

United States Department of Agriculture Natural Resources Conservation Service

Ecological Site Description

Site Type: Rangeland

Site Name: Thin Upland

Site ID: R061XN012SD

Major Land Resource Area (MLRA): 61 – Black Hills Foot Slopes

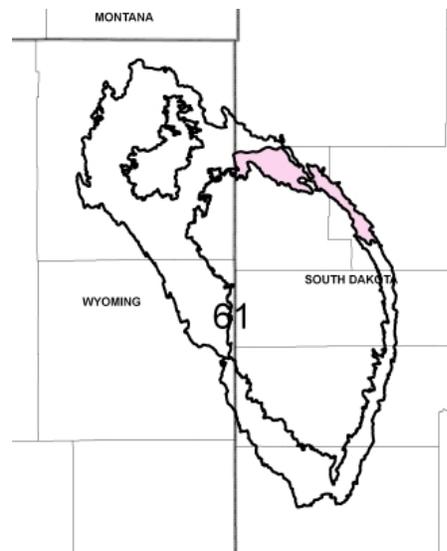
Physiographic Features

This site occurs on moderately to steeply sloping uplands.

Landform: hogback, hill, plain

Aspect: N/A

	<u>Minimum</u>	<u>Maximum</u>
Elevation (feet):	2,900	4,000
Slope (percent):	5	30
Water Table Depth (inches):	None	None
Flooding:		
Frequency:	None	None
Duration:	None	None
Ponding:		
Depth (inches):	None	None
Frequency:	None	None
Duration:	None	None
Runoff Class:	Medium	Very high



Climatic Features

The climate in this MLRA is typical of the drier portions of the Northern Great Plains where sagebrush steppes to the west yield to grassland steppes to the east. Annual precipitation ranges from 18 to 21 inches per year with most occurring during the growing season. Temperatures show a wide range between summer and winter and between daily maximums and minimums, due to the high elevation and dry air, which permits rapid incoming and outgoing radiation. Cold air outbreaks from Canada in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Chinook winds may occur in winter and bring rapid rises in temperature. Extreme storms may occur during the winter, but most severely affect ranch operations during late winter and spring.

The average annual temperature is about 46°F. January is the coldest month with average temperatures ranging from about 20°F (Sundance, Wyoming (WY)), to about 26°F (Fort Meade, South Dakota (SD)). July is the warmest month with temperatures averaging from about 69°F (Sundance, WY), to about 72°F (Fort Meade, SD). The range of average monthly temperatures between the coldest and warmest months is about 48°F. Hourly winds are estimated to average about 11 miles per hour (mph) annually, ranging from about 13 mph during the spring to about 10 mph during the summer. Daytime winds are generally stronger than nighttime and occasional 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):	116	140
Freeze-free period (days):	143	167
Mean Annual Precipitation (inches):	18	21

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

	Precip. Min.	Precip. Max	Temp. Min.	Temp. Max.
January	0.53	0.74	9.3	37.5
February	0.71	0.72	12.6	38.3
March	1.05	1.33	18.9	46.8
April	1.89	2.38	29.0	58.1
May	2.73	4.15	38.9	66.6
June	3.25	3.42	47.7	76.5
July	2.00	2.57	54.6	85.5
August	1.43	1.68	52.8	84.7
September	1.28	1.40	43.0	76.0
October	1.34	1.68	32.6	62.6
November	0.80	0.87	20.9	49.5
December	0.58	0.74	12.8	38.8

Climate Stations		Period	
Station ID	Location or Name	From	To
SD3069	Fort Meade	1902	2008
SD7882	Spearfish	1893	2008
WY8705	Sundance	1915	2005

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 common features of soils in this site are very fine sandy loam to silt loam textured subsurface soils, with slopes ranging from about 5 to 30 percent. The soils in this site are well-drained and formed in residuum or colluvium. The loam or silt loam surface layer is four to eight inches thick. The soils have a moderately slow to slow infiltration rate. These soils are calcareous at or near the surface. This site typically should show slight to no evidence of rills, wind scoured areas, or pedestalled plants. If present, water flow paths are broken, irregular in appearance, or discontinuous. The soil surface is stable and intact. Subsurface soil layers are nonrestrictive to water movement and root penetration.

These soils are mainly susceptible to water erosion. The hazard of water erosion increases on slopes greater than about 10 percent. Loss of 50 percent or more of the surface layer of the soils on this site can result in a shift in species composition and/or production.

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

Parent Material Kind: residuum, colluvium
Parent Material Origin:
Surface Texture: loam, silt loam
Surface Texture Modifier: none
Subsurface Texture Group: loamy
Surface Fragments ≤3” (% Cover): 0-10
Surface Fragments >3” (%Cover): 0-15
Subsurface Fragments ≤3” (% Volume): 0-30
Subsurface Fragments >3” (% Volume): 0-12

	<u>Minimum</u>	<u>Maximum</u>
Drainage Class:	well	well
Permeability Class:	slow	moderately slow
Depth (inches):	40	80
Electrical Conductivity (mmhos/cm)*:	0	4
Sodium Absorption Ratio*:	0	1
Soil Reaction (1:1 Water)*:	6.6	9.0
Soil Reaction (0.1M CaCl2)*:	NA	NA
Available Water Capacity (inches)*:	6	8
Calcium Carbonate Equivalent (percent)*:	5	40

