United States Department of Agriculture
Natural Resources Conservation Service

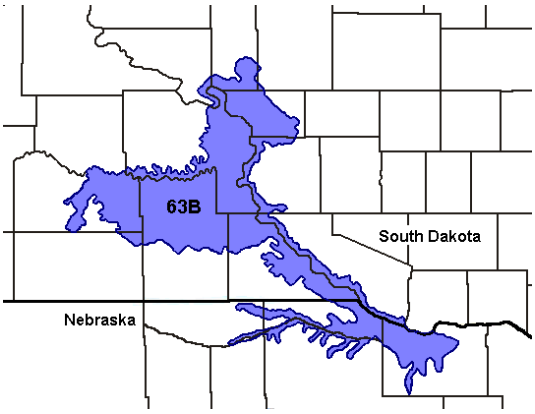
Ecological Site Description

Site Type: Rangeland

Site Name: Closed Depression

Site ID: R063BY019SD

Major Land Resource Area (MLRA): 63B – Southern Rolling Pierre Shale Plains



Physiographic Features

This site occurs on concave to nearly level depressions on uplands.

Landform: depression

Aspect: N/A

	Minimum	Maximum
Elevation (feet):	1,300	2,000
Slope (percent):	0	1
Water Table Depth (inches):	0	80
Flooding:		
Frequency:	None	None
Duration:	None	None
Ponding:		
Depth (inches):	0	12
Frequency:	Occasional	Frequent
Duration:	Long	Long
Runoff Class:	Negligible	Negligible

Climatic Features

MLRA 63B is considered to have a continental climate – cold winters and hot summers, low humidity, light rainfall, and much sunshine. Extremes in temperature may also abound. The climate is the result of this MLRA's location near the geographic center of North America. There are few natural barriers on the Northern Great Plains and air masses move freely across the plains and account for rapid changes in temperature.

Annual precipitation typically ranges from 19 to 24 inches per year. The average annual temperature is about 48°F. January is the coldest month with average temperatures ranging from about 15°F (Stephan, South Dakota (SD)), to about 22°F (Winner, SD). July is the warmest month with temperatures averaging from about 73°F (Stephan, SD), to about 76°F (Winner, SD). The range of normal average monthly temperatures between the coldest and warmest months is about 56°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 (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 strong storms may bring brief periods of high winds with gusts to more than 50 mph.

Growth of cool-season plants begins in early to mid-March slowing or ceasing in late June. Warm-season plants begin growth about mid-May and continue to early or mid-September. Greenup of cool-season plants may occur in September and October when adequate soil moisture is present.

	Minimum	Maximum
Frost-free period (days):	130	162
Freeze-free period (days):	148	180
Mean Annual Precipitation (inches):	19	24

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

	Precip. Min.	Precip. Max	Temp. Min.	Temp. Max.
January	0.39	0.45	3.1	33.0
February	0.54	0.71	8.9	38.7
March	1.11	1.59	18.7	47.5
April	1.90	2.72	31.4	62.0
May	2.80	3.40	42.7	73.1
June	3.05	3.60	53.0	82.6
July	2.70	3.16	58.5	89.9
August	2.03	2.69	56.2	88.4
September	1.76	2.51	45.8	78.9
October	1.47	1.55	33.2	65.7
November	0.59	0.94	19.2	47.8
December	0.35	0.62	8.1	36.5

Climate Stations		Period	
Station ID	**Location or Name**	**From**	**To**
NE5040	Lynch	1948	2007
NE5960	Niobrara	1948	2005
SD7992	Stephan	1948	2007
SD9367	Winner	1948	2007

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

Riparian and Wetland Features

Wetland Description:	System	Subsystem	Class	Sub-class
(Cowardin, et al., 1979):	Palustrine			

Representative Soil Features

The common features of soils in this site are the clay to clay loam textured subsoil and slopes of zero to one percent. The soils in this site are poorly drained and formed in alluvium. The silt loam to clay surface layer is two to nine inches thick. Some soils exhibit an extremely hard clayey Btn horizon that has round-topped or bun shaped columnar structure. These Btn horizons are high in sodium. The soils have a very slow infiltration rate. Available water capacity is four to six inches. The soils crack when dry and heavy traffic can cause surface compaction when wet. Subsurface soil layers are restrictive to water movement and root penetration. This site should show slight to no evidence of rills, wind scoured areas, or pedestalled plants. Water flow paths are broken, irregular in appearance, or discontinuous. The soil surface is stable and intact. High accumulations of sodium and slow permeability strongly influence the soil-water-plant relationship on this site.

