEASON GRASSES		2	280 - 560	10 - 20	2	0 - 105	0 - 5	2		
little bluestem	SCSC	2	280 - 560	10 - 20	2	0 - 105	0 - 5			
sideoats grama	BOCU	2	0 - 84	0 - 3						
purple lovegrass	ERSP	2	0 - 84	0 - 3	2	0 - 105	0 - 5			
NEEDLEGRASS		3	280 - 420	10 - 15	3	210 - 420	10 - 20	3	0 - 270	0 - 15
porcupine grass	HEBP11	3	140 - 420	5 - 15	3	0 - 63	0 - 3			
needleandthread	HECOC8	3	140 - 420	5 - 15	3	210 - 420	10 - 20	3	0 - 270	0 - 15
SHORT WARM-SEASON GRASSES		4	84 - 280	3 - 10	4	105 - 315	5 - 15	4	36 - 180	2 - 10
blue grama	BOGR2	4	28 - 140	1 - 5	4	42 - 210	2 - 10	4	0 - 90	0 - 5
hairy grama	BOHI2	4	28 - 140	1 - 5	4	0 - 168	0 - 8	4	0 - 36	0 - 2
sand dropseed	SPCR	4	28 - 140	1 - 5	4	42 - 210	2 - 10	4	18 - 144	1 - 8
sand paspalum	PASE5	4	0 - 84	0 - 3						
OTHER NATIVE GRASSES		5	84 - 280	3 - 10	5	21 - 168	1 - 8	5	0 - 90	0 - 5
western wheatgrass	PASM	5	28 - 140	1 - 5	5	0 - 105	0 - 5			
prairie junegrass	KOMA	5	28 - 84	1 - 3	5	21 - 42	1 - 2	5	0 - 18	0 - 1
Scribner panicum	DIOLS	5	28 - 84	1 - 3	5	0 - 42	0 - 2	5	0 - 18	0 - 1
Wilcox panicum	DIW15	5	0 - 56	0 - 2	5	0 - 21	0 - 1	5	0 - 36	0 - 2
other grasses	2GRAM	5	0 - 140	0 - 5	5	0 - 105	0 - 5	5	0 - 72	0 - 4
GRASS-LIKES		6	28 - 140	1 - 5	6	42 - 210	2 - 10	6	18 - 126	1 - 7
threadleaf sedge	CAFI	6	28 - 140	1 - 5	6	42 - 210	2 - 10	6	18 - 126	1 - 7
other grass-likes	2GL	6	0 - 84	0 - 3	6	0 - 63	0 - 3	6	0 - 36	0 - 2
NON-NATIVE GRASSES		7			7	63 - 252	3 - 12	7	450 - 990	25 - 55
annual bromegrass	2BROMU				7	21 - 168	1 - 8	7	18 - 180	1 - 10
Kentucky bluegrass	POPR				7	42 - 252	2 - 12	7	360 - 900	20 - 50
FORBS		8	140 - 280	5 - 10	8	105 - 210	5 - 10	8	90 - 180	5 - 10
Carolina puccoon	LICA13	8	0 - 56	0 - 2						
cutweed sagewort	ARLU	8	28 - 56	1 - 2	8	21 - 63	1 - 3	8	18 - 90	1 - 5
cutleaf ironplant	MAPI	8	0 - 28	0 - 1						
eriogonum	ERIOG	8	0 - 56	0 - 2	8	0 - 42	0 - 2	8	0 - 54	0 - 3
false boneset	BREU	8	28 - 56	1 - 2						
Flodman's thistle	CIFL	8	0 - 28	0 - 1	8	0 - 21	0 - 1			
gayfeather	LIATR	8	28 - 56	1 - 2	8	0 - 21	0 - 1			
goldenrod	SOLID	8	28 - 56	1 - 2	8	21 - 63	1 - 3	8	0 - 54	0 - 3
green sagewort	ARCA12	8	28 - 56	1 - 2	8	21 - 63	1 - 3	8	18 - 72	1 - 4
groundplum milkwetch	ASCR2	8	0 - 28	0 - 1						
heath aster	SYER	8	28 - 56	1 - 2	8	21 - 42	1 - 2	8	0 - 36	0 - 2
hoary puccoon	LICA12	8	28 - 56	1 - 2						
horsetail	EQLA	8	0 - 28	0 - 1	8	0 - 63	0 - 3	8	0 - 54	0 - 3
penstemon	PENST	8	28 - 56	1 - 2	8	0 - 21	0 - 1			
plains larkspur	DECAV2	8	0 - 28	0 - 1						
prairie coneflower	RACO3	8	28 - 56	1 - 2	8	0 - 21	0 - 1			
prairie groundsel	PAPL12	8	0 - 28	0 - 1	8	0 - 21	0 - 1			
bracted spiderwort	TRBR	8	28 - 56	1 - 2						
purple prairie clover	DAPU5	8	28 - 56	1 - 2	8	0 - 21	0 - 1			
scurfpea	PSORA2	8	28 - 56	1 - 2	8	21 - 42	1 - 2	8	18 - 54	1 - 3
serrateleaf eveningprimrose	CASE12	8	0 - 28	0 - 1						
stiff sunflower	HEPA19	8	28 - 56	1 - 2						
western ragweed	AMPS	8	0 - 28	0 - 1	8	21 - 84	1 - 4	8	18 - 90	1 - 5
woolly verbena	VEST	8	0 - 28	0 - 1	8	0 - 42	0 - 2	8	0 - 36	0 - 2
native forbs	2FN	8	28 - 84	1 - 3	8	0 - 42	0 - 2	8	0 - 54	0 - 3
introduced forbs	2FI				8	0 - 63	0 - 3	8	18 - 90	1 - 5
SHRUBS		9	56 - 140	2 - 5	9	21 - 105	1 - 5	9	0 - 54	0 - 3
leadplant	AMCA6	9	28 - 84	1 - 3	9	0 - 21	0 - 1			
rose	ROSA5	9	28 - 56	1 - 2	9	0 - 21	0 - 1			
snowberry	SYMPH	9	0 - 28	0 - 1	9	0 - 42	0 - 2			
western sandcherry	PRPUB	9	0 - 28	0 - 1						
yucca	YUGL	9	0 - 28	0 - 1	9	0 - 63	0 - 3	9	0 - 54	0 - 3
other shrubs	2SHRUB	9	0 - 56	0 - 2	9	0 - 42	0 - 2	9	0 - 18	0 - 1
Annual Production lbs./acre			LOW RV HIGH		LOW RV HIGH		LOW RV HIGH		LOW RV HIGH	
GRASSES & GRASS-LIKES			1820 - 2492 - 3125		1385 - 1880 - 2245		1115 - 1638 - 2145			
FORBS			125 - 210 - 320		95 - 158 - 240		85 - 135 - 200			
SHRUBS			55 - 98 - 155		20 - 63 - 115		0 - 27 - 55			
TOTAL			2000 - 2800 - 3600		1500 - 2100 - 2600		1200 - 1800 - 2400			

