United States Department of Agriculture
Natural Resources Conservation Service

Ecological Site Description

Site Type: Rangeland

Site Name: Dense Clay

Site ID: R063AY018SD

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

Physiographic Features

This site occurs on nearly level to sloping uplands.

Landform: terrace, fan, plain

Aspect: N/A

	Minimum	Maximum
Elevation (feet):	1600	2700
Slope (percent):	0	15
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

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.

	Minimum	Maximum
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

The soils in this site are well drained and formed in clayey alluvium or residuum from soft shale. The clay surface layer is one to five inches thick. The soils have a slow to very slow infiltration rate except after dry periods when initial uptake may be rapid due to cracking of the surface. Gilgai microrelief occurs in most areas. When dry these soils crack. Wet surface compaction can occur with heavy traffic. This site should show slight to no evidence of rills or wind scoured areas. It is not uncommon to have some pedestalling of plants due to the inherent instability of the soils. Water flow paths are broken, irregular in appearance, or discontinuous with numerous debris dams or vegetative barriers. The soil surface is stable and intact. Subsurface soil layers are restrictive to water movement and root penetration.

These soils are highly susceptible to wind and water erosion. The hazard of water erosion increases on slopes greater than six percent or where vegetative cover is not adequate.

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

Parent Material Kind: alluvium, residuum, shale
Parent Material Origin: shale, unspecified
Surface Texture: clay
Surface Texture Modifier: none
Subsurface Texture Group: clayey
Surface Fragments ≤3" (% Cover): 0
Surface Fragments >3" (%Cover): 0
Subsurface Fragments ≤3" (% Volume): 0-20
Subsurface Fragments >3" (% Volume): 0-10

	Minimum	Maximum
Drainage Class:	well	well
Permeability Class:	very slow	moderately slow
Depth to Bedrock (inches):	10	60
Electrical Conductivity (mmhos/cm)*:	0	16
Sodium Absorption Ratio*:	0	15
Soil Reaction (1:1 Water)*:	5.6	9.0
Soil Reaction (0.1M CaCl2)*:	NA	NA
Available Water Capacity (inches)*:	2	4
Calcium Carbonate Equivalent (percent)*:	0	10

*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, natural influences of large herbivores, occasional fire, 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. Green needlegrass is more prevalent in the western portions of the MLRA, and partially replaces the wheatgrasses.

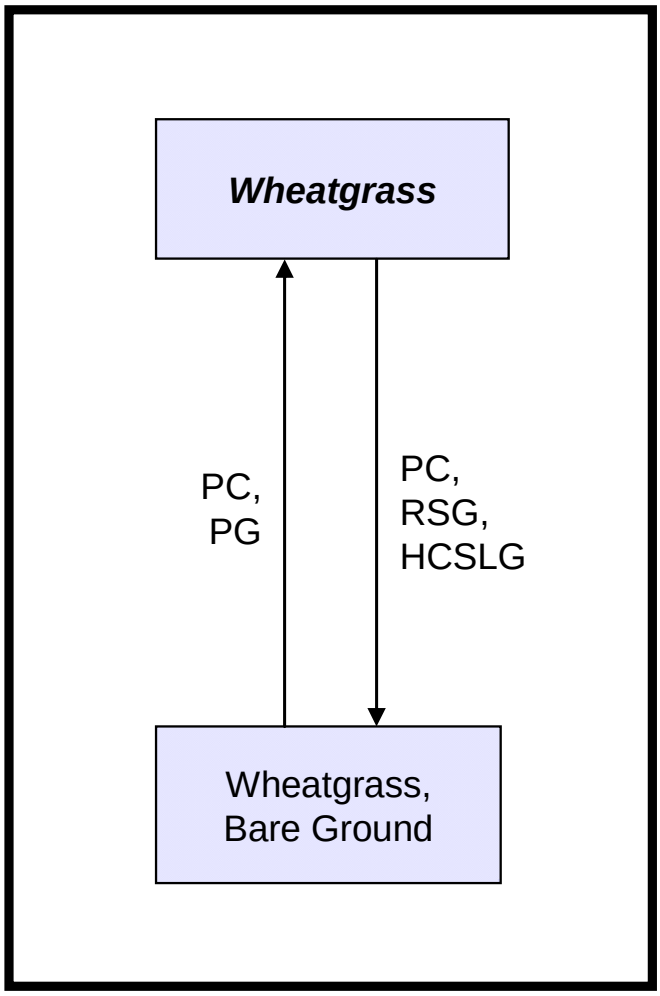
These soils are high in clay and have a low available water capacity. The shrink-swell potential is very high, resulting in cracks greater than two inches wide during dry periods. The native wheatgrasses with their strong rhizomes and high drought tolerance are able to thrive in these soils. Wheatgrasses dominate the site and production is closely related to the vigor of the native wheatgrass. Slick spots are sometimes associated with this site. Slick spots are bare ground areas that are affected by high sodium concentrations. The soil factors are the dominant influence and grazing management does not typically affect these areas.