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

Parent Material Kind: alluvium
Parent Material Origin: shale, clayey
Surface Texture: silt loam, clay, silty clay
Surface Texture Modifier: none
Subsurface Texture Group: clayey
Surface Fragments ≤3" (% Cover): 0
Surface Fragments >3" (%Cover): 0
Subsurface Fragments ≤3" (% Volume): 0-5
Subsurface Fragments >3" (% Volume): 0

	Minimum	Maximum
Drainage Class:	poorly	poorly
Permeability Class:	very slow	very slow
Depth (inches):	80	80
Electrical Conductivity (mmhos/cm)*:	0	16
Sodium Absorption Ratio*:	0	20
Soil Reaction (1:1 Water)*:	5.6	9.0
Soil Reaction (0.1M CaCl2)*:	NA	NA
Available Water Capacity (inches)*:	4	6
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.

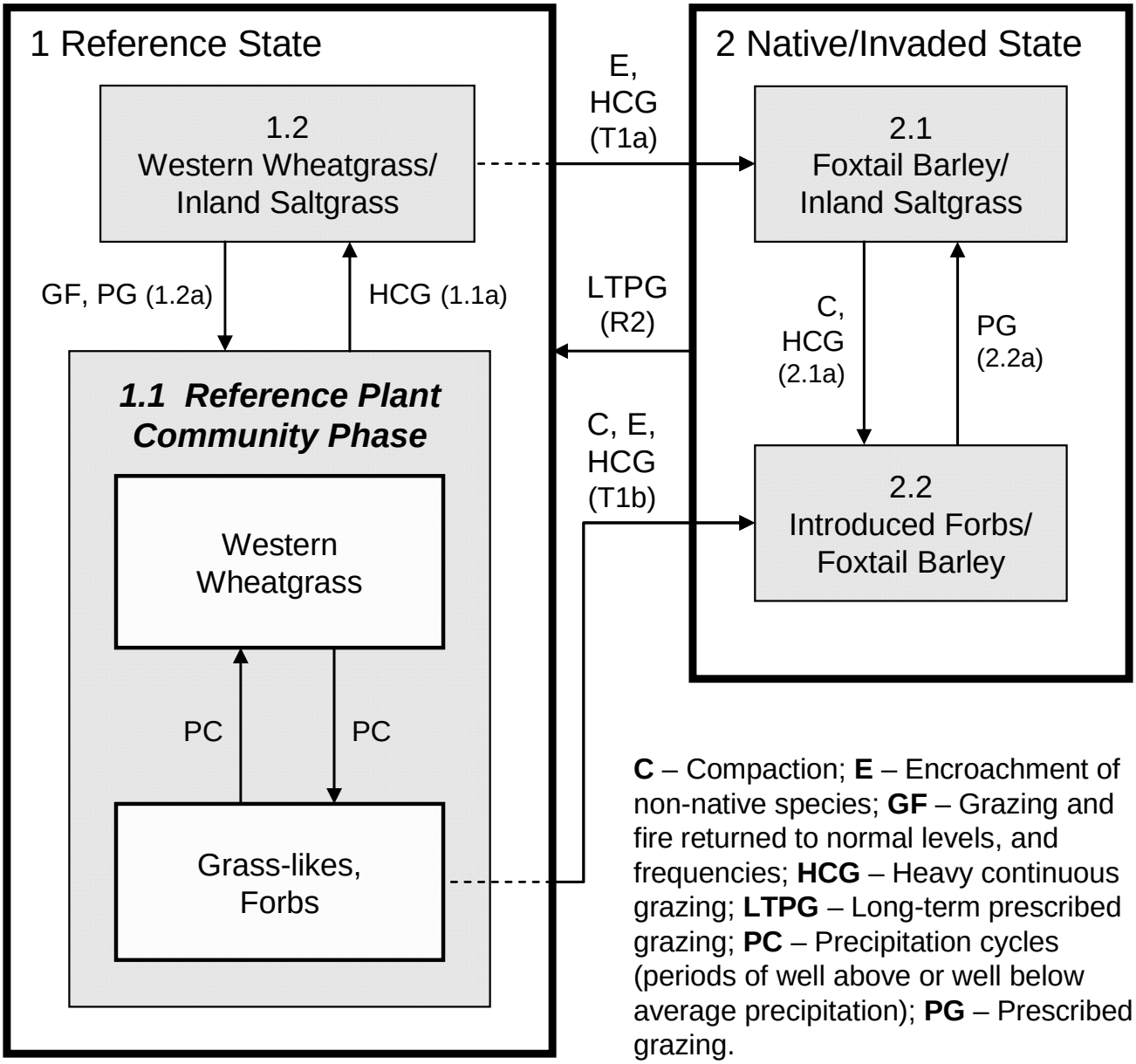
This site is very sensitive to precipitation fluctuations from year to year. With above average precipitation, the site becomes very wet, leading to a much different plant community than what would be present with average to below average precipitation. In dry years, plant density becomes very low. The two plant communities influenced strongly by precipitation alone (Western Wheatgrass and Grass-likes, Forbs) make up the natural fluctuation of what could be considered the Reference Plant Community Phase.

