

United States Department of Agriculture Natural Resources Conservation Service

Ecological Site Description

Site Type: Rangeland

Site Name: Shallow Clayey

Site ID: R061XS017SD

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

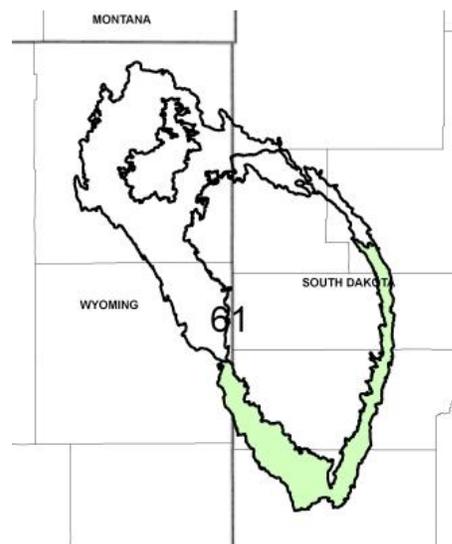
Physiographic Features

This site occurs on moderately to steeply sloping uplands.

Landform: mountain slope

Aspect: N/A

	<u>Minimum</u>	<u>Maximum</u>
Elevation (feet):	2,900	4,000
Slope (percent):	15	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:	High	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 14 to 19 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 47°F. January is the coldest month with average temperatures ranging from about 22°F (Hermosa 3 SSW, South Dakota (SD)), to about 25°F (Hot Springs, SD). July is the warmest month with temperatures averaging from about 71°F (Hermosa 3 SSW, SD), to about 73°F (Hot Springs, SD). The range of average monthly temperatures between the coldest and warmest months is about 49°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):	129	148
Freeze-free period (days):	144	168
Mean Annual Precipitation (inches):	14	19

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

	Precip. Min.	Precip. Max	Temp. Min.	Temp. Max.
January	0.32	0.49	8.6	37.9
February	0.36	0.58	12.7	41.9
March	0.77	1.12	20.7	49.9
April	1.77	2.10	31.8	61.0
May	3.17	3.27	41.1	70.7
June	3.20	3.47	51.2	80.9
July	2.34	2.69	57.7	89.3
August	1.84	2.21	55.4	88.0
September	1.25	1.45	45.1	78.4
October	0.98	1.34	33.9	65.5
November	0.42	0.56	23.4	49.6
December	0.33	0.34	12.3	39.9

Climate Stations		Period	
Station ID	Location or Name	From	To
SD3775	Hermosa 3 SSW	1906	2009
SD4007	Hot Springs	1894	2009
SD6947	Rapid City	1916	2009
SD9347	Wind Cave	1948	2009

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 the silty clay loam to clay textured subsurface soils, with slopes ranging from about 15 to 30 percent. The soils in this site are well-drained and formed in residuum. The silty clay loam surface layer is three to five inches thick. The soils have a slow to very slow infiltration rate. 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. There is a restrictive layer (weathered shale bedrock) at about 16 inches in depth which impedes water movement and root penetration.

These soils are mainly susceptible to water erosion. The hazard of water erosion increases on slopes greater than about 20 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
Parent Material Origin:
Surface Texture: silty clay loam
Surface Texture Modifier: none
Subsurface Texture Group: clayey
Surface Fragments ≤3" (% Cover): 0-14
Surface Fragments >3" (%Cover): 0
Subsurface Fragments ≤3" (% Volume): 0-4
Subsurface Fragments >3" (% Volume): 0

	<u>Minimum</u>	<u>Maximum</u>
Drainage Class:	well	well
Permeability Class:	very slow	slow
Depth (inches):	10	20
Electrical Conductivity (mmhos/cm)*:	2	4
Sodium Absorption Ratio*:	0	5
Soil Reaction (1:1 Water)*:	6.6	9.0
Soil Reaction (0.1M CaCl ₂)*:	NA	NA
Available Water Capacity (inches)*:	2	3
Calcium Carbonate Equivalent (percent)*:	0	15

