

United States Department of Agriculture Natural Resources Conservation Service

Ecological Site Description

Site Type: Rangeland

Site Name: Shallow to Gravel

Site ID: R063AY014SD

Major Land Resource Area (MLRA): 63A – Northern
Rolling Pierre Shale Plains



Physiographic Features

This site typically occurs on gently to steeply sloping uplands.

Landform: terrace, knoll, ridge

Aspect: N/A

	<u>Minimum</u>	<u>Maximum</u>
Elevation (feet):	1600	2700
Slope (percent):	2	25
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:	Very low	Medium

Climatic Features

MLRA 63A 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 ranges from 16 to 20 inches per year. The average annual temperature is about 47°F. January is the coldest month with average temperatures ranging from about 11°F (Pollock, South Dakota (SD)), to about 22°F (Cedar Butte, SD). July is the warmest month with temperatures averaging from about 72°F (Pollock, SD), to about 76°F (Cedar Butte, 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 11 miles per hour annually, ranging from about 13 miles per hour during the spring to about 10 miles per hour during the summer. Daytime winds are generally stronger than nighttime and

occasional strong storms may bring brief periods of high winds with gusts to more than 50 miles per hour.

Growth of cool-season plants begins in early to mid-March, slowing or ceasing in late June. Warm-season plants begin growth about mid-May and continue to early or mid-September. Green up 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):	126	149
Freeze-free period (days):	149	165
Mean Annual Precipitation (inches):	16	20

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

	Precip. Min.	Precip. Max	Temp. Min.	Temp. Max.
January	0.40	0.41	-0.9	34.0
February	0.44	0.49	5.8	39.2
March	0.87	1.36	17.3	49.0
April	1.77	2.18	31.3	61.2
May	2.82	3.29	43.3	72.2
June	2.96	3.45	53.2	82.5
July	2.04	2.84	58.5	90.8
August	1.57	2.38	56.5	90.3
September	1.13	1.53	45.4	79.2
October	1.02	1.38	33.4	65.7
November	0.48	0.63	19.3	48.2
December	0.23	0.35	5.7	37.2

Climate Stations		Period	
Station ID	Location or Name	From	To
SD1539	Cedar Butte	1951	2004
SD1972	Cottonwood 3 E	1909	2004
SD6712	Pollock	1948	2004
SD6790	Presho 7 NW	1975	2004

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

These soils are very deep and well drained. Soil textures include loam and gravelly loam soils over sand or sand and gravel between the depths of 15 to 25 inches. Permeability is moderately rapid to moderate in the upper part and very rapid in the lower part. Available water capacity is moderate in the upper part and low to very low in the lower part. Salinity and sodicity are minimal. This site occurs on flats, rises, and side slopes on outwash plains and terraces. Slope ranges from 2 to 25 percent. Runoff as evidenced by patterns of rill, gully, or other water flow is negligible to low, in spite of the slopes, due to the very high intake rate of these soils. Some pedestalling of plants occurs, but it is not very evident on casual observation and occurs on less than five percent of the plants.

These soils are mainly susceptible to water erosion. The hazard of water erosion increases on slopes greater than about 15 percent. Low available water capacity caused by the shallow rooting depth strongly 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/>) for specific local soils information.

Parent Material Kind: alluvium
Parent Material Origin: metasedimentary
Surface Texture: gravelly loam, loam
Surface Texture Modifier: none
Subsurface Texture Group: sandy
Surface Fragments ≤3" (% Cover): 0-50
Surface Fragments >3" (%Cover): 0-5
Subsurface Fragments ≤3" (% Volume): 15-90
Subsurface Fragments >3" (% Volume): 1-5

	<u>Minimum</u>	<u>Maximum</u>
Drainage Class	well	well
Permeability Class:	moderate	moderately rapid
Depth to Bedrock (inches):	60	60
Electrical Conductivity (mmhos/cm)*:	0	2
Sodium Absorption Ratio*:	0	0
Soil Reaction (1:1 Water)*:	6.1	8.4
Soil Reaction (0.1M CaCl₂)*:	NA	NA
Available Water Capacity (inches)*:	3	3
Calcium Carbonate Equivalent (percent)*:	0	15

*These attributes represent 0-40 inches in depth 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 between communities that will occur, severe disturbances, such as periods of well below average precipitation, can cause significant shifts in plant communities and/or species composition.