Interpretations are primarily based on the Western Wheatgrass and Grass-likes, Forbs Plant Community Phases. These have 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 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



C – Compaction; **E** – Encroachment of non-native species; **GF** – Grazing and fire returned to normal levels, and frequencies; **HCG** – Heavy continuous grazing; **LTPG** – Long-term prescribed grazing; **PC** – Precipitation cycles (periods of well above or well below average precipitation); **PG** – Prescribed grazing.

Plant Community Composition and Group Annual Production

			1.1 Reference Plant Community Phase		
COMMON/GROUP NAME	**SCIENTIFIC NAME**	**SYMBOL**	**Group**	**lbs./acre**	**% Comp**
GRASSES & GRASS-LIKES				*1400 - 3325*	*40 - 95*
WHEATGRASSES			**1**	**700 - 2975**	**20 - 85**
western wheatgrass	Pascopyrum smithii	PASM	1	700 - 2975	20 - 85
slender wheatgrass	Elymus trachycaulus	ELTR7	1	0 - 175	0 - 5
COOL-SEASON BUNCHGRASSES			**2**	**175 - 1400**	**5 - 40**
foxtail barley	Hordeum jubatum	HOJU	2	70 - 1225	2 - 35
Nuttall's alkaligrass	Puccinellia nuttalliana	PUNU2	2	70 - 525	2 - 15
SHORT WARM-SEASON GRASSES			**3**	**35 - 350**	**1 - 10**
inland saltgrass	Distichlis spicata	DISP	3	35 - 350	1 - 10
buffalograss	Bouteloua dactyloides	BODA2	3	0 - 175	0 - 5
OTHER NATIVE GRASSES			**4**	**70 - 350**	**2 - 10**
fowl bluegrass	Poa palustris	POPA2	4	35 - 175	1 - 5
plains bluegrass	Poa arida	POAR3	4	35 - 175	1 - 5
other grasses		2GRAM	4	0 - 350	0 - 10
GRASS-LIKES			**5**	**350 - 1575**	**10 - 45**
common spikerush	Eleocharis palustris	ELPA3	5	175 - 1400	5 - 40
needle spikerush	Eleocharis acicularis	ELAC	5	35 - 525	1 - 15
sedge	Carex spp.	CAREX	5	70 - 350	2 - 10
rush	Juncus spp.	JUNCU	5	0 - 175	0 - 5
other grass-likes		2GL	5	0 - 350	0 - 10
FORBS			*7*	*175 - 2100*	*5 - 60*
American licorice	Glycyrrhiza lepidota	GLLE3	7	0 - 175	0 - 5
bushy knotweed	Polygonum ramosissimum	PORA3	7	0 - 175	0 - 5
cinquefoil	Potentilla spp.	POTEN	7	0 - 175	0 - 5
creeping woodsorrel	Oxalis corniculata	OXCO	7	0 - 105	0 - 3
curlytop knotweed	Polygonum lapathifolium	POLA4	7	0 - 525	0 - 15
evening-primrose	Oenothera spp.	OENOT	7	0 - 175	0 - 5
Indianhemp	Apocynum cannabinum	APCA	7	0 - 175	0 - 5
lambsquarters	Chenopodium album	CHAL7	7	0 - 350	0 - 10
mealy goosefoot	Chenopodium incanum	CHIN2	7	0 - 175	0 - 5
mint	Mentha spp.	MENTH	7	0 - 175	0 - 5
New England aster	Symphyotrichum novae-angliae	SYNO2	7	0 - 350	0 - 10
pale dock	Rumex altissimus	RUAL4	7	0 - 525	0 - 15
Pennsylvania smartweed	Polygonum pensylvanicum	POPE2	7	0 - 525	0 - 15
plains coreopsis	Coreopsis tinctoria	COTI3	7	0 - 175	0 - 5
plantain	Plantago spp.	PLANT	7	0 - 175	0 - 5
povertyweed	Iva axillaris	IVAX	7	0 - 175	0 - 5
Pursh seepweed	Suaeda calceoliformis	SUCA2	7	0 - 350	0 - 10
smooth horsetail	Equisetum laevigatum	EQLA	7	0 - 105	0 - 3
tall fringed bluebells	Mertensia ciliata	MECI3	7	0 - 105	0 - 3
western dock	Rumex aquaticus	RUAQ	7	0 - 350	0 - 10
native forbs		2FN	7	0 - 700	0 - 20