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

Plant Communities

Ecological Dynamics of the Site

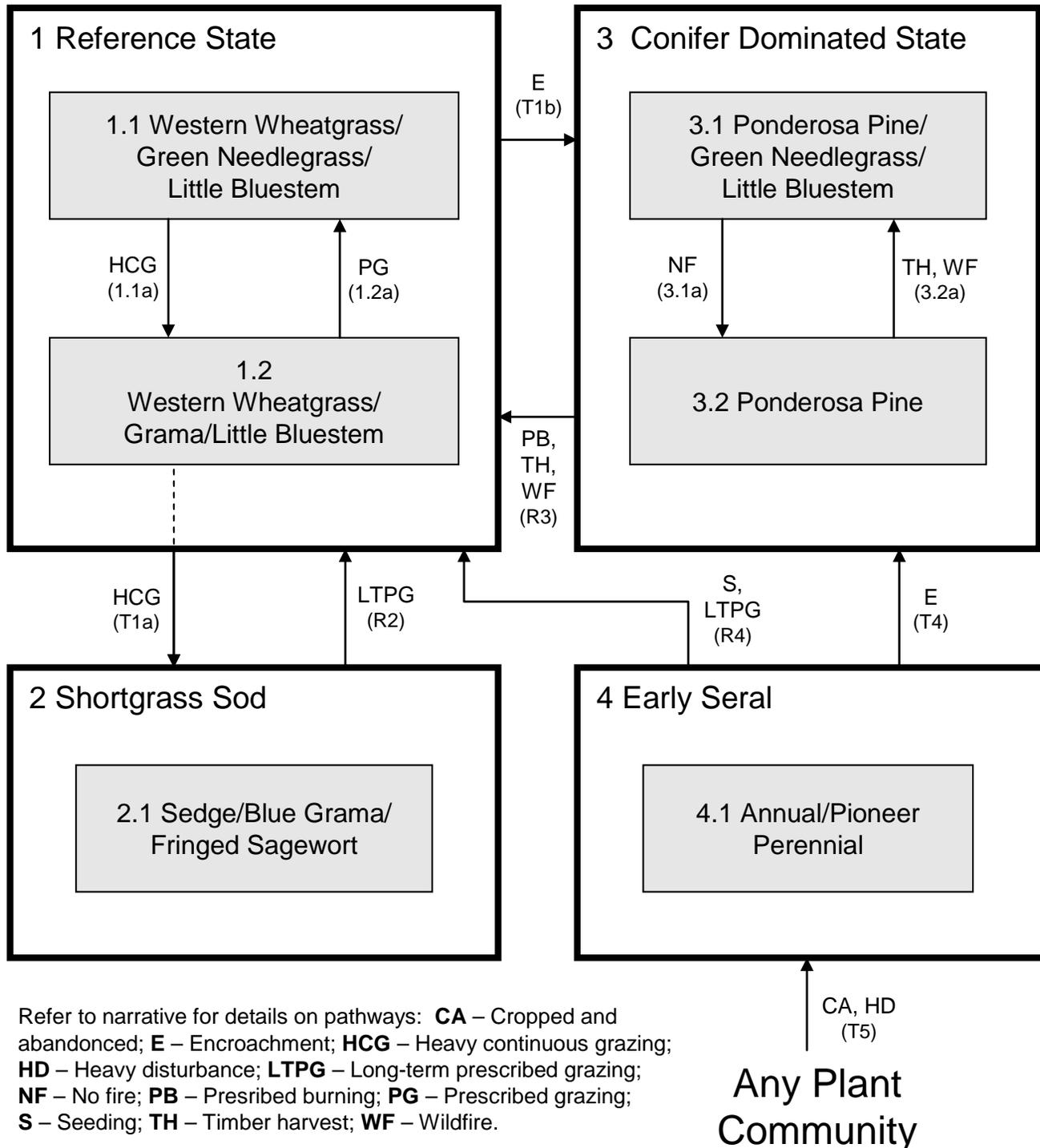
This site developed under Northern Great Plains climatic conditions, light to severe grazing by bison and other large herbivores, sporadic natural or man-caused wildfire (often of light intensities), and other biotic and abiotic factors that typically influence soil/site development. Changes will occur 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 Western Wheatgrass/Green Needlegrass/Little Bluestem Plant Community Phase (1.1). Blue grama and sedge can increase and eventually develop into a sod. Western wheatgrass will increase initially and then begin to decrease. Needleandthread, green needlegrass, big bluestem, sideoats grama, and little bluestem will decrease in frequency and production. Excessive defoliation can cause threeawn and annuals to increase and dominate the site. A few mature trees comprised of ponderosa pine and Rocky Mountain juniper occupy this site. With extended periods of a lack of fire, trees will begin to encroach into the herbaceous community and may eventually dominate the site.