This list of plants and their relative proportions are based on near normal years. Fluctuations in species composition and relative production may change from year to year dependent upon precipitation or other climatic factors. RV = Representative value. Refer to PLANTS database for scientific names and codes: <http://plants.usda.gov>

Plant Community and Vegetation State Narratives

Reference State (State 1)

This state represents the natural range of variability that dominated the dynamics of this ES. This state was dominated by warm-season grasses with cool-season grasses being subdominant. In pre-European times, the primary disturbance mechanisms for this site in the reference condition included periods of below and/or above average precipitation, sporadic fire, and herbivory by insects and large ungulates. Timing of fires and herbivory coupled with 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.

1.1 Bluestem/Prairie Sandreed/Needlegrass Plant Community Phase

Interpretations are based primarily on the Bluestem/Prairie Sandreed/Needlegrass Plant Community Phase (this is also considered to be climax). 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 and/or big bluestem, prairie sandreed, switchgrass, little bluestem, needleandthread, and porcupine grass. Other grass or grass-like species included sideoats grama, western wheatgrass, blue grama, hairy grama, threadleaf sedge, Indiangrass, and sand dropseed. This plant community was resilient and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allowed for high drought tolerance. This was a sustainable plant community in regards to site/soil stability, watershed function, and biologic integrity.

The following growth curve is an estimate of the monthly percentages of total annual growth of the dominant species expected during an average year:

Growth curve number: SD5504

Growth curve name: Southern Black Glaciated Plains, warm-season dominant, cool-season subdominant.