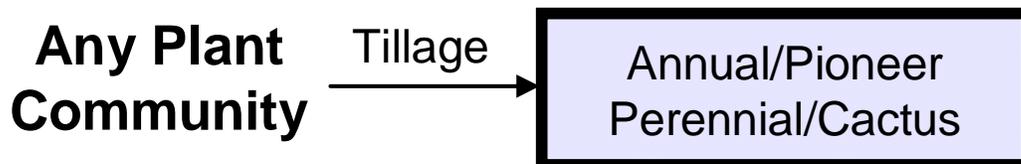
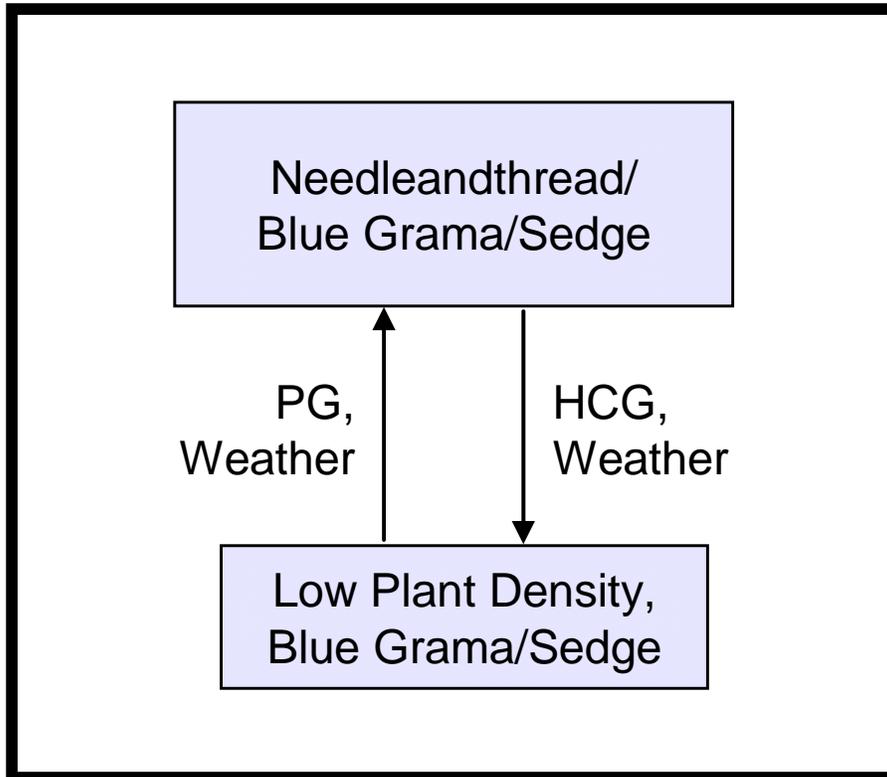
Interpretations are primarily based on the Needleandthread/Blue Grama/Sedge Plant Community, which is considered to be climax. It has been determined by study of rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. Trends in plant community dynamics ranging from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts also have been used. Plant communities, states, transitional pathways, and thresholds have been determined through similar studies and experience.

This site can be relatively productive but can deteriorate rapidly if not managed properly. The native grasses are typically under stress due to the low available water holding capacity. Further stress from

overgrazing can result in a plant community dominated by short grasses and grass-likes, and the site also can have a high cover of club moss when the native grasses are of low vigor.