Interpretations are primarily based on the Western Wheatgrass/Green Needlegrass/Little Bluestem 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



Plant Community Composition and Group Annual Production

			1.1 Western Wheatgrass/Green Needlegrass/Little Bluestem		
COMMON/GROUP NAME	SCIENTIFIC NAME	SYMBOL	Group	lbs./acre	% Comp
GRASSES & GRASS-LIKES				1360 - 1530	80 - 90
WHEATGRASS			1	255 - 595	15 - 35
western wheatgrass	Pascopyrum smithii	PASM	1	255 - 595	15 - 35
COOL-SEASON BUNCHGRASSES			2	170 - 425	10 - 25
green needlegrass	Nassella viridula	NAVI4	2	170 - 425	10 - 25
needleandthread	Hesperostipa comata ssp. comata	HECOC8	2	0 - 85	0 - 5
bluebunch wheatgrass	Pseudoroegneria spicata	PSSP6	2	0 - 85	0 - 5
MID WARM-SEASON GRASSES			3	255 - 425	15 - 25
little bluestem	Schizachyrium scoparium	SCSC	3	85 - 340	5 - 20
sideoats grama	Bouteloua curtipendula	BOCU	3	85 - 255	5 - 15
plains muhly	Muhlenbergia cuspidata	MUCU3	3	0 - 85	0 - 5
SHORT WARM-SEASON GRASSES			4	85 - 170	5 - 10
blue grama	Bouteloua gracilis	BOGR2	4	34 - 119	2 - 7
buffalograss	Bouteloua dactyloides	BODA2	4	17 - 68	1 - 4
threeawn	Aristida spp.	ARIST	4	0 - 34	0 - 2
OTHER NATIVE GRASSES			5	51 - 136	3 - 8
big bluestem	Andropogon gerardii	ANGE	5	0 - 85	0 - 5
prairie junegrass	Koeleria macrantha	KOMA	5	17 - 51	1 - 3
bottlebrush squirreltail	Elymus elymoides	ELEL5	5	0 - 34	0 - 2
Sandberg bluegrass	Poa secunda	POSE	5	17 - 34	1 - 2
Cusick's bluegrass	Poa cusickii	POCU3	5	17 - 34	1 - 2
other grasses		2GRAM	5	0 - 68	0 - 4
GRASS-LIKES			6	34 - 119	2 - 7
needleleaf sedge	Carex duriuscula	CADU6	6	34 - 119	2 - 7
other grass-likes		2GL	6	0 - 51	0 - 3
FORBS			8	85 - 170	5 - 10
cudweed sagewort	Artemisia ludoviciana	ARLU	8	17 - 34	1 - 2
desert biscuitroot	Lomatium foeniculaceum	LOFO	8	17 - 34	1 - 2
false boneset	Brickellia eupatorioides	BREU	8	0 - 34	0 - 2
goldenpea	Thermopsis rhombifolia	THRH	8	0 - 34	0 - 2
groundplum milkvetch	Astragalus crassicaarpus	ASCR2	8	0 - 17	0 - 1
Indian breadroot	Pediomelum esculentum	PEES	8	0 - 34	0 - 2
milkvetch	Astragalus spp.	ASTRA	8	17 - 34	1 - 2
prairie coneflower	Ratibida columnifera	RACO3	8	17 - 34	1 - 2
purple coneflower	Echinacea angustifolia	ECAN2	8	17 - 34	1 - 2
purple prairie clover	Dalea purpurea	DAPU5	8	0 - 34	0 - 2
pussytoes	Antennaria spp.	ANTEN	8	0 - 17	0 - 1
scarlet gaura	Gaura coccinea	GACO5	8	17 - 34	1 - 2
scarlet globemallow	Sphaeralcea coccinea	SPCO	8	17 - 34	1 - 2
silverleaf scurfpea	Pediomelum argophyllum	PEAR6	8	17 - 34	1 - 2
slimflower scurfpea	Psoraleidium tenuiflorum	PSTE5	8	0 - 17	0 - 1
textile onion	Allium textile	ALTE	8	17 - 34	1 - 2
western wallflower	Erysimum capitatum var. capitatum	ERCAC	8	0 - 17	0 - 1
white prairie aster	Symphotrichum falcatum	SYFA	8	17 - 34	1 - 2
wild parsley	Musineon divaricatum	MUDI	8	0 - 17	0 - 1
Wyoming kittentail	Besseyia wyomingensis	BEWY	8	0 - 17	0 - 1
yellow wild buckwheat	Eriogonum flavum var. flavum	ERFLF	8	0 - 17	0 - 1
native forbs		2FN	8	17 - 85	1 - 5
SHRUBS			9	85 - 170	5 - 10
big sagebrush	Artemisia tridentata	ARTR2	9	0 - 51	0 - 3
fringed sagewort	Artemisia frigida	ARFR4	9	17 - 34	1 - 2
leadplant	Amorpha canescens	AMCA6	9	17 - 51	1 - 3
rose	Rosa spp.	ROSA5	9	17 - 34	1 - 2
silver sagebrush	Artemisia cana	ARCA13	9	0 - 34	0 - 2
skunkbush sumac	Rhus trilobata	RHTR	9	0 - 51	0 - 3
winterfat	Krascheninnikovia lanata	KRLA2	9	17 - 34	1 - 2
yucca	Yucca glauca	YUGL	9	0 - 34	0 - 2
other shrubs		2SHRUB	9	0 - 51	0 - 3
TREES			10	0 - 34	0 - 2
juniper	Juniperus spp.	JUNIP	10	0 - 34	0 - 2
ponderosa pine	Pinus ponderosa	PIPO	10	0 - 34	0 - 2
other trees		2TREE	10	0 - 34	0 - 2