Growth curve description: Warm-season dominant, cool-season subdominant.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	3	7	18	25	25	15	7	1	0	0

Transitions or pathways leading to other plant communities were as follows:

- 1.1a – Heavy continuous grazing which included herbivory at moderate to heavy levels at the same time of year each year without adequate recovery periods or a combination of disturbances such as extended periods of below average precipitation coupled with periodic or chronic heavy grazing will shift this community to the *1.2 Prairie Sandreed/Switchgrass/Needleandthread Plant Community Phase*.
- 1.1b – Fire occurring at relatively frequent intervals and occasional grazing events immediately following early season fire 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 Big Bluestem/Switchgrass/Prairie Sandreed Plant Community Phase*.

1.2 Prairie Sandreed/Switchgrass/Needleandthread Plant Community Phase

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, needleandthread, blue grama, sand dropseed, and threadleaf sedge. Grasses of secondary importance included little bluestem, purple lovegrass, hairy grama, western wheatgrass, sand and/or big bluestem, and porcupine grass. Forbs commonly found in this plant community included cudweed sagewort, green sagewort, western ragweed, and scurfpea. This plant community had similar plant composition to the 3.2 Sandreed/Switchgrass/Needleandthread/Kentucky Bluegrass Plant Community Phase (refer to the plant composition tables). The main difference is that this plant community phase did not have the presence of nonnative invasive species such as Kentucky bluegrass.

When compared to the Bluestem/Prairie Sandreed/Needlegrass Plant Community Phase (1.1), prairie sandreed, needleandthread, sand dropseed, threadleaf sedge, and blue grama increased. Bluestems and porcupine grass decreased 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.

The following growth curve is an estimate of the monthly percentages of total annual growth of the dominant species expected during an average year:

Growth curve number: SD5504

Growth curve name: Southern Black Glaciated Plains, warm-season dominant, cool-season subdominant.

Growth curve description: Warm-season dominant, cool-season subdominant.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	3	7	18	25	25	15	7	1	0	0

Transitions or pathways leading to other plant communities are as follows:

- T1a – 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 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)*.
- 1.2a – Grazing, precipitation, and/or fire returned 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 Bluestem/Prairie Sandreed/Needlegrass Plant Community Phase*.

2.1 Active Blowout Plant Community Phase

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 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, 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.

The following growth curve is an estimate of the monthly percentages of total annual growth of the dominant species expected during an average year:

Growth curve number: SD5505

Growth curve name: Southern Black Glaciated Plains, warm-season dominant.

Growth curve description: 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

1.3 Bluestem/Switchgrass/Prairie Sandreed Plant Community Phase

This plant community was a result of fire occurring at relatively frequent intervals. 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 and/or big bluestem, switchgrass, prairie sandreed, Indiangrass, little bluestem, and sideoats grama. Other grass or grass-like species included blue grama, hairy grama, sand dropseed, needleandthread, porcupine grass, and threadleaf sedge. This plant community was not resistant to change and would have readily shifted back to the 1.1 Bluestem/Prairie Sandreed/Needlegrass Plant Community Phase with a return of more normal fire return intervals.

The following growth curve is an estimate of the monthly percentages of total annual growth of the dominant species expected during an average year:

Growth curve number: SD5505

Growth curve name: Southern Black Glaciated Plains, warm-season dominant.

Growth curve description: 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

Transitions or pathways leading to other plant communities were as follows:

- 1.3a – Grazing, precipitation, and/or fire returned 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 Bluestem/Prairie Sandreed/Needlegrass Plant Community Phase*.

Transition from Reference State (State 1) to the Native/Invaded Grass State (State 3)

- T1b – Encroachment of non-native grasses such as Kentucky bluegrass and disruption of natural disturbance regimes (typically as a result of fire suppression following settlement) led this state over a threshold to the *Native/Invaded Grass State (State 3)*.

Native/Invaded Grass State (State 3)

This 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.

3.1 Bluestem/Prairie Sandreed/Needlegrass Plant Community Phase

This plant community phase is similar to the 1.1 Bluestem/Prairie Sandreed/Needlegrass Plant Community Phase but it also contains minor amounts of nonnative invasive grass species such as Kentucky bluegrass and smooth brome grass (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/or big bluestem, prairie sandreed, switchgrass, little bluestem, needleandthread, and porcupine grass. 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 drought tolerance. This is a sustainable plant community in regards to site/soil stability, watershed function, and biologic integrity.

The following growth curve is an estimate of the monthly percentages of total annual growth of the dominant species expected during an average year:

Growth curve number: SD5504

Growth curve name: Southern Black Glaciated Plains, warm-season dominant, cool-season subdominant.