Interpretations are primarily based on the Western Wheatgrass Plant Community. 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.

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



HCSLG - Heavy, continuous season-long grazing; **PC** - Precipitation cycles; **PG** - Prescribed grazing; **RSG** - Repeated seasonal grazing.

Plant Community Composition and Group Annual Production

			Wheatgrass		
COMMON/GROUP NAME	**SCIENTIFIC NAME**	**SYMBOL**	**Group**	**lbs./acre**	**% Comp**
GRASSES & GRASS-LIKES				*1275 - 1425*	*85 - 95*
western wheatgrass	Pascopyrum smithii	PASM	1	750 - 1200	50 - 80
green needlegrass	Nassella viridula	NAVI4	2	30 - 150	2 - 10
WARM-SEASON GRASSES			**3**	**75 - 225**	**5 - 15**
buffalograss	Bouteloua dactyloides	BODA2	3	30 - 150	2 - 10
blue grama	Bouteloua gracilis	BOGR2	3	30 - 150	2 - 10
sideoats grama	Bouteloua curtipendula	BOCU	3	0 - 75	0 - 5
inland saltgrass	Distichlis spicata	DISP	3	0 - 45	0 - 3
GRASS-LIKES			**4**	**15 - 75**	**1 - 5**
needleleaf sedge	Carex duriuscula	CADU6	4	15 - 75	1 - 5
other grass-likes		2GL	4	0 - 75	0 - 5
FORBS			*6*	*75 - 150*	*5 - 10*
American vetch	Vicia americana	VIAM	6	0 - 15	0 - 1
biscuitroot	Lomatium spp.	LOMAT	6	15 - 30	1 - 2
heath aster	Symphyotrichum ericoides	SYER	6	15 - 30	1 - 2
prairie coneflower	Ratibida columnifera	RACO3	6	0 - 30	0 - 2
pussytoes	Antennaria spp.	ANTEN	6	0 - 15	0 - 1
scarlet gaura	Gaura coccinea	GACO5	6	0 - 15	0 - 1
scarlet globemallow	Sphaeralcea coccinea	SPCO	6	15 - 30	1 - 2
spiny phlox	Phlox hoodii	PHHO	6	0 - 15	0 - 1
spurge	Euphorbia spp.	EUPHO	6	0 - 15	0 - 1
textile onion	Allium textile	ALTE	6	0 - 15	0 - 1
western wallflower	Erysimum capitatum var. capitatum	ERCAC	6	0 - 15	0 - 1
western yarrow	Achillea millefolium var. occidentalis	ACMIO	6	0 - 15	0 - 1
wild parsley	Musineon divaricatum	MUDI	6	15 - 30	1 - 2
native forbs		2FN	6	15 - 45	1 - 3
SHRUBS				*15 - 30*	*1 - 2*
brittle cactus	Opuntia fragilis	OPFR		15 - 30	1 - 2
plains pricklypear	Opuntia polyacantha	OPPO		0 - 30	0 - 2
other shrubs		2SHRUB		0 - 30	0 - 2

Annual Production lbs./acre	LOW	RV	HIGH
GRASSES & GRASS-LIKES	820 -	1365	- 1800
FORBS	70 -	113	- 165
SHRUBS	10 -	23	- 35
TOTAL	900 -	1500	- 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 Composition and Group Annual Production