Annual Production lbs./acre	LOW RV HIGH
GRASSES & GRASS-LIKES	1845 - 2363 - 3050
FORBS	155 - 1138 - 1450
TOTAL	2000 - 3500 - 4500

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

		1.1 Reference Plant Community Phase			1.2 Western Wheatgrass/ Inland Saltgrass			2.1 Foxtail Barley/Inland Saltgrass		
COMMON/GROUP NAME	**SYMBOL**	**Grp**	**lbs./acre**	**% Comp**	**Grp**	**lbs./acre**	**% Comp**	**Grp**	**lbs./acre**	**% Comp**
GRASSES & GRASS-LIKES			*1400 - 3325*	*40 - 95*		*1430 - 2090*	*65 - 95*		*900 - 1140*	*75 - 95*
WHEATGRASSES		**1**	**700 - 2975**	**20 - 85**	**1**	**330 - 880**	**15 - 40**	**1**	**0 - 60**	**0 - 5**
western wheatgrass	PASM	1	700 - 2975	20 - 85	1	330 - 880	15 - 40	1	0 - 60	0 - 5
slender wheatgrass	ELTR7	1	0 - 175	0 - 5						
COOL-SEASON BUNCHGRASSES		**2**	**175 - 1400**	**5 - 40**	**2**	**110 - 440**	**5 - 20**	**2**	**240 - 600**	**20 - 50**
foxtail barley	HOJU	2	70 - 1225	2 - 35	2	66 - 330	3 - 15	2	240 - 600	20 - 50
Nuttall's alkaligrass	PUNU2	2	70 - 525	2 - 15	2	22 - 220	1 - 10	2	0 - 36	0 - 3
SHORT WARM-SEASON GRASSES		**3**	**35 - 350**	**1 - 10**	**3**	**220 - 880**	**10 - 40**	**3**	**120 - 480**	**10 - 40**
inland saltgrass	DISP	3	35 - 350	1 - 10	3	220 - 880	10 - 40	3	120 - 480	10 - 40
buffalograss	BODA2	3	0 - 175	0 - 5	3	0 - 66	0 - 3			
OTHER NATIVE GRASSES		**4**	**70 - 350**	**2 - 10**	**4**	**0 - 110**	**0 - 5**	**4**	**0 - 60**	**0 - 5**
fowl bluegrass	POPA2	4	35 - 175	1 - 5	4	0 - 66	0 - 3			
plains bluegrass	POAR3	4	35 - 175	1 - 5	4	0 - 66	0 - 3			
other grasses	2GRAM	4	0 - 350	0 - 10	4	0 - 110	0 - 5	4	0 - 60	0 - 5
GRASS-LIKES		**5**	**350 - 1575**	**10 - 45**	**5**	**110 - 550**	**5 - 25**	**5**	**60 - 240**	**5 - 20**
common spikerush	ELPA3	5	175 - 1400	5 - 40	5	44 - 330	2 - 15	5	24 - 180	2 - 15
needle spikerush	ELAC	5	35 - 525	1 - 15	5	0 - 110	0 - 5	5	0 - 60	0 - 5
sedge	CAREX	5	70 - 350	2 - 10	5	0 - 176	0 - 8	5	0 - 60	0 - 5
rush	JUNCU	5	0 - 175	0 - 5	5	0 - 110	0 - 5	5	0 - 36	0 - 3
other grass-likes	2GL	5	0 - 350	0 - 10	5	0 - 110	0 - 5	5	0 - 36	0 - 3
NON-NATIVE GRASSES		**6**			**6**	**22 - 220**	**1 - 10**	**6**	**12 - 96**	**1 - 8**
bluegrass	POA				6	0 - 220	0 - 10	6	0 - 60	0 - 5
cheatgrass	BRTE				6	22 - 110	1 - 5	6	12 - 60	1 - 5
FORBS		*7*	*175 - 2100*	*5 - 60*	*7*	*110 - 770*	*5 - 35*	*7*	*60 - 300*	*5 - 25*
American licorice	GLLE3	7	0 - 175	0 - 5	7	0 - 66	0 - 3			
bushy knotweed	PORA3	7	0 - 175	0 - 5	7	0 - 110	0 - 5	7	0 - 36	0 - 3