Growth curve description: Warm-season dominant, cool-season subdominant.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	3	7	18	25	25	15	7	1	0	0

Transitions or pathways leading to other plant communities are as follows:

- 3.1a – 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 continuous season-long grazing, or a combination of disturbances such as extended periods of below average precipitation coupled with periodic heavy grazing will shift this community to the *3.2 Sandreed/Switchgrass/Needleandthread/Kentucky Bluegrass Plant Community Phase*.

3.2 Sandreed/Switchgrass/Needleandthread/Kentucky Bluegrass Plant Community

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, needleandthread, blue grama, sand dropseed, and threadleaf sedge. Grasses of secondary importance include little bluestem, purple lovegrass, hairy grama, western wheatgrass, sand and/or big bluestem, and porcupine grass. Forbs commonly found in this plant community include cudweed sagewort, green sagewort, western ragweed, and scurfpea.

When compared to the Bluestem/Prairie Sandreed/Needlegrass Plant Community Phase (1.1), prairie sandreed, needleandthread, sand dropseed, threadleaf sedge, and blue grama increase. Bluestems and porcupine grass 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.

The following growth curve is an estimate of the monthly percentages of total annual growth of the dominant species expected during an average year:

Growth curve number: SD5504

Growth curve name: Southern Black Glaciated Plains, warm-season dominant, cool-season subdominant.

Growth curve description: Warm-season dominant, cool-season subdominant.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	3	7	18	25	25	15	7	1	0	0

Transitions or pathways leading to other plant communities are as follows:

- T3b – Heavy continuous seasonal grazing (stocking levels well above carrying capacity for extended portions of the growing season and at the same time of year each year) will cause a shift across a threshold leading to the *4.1 Kentucky Bluegrass/Prairie Sandreed/Needleandthread Plant Community Phase* within the *Invaded State (State 4)*.
- 3.2a – 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 Bluestem/Prairie Sandreed/Needlegrass Plant Community Phase*.

Invaded State (State 4)

This 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 would tend to 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 greenup and increased moisture and humidity at the soil surface and grazing pressure cannot cause a reduction in sodgrass 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.

4.1 Kentucky Bluegrass/Prairie Sandreed/Needleandthread Plant Community Phase

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, needleandthread, 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. 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.

The following growth curve is an estimate of the monthly percentages of total annual growth of the dominant species expected during an average year:

Growth curve number: SD5502

Growth curve name: Southern Black Glaciated Plains, cool-season dominant, warm-season subdominant.

Growth curve description: 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

Transition Pathway from Any Plant Community to the 4.2 Annual/Pioneer, Non-Native Perennial Plant Community Phase within the Invaded State (State 4)

- T5 – Encroachment of non-native invasive/noxious species, abandonment of cropping, or seeding of introduced and/or native improved varieties of forage species may lead this plant community phase over a threshold to the *Invaded State (State 4)* and more specifically to the *4.2 Annual/Pioneer, Non-native Perennial Plant Community Phase*. In the case of a seeding, refer to the corresponding Forage Suitability Group (FSG) description for adapted species and expected production (production estimates in the FSG description may be unrealistically high due to the degraded condition of the site at this phase).

4.2 Annual/Pioneer, Non-Native Perennial Plant Community Phase

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 nonnative invasive and/or 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.

Transitions or pathways leading to other plant communities are as follows:

- 4.2a – 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*.

Transition Pathway from the Native/Invaded State (State 3) to the Eroded State (State 2)

- T3a – 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 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)*.

Restoration Pathway from the Invaded State (State 4) to the Native/Invaded Grass State (State 3)

- R4 - 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) may lead this plant community phase over a threshold to the *Native/Invaded Grass State (State 3)*. Pest management (i.e., herbicide) may also be needed to suppress cool-season invasive grasses. This will likely take a long period of time, possibly up to 10 years or more and recovery may not be attainable. Success depends on whether native reproductive propagules remain intact on the site.