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

Plant Communities

Ecological Dynamics of the Site

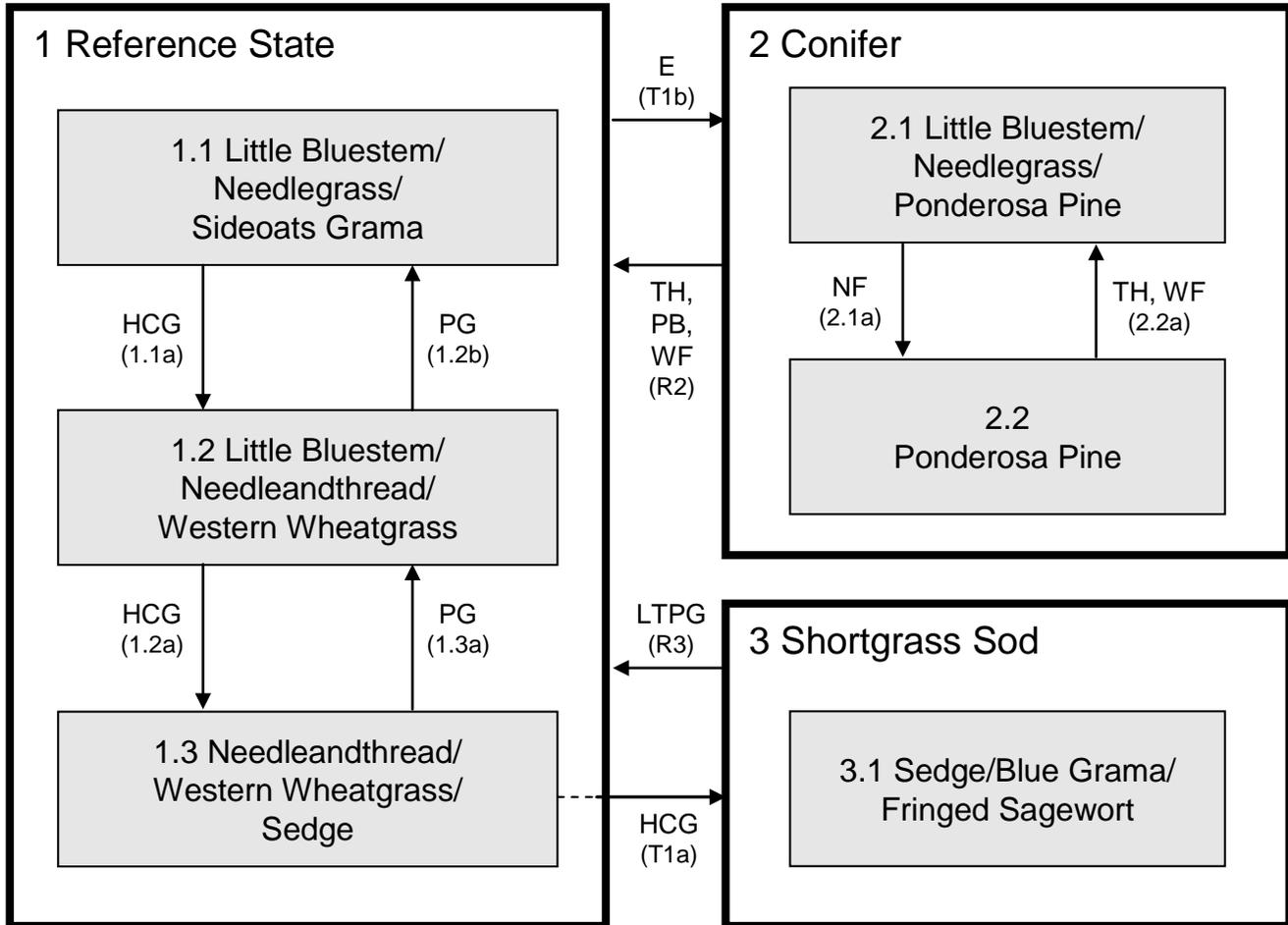
This site developed under Northern Great Plains climatic conditions, light to severe grazing by bison and other large herbivores, sporadic natural or man-caused wildfire (often of light intensities), and other biotic and abiotic factors that typically influence soil/site development. Changes will occur 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 (e.g., every spring and/or every summer at moderate to heavy stocking levels) without adequate recovery periods following grazing events causes departure from the Little Bluestem/Needlegrass/Sideoats Grama Plant Community Phase (1.1). Blue grama and sedge will increase and eventually develop into a sod. Western wheatgrass will increase initially and then begin to decrease. Needleandthread, green needlegrass, big bluestem, sideoats grama, Indiangrass, and little bluestem will decrease in frequency and production. Excessive defoliation can cause threewain and annuals to increase and dominate the site. 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 green needlegrass, western wheatgrass, bluegrass, smooth brome grass, and cheatgrass.

Interpretations are primarily based on the Little Bluestem/Needlegrass/Sideoats Grama Plant Community Phase (1.1). 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: **E** – Encroachment; **HCG** – Heavy continuous grazing; **LTPG** – Long-term prescribed grazing; **NF** – No fire; **PB** – Prescribed burning; **PG** – Prescribed grazing; **TH** – Timber harvest; **WF** – Wildfire.