cinquefoil	POTEN	7	0 - 175	0 - 5	7	0 - 22	0 - 1			
cocklebur	XANTH2				7	0 - 110	0 - 5	7	0 - 60	0 - 5
creeping woodsorrel	OXCO	7	0 - 105	0 - 3	7	0 - 110	0 - 5	7	0 - 36	0 - 3
curly dock	RUCR				7	0 - 66	0 - 3	7	0 - 120	0 - 10
curlycup gumweed	GRSQ				7	0 - 66	0 - 3	7	0 - 60	0 - 5
curlytop knotweed	POLA4	7	0 - 525	0 - 15	7	0 - 220	0 - 10	7	0 - 36	0 - 3
evening-primrose	OENOT	7	0 - 175	0 - 5	7	0 - 66	0 - 3			
Indianhemp	APCA	7	0 - 175	0 - 5	7	0 - 66	0 - 3			
lambsquarters	CHAL7	7	0 - 350	0 - 10	7	0 - 220	0 - 10	7	0 - 180	0 - 15
mealy goosefoot	CHIN2	7	0 - 175	0 - 5	7	0 - 66	0 - 3	7	0 - 24	0 - 2
mint	MENTH	7	0 - 175	0 - 5						
New England aster	SYNO2	7	0 - 350	0 - 10	7	0 - 66	0 - 3			
pale dock	RUAL4	7	0 - 525	0 - 15	7	0 - 66	0 - 3			
Pennsylvania smartweed	POPE2	7	0 - 525	0 - 15	7	0 - 220	0 - 10	7	0 - 36	0 - 3
plains coreopsis	COTI3	7	0 - 175	0 - 5						
plantain	PLANT	7	0 - 175	0 - 5	7	0 - 110	0 - 5	7	0 - 36	0 - 3
povertyweed	IVAX	7	0 - 175	0 - 5	7	0 - 110	0 - 5	7	0 - 36	0 - 3
Pursh seepweed	SUCA2	7	0 - 350	0 - 10	7	0 - 110	0 - 5	7	0 - 12	0 - 1
smooth horsetail	EQLA	7	0 - 105	0 - 3	7	0 - 66	0 - 3	7	0 - 36	0 - 3
tall fringed bluebells	MECI3	7	0 - 105	0 - 3						
western dock	RUAQ	7	0 - 350	0 - 10	7	0 - 66	0 - 3			
native forbs	2FN	7	0 - 700	0 - 20	7	0 - 110	0 - 5	7	0 - 60	0 - 5
introduced forbs	2FI				7	0 - 220	0 - 10	7	0 - 120	0 - 10

Annual Production lbs./acre	LOW RV HIGH	LOW RV HIGH	LOW RV HIGH
GRASSES & GRASS-LIKES	1845 - 2363 - 3050	1400 - 1760 - 1875	745 - 1020 - 1455
FORBS	155 - 1138 - 1450	100 - 440 - 925	55 - 180 - 345
TOTAL	2000 - 3500 - 4500	1500 - 2200 - 2800	800 - 1200 - 1800

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. In pre-European times, the primary disturbance mechanisms for this site in the reference condition included periods of below average and above average precipitation (resulting in alternating periods of ponding and drying), and grazing by large herding ungulates. Timing of grazing coupled with weather events dictated the dynamics that occurred within the natural range of variability. Today, this 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. Wheatgrass species can decline and a corresponding increase in foxtail barley, short, warm-season grasses, and forbs will occur. Under extended periods of disturbance, the main change is a reduction in vigor and production and an increase in bare ground and forb composition.