Ecological Site Interpretations

Animal Community – Wildlife Interpretations

-- Under Development --

Bluestem/Prairie Sandreed/Needlegrass Plant Community Phases (1.1 & 3.1):

Prairie Sandreed/Switchgrass/Needleandthread Plant Community Phases (1.2):

Bluestem/Switchgrass/Prairie Sandreed Plant Community Phase (1.3):

Active Blowout Plant Community Phase (2.1):

Sandreed/Switchgrass/Needleandthread/Kentucky Bluegrass Plant Community Phase (3.2):

Kentucky Bluegrass/Prairie Sandreed/Needleandthread Plant Community Phase (4.1):

Annual/Pioneer, Non-native Perennial Plant Community Phase (4.2):

Animal Preferences (Quarterly – 1,2,3,4†)

Common Name	Cattle	Sheep	Horses	Deer	Antelope	Bison	Elk
Grasses and Grass-like							
big bluestem	U D P D	U D U U	U D P D	U D U U	U D U U	U D P D	U D P D
blue grama	U D P U	D P P D	U D P U	D P P D	D P P D	U D P U	U D P U
hairy grama	U D P U	D P P D	U D P U	D P P D	D P P D	U D P U	U D P U
Indiangrass	U D P D	U D U U	U D P D	U D U U	U D U U	U D P D	U D P D
little bluestem	U D D U	N D N N	U D D U	N D N N	N D N N	U D D U	U D D U
needleandthread	U D U D	N D N U	U D U D	N D N U	N D N U	U D U D	U D U D
porcupine grass	U P U D	N D N U	U P U D	N D N U	N D N U	U P U D	U P U D
prairie junegrass	U D U D	N D N U	U D U D	N D N U	N D N U	U D U D	U D U D
prairie sandreed	U D D U	U D U U	U D D U	U D U U	U D U U	U D D U	U D D U
purple lovegrass	U U U U	N N N N	U U U U	N N N N	N N N N	U U U U	U U U U
sand bluestem	U D P D	U D U U	U D P D	U D U U	U D U U	U D P D	U D P D
sand dropseed	N U N N	N U N N	N U N N	N U N N	N U N N	N U N N	N U N N
sand paspalum	N U U N	N U N N	N U U N	N U N N	N U N N	N U U N	N U U N
Scribner panicum	U U D U	N U N N	U U D U	N U N N	N U N N	U U D U	U U D U
sideoats grama	U D P U	U P D U	U D P U	U P D U	U P D U	U D P U	U D P U
switchgrass	U D D U	U D U U	U D D U	N N N N	N N N N	U D D U	U D D U
threadleaf sedge	U D U D	U P N D	U D U D	U D U D	U D U D	U D U D	U D U D
western wheatgrass	U P D U	N D N N	U P D U	N D N N	N D N N	U P D U	U P D U
Wilcox panicum	U U U U	N U N N	U U U U	N U N N	N U N N	U U U U	U U U U
Forbs							
Carolina puccoon	U U U U	U U U U	U U U U	U U U U	U U U U	U U U U	U U U U
cudweed sagewort	U U U U	U U D U	U U U U	U U D U	U U D U	U U U U	U U D U
cutleaf ironplant	U U U U	N U U N	U U U U	N U U N	N U U N	U U U U	N U U N
erigonum	U U D U	U U U U	U U D U	U U U U	U U U U	U U D U	U U U U
false boneset	U U D U	N D U N	U U D U	N D U N	N D U N	U U D U	N D U N
Flodman's thistle	N U U N	N U U N	N U U N	N U U N	N U U N	N U U N	N U U N
gayfeather	U U D U	U P P U	U U D U	U P P U	U P P U	U U D U	U P P U
goldenrod	U U D U	N U U N	U U D U	N U U N	N U U N	U U D U	N U U N
green sagewort	U U U U	U U U U	U U U U	U U U U	U U U U	U U U U	U U U U
groundplum milkvetch	U D U U	U D D U	U D U U	U D D U	U D D U	U D U U	U D D U
heath aster	U U D U	U U P U	U U D U	U U P U	U U P U	U U D U	U U P U
hoary puccoon	U U U U	N U U N	U U U U	N U U N	N U U N	U U U U	N U U N
horsetail	T T T T	T T T T	T T T T	T T T T	T T T T	T T T T	T T T T
penstemon	U U U U	U P P U	U U U U	U P P U	U P P U	U U U U	U P P U
plains larkspur	T T T T	T T T T	T T T T	T T T T	T T T T	T T T T	T T T T
prairie coneflower	U U D U	U P P U	U U D U	U P P U	U P P U	U U D U	U P P U
prairie groundsel	T T T T	T T T T	T T T T	T T T T	T T T T	T T T T	T T T T
bracted spiderwort	U U U U	N N N N	U U U U	N N N N	N N N N	U U U U	N N N N
purple prairie clover	U D P U	U P P U	U D P U	U P P U	U P P U	U D P U	U P P U
scurfpea	U U U U	N U U N	U U U U	N U U N	N U U N	U U U U	N U U N
serrateleaf eveningprimrose	U U U U	N U U N	U U U U	N U U N	N U U N	U U U U	N U U N
stiff sunflower	U D P U	U D P U	U D P U	U D P U	U D P U	U D P U	U D P U
western ragweed	U U U U	N N N N	U U U U	N N N N	N N N N	U U U U	N N N N
woolly verbena	U U U U	N N N N	U U U U	N N N N	N N N N	U U U U	N N N N
Shrubs							
leadplant	U P D U	U P D U	U P D U	U P D U	U P D U	U P D U	U P D U
rose	U D D U	U D D U	U D D U	U D D U	U D D U	U D D U	U D D U
snowberry	U U U U	U U U U	U U U U	D U D D	U U U U	U U U U	D U U U
western sandcherry	D P P D	D U U D	D P P D	P U D P	D U U D	D P P D	P U U P
yucca	D N N D	D U U D	D N N D	D U U D	D U U D	D N N D	D U U D