Annual Production lbs./acre	LOW	RV	HIGH
GRASSES & GRASS-LIKES	1040	1428	1785
FORBS	80	128	190
SHRUBS	80	128	190
TREES	0	17	35
TOTAL	1200	1700	2200

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 Western Wheatgrass/Green Needlegrass/Little Bluestem			1.2 Western Wheatgrass/Grama/Little Bluestem			2.1 Sedge/Grama/Fringed Sagewort			3.1 Ponderosa Pine/Green Needlegrass/Little Bluestem		
		Grp	lbs./acre	% Comp	Grp	lbs./acre	% Comp	Grp	lbs./acre	% Comp	Grp	lbs./acre	% Comp
GRASSES & GRASS-LIKES													
WHEATGRASS													
western wheatgrass	PASM	1	255 - 595	15 - 35	1	280 - 560	20 - 40	1	11 - 88	1 - 8	1	0 - 39	0 - 3
COOL-SEASON BUNCHGRASSES													
green needlegrass	NAVI4	2	170 - 425	10 - 25	2	70 - 210	5 - 15	2	0 - 44	0 - 4	2	13 - 104	1 - 8
needleandthread	HECOC8	2	0 - 85	0 - 5	2	0 - 70	0 - 5	2	0 - 55	0 - 5	2	13 - 91	1 - 7
bluebunch wheatgrass	PSSP6	2	0 - 85	0 - 5	2	0 - 28	0 - 2						
MID WARM-SEASON GRASSES													
sideoats grama	BOCU3	3	85 - 340	5 - 20	3	70 - 210	5 - 15	3	11 - 88	1 - 8	3	0 - 52	0 - 4
little bluestem	SCSC	3	85 - 255	5 - 15	3	14 - 98	1 - 7	3	0 - 55	0 - 5	3	13 - 104	1 - 8
plains muhly	MUCU3	3	0 - 85	0 - 5	3	0 - 28	0 - 2						
SHORT WARM-SEASON GRASSES													
blue grama	BOGR2	4	85 - 170	5 - 10	4	98 - 210	7 - 15	4	110 - 330	10 - 30	4	26 - 130	2 - 10
buffalograss	BODA2	4	34 - 119	2 - 7	4	70 - 210	5 - 15	4	88 - 275	8 - 25	4	13 - 78	1 - 6
threeawn	ARIS1	4	17 - 68	1 - 4	4	14 - 98	1 - 7	4	11 - 88	1 - 8	4	0 - 52	0 - 4
OTHER NATIVE GRASSES													
big bluestem	ANGE	5	0 - 34	0 - 2	4	14 - 42	1 - 3	4	0 - 55	0 - 5	4	13 - 91	1 - 7
prairie junegrass	KOMA	5	01 - 136	3 - 8	5	14 - 70	1 - 5	5	11 - 55	1 - 5	5	26 - 65	2 - 5
bottlebrush squirreltail	ELEL5	5	0 - 85	0 - 5	5	0 - 28	0 - 2						
Sandberg bluegrass	POSE	5	0 - 85	0 - 5	5	0 - 28	0 - 2						