The following diagram illustrates the common plant communities and vegetation states commonly occurring on the site and the transition pathways between communities and states. The ecological processes will be discussed in more detail in the plant community descriptions following the diagram.

Plant Communities and Transitional Pathways



HCG – Heavy continuous grazing; **PG** – Prescribed grazing; **Weather** – Extended periods of below or above average precipitation.

Plant Community Composition and Group Annual Production

COMMON/GROUP NAME	SCIENTIFIC NAME	SYMBOL	Needleandthread/Blue Grama/Sedge		
			Group	lbs./acre	% Comp
GRASSES & GRASS-LIKES				1280 - 1440	80 - 90
NEEDLEGRASSES			1	240 - 480	15 - 30
needleandthread	Hesperostipa comata ssp. comata	HECOC8	1	240 - 480	15 - 30
porcupine grass	Hesperostipa spartea	HESP11	1	0 - 80	0 - 5
SHORT WARM-SEASON GRASSES			2	240 - 400	15 - 25
blue grama	Bouteloua gracilis	BOGR2	2	160 - 320	10 - 20
hairy grama	Bouteloua hirsuta	BOHI2	2	32 - 160	2 - 10
buffalograss	Bouteloua dactyloides	BODA2	2	0 - 48	0 - 3
threeawn	Aristida spp.	ARIST	2	0 - 48	0 - 3
MID & TALL WARM-SEASON GRASSES			3	160 - 320	10 - 20
little bluestem	Schizachyrium scoparium	SCSC	3	80 - 240	5 - 15
sideoats grama	Bouteloua curtipendula	BOCU	3	32 - 160	2 - 10
plains muhly	Muhlenbergia cuspidata	MUCU3	3	16 - 128	1 - 8
prairie sandreed	Calamovilfa longifolia	CALO	3	0 - 64	0 - 4
WHEATGRASS			4	32 - 160	2 - 10
western wheatgrass	Pascopyrum smithii	PASM	4	32 - 160	2 - 10
OTHER NATIVE GRASSES			5	16 - 80	1 - 5
prairie junegrass	Koeleria macrantha	KOMA	5	16 - 48	1 - 3
sixweeks fescue	Vulpia octoflora	VUOC	5	0 - 16	0 - 1
other grasses		2GRAM	5	0 - 48	0 - 3
GRASS-LIKES			6	80 - 160	5 - 10
threadleaf sedge	Carex filifolia	CAFI	6	80 - 160	5 - 10
other grass-likes		2GL	6	0 - 80	0 - 5
FORBS			8	80 - 160	5 - 10
cudweed sagewort	Artemisia ludoviciana	ARLU	8	16 - 48	1 - 3
cutleaf ironplant	Machaeranthera pinnatifida	MAPI	8	0 - 16	0 - 1
dotted gayfeather	Liatris punctata	LIPU	8	16 - 32	1 - 2
false boneset	Brickellia eupatorioides	BREU	8	0 - 32	0 - 2
green sagewort	Artemisia campestris	ARCA12	8	16 - 48	1 - 3
hairy goldaster	Heterotheca villosa	HEVI4	8	16 - 32	1 - 2
Missouri goldenrod	Solidago missouriensis	SOMI2	8	16 - 32	1 - 2
prairie coneflower	Ratibida columnifera	RACO3	8	0 - 16	0 - 1
prairie spiderwort	Tradescantia occidentalis	TROC	8	0 - 16	0 - 1
purple coneflower	Echinacea angustifolia	ECAN2	8	16 - 32	1 - 2
purple prairie clover	Dalea purpurea	DAPU5	8	0 - 32	0 - 2
rush skeletonweed	Lygodesmia juncea	LYJU	8	0 - 16	0 - 1
scurfpea	Psoralidium spp.	PSORA2	8	16 - 32	1 - 2
stiff sunflower	Helianthus pauciflorus	HEPA19	8	0 - 16	0 - 1
western ragweed	Ambrosia psilostachya	AMPS	8	0 - 16	0 - 1
white prairie aster	Symphotrichum falcatum	SYFA	8	16 - 32	1 - 2
woolly verbena	Verbena stricta	VEST	8	0 - 16	0 - 1
native forbs		2FN	8	0 - 80	0 - 5
SHRUBS			9	80 - 160	5 - 10
brittle cactus	Opuntia fragilis	OPFR	9	0 - 16	0 - 1
broom snakeweed	Gutierrezia sarothrae	GUSA2	9	0 - 16	0 - 1
fringed sagewort	Artemisia frigida	ARFR4	9	16 - 64	1 - 4
leadplant	Amorpha canescens	AMCA6	9	16 - 80	1 - 5
plains pricklypear	Opuntia polyacantha	OPPO	9	16 - 48	1 - 3
rose	Rosa spp.	ROSA5	9	16 - 48	1 - 3
other shrubs		2SHRUB	9	0 - 48	0 - 3