		Wheatgrass			Wheatgrass, Bare Ground		
COMMON/GROUP NAME	**SYMBOL**	**Group**	**lbs./acre**	**% Comp**	**Group**	**lbs./acre**	**% Comp**
GRASSES & GRASS-LIKES			*1275 - 1425*	*85 - 95*		*720 - 760*	*90 - 95*
western wheatgrass	PASM	1	750 - 1200	50 - 80		480 - 640	60 - 80
green needlegrass	NAVI4	2	30 - 150	2 - 10		0 - 40	0 - 5
WARM-SEASON GRASSES		**3**	**75 - 225**	**5 - 15**		**0 - 40**	**0 - 5**
buffalograss	BODA2	3	30 - 150	2 - 10		0 - 40	0 - 5
blue grama	BOGR2	3	30 - 150	2 - 10		0 - 40	0 - 5
sideoats grama	BOCU	3	0 - 75	0 - 5		0 - 24	0 - 3
inland saltgrass	DISP	3	0 - 45	0 - 3		0 - 24	0 - 3
GRASS-LIKES		**4**	**15 - 75**	**1 - 5**		**0 - 24**	**0 - 3**
needleleaf sedge	CADU6	4	15 - 75	1 - 5		0 - 24	0 - 3
other grass-likes	2GL	4	0 - 75	0 - 5		0 - 24	0 - 3
FORBS		*6*	*75 - 150*	*5 - 10*		*0 - 40*	*0 - 5*
American vetch	VIAM	6	0 - 15	0 - 1		0 - 8	0 - 1
biscuitroot	LOMAT	6	15 - 30	1 - 2		0 - 8	0 - 1
heath aster	SYER	6	15 - 30	1 - 2		0 - 16	0 - 2
prairie coneflower	RACO3	6	0 - 30	0 - 2		0 - 8	0 - 1
pussytoes	ANTEN	6	0 - 15	0 - 1		0 - 8	0 - 1
scarlet gaura	GACO5	6	0 - 15	0 - 1		0 - 8	0 - 1
scarlet globemallow	SPCO	6	15 - 30	1 - 2		0 - 8	0 - 1
spiny phlox	PHHO	6	0 - 15	0 - 1		0 - 8	0 - 1
spurge	EUPHO	6	0 - 15	0 - 1		0 - 16	0 - 2
textile onion	ALTE	6	0 - 15	0 - 1		0 - 8	0 - 1
western wallflower	ERCAC	6	0 - 15	0 - 1		0 - 8	0 - 1
western yarrow	ACMIO	6	0 - 15	0 - 1		0 - 8	0 - 1
wild parsley	MUDI	6	15 - 30	1 - 2		0 - 8	0 - 1
native forbs	2FN	6	15 - 45	1 - 3		8 - 16	1 - 2
SHRUBS		*7*	*15 - 30*	*1 - 2*		*0 - 40*	*0 - 5*
brittle cactus	OPFR	7	15 - 30	1 - 2		8 - 24	1 - 3
plains pricklypear	OPPO	7	0 - 30	0 - 2		0 - 24	0 - 3
other shrubs	2SHRUB	7	0 - 30	0 - 2		0 - 16	0 - 2

Annual Production lbs./acre	LOW	RV	HIGH	LOW	RV	HIGH
GRASSES & GRASS-LIKES	820	1365	1810	500	760	910
FORBS	70	113	155	0	20	45
SHRUBS	10	23	35	0	20	45
TOTAL	900	1500	2000	500	800	1000

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.

Wheatgrass Plant Community

Interpretations are based primarily on the Western Wheatgrass Plant Community, which is also considered to be climax. This plant community evolved with grazing by large herbivores and occasional fire, and can be maintained with prescribed grazing, prescribed burning, or areas receiving occasional short periods of rest or deferment. The potential vegetation is about 85 percent grasses or grass-like plants, 10 percent forbs, and 2 percent shrubs. Cool-season grasses dominate the plant community. The major grasses include western wheatgrass and green needlegrass. Plant diversity is low, being dominated by wheatgrasses. Other grasses and grass-likes occurring on this site may include buffalograss, blue grama, sideoats grama, and sedge. The dominant forbs include biscuitroot, heath aster, and wild parsley. Shrubs that can occur in this plant community are brittle cactus and plains pricklypear. Plant diversity is relatively low.