Cusick's bluegrass	POCU3	5	17 - 51	1 - 3	5	14 - 42	1 - 3	5	11 - 22	1 - 2	5	13 - 39	1 - 3
other grasses	2GRAM	5	0 - 34	0 - 2	4	14 - 42	1 - 3	4	0 - 33	0 - 3	5	0 - 39	0 - 3
GRASS-LIKES													
needleleaf sedge	CADU6	6	34 - 119	2 - 7	6	70 - 182	5 - 13	6	110 - 330	10 - 30	6	13 - 130	1 - 10
other grass-likes	2GL	6	34 - 119	2 - 7	6	70 - 182	5 - 13	6	110 - 330	10 - 30	6	13 - 130	1 - 10
NON-NATIVE GRASSES													
annual bromegrass	BROMU	7	0 - 51	0 - 3	7	14 - 70	1 - 5	7	22 - 110	2 - 10	7	13 - 130	1 - 10
bluegrass	POA	7	0 - 51	0 - 3	7	14 - 70	1 - 5	7	22 - 110	2 - 10	7	13 - 130	1 - 10
FORBS													
cudweed sagewort	ARLU	8	85 - 170	5 - 10	8	70 - 140	5 - 10	8	55 - 110	5 - 10	8	39 - 91	3 - 7
desert biscuitroot	LOFO	8	17 - 34	1 - 2	8	14 - 42	1 - 3	8	11 - 33	1 - 3	8	13 - 26	1 - 2
false boneset	BREU	8	17 - 34	1 - 2	8	0 - 28	0 - 2						
goldenpea	THRH	8	0 - 34	0 - 2	8	0 - 14	0 - 1						
groundplum milkvetch	ASCR2	8	0 - 34	0 - 2	8	0 - 28	0 - 2	8	0 - 22	0 - 2	8	0 - 13	0 - 1
Indian breadroot	PEDIO2	8	0 - 17	0 - 1	8	0 - 14	0 - 1						
milkvetch	ASTRA	8	0 - 34	0 - 2	8	0 - 14	0 - 1						
prairie coneflower	RACO3	8	17 - 34	1 - 2	8	14 - 28	1 - 2	8	11 - 22	1 - 2	8	0 - 13	0 - 1
purple coneflower	ECAN2	8	17 - 34	1 - 2	8	0 - 14	0 - 1						
purple prairie clover	DAPU5	8	17 - 34	1 - 2	8	0 - 14	0 - 1						
pussytoes	ANTEN	8	0 - 34	0 - 2	8	0 - 14	0 - 1	8	0 - 22	0 - 2	8	0 - 26	0 - 2
scarlet gaura	GACO5	8	0 - 17	0 - 1	8	0 - 14	0 - 1						
scarlet globemallow	SPCO	8	17 - 34	1 - 2	8	14 - 28	1 - 2	8	11 - 22	1 - 2	8	0 - 13	0 - 1
silverleaf scurfpea	PEAR6	8	17 - 34	1 - 2	8	14 - 28	1 - 2	8	11 - 33	1 - 3	8	0 - 26	0 - 2
slimflower scurfpea	PSTE5	8	0 - 17	0 - 1	8	0 - 14	0 - 1						
textile onion	ALTE	8	0 - 17	0 - 1	8	0 - 14	0 - 1	8	0 - 11	0 - 1	8	0 - 13	0 - 1
western wallflower	ERCAC	8	0 - 17	0 - 1	8	0 - 14	0 - 1	8	0 - 11	0 - 1	8	0 - 13	0 - 1