1.1 Reference Plant Community Phase

Interpretations are based primarily on the Western Wheatgrass and Grass-likes, Forb Plant Communities, which are also considered to be climax. This plant community evolved with grazing by large herbivores and occasional fire, as well as, periodic flooding and drying, and can be maintained with prescribed grazing, prescribed burning, or areas receiving occasional short periods of rest or deferment. This plant community phase has two sub-phases, just referred to as plant communities here. These sub-phases are mainly driven by precipitation and flooding/drying sequences.

Western Wheatgrass Plant Community: Following several years of above average precipitation, the plant community stabilizes and becomes dominated with perennial grasses such as western wheatgrass. Other grasses and grass-likes present include Nuttall's alkaligrass, sedge, rush, and slender wheatgrass. The occurrence of forbs will be considerably lower including some species such as American licorice, curlycup knotweed, and Pennsylvania smartweed, Pursh seepweed, and western dock. The plant community is made up of about 80 to 90 percent grasses and grass-likes and about 10 to 20 percent forbs. The total annual production (air-dry weight) of this plant community is typically about 3,500 pounds per acre.

Grass-likes, Forbs Plant Community: This plant community often occurs after a period of higher precipitation that follows an extended dry cycle. Grasses and grass-likes commonly occurring include sedge, spikerush, rush, foxtail barley, western wheatgrass, and bluegrasses. The forbs commonly found include western dock, mint, Pursh seepweed, lambsquarters, knotweed, evening-primrose, buttercup, and New England aster. The plant community is made up of about 5 to 10 percent grasses, 30 to 40 percent grass-likes, and about 50 to 60 percent forbs. The total annual production (air-dry weight) is about 2,200 pounds per acre.

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

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

- Precipitation cycles will shift this community between the *Western Wheatgrass* and *Grass-likes, Forbs Plant Communities.* After several years of above average precipitation, the plant community stabilizes and perennial grasses/western wheatgrass will dominate the site with few grass-likes and forbs; and in the instance of higher precipitation received after extended years of drought, there will be an increase in the grass-likes and forbs components.

- 1.1a – Heavy continuous grazing (grazing at full to heavy levels for extended portions of the growing season without adequate recovery periods) will shift this community to the *1.2 Western Wheatgrass/Inland Saltgrass Plant Community.*

1.2 Western Wheatgrass/Inland Saltgrass Plant Community Phase

This plant community is the result of heavy continuous grazing. Repeated defoliation depletes stored carbohydrates, resulting in weakening and eventual death of the most palatable grasses. Lack of litter and reduced plant vigor result in higher soil temperatures, poor water infiltration rates, high evapotranspiration and increased percolation of the high water table, which increases salt concentrations on the surface. This gives inland saltgrass and other salt tolerant species a competitive advantage over less tolerant species.

Inland saltgrass drastically increases and competes with western wheatgrass as the dominant species. Other grass and grass-like species present will include Nuttall's alkaligrass, plains bluegrass, common spikerush, needle Spikerush, and other sedges and rushes. Early cool-season grasses including foxtail barley, fowl bluegrass, and Kentucky bluegrass begin to invade. Forbs that will invade are curly dock and cocklebur. Common forbs to the site include lambsquarters, Pennsylvania smartweed, curlytop knotweed, plantain, and povertyweed.

This plant community is relatively stable and well adapted to increased salinity. Plant vigor, litter, frequency, and production have decreased. The biological integrity, water, and nutrient cycles of this plant community are becoming impaired. This plant community is less productive than the 1.1 Reference Plant Community 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: 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:

- 1.2a – Grazing and fire returned to normal disturbance regime levels and frequencies, periodic light to moderate grazing possibly including periodic rest, or prescribed grazing (a planned grazing system that allows for adequate recovery periods and alternating season-of-use) will convert this plant community to the *1.1 Reference Plant Community Phase*.