Annual Production lbs./acre	LOW	RV	HIGH
GRASSES & GRASS-LIKES	1050 -	1360	- 1640
FORBS	75 -	120	- 180
SHRUBS	75 -	120	- 180
TOTAL	1200 -	1600	- 2000

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 and Vegetation State Narratives

Following are the narratives for each of the described plant communities. These plant communities may not represent every possibility, but they are the most prevalent and recurring plant communities. The plant composition tables shown above have been developed from the best available knowledge at the time of this revision. As more data is collected, some of these plant communities may be revised or removed, and new ones may be added. None of these plant communities should necessarily be thought of as “Desired Plant Communities (DPC).” According to the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) National Range and Pasture Handbook, DPCs will be determined by the decision-makers and will meet minimum quality criteria established by the NRCS. The main purpose for including any description of a plant community here is to capture the current knowledge and experience at the time of this revision.

Needleandthread/Blue Grama/Sedge Plant Community

This is the interpretive plant community and is considered to be the climax plant community. This community evolved with grazing by large herbivores and occasional prairie fire. It is well suited for grazing by domestic livestock and can be found on areas that are properly managed with prescribed grazing that allows for proper utilization, changes in season of use, and adequate recovery periods following each grazing event. The potential vegetation is about 80-90 percent grasses or grass-like plants, 5-10 percent forbs, 5-10 percent shrubs.

The major grasses and grass-likes include needleandthread, blue grama, and little bluestem. Other grasses occurring on this plant community include hairy grama, sideoats grama, plains muhly, and sedges. Common forbs include cudweed sagewort, dotted gayfeather, green sagewort, hairy goldaster, Missouri goldenrod, purple coneflower, and scurfpea. Significant shrubs include fringed sagewort and leadplant.

This plant community is well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allows for high drought tolerance. This is a healthy and sustainable plant community (site/soil stability, watershed function, and biologic integrity).

The following growth curve is an estimate of the monthly percentages of the annual growth of the dormant species expected during the normal year.

Growth curve number: SD6303

Growth curve name: Pierre Shale Plains, 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:

- Heavy continuous grazing will convert the plant community to the *Low Plant Density, Blue Grama/Sedge Plant Community*.

Low Plant Density, Blue Grama/Sedge Plant Community

This plant community develops after heavy continuous grazing or from extended periods of below or above average precipitation. This plant community is dispersed throughout the pasture, encircling spot grazed areas, and areas distant from water sources. This is a typical pattern found in properly stocked pastures grazed season-long. Plant litter may accumulate as this plant community first develops. Due to a lack of tiller stimulation and sunlight, native bunchgrasses typically develop dead centers and native rhizomatous grasses are limited to colonies.

Standing decadent plants and moderate litter covers shorter understory species (i.e., shortgrasses and sedges), restricting their ability to capture adequate sunlight for photosynthesis. Vigor and diversity of native plants are reduced. Annual and/or biennial forbs and annual grasses commonly fill interspaces once occupied by desirable species.