Plant Community Composition and Group Annual Production

COMMON/GROUP NAME	SCIENTIFIC NAME	SYMBOL	1.1 Little Bluestem/Needlegrass/ Sideoats Grama		
			Group	lbs./acre	% Comp
GRASSES & GRASS-LIKES				1920 - 2160	80 - 90
MID WARM-SEASON GRASSES			1	600 - 960	25 - 40
little bluestem	Schizachyrium scoparium	SCSC	1	360 - 960	15 - 40
sideoats grama	Bouteloua curtipendula	BOCU	1	120 - 360	5 - 15
plains muhly	Muhlenbergia cuspidata	MUCU3	1	24 - 192	1 - 8
prairie dropseed	Sporobolus heterolepis	SPHE	1	0 - 120	0 - 5
COOL-SEASON BUNCHGRASSES			2	240 - 600	10 - 25
needleandthread	Hesperostipa comata ssp. comata	HECOC8	2	120 - 480	5 - 20
porcupine grass	Hesperostipa spartea	HESP11	2	48 - 360	2 - 15
green needlegrass	Nassella viridula	NAVI4	2	24 - 120	1 - 5
bluebunch wheatgrass	Pseudoroegneria spicata	PSSP6	2	0 - 120	0 - 5
TALL WARM-SEASON GRASSES			3	120 - 360	5 - 15
big bluestem	Andropogon gerardii	ANGE	3	120 - 360	5 - 15
Indiangrass	Sorghastrum nutans	SONU2	3	0 - 120	0 - 5
prairie sandreed	Calamovilfa longifolia	CALO	3	0 - 120	0 - 5
WHEATGRASS			4	120 - 240	5 - 10
western wheatgrass	Pascopyrum smithii	PASM	4	120 - 240	5 - 10
slender wheatgrass	Elymus trachycaulus	ELTR7	4	0 - 120	0 - 5
SHORT WARM-SEASON GRASSES			5	24 - 120	1 - 5
blue grama	Bouteloua gracilis	BOGR2	5	24 - 120	1 - 5
hairy grama	Bouteloua hirsuta	BOHI2	5	0 - 72	0 - 3
threeawn	Aristida spp.	ARIST	5	0 - 24	0 - 1
OTHER NATIVE GRASSES			6	24 - 120	1 - 5
prairie junegrass	Koeleria macrantha	KOMA	6	24 - 72	1 - 3
Cusick's bluegrass	Poa cusickii	POCU3	6	0 - 48	0 - 2
Sandberg bluegrass	Poa secunda	POSE	6	0 - 24	0 - 1
other grasses		2GRAM	6	0 - 96	0 - 4
GRASS-LIKES			7	24 - 120	1 - 5
threadleaf sedge	Carex filifolia	CAFI	7	24 - 120	1 - 5
other grass-likes		2GL	7	0 - 72	0 - 3
FORBS			9	120 - 240	5 - 10
American vetch	Vicia americana	VIAM	9	24 - 48	1 - 2
bigtop dalea	Dalea enneandra	DAEN	9	0 - 48	0 - 2
cudweed sagewort	Artemisia ludoviciana	ARLU	9	24 - 48	1 - 2
dotted gayfeather	Liatris punctata	LIPU	9	24 - 48	1 - 2
downy Indian paintbrush	Castilleja purpurea	CAPU11	9	0 - 24	0 - 1
goldenrod	Solidago spp.	SOLID	9	24 - 48	1 - 2
green sagewort	Artemisia campestris	ARCA12	9	0 - 24	0 - 1
groundplum milkvetch	Astragalus crassicaerpus	ASCR2	9	0 - 24	0 - 1
hairy goldaster	Heterotheca villosa	HEVI4	9	0 - 24	0 - 1
penstemon	Penstemon spp.	PENST	9	24 - 48	1 - 2
prairie coneflower	Ratibida columnifera	RACO3	9	24 - 48	1 - 2
prairie spiderwort	Tradescantia occidentalis	TROC	9	0 - 24	0 - 1
purple coneflower	Echinacea angustifolia	ECAN2	9	24 - 72	1 - 3
purple prairie clover	Dalea purpurea	DAPU5	9	0 - 24	0 - 1
pussytoes	Antennaria spp.	ANTEN	9	0 - 24	0 - 1
scarlet gaura	Gaura coccinea	GACO5	9	24 - 48	1 - 2
scarlet globemallow	Sphaeralcea coccinea	SPCO	9	0 - 24	0 - 1
scurfpea	Psoralegium spp.	PSORA2	9	24 - 48	1 - 2
spiny phlox	Phlox hoodii	PHHO	9	0 - 24	0 - 1
stiff sunflower	Helianthus pauciflorus	HEPA19	9	24 - 48	1 - 2
white prairie aster	Symphyotrichum falcatum	SYFA	9	24 - 48	1 - 2
native forbs		2FN	9	24 - 72	1 - 3
SHRUBS			10	120 - 240	5 - 10
cactus	Opuntia spp.	OPUNT	10	0 - 24	0 - 1
elderberry	Sambucus spp.	SAMBU	10	0 - 24	0 - 1
fringed sagewort	Artemisia frigida	ARFR4	10	24 - 48	1 - 2
juneberry	Amelanchier alnifolia	AMAL2	10	0 - 24	0 - 1
leadplant	Amorpha canescens	AMCA6	10	24 - 96	1 - 4
rose	Rosa spp.	ROSA5	10	24 - 48	1 - 2
skunkbush sumac	Rhus trilobata	RHTR	10	0 - 24	0 - 1
snowberry	Symphoricarpos spp.	SYMPH	10	24 - 72	1 - 3
other shrubs		2SHRUB	10	0 - 72	0 - 3

Annual Production lbs./acre	LOW	RV	HIGH
GRASSES & GRASS-LIKES	1390 -	2040	2650
FORBS	105 -	180	275
SHRUBS	105 -	180	275
TOTAL	1600 -	2400	3200