- T1a – Heavy continuous grazing (grazing at full to heavy levels for extended portions of the growing season without adequate recovery periods) in conjunction with encroachment of non-native species will likely cause this site to cross a threshold leading to the *2.1 Foxtail Barley/Inland Saltgrass Plant Community Phase* within the *Native/Invaded State (State 2)*.

2.1 Foxtail Barley/Inland Saltgrass Plant Community Phase

This plant community developed with heavy continuous grazing where adequate recovery periods between grazing events were not allowed. Patches of inland saltgrass sod are typical and foxtail barley and fowl bluegrass are well distributed throughout the community. Nuttall's alkaligrass and western wheatgrass have been greatly reduced in production and vigor and may persist in remnant amounts. This plant community is resistant to change due to the grazing tolerance of inland saltgrass and increased surface salts. A significant amount of production and diversity has been lost when compared to the 1.1 Reference Plant Community Phase. Loss of key cool-season grasses and increased bare ground have negatively impacted energy flow and nutrient cycling. Water infiltration is reduced significantly due to the massive shallow root system "root pan," characteristic of inland saltgrass and increased bare ground.

It will take a long time to bring this plant community back to the Reference State (State 1) with management alone. Renovation (mechanical and/or chemical inputs) is typically not effective due to high salt content of the soil and saltgrass persistence.

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: 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:

- R2 – Long-term prescribed grazing that includes alternating season of use and allowing adequate recovery periods between grazing events may eventually lead this plant community back to the *1.2 Western Wheatgrass/Inland Saltgrass Plant Community Phase* within the *Reference State (State 1)*.

- 2.1a – Heavy continuous grazing (grazing at full to heavy levels for extended portions of the growing season without adequate recovery periods) in conjunction with compaction resulting from grazing occurring when the soil is saturated will cause this site to shift to the *2.2 Introduced Forbs/Foxtail Barley Plant Community Phase*.

2.2 Introduced Forbs/Foxtail Barley Plant Community Phase

This plant community can be reached with heavy continuous grazing coupled with compaction due to grazing when the soil is saturated. This plant community can also result from long-term ponding and occasional subsequent drying as when this site is developed for a water source. The dominant vegetation includes pioneer annual grasses, forbs, invaders, and early successional biennial and perennial species. Grasses may include foxtail barley, which may become dominant along with fowl bluegrass, Nuttall's alkaligrass, and western wheatgrass. The dominant forbs include curly dock, curlycup gumweed, kochia, cocklebur, and other early successional salt tolerant species. The community is susceptible to nonnative species due to severe soil disturbances and relatively high percent of bare ground. This plant community is resistant to change, as long as soil disturbance or severe vegetation defoliation persists, thus holding back secondary plant succession. Secondary succession is highly variable, depending upon availability and diversity of a viable seed bank of higher successional species within the existing plant community and neighboring plant communities.

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

- 2.2a – Prescribed grazing (alternating season of use and providing adequate recovery periods) or periodic light to moderate grazing possibly including periodic rest will eventually convert this plant community to the *2.1 Foxtail Barley/Inland Saltgrass Plant Community Phase*. This pathway would also require the return of more normal flooding and drying cycles.

Transition from Reference State (State 1) to the Native/Invaded State (State 2)

- T1b – Compaction due to heavy grazing when the soils are saturated coupled with heavy continuous grazing and encroachment of non-native species may cause a shift across a threshold to the *Native/Invaded State (2)*. During the wet cycles prior to drying, the 1.1 Reference Plant Community Phase is highly susceptible to compaction if heavy grazing occurs when the soil is saturated. This type of disturbance can cause a rapid decline in the native vegetation and a subsequent influx of nonnative forb species to occur.