white prairie aster	SYFA	8	17 - 34	1 - 2	8	14 - 28	1 - 2	8	11 - 22	1 - 2	8	13 - 26	1 - 2
wild parsley	MUDI	8	0 - 17	0 - 1	8	0 - 14	0 - 1						
Wyoming kittentail	BEWY	8	0 - 17	0 - 1	8	0 - 14	0 - 1						
yellow wild buckwheat	ERFLF	8	0 - 17	0 - 1	8	0 - 14	0 - 1	8	0 - 11	0 - 1	8	0 - 13	0 - 1
native forbs	2FN	8	17 - 85	1 - 5	8	14 - 42	1 - 3	8	11 - 44	1 - 4	8	0 - 39	0 - 3
introduced forbs	2FI	8	17 - 85	1 - 5	8	0 - 42	0 - 3	8	11 - 77	1 - 7	8	13 - 39	1 - 3
SHRUBS													
big sagebrush	ARTR2	9	85 - 170	5 - 10	9	70 - 140	5 - 10	9	55 - 165	5 - 15	9	65 - 130	5 - 10
fringed sagewort	ARFR4	9	0 - 51	0 - 3	9	0 - 28	0 - 2						
leadplant	AMCA6	9	17 - 34	1 - 2	9	14 - 56	1 - 4	9	33 - 88	3 - 8	9	13 - 78	1 - 6
rose	ROSA5	9	17 - 51	1 - 3	9	0 - 14	0 - 1						
silver sagebrush	ARCA13	9	17 - 34	1 - 2	9	14 - 28	1 - 2	9	0 - 22	0 - 2	9	0 - 39	0 - 3
skunkbush sumac	RHTR	9	0 - 34	0 - 2	9	0 - 28	0 - 2	9	0 - 11	0 - 1	9	0 - 13	0 - 1
winterfat	KRLA2	9	0 - 51	0 - 3	9	0 - 28	0 - 2	9	0 - 22	0 - 2	9	0 - 39	0 - 3
yucca	YUGL	9	17 - 34	1 - 2	9	0 - 14	0 - 1						
other shrubs	2SHRUB	9	0 - 34	0 - 2	9	14 - 56	1 - 4	9	11 - 88	1 - 8	9	13 - 65	1 - 5
TREES													
juniper	JUNIP	10	0 - 51	0 - 3	10	0 - 28	0 - 2	10	0 - 55	0 - 5	10	0 - 52	0 - 4
ponderosa pine	PIPO	10	0 - 34	0 - 2	10	0 - 28	0 - 2	10	0 - 22	0 - 2	10	390 - 650	30 - 50
other trees	2TREE	10	0 - 34	0 - 2	10	0 - 28	0 - 2	10	0 - 22	0 - 2	10	26 - 195	2 - 15
Annual Production lbs./acre													
GRASSES & GRASS-LIKES		LOW	RV	HIGH	LOW	RV	HIGH	LOW	RV	HIGH	LOW	RV	HIGH
FORBS		1040	1428	-1785	870	1176	-1460	600	897	-1170	485	618	-680
SHRUBS		80	128	-190	65	105	-155	50	83	-120	35	65	-95
TREES		80	128	-190	65	105	-155	50	110	-185	60	98	-145
TOTAL		0 - 17	-35		0 - 14	-30		0 - 11	-25		320	520	-780
TOTAL		1200	1700	-2200	1000	1400	-1800	700	1100	-1500	900	1300	-1700