Dominant grass and grass-like species include blue grama, hairy grama, threeawn, and sedge. Other grasses present include needleandthread, sideoats grama, and little bluestem. Eventually, species such as Kentucky bluegrass, cheatgrass, and sweetclover tend to invade and may dominate this plant community. The common forbs include green sagewort, cudweed, western ragweed, scurfpea, and white prairie aster. Fringed sagewort and plains pricklypear are the principal shrubs.

This plant community is resistant to change without prescribed grazing and/or severe lack or an overabundance of precipitation. Soil erosion is low. Runoff is similar to the climax plant community. Once this plant community is reached, any of the preferred treatments can readily return the diversity and production of the site.

The following growth curve is an estimate of the monthly percentages of the annual growth of the dormant species expected during the normal year.

Growth curve number: SD6003

Growth curve name: Pierre Shale Plains, 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

Transitional pathways leading to other plant communities are as follows:

- Prescribed grazing will adequate precipitation and recovery time from grazing occurrences will move this plant community toward the *Needleandthread/Blue Grama/Sedge Plant Community*.

Ecological Site Interpretations

Animal Community – Wildlife Interpretations

-- Under development --

Needleandthread/Blue Grama/Sedge Plant Community:

Low Plant Density, Blue Grama/Sedge Plant Community:

Annual/Pioneer Perennial/Cactus Plant Community:

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

Common Name	Cattle	Sheep	Horses	Deer	Antelope	Bison	Elk
Grasses & Grass-like							
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
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
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
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 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
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
sixweeks fescue	N N N N	N U N N	N N N N	N U N N	N U N N	N N N N	N N N N
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							
cutweed 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
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
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
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
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
Missouri 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
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
rush skeletonweed	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
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
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
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
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							
brittle 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
broom snakeweed	N N N N	U U U U	N N N N	U U U U	U U U U	N N N N	U 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
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
plains pricklypear	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
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

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 ecological site 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)
Needleandthread/Blue Grama/Sedge	1600	0.44
Low Plant Density, Blue Grama/Sedge	1100	0.30

*Based on 912 lbs./acre (air-dry weight) per Animal Unit Month (AUM), and on 25 percent harvest efficiency (refer to USDA 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 varies from moderate to rapid and runoff potential varies from negligible to medium for this site 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 exception would be where shortgrasses form a dense sod and dominate the site. Areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff (refer to Section 4, NRCS National Engineering Handbook for runoff quantities and hydrologic curves).

Recreational Uses

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

Wood Products

Timber harvest of eastern redcedar may occur on localized areas of this site.

Other Products

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

Supporting Information

Associated Sites

Loamy (R063AY010SD), Sandy (R063AY009SD), Very Shallow (R063AY016SD)

Similar Sites

(R063AY016SD) – Very Shallow [more needleandthread, but less blue grama, plains muhly, green needlegrass, and western wheatgrass]

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: April Boltjes, Range Management Specialist (RMS), NRCS; Stan Boltz, RMS, NRCS; Kent Cooley, Soil Scientist, NRCS; Rick Peterson, RMS, NRCS; and L. Michael Stirling, 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	0			

State Correlation

MLRA 63A lies entirely within SD, so no cross-state correlation has occurred.

Field Offices/Counties

Dupree, SD	Ziebach	McIntosh, SD	Corson	Pierre, SD	Hughes/Stanley
Faith, SD	Meade	Mound City, SD	Campbell	Selby, SD	Walworth
Gettysburg, SD	Potter	Murdo, SD	Jones	Timber Lake, SD	Dewey
Kadoka, SD	Jackson	Onida, SD	Sully	Wall, SD	East Pennington
Kennebec, SD	Lyman	Philip, SD	Haakon	White River, SD	Mellette

Relationship to Other Established Classifications

Level IV Ecoregions of the Conterminous United States: 43c – River Breaks and 43f – Subhumid Pierre Shale Plains.

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://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