Ecological Site Interpretations

Animal Community – Wildlife Interpretations

-- Under Development --

Western Wheatgrass, Reference Plant Community Phase (1.1):

Grass-likes, Forbs, Reference Plant Community Phase (1.1):

Western Wheatgrass/Inland Saltgrass Plant Community Phase (1.2):

Foxtail Barley/Inland Saltgrass Plant Community Phase (2.1):

Introduced Forbs/Foxtail Barley Plant Community Phase (2.2):

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

	Cattle	Sheep	Horses	Deer	Antelope	Bison	Elk
Grasses & Grass-likes							
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
slender wheatgrass	U P U U	N D U N	U P U U	N D U N	N D U N	U P U U	U P U U
foxtail barley	U D N N	N P N N	U D N N	N P N N	N P N N	U D N N	U D N N
Nuttall's alkaligrass	U P D D	P P P P	U P D D	P P P P	P P P P	U P D D	U P D 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
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
fowl bluegrass	N U U N	N U U N	N U U N	N U U N	N U U N	N U U N	N U U N
plains bluegrass	U D U D	N D N U	U D U D	U P N D	U P N D	U D U D	U D U D
common spikerush	N U D U	N U U N	N U D U	N U U N	N U U N	N U D U	N U D U
needle spikerush	N U D U	N U U N	N U D U	N U U N	N U U N	N U D U	N U D U
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
rush	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
Forbs							
American licorice	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
cinquefoil	U U D U	U U U U	U U D U	U U U U	U U U U	U U D U	U U U U
evening-primrose	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
Indianhemp	T T T T	T T T T	T T T T	T T T T	T T T T	T T T T	T T T T
lambsquarters	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
mint	N N U N	N U U N	N N U N	N U U N	N U U N	N N U N	N N U N
Pennsylvania smartweed	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
povertyweed	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
Pursh seepweed	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
western dock	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

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)
Reference Plant Community Phase (1.1)	3,500	0.96
Western Wheatgrass/Inland Saltgrass (1.2)	2,200	0.60
Foxtail Barley/Inland Saltgrass (2.1)	1,200	0.33

*Based on 912 lbs./acre (air-dry weight) per Animal Unit Month (AUM) and on 25 percent harvest efficiency (refer to United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), National Range and Pasture Handbook).

Grazing by domestic livestock is one of the major income-producing industries in the area. Rangeland in this area may provide yearlong forage. During the dormant period, the forage for livestock will likely be lacking protein to meet livestock requirements and added protein will allow ruminants to better utilize the energy stored in grazed plant materials. A forage quality test (either directly or through fecal sampling) should be used to determine the level of supplementation needed.

Hydrology Functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group D. Infiltration is slow and runoff potential for this site is high. In many cases, areas with greater than 75 percent ground cover have the greatest potential for higher infiltration and lower runoff. An example of an exception would be where shortgrasses form a strong sod and dominate the site. Dominance by inland saltgrass 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

Clayey (R063BY011SD), Loamy (R063BY010SD)

Similar Sites

(R063BY021SD) – Clayey Overflow [higher diversity; more big bluestem, green needlegrass, and shrubs]

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; and Dana Larsen, RMS, NRCS.

Data Source	Number of Records	Sample Period	State	County
SCS-RANGE-417	1	2006	SD	Brule

State Correlation

This site has been correlated with Nebraska (NE) and SD in MLRA 63B.

Field Offices/Counties

Ainsworth, NE	Keya Paha/Rock	Highmore, SD	Hyde	Pierre, SD	Hughes
Bloomfield, NE	Knox	Kennebec, SD	Lyman	Spencer, NE	Boyd
Burke, SD	Gregory	Lake Andes, SD	Charles Mix	White River, SD	Todd/Mellette
Chamberlain, SD	Brule/Buffalo	O'Neill, NE	Holt		

Relationship to Other Established Classifications

Level IV Ecoregions of the Conterminous United States: 42h - Southern River Breaks.

Other References

High Plains Regional Climate Center, University of Nebraska, 830728 Chase Hall, Lincoln, NE 68583-0728. (http://www.hprcc.unl.edu/)
USDA, NRCS. National Water and Climate Center, 101 SW Main, Suite 1600, Portland, OR 97204-3224. (http://wcc.nrcs.usda.gov)
USDA, NRCS. National Range and Pasture Handbook, September 1997
USDA, NRCS. National Soil Information System, Information Technology Center, 2150 Centre Avenue, Building A, Fort Collins, CO 80526. (http://nasis.nrcs.usda.gov)
USDA, NRCS. 2001. The PLANTS Database, Version 3.1 (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

Site Description Approval

_____ _____
SD, State Range Management Specialist Date

_____ _____
NE, State Range Management Specialist Date