This plant community is well adapted to the Northern Great Plains climatic conditions. However, two to three years of drought can greatly reduce the vigor and abundance of the green needlegrass and western wheatgrass, while increasing the percent bare ground and creating moderate to high soil erosion potential. The actual plant composition may not be greatly changed, inherently the production of this plant community can vary tremendously with fluctuation is precipitation. Having average precipitation or above average, the plant community can make a fast recovery. If disturbed, dense clays are resilient. Mechanical practices such as deep ripping and furrowing can improve the hydrology, which invigorates the plant community. The native wheatgrass is strongly rhizomatous and adapted to droughty, saline soils. Water infiltration is low and runoff is very high due to the high clay content of the soil. Plant litter is properly distributed with some movement offsite and natural plant mortality is low.

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: SD6301
Growth curve name: Pierre Shale Plains, cool-season dominant.
Growth curve description: Cool-season dominant.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	4	12	25	36	10	5	4	4	0	0

Transitional pathways and/or community pathways leading to other plant communities are as follows:

- Precipitation cycles, repeated seasonal grazing, and heavy, continuous season-long grazing will shift the community to a *Western Wheatgrass/Bare Ground Plant Community.*

Wheatgrass, Bare Ground Plant Community

This plant community develops under droughty conditions, heavy spring grazing, or long-term heavy continuous grazing. The potential vegetation is made up of 90 percent grasses and grass-like plants, 5 percent forbs, and 5 percent shrubs. The grass component is almost entirely native wheatgrasses. Other perennial grasses are generally not found on this site. Drought and heavy spring use will lower basal density of green needlegrass and native wheatgrasses creating opportunities for invasive species pennycress, curlycup gumweed, sweetclover, and annual forbs to occur. Brittle cactus and prickly pear are the commonly found shrubs.

When compared to the Wheatgrass Plant Community, the vigor production and basal density of the grasses has been reduced. Often the site will be bare ground with a few sprigs of western wheatgrass and a likely chance of cheatgrass invading the site. Cool-season grass production is lessened along with a reduction in warm-season grasses such as blue grama and buffalograss. Plant diversity is extremely low. Due to low basal density, soil erosion hazards are high.

This plant community is resistant to change. Moving this plant community toward the Wheatgrass Plant Community can be accomplished through prescribed grazing, favorable climatic conditions, or severe disturbances such as mechanical ripping and chiseling.

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: SD6301
Growth curve name: Pierre Shale Plains, cool-season dominant.
Growth curve description: Cool-season dominant.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	4	12	25	36	10	5	4	4	0	0

Transitional pathways and/or community pathways leading to other plant communities are as follows:

- With prescribed grazing and above average precipitation, this plant community will move towards the *Wheatgrass Plant Community.*

Ecological Site Interpretations

Animal Community – Wildlife Interpretations

-- Under Development --

Wheatgrass Plant Community:

Wheatgrass, Bare Ground Plant Community:

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

Common Name	Cattle	Sheep	Horses	Deer	Antelope	Bison	Elk
Grasses & Grass-likes							
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
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
inland saltgrass	N U U N	N N N N	N U U N	N N N N	N N N N	N U U N	N U U N
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
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
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
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
heath aster	U U D U	U U P U	U U D U	U U P U	U U P U	U U D U	U U P U
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
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
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
spurge	U U U U	U P U U	U U U U	U U U U	U U U U	U U U U	U U U U
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
western yarrow	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
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
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
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

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)
Wheatgrass	1500	0.41
Wheatgrass, Bare Ground	800	0.22

*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 D. Infiltration is very slow to slow and runoff potential is very high depending on slope and ground cover. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be where shortgrasses form a strong sod and dominate the site. Areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff (refer to Section 4, NRCS National Engineering Handbook for runoff quantities and hydrologic curves).

Recreational Uses

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

Wood Products

No appreciable wood products are typically present on this site.

Other Products

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

Supporting Information

Associated Sites

(R063AY011SD) – Clayey
(R063AY015SD) – Thin Claypan
(R063AY021SD) – Clayey Overflow

Similar Sites

(R063AY011SD) – Clayey [more short grasses; higher production]
(R063AY015SD) – Thin Claypan [more short grasses and plains pricklypear; contains slick spots]

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, RMS, NRCS.

Data Source	Number of Records	Sample Period	State	County
SCS-RANGE-417	2	1968 – 1977	SD	Corson and Stanley

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