N = not used; **U** = undesirable; **D** = desirable; **P** = preferred; **T** = toxic

† Quarters: 1 – Jan., Feb., Mar.; 2 – Apr., May, Jun.; 3 – Jul., Aug., Sep.; 4 – Oct., Nov., Dec.

Animal Community – Grazing Interpretations

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.

Plant Community	Average Annual Production (lbs./acre, air-dry)	Stocking Rate* (AUM/acre)
Bluestem/Prairie Sandreed/Needlegrass (1.1 & 3.1)	2,800	0.77
Sandreed/Switchgrass/Needleandthread/Kentucky Bluegrass (3.2)	2,100	0.58
Kentucky Bluegrass/Prairie Sandreed/Needleandthread (4.1)	1,800	0.49
Annual/Pioneer, Non-Native Perennial (4.2)	800	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.

Hydrology 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 shortgrasses form a strong sod and dominate the site. Dominance by blue grama, sedge, bluegrass, and/or 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 esthetic 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.

Supporting Information

Associated Sites

Loamy (R055CY010SD), Thin Upland (R055CY012SD), Loamy Overflow (R055CY020SD)

Similar Sites

(R055CY009SD) – Sandy [more needlegrass and less prairie sandreed; higher production]

Inventory Data References

Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range-trained personnel were also used. Those involved in developing this site include: Stan Boltz, Range Management Specialist, NRCS.

<u>Data Source</u>	<u>Number of Records</u>	<u>Sample Period</u>	<u>State</u>	<u>County</u>
SCS-RANGE-417	2	2005	SD	Sanborn

State Correlation

This site has been correlated in SD in MLRA 55C.

Field Offices/Counties

Armour	Douglas	Huron	Beadle	Plankinton	Aurora
Chamberlain	Brule	Lake Andes	Charles Mix	Redfield	Spink
Clark	Clark	Madison	Lake	Salem	McCook
De Smet	Kingsbury	Miller	Hand	Tyndall	Bon Homme
Faulkton	Faulk	Mitchell	Davison/Hanson	Wessington Springs	Jerauld
Highmore	Hyde	Parker	Turner	Woonsocket	Sanborn
Howard	Miner	Parkston	Hutchinson	Yankton	Yankton

Relationship to Other Established Classifications

Level IV Ecoregions of the Conterminous United States: 42e – Southern Missouri Coteau, 42f – Southern Missouri Coteau Slope, 46n – James River Lowland.

Other References

High Plains Regional Climate Center, University of Nebraska, 830728 Chase Hall, Lincoln, NE 68583-0728. (<http://www.hprcc.unl.edu/>)

USDA, NRCS. National Water and Climate Center, 101 SW Main, Suite 1600, Portland, OR 97204-3224. (<http://wcc.nrcs.usda.gov>)

USDA, NRCS. National Range and Pasture Handbook, September 1997

USDA, NRCS. National Soil Information System, Information Technology Center, 2150 Centre Avenue, Building A, Fort Collins, CO 80526. (<http://nasis.nrcs.usda.gov>)

USDA, NRCS. 2001. The PLANTS Database, Version 3.1 (<http://plants.usda.gov>). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

Site Description Approval

SD, State Range Management Specialist

Date