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 Little Bluestem/Needle-grass/Sideoats Grama			1.2 Little Bluestem/Needleand-thread/Western Wheatgrass			1.3 Needleandthread/Western Wheatgrass/Sedge			3.1 Sedge/Blue Grama/Fringed Sagewort		
		Grp	lbs./acre	% Comp	Grp	lbs./acre	% Comp	Grp	lbs./acre	% Comp	Grp	lbs./acre	% Comp
GRASSES & GRASS-LIKES			1920 - 2160	80 - 90		1600 - 1800	80 - 90		1280 - 1440	80 - 90		840 - 1020	70 - 85
MID WARM-SEASON GRASSES		1	600 - 960	25 - 40	1	300 - 600	15 - 30	1	32 - 160	2 - 10	1	0 - 60	0 - 5
little bluestem	SCSC	1	360 - 960	15 - 40	1	200 - 600	10 - 30	1	16 - 160	1 - 10	1	0 - 36	0 - 3
sideoats grama	BOCU	1	120 - 360	5 - 15	1	40 - 200	2 - 10	1	16 - 112	1 - 7	1	0 - 48	0 - 4
plains muhly	MUCU3	1	24 - 192	1 - 8	1	0 - 60	0 - 3						
prairie dropseed	SPHE	1	0 - 120	0 - 5									
COOL-SEASON BUNCHGRASSES		2	240 - 600	10 - 25	2	200 - 500	10 - 25	2	240 - 480	15 - 30	2	0 - 120	0 - 10
needleandthread	HECOC8	2	120 - 480	5 - 20	2	200 - 500	10 - 25	2	240 - 480	15 - 30	2	0 - 120	0 - 10
porcupine grass	HESP11	2	48 - 360	2 - 15	2	0 - 160	0 - 8	2	0 - 48	0 - 3			
green needlegrass	NAV14	2	24 - 120	1 - 5	2	0 - 80	0 - 4	2	0 - 64	0 - 4			
bluebunch wheatgrass	PSSP6	2	0 - 120	0 - 5	2	0 - 20	0 - 1						
TALL WARM-SEASON GRASSES		3	120 - 360	5 - 15	3	20 - 200	1 - 10	3	0 - 80	0 - 5	3		
big bluestem	ANGE	3	120 - 360	5 - 15	3	20 - 160	1 - 8	3	0 - 80	0 - 5			
Indiangrass	SONU2	3	0 - 120	0 - 5									
prairie sandreed	CALO	3	0 - 120	0 - 5	3	0 - 80	0 - 4	3	0 - 48	0 - 3			
WHEATGRASS		4	120 - 240	5 - 10	4	100 - 300	5 - 15	4	160 - 320	10 - 20	4	0 - 120	0 - 10
western wheatgrass	PASM	4	120 - 240	5 - 10	4	100 - 300	5 - 15	4	160 - 320	10 - 20	4	0 - 120	0 - 10
slender wheatgrass	ELTR7	4	0 - 120	0 - 5	4	0 - 60	0 - 3						
SHORT WARM-SEASON GRASSES		5	24 - 120	1 - 5	5	20 - 200	1 - 10	5	80 - 240	5 - 15	5	120 - 360	10 - 30
blue grama	BOGR2	5	24 - 120	1 - 5	5	20 - 160	1 - 8	5	32 - 192	2 - 12	5	120 - 360	10 - 30
hairy grama	BOH12	5	0 - 72	0 - 3	5	0 - 100	0 - 5	5	0 - 112	0 - 7	5	0 - 120	0 - 10
threeawn	ARIST	5	0 - 24	0 - 1	5	0 - 40	0 - 2	5	0 - 48	0 - 3	5	0 - 60	0 - 5
OTHER NATIVE GRASSES		6	24 - 120	1 - 5	6	20 - 100	1 - 5	6	16 - 80	1 - 5	6	12 - 60	1 - 5
prairie junegrass	KOMA	6	24 - 72	1 - 3	6	20 - 60	1 - 3	6	16 - 64	1 - 4	6	12 - 36	1 - 3
Cusick's bluegrass	POCU3	6	0 - 48	0 - 2	6	0 - 20	0 - 1						
Sandberg bluegrass	POSE	6	0 - 24	0 - 1	6	0 - 20	0 - 1	6	0 - 32	0 - 2	6	0 - 36	0 - 3
other grasses	2GRAM	6	0 - 96	0 - 4	6	0 - 60	0 - 3	6	0 - 64	0 - 4	6	0 - 36	0 - 3
GRASS-LIKES		7	24 - 120	1 - 5	7	20 - 160	1 - 8	7	80 - 240	5 - 15	7	120 - 360	10 - 30
threadleaf sedge	CAFI	7	24 - 120	1 - 5	7	20 - 160	1 - 8	7	80 - 240	5 - 15	7	120 - 360	10 - 30
other grass-likes	2GL	7	0 - 72	0 - 3	7	0 - 60	0 - 3	7	0 - 80	0 - 5	7	0 - 96	0 - 8
NON-NATIVE GRASSES		8			8	20 - 140	1 - 7	8	32 - 160	2 - 10	8	0 - 120	0 - 10
annual bromegrass	BROMU				8	20 - 100	1 - 5	8	16 - 128	1 - 8	8	0 - 84	0 - 7
bluegrass	POA				8	0 - 100	0 - 5	8	0 - 160	0 - 10	8	0 - 60	0 - 5