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 cool-season grasses, with warm-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 Western Wheatgrass/Green Needlegrass/Little Bluestem Plant Community Phase

Interpretations are based primarily on the Western Wheatgrass/Green Needlegrass/Little Bluestem 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, 10 percent shrubs, and scattered mature trees. The community is dominated by cool-season grasses, with warm-season grasses being subdominant. The major grasses include western wheatgrass, green needlegrass, sideoats grama, and little bluestem. Other grass and grass-like species include plains muhly, big bluestem, needleandthread, bluebunch wheatgrass, blue grama, and needleleaf sedge. 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: 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:

- 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 Western Wheatgrass/Grama/Little Bluestem Plant Community Phase*.

1.2 Western Wheatgrass/Grama/Little Bluestem 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, 10 percent shrubs, and a minor amount of mature trees scattered randomly across the site. Dominant grass and grass-like species include western wheatgrass, green needlegrass, sideoats grama, blue grama, needleleaf sedge, and little bluestem. Grasses of secondary importance include needleandthread, buffalograss, prairie Junegrass, and bottlebrush squirreltail. Forbs commonly found in this plant community include cudweed sagewort, desert biscuitroot, goldenpea, milkvetch, scarlet globemallow, silverleaf scurfpea, and white prairie aster. Dominant shrubs include fringed sagewort and yucca.

When compared to the Western Wheatgrass/Green Needlegrass/Little Bluestem Plant Community Phase (1.1), blue grama and needleleaf sedge have increased. Tall and mid-cool- and 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 *2.1 Sedge/Blue Grama/Fringed Sagewort Plant Community Phase* within the *Shortgrass Sod State (State 2)*.
- 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 *1.1 Western Wheatgrass/Green Needlegrass/Little Bluestem Plant Community Phase*.

Shortgrass Sod State (State 2)

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, tall and mid-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.

2.1 Sedge/Blue Grama/Fringed Sagewort Plant Community

This plant community evolved under heavy continuous grazing or from over utilization during extended drought periods. The potential plant community is made up of approximately 75 percent grasses and grass-like species, 10 percent forbs, 15 percent shrubs, and scattered mature trees. Dominant grass and grass-like species include needleleaf sedge and blue grama. Other grasses include western wheatgrass, sideoats grama, buffalograss, and a variety of other grasses. Cheatgrass may also invade and become quite prevalent. Forbs commonly found in this plant community include cudweed sagewort, silverleaf scurfpea, and white prairie aster.

When compared to the Western Wheatgrass/Green Needlegrass/Little Bluestem 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: 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 recovery pathways leading to other plant communities are as follows:

- R2 – 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 Dominated State (State 3)

- 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 Dominated State (State 3)*. This threshold will be crossed when tree canopy reaches about 25 percent or more of mature trees.

Conifer Dominated State (State 3)

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 eastern redcedar, Rocky Mountain juniper, and other trees may also be present in varying amounts.

3.1 Ponderosa Pine/Green Needlegrass/Little Bluestem Plant Community Phase

This plant community develops where trees from adjacent sites encroach, or trees naturally occurring on the site increase 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 and Rocky Mountain juniper. 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 35 percent grasses and grass-like species, 5 percent forbs, 10 percent shrubs, and 50 percent trees. Dominant grass

and grass-like species include little bluestem, green needlegrass, needleandthread, blue grama, threeawn, and needleleaf 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, white prairie aster, silverleaf scurfpea, and pussytoes. Nonnative species such as cheatgrass and bluegrass will tend to invade.