smooth bromegrass	BRIN2				8	0 - 60	0 - 3	8	0 - 80	0 - 5			
FORBS		9	120 - 240	5 - 10	9	100 - 200	5 - 10	9	80 - 160	5 - 10	9	60 - 180	5 - 15
American vetch	VIAM	9	24 - 48	1 - 2	9	0 - 20	0 - 1	9	0 - 16	0 - 1			
bigtop dalea	DAEN	9	0 - 48	0 - 2	9	0 - 20	0 - 1						
cutweed sagewort	ARLU	9	24 - 48	1 - 2	9	20 - 60	1 - 3	9	16 - 64	1 - 4	9	12 - 60	1 - 5
dotted gayfeather	LIPU	9	24 - 48	1 - 2	9	0 - 20	0 - 1	9	0 - 16	0 - 1			
downy Indian paintbrush	CAPU11	9	0 - 24	0 - 1									
goldenrod	SOLID	9	24 - 48	1 - 2	9	20 - 60	1 - 3	9	16 - 64	1 - 4	9	12 - 60	1 - 5
green sagewort	ARCA12	9	0 - 24	0 - 1	9	0 - 40	0 - 2	9	16 - 32	1 - 2	9	12 - 48	1 - 4
groundplum milkvetch	ASCR2	9	0 - 24	0 - 1	9	0 - 20	0 - 1						
hairy goldaster	HEVI4	9	0 - 24	0 - 1	9	0 - 20	0 - 1	9	0 - 16	0 - 1			
penstemon	PENST	9	24 - 48	1 - 2	9	0 - 20	0 - 1						
prairie coneflower	RACO3	9	24 - 48	1 - 2	9	0 - 40	0 - 2	9	0 - 16	0 - 1			
prairie spiderwort	TROC	9	0 - 24	0 - 1									
purple coneflower	ECAN2	9	24 - 72	1 - 3	9	0 - 40	0 - 2	9	0 - 16	0 - 1			
purple prairie clover	DAPU5	9	0 - 24	0 - 1	9	0 - 20	0 - 1	9	0 - 16	0 - 1			
pussytoes	ANTEN	9	0 - 24	0 - 1	9	0 - 20	0 - 1	9	0 - 16	0 - 1	9	0 - 24	0 - 2
scarlet gaura	GACO5	9	24 - 48	1 - 2	9	0 - 20	0 - 1						
scarlet globemallow	SPCO	9	0 - 24	0 - 1	9	0 - 20	0 - 1	9	0 - 16	0 - 1	9	0 - 12	0 - 1
scurfpea	PSORA2	9	24 - 48	1 - 2	9	20 - 60	1 - 3	9	16 - 48	1 - 3	9	12 - 36	1 - 3
spiny phlox	PHHO	9	0 - 24	0 - 1	9	0 - 20	0 - 1	9	16 - 32	1 - 2	9	12 - 24	1 - 2
stiff sunflower	HEPA19	9	24 - 48	1 - 2	9	0 - 20	0 - 1						
white prairie aster	SYFA	9	24 - 48	1 - 2	9	20 - 40	1 - 2	9	16 - 32	1 - 2	9	0 - 24	0 - 2
native forbs	2FN	9	24 - 72	1 - 3	9	20 - 60	1 - 3	9	0 - 32	0 - 2	9	0 - 24	0 - 2
introduced forbs	2FI				9	20 - 60	1 - 3	9	16 - 64	1 - 4	9	12 - 84	1 - 7
SHRUBS		10	120 - 240	5 - 10	10	100 - 200	5 - 10	10	80 - 160	5 - 10	10	60 - 180	5 - 15
cactus	OPUNT	10	0 - 24	0 - 1	10	0 - 20	0 - 1	10	0 - 32	0 - 2	10	0 - 48	0 - 4
elderberry	SAMBU	10	0 - 24	0 - 1									
fringed sagewort	ARFR4	10	24 - 48	1 - 2	10	20 - 60	1 - 3	10	16 - 80	1 - 5	10	24 - 120	2 - 10
juneberry	AMAL2	10	0 - 24	0 - 1	10	0 - 20	0 - 1						
leadplant	AMCA6	10	24 - 96	1 - 4	10	0 - 40	0 - 2						
rose	ROSA5	10	24 - 48	1 - 2	10	20 - 40	1 - 2	10	0 - 48	0 - 3	10	0 - 36	0 - 3
skunkbush sumac	RHTR	10	0 - 24	0 - 1	10	0 - 20	0 - 1	10	0 - 16	0 - 1			
snowberry	SYMPH	10	24 - 72	1 - 3	10	20 - 80	1 - 4	10	16 - 48	1 - 3	10	0 - 24	0 - 2
other shrubs	2SHRUB	10	0 - 72	0 - 3	10	0 - 40	0 - 2	10	0 - 48	0 - 3	10	0 - 48	0 - 4
Annual Production lbs./acre			LOW RV HIGH		LOW RV HIGH		LOW RV HIGH		LOW RV HIGH		LOW RV HIGH		LOW RV HIGH
GRASSES & GRASS-LIKES			1390 - 2040 - 2650		1210 - 1700 - 2150		1050 - 1360 - 1640		690 - 960 - 1200				
FORBS			105 - 180 - 275		95 - 150 - 225		75 - 120 - 180		55 - 120 - 200				
SHRUBS			105 - 180 - 275		95 - 150 - 225		75 - 120 - 180		55 - 120 - 200				
TOTAL			1600 - 2400 - 3200		1400 - 2000 - 2600		1200 - 1600 - 2000		800 - 1200 - 1600				

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 dominates the dynamics of this ecological site (ES). This state is 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 occasional fire and grazing by large ungulates. Timing of fires and grazing coupled with weather events dictated the dynamics that occurred within the natural range of variability. Taller cool- and warm-season grasses would have declined and a corresponding increase in short statured grass and grass-like species would have occurred. Today, a similar state can be found on areas that are properly managed with grazing and/or prescribed burning, and sometimes on areas receiving occasional short periods of rest.

1.1 Little Bluestem/Needlegrass/Sideoats Grama Plant Community Phase

Interpretations are based primarily on the Little Bluestem/Needlegrass/Sideoats Grama Plant Community Phase (this is also considered to be climax). The potential vegetation is about 80 percent grasses or grass-like plants, 10 percent forbs, and 10 percent shrubs. The community is dominated by warm-season grasses, with cool-season grasses being subdominant. The major grasses include little bluestem, needleandthread, sideoats grama, porcupine grass, and big bluestem. Other grasses include western wheatgrass, plains muhly, slender wheatgrass, green needlegrass, prairie dropseed, Indiangrass, prairie sandreed, blue grama, and a variety of other grass and grass-like species. 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: SD6104

Growth curve name: Black Hills Foot Slopes, 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	17	25	25	15	7	1	0	0

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

- 1.1a – Heavy continuous grazing (stocking levels well above carrying capacity for extended portions of the growing season) or a combination of disturbances for extended periods of time will lead to the *1.2 Little Bluestem/Needleandthread/Western Wheatgrass Plant Community Phase*.

1.2 Little Bluestem/Needleandthread/Western Wheatgrass Plant Community Phase

This plant community developed under heavy continuous grazing or from over utilization during extended drought periods. This community can also develop where this site occurs near water sources. The potential plant community is made up of approximately 80 percent grasses and grass-like species, 10 percent forbs, and 10 percent shrubs. Dominant grasses include little bluestem, needleandthread, and western wheatgrass. Grasses and grass-like species of secondary importance include sideoats grama, porcupine grass, big bluestem, threadleaf sedge, blue grama, and a variety of other grasses. Forbs commonly found in this plant community include cudweed sagewort, goldenrod, white prairie aster, and scurfpea.

When compared to the Little Bluestem/Needlegrass/Sideoats Grama Plant Community Phase (1.1), blue grama, sedge, and western wheatgrass have increased. Tall warm-season grasses have

decreased, and production has also been reduced. Needleandthread will persist in this phase. This plant community is moderately resistant to change. This is due in part to the shallow rooted nature of the shortgrass species which decreases infiltration especially to the deeper rooted tall and mid grass species. The herbaceous species present are well adapted to grazing; however, species composition can be altered through continued 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: SD6103

Growth curve name: Black Hills Foot Slopes, cool-season/warm-season codominant.

Growth curve description: Cool-season, warm-season codominant.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	3	10	20	28	21	10	5	3	0	0

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

- 1.2a – Heavy continuous grazing (stocking levels well above carrying capacity for extended portions of the growing season) or a combination of disturbances for extended periods of time will lead to the *1.3 Needleandthread/Western Wheatgrass/Sedge Plant Community Phase*.
- 1.2b – 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 *1.1 Little Bluestem/Needlegrass/Sideoats Grama Plant Community Phase*.

1.3 Needleandthread/Western Wheatgrass/Sedge Plant Community Phase

This plant community developed under heavy continuous grazing or from over utilization during extended drought periods. This community can also develop where this site occurs near water sources. The potential plant community is made up of approximately 80 percent grasses and grass-like species, 10 percent forbs, and 10 percent shrubs. Dominant grass and grass-like species include needleandthread, western wheatgrass, threadleaf sedge, and blue grama. Grasses of secondary importance include little bluestem, hairy grama, sideoats grama, big bluestem, green needlegrass, Kentucky and/or Canada bluegrass, and a variety of other grasses. Forbs commonly found in this plant community include cudweed sagewort, goldenrod, white prairie aster, scurfpea, and green sagewort.

When compared to the Little Bluestem/Needlegrass/Sideoats Grama Plant Community Phase (1.1), blue grama, sedge, and western wheatgrass have increased. Tall and mid-warm-season grasses have decreased and production has also been reduced. This plant community is moderately resistant to change. This is due in part to the shallow rooted nature of the shortgrass species which decreases infiltration especially to the deeper rooted tall and mid-grass species. The herbaceous species present are well adapted to grazing; however, species composition can be altered through continued overgrazing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term. This plant community phase is reaching a critical point where continued overgrazing will likely shift this community over a threshold leading to a short grass and grass-like dominated state. The shorter, more grazing tolerant species tend to self-perpetuate as the shallow, dense rooting structure takes advantage of rainfall and reduces deeper infiltration to the taller species.

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: SD6102

Growth curve name: Black Hills Foot Slopes, 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

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) or a combination of disturbances for extended periods of time will lead this plant community over a threshold and result in the *3.1 Sedge/Blue Grama/Fringed Sagewort Plant Community Phase* within the *Shortgrass Sod State (State 3)*.
- 1.3a – 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 *1.2 Little Bluestem/Needleandthread/Western Wheatgrass Plant Community Phase*.

Shortgrass Sod State (State 3)

This state is a result of overgrazing (individual plants of selected species being repeatedly grazed due to continuous grazing systems which allow for long paddock occupation periods). This type of grazing causes reduced vigor of the selected species (i.e., typically the most desired by grazing ungulates). As the photosynthetic area of these species is repeatedly removed, carbohydrate production needed for root respiration is inadequate and the root systems of these species begin to falter. The shorter, more grazing tolerant species are given the advantage and will dominate the site. In the early stages of this state, mid- and tall grass remnants may be present in sufficient quantities to allow for recovery to the Reference State. Over time, this recovery will become less likely due to higher runoff and reduced infiltration.