Compared to the Western Wheatgrass/Green Needlegrass/Little Bluestem Plant Community Phase (1.1), tree canopy increases 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 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:

- 3.1a – No fire or harvest for extended periods of time will cause tree canopy to continue to increase and shift this plant community to the *3.2 Ponderosa Pine Plant Community Phase*.

3.1 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:

- 3.2a – 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 *3.1 Ponderosa Pine/Green Needlegrass/Little Bluestem Plant Community Phase*.

Restoration Pathway from the Conifer Dominated State (State 3) to the Reference State (State 1)

- R3 – 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)*.

Transition Pathway from Any Plant Community to the 4.1 Annual/Pioneer Perennial Plant Community Phase within the Early Seral State (State 4)

- T5 – Cropping followed by abandonment or heavy disturbance (e.g., feeding areas, areas adjacent to water sources, or occupation of the area by rodents) may lead this plant community phase over a threshold to the *Early Seral State (State 4)* and more specifically to the *4.1 Annual/Pioneer Perennial Plant Community Phase*.

4.1 Annual/Pioneer 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.

Transitions or restoration pathways leading to other states are as follows:

- T4 – 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 Dominated State (State 3)*. This threshold will be crossed when tree canopy reaches about 25 percent or more of mature trees.
- 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 *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. Success depends on whether native reproductive propagules remain intact on the site. Seeding of native species may result in a plant community phase that resembles a phase within the *Reference State (State 1)*.

Ecological Site Interpretations

Animal Community – Wildlife Interpretations

-- Under Development --

Western Wheatgrass/Green Needlegrass/Little Bluestem Plant Community Phase (1.1):

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

Sedge/Blue Grama/Fringed Sagewort Plant Community Phase (2.1):

Ponderosa Pine/Green Needlegrass/Little Bluestem Plant Community Phase (3.1):

Ponderosa Pine Plant Community Phase (3.2):

Annual/Pioneer Perennial Plant Community Phase (4.1):

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
bottlebrush squirreltail	U D U U	N D U N	U D U U	N D U N	N D U N	U D U U	U D U U
buffalograss	U U D U	N U D U	U U D U	N U D U	N U D U	U U D U	U U D U
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
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
needleleaf 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
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
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
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
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							
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
desert biscuitroot	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
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
goldenpea	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 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
Indian breadroot	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 U
milkvetch	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 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
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
silverleaf 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
slimflower 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
textile onion	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
western wallflower	U D U U	N U U N	U D U U	N U U N	N U U N	U D U U	N U U N
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
wild parsley	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
Wyoming kittentail	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
yellow wild buckwheat	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 N U N
Shrubs and Trees							
big sagebrush	U N U U	D U U D	U N U U	P U D P	P P P P	U N U U	D U U U
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
juniper	U N N U	U N N U	U N N U	D U U D	U N N U	U N N U	U N N 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
ponderosa pine	U T T U	U N N U	U N N U	U N N U	U N N U	U T T U	U N N 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
silver sagebrush	D U U D	D U U D	D U U D	P D D P	P P P P	D U U D	D U U D
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
winterfat	P P P P	P P P P	P P P P	P P P P	P P P P	P P P P	P P P 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)
Western Wheatgrass/Green Needlegrass/Little Bluestem (1.1)	1,700	0.47
Western Wheatgrass/Grama/Little Bluestem (1.2)	1,400	0.38
Sedge/Blue Grama/Fringed Sagewort (2.1)	1,100	0.30
Ponderosa Pine/Green Needlegrass/Little Bluestem (3.1)	1,300	0.16
Annual/Pioneer Perennial (4.1)	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 D. 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, buffalograss, 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 (R061XS010SD), Thin Upland (R061XS012SD), Clayey (R061XS011SD)

Similar Sites

(R061XS012SD) – Thin Upland [more little bluestem and big bluestem; 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 (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

Hot Springs, SD Custer & Fall River Rapid City, SD Pennington Sturgis, SD Meade

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