3.1 Sedge/Blue Grama/Fringed Sagewort Plant Community

This plant community evolved under heavy continuous grazing, heavy continuous season-long grazing, or from over utilization during extended drought periods. The potential plant community is made up of approximately 70 percent grasses and grass-like species, 15 percent forbs, and 15 percent shrubs. Dominant grass and grass-like species include threadleaf sedge, blue grama, and threeawn. Grasses of secondary importance include western wheatgrass, needleandthread, little bluestem, sideoats grama, hairy grama, and prairie Junegrass. Cheatgrass may also invade and become quite prevalent. Forbs commonly found in this plant community include cudweed sagewort, goldenrod, spiny phlox, and green sagewort. When compared to the Little Bluestem/Needlegrass/Sideoats Grama Plant Community Phase (1.1), short statured species are dominant on this plant community. Tall and mid-grasses have decreased significantly. This vegetation state is very resistant to change due to the increase in the root mat near the surface of the soil which further reduces infiltration. The herbaceous species present are well adapted to grazing.

This plant community is less productive than other plant community phases. The thick sod prevents other species from getting established. Lack of litter and reduced plant vigor causes higher soil temperatures, poor water infiltration rates, and high evapotranspiration which give the short statured species a competitive advantage. Soil erosion will be minimal due to the sod forming habit of dominant species 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: SD6103

Growth curve name: Black Hills Foot Slopes, cool-season/warm-season codominant.

Growth curve description: Cool-season, warm-season codominant.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	3	10	20	28	21	10	5	3	0	0

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

- R3 – 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 *Reference State (State 1)*. This will likely take a long period of time, possibly up to 10 years or more, and recovery may not be attainable. Under certain circumstances, the harsh conditions created by the shortgrass sod can lead to the elimination of invasive grass species such as Kentucky bluegrass.

Transition from the Reference State (State 1) to the Conifer State (State 2)

- T1b – Encroachment and/or an increase in canopy cover of native coniferous tree species will lead this plant community phase over a threshold to the *Conifer State (State 3)*. This threshold will be crossed when tree canopy reaches about 25 percent or more of mature trees.

Conifer State (State 2)

This state consists of areas where tree canopy increases to a level that impedes the reproductive capability of the major native perennial grass species. The increase in tree canopy is a result of a disruption of the natural historic fire regime that kept the trees at an immature stage. This state is reached when mature tree canopy reaches about 25 percent or more. Tree canopy typically is dominated by ponderosa pine, but bur oak, eastern redcedar, and Rocky Mountain juniper may also be present in varying amounts.

2.1 Little Bluestem/Needlegrass/Ponderosa Pine Plant Community Phase

This plant community develops where trees from adjacent sites encroach and begin to shade out the herbaceous component. Ponderosa pine is the most common species to occupy the site but encroachment also occurs by eastern redcedar, Rocky Mountain juniper, and/or occasionally deciduous trees such as bur oak. These species expand on this site due to suppression of fire. The tree canopy is 25 percent or greater. The potential plant community is made up of approximately 45 percent grasses and grass-like species, 10 percent forbs, 10 percent shrubs, and 35 percent trees. Dominant grass and grass-like species include little bluestem, needleandthread, green needlegrass, sideoats grama, western wheatgrass, and threadleaf sedge. As the canopy increases, warm-season grasses tend to decrease as the cool-season grasses initially increase. Forbs commonly found in this community include cudweed sagewort, goldenrod, and green sagewort. Nonnative species such as cheatgrass and bluegrass will tend to invade.

Compared to the Little Bluestem/Needlegrass/Sideoats Grama Plant Community Phase (1.1), trees encroach and increase significantly. The grass component decreases dramatically with increased shading and the buildup of duff. Annual herbaceous production also decreases significantly. While the tree canopy provides excellent protection from the weather for both livestock and wildlife, it is not capable of supporting large numbers of wildlife and livestock due to decreased production.

A significant reduction of tree canopy can be accomplished through timber harvest or crown fire. The vegetation in the understory is capable of enduring fire; however, very hot crown fires will have a detrimental effect to the plant community. The total annual production of the understory can range from nearly nonexistent under a closed canopy to about 500 pounds per acre (air-dry weight) under a medium canopy.

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: SD6111

Growth curve name: Black Hills Foot Slopes, heavy conifer canopy.

Growth curve description: Mature ponderosa pine/juniper overstory.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	3	7	11	24	27	12	5	4	3	2	1

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

- 2.1a – No fire or harvest for extended periods of time will cause tree canopy to continue to increase and shift this plant community to the *2.2 Ponderosa Pine Plant Community Phase*.

2.2 Ponderosa Pine Plant Community Phase

This plant community is a result of continued suppression of fire and a lack of tree harvest. The tree canopy eventually becomes closed and most of the herbaceous understory is lost. Tree canopy approaches 45 percent or higher and competition slows the growth rate of the trees. A few cool-season species may survive, as well as, shrubs and possibly vines. This plant community may only be altered through harvest or possibly a wildfire that has enough energy to cause crowning of the trees. This plant community phase will also be accompanied by a relatively thick layer of acidic duff from the needles of the trees which will further reduce the establishment of herbaceous species.

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

- 2.2a – Timber harvest or wildfire (i.e., crown fire) will be required to shift this plant community away from this phase. Reproductive propagules of the herbaceous species will need to be present to result in a shift to the *2.1 Little Bluestem/Needlegrass/Ponderosa Pine Plant Community Phase*.

Restoration Pathway from the Conifer State (State 2) to the Reference State (State 1)

- R2 – Prescribed burning in conjunction with long-term prescribed grazing may lead this plant community across a threshold back to the *Reference State (State 1)*. This would have to take place before the trees reach maturity and are still susceptible to fire and reproductive propagules of the perennial grasses are still present. After trees reach maturity, a crown fire or timber harvest would be needed to move this plant community over the threshold back to the *Reference State (State 1)*.

Ecological Site Interpretations

Animal Community – Wildlife Interpretations

-- Under Development --

Little Bluestem/Needlegrass/Sideoats Grama Plant Community Phase (1.1):

Little Bluestem/Needleandthread/Western Wheatgrass Plant Community Phase (1.2):

Needleandthread/Western Wheatgrass/Sedge Plant Community Phase (1.3):

Sedge/Blue Grama/Fringed Sagewort Plant Community Phase (3.1):

Little Bluestem/Needlegrass/Ponderosa Pine Plant Community Phase (2.1):

Ponderosa Pine Plant Community Phase (2.2):

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

Common Name	Cattle	Sheep	Horses	Deer	Antelope	Bison	Elk
Grasses and Grass-likes							
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
bluebunch wheatgrass	U P D D	P P P P	U P D D	D D D D	D D D D	U P D D	U P D D
Cusick's bluegrass	U P U D	D P U D	U P U D	U P N D	U P N D	U P U D	U P U D
green needlegrass	U P U D	N P N P	U P U D	N P N P	N P N P	U P U D	U P U D
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
plains muhly	U U D U	U U D U	U U D U	N N N N	N N N N	U U D U	U U D U
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 dropseed	N U P U	N U D U	N U P U	N U D U	N U D U	N U P U	N U P U
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 U D U	U U D U	U D D U	U D D U
Sandberg bluegrass	N U N N	N D N N	N U N N	N D N N	N D N N	N U N N	N U N N
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
slender wheatgrass	U P U U	N D U N	U P U U	N D U N	N D U N	U P U U	U P U 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
threeawn	N N N N	N N N N	N N N N	N N N N	N N N N	N N N N	N N N N
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
Forbs							
American vetch	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
bigtop dalea	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
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
dotted 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
downy Indian paintbrush	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
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
hairy goldaster	U U D U	N N N N	U U D U	N N N N	N N N N	U U D U	N N N N
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
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 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 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
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
pussytoes	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
scarlet gaura	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
scarlet globemallow	U U D U	U D D U	U U D U	U D D U	U D D U	U U D U	U D D 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
spiny phlox	U D U U	U P P U	U D U U	U P P U	U P P U	U D U U	U P P U
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
white prairie aster	U U D U	N N N N	U U D U	N N N N	N N N N	U U D U	N N N N
Shrubs							
cactus	N N N N	N N N N	N N N N	N N N N	N N N N	N N N N	N N N N
elderberry	U D D U	U P P D	U D D U	U P P D	U U U U	U D D U	U P P D
fringed sagewort	U U U U	U U U U	U U U U	U D D U	U P P D	U U U U	U U U D
juneberry	N D P U	N D P U	N D P U	N D P U	N D P U	N D P U	N D P U
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
skunkbush sumac	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 U D
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

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)
Little Bluestem/Needlegrass/Sideoats Grama (1.1)	2,400	0.66
Little Bluestem/Needleandthread/Western Wheatgrass (1.2)	2,000	0.55
Needleandthread/Western Wheatgrass/Sedge (1.3)	1,600	0.44
Sedge/Blue Grama/Fringed Sagewort (3.1)	1,200	0.33
Little Bluestem/Needlegrass/Ponderosa Pine (2.1)	500	0.14

*Based on 912 lbs./acre (air-dry weight) per Animal Unit Month (AUM), and on 25 percent harvest efficiency (refer to the 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 B. Infiltration and runoff potential for this site varies from moderate to high depending on soil hydrologic group, slope and ground cover. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be where shortgrasses form a strong sod and dominate the site. Dominance by blue grama and/or sedge 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 (R061XN010SD), Shallow Loamy (R061XN024SD), Stony Hills (R061XN029SD)

Similar Sites

(R061XN029SD) – Stony Hills [more big bluestem and ponderosa pine; higher production]
(R061XN024SD) – Shallow Loamy [less little bluestem; lower 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 (RMS), NRCS; Cynthia Englebert, RMS, Forest Service; George Gamblin, RMS, NRCS; Tate Lantz, RMS, NRCS; Ryan Murray, RMS, NRCS; Cheryl Nielsen, RMS, NRCS; L. Michael Stirling, RMS, NRCS; and Jim Westerman, Soil Scientist, NRCS.

State Correlation

This site has been correlated with SD and WY in MLRA 61.

Field Offices/Counties

Belle Fourche, SD Butte and Lawrence Sturgis, SD Meade Sundance, WY Crook

Relationship to Other Established Classifications

Level IV Ecoregions of the Conterminous United States: 17a – Black Hills Foothills.

Other References

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

USDA, NRCS. National Water and Climate Center, 101 SW Main, Suite 1600, Portland, OR 97204-3224. (<http://www.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.

USDA, NRCS, Various Published Soil Surveys.

Site Description Approval

SD, State Range Management Specialist

Date

WY, State Range Management Specialist

Date