

United States Department of Agriculture Natural Resources Conservation Service

Ecological Site Description

Site Type: Rangeland

Site Name: Dense Clay

Site ID: R060AY018SD

Major Land Resource Area (MLRA): 60A – Pierre Shale Plains

Physiographic Features

This site occurs on nearly level to sloping uplands.

Landform: terrace, fan, plain

Aspect: N/A

	<u>Minimum</u>	<u>Maximum</u>
Elevation (feet):	2,500	4,300
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:	Low	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 13 to 18 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 masses 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 normal average annual temperature is about 46°F. January is the coldest month with average temperatures ranging from about 19°F (Moorcroft CAA, Wyoming (WY)), to about 22°F (Belle Fourche, South Dakota (SD)). July is the warmest month with temperatures averaging from about 70°F (Moorcroft CAA, WY), to about 72°F (Belle Fourche, SD). The range of normal, average monthly temperatures between the coldest and warmest months is about 51°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 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 can 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):	122	129
Freeze-free period (days):	145	152
Mean Annual Precipitation (inches):	13	18

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

	Precip. Min.	Precip. Max	Temp. Min.	Temp. Max.
January	0.32	0.43	7.1	34.1
February	0.44	0.57	12.6	40.1
March	0.65	0.94	19.7	46.5
April	1.43	1.72	29.4	60.2
May	2.45	3.19	39.7	70.6
June	2.34	3.38	48.5	80.1
July	1.60	2.78	54.8	88.0
August	1.24	1.76	53.1	87.7
September	1.01	1.50	42.3	77.0
October	0.90	1.11	31.4	64.9
November	0.40	0.61	19.8	47.5
December	0.40	0.48	10.2	38.0

Climate Stations		Period	
Station ID	Location or Name	From	To
SD0236	Ardmore 2 N	1948	1999
SD0559	Belle Fourche	1948	1999
SD1124	Buffalo Gap	1951	1999
WY6395	Moorcroft CAA	1948	1998
WY9207	Upton 13 SW	1949	1998

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

Influencing Water Features

No significant water features influence this site.

Representative Soil Features

The soils in this site are moderately well to 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 typically should show slight to no evidence of rills, wind scoured areas, or pedestalled plants. 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 susceptible to wind and water erosion. The hazard of water erosion increases on slopes greater than about six percent. More information can be found in the various soil survey reports. Contact the local USDA Service Center for soil survey reports that include more detail specific to your location.

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
Subsurface Fragments >3” (% Volume): 0

	<u>Minimum</u>	<u>Maximum</u>
Drainage Class:	moderately well	well
Permeability Class:	very slow	very slow
Depth (inches):	20	60
Electrical Conductivity (mmhos/cm)*:	0	16
Sodium Absorption Ratio*:	0	13
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	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, 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.

Encroachment may occur from associated sites. Black greasewood, winterfat, and saltbush may occur on areas that are higher in salt content. These are typically drier areas in association with the Saline Upland Ecological Site (e.g., west of Highway 85 in Butte County, SD). Slick spots are associated with Swanboy and Wasa soils. Slickspots are bare ground areas that are affected by high sodium concentrations. The soil factors are the dominant influence and grazing management does not affect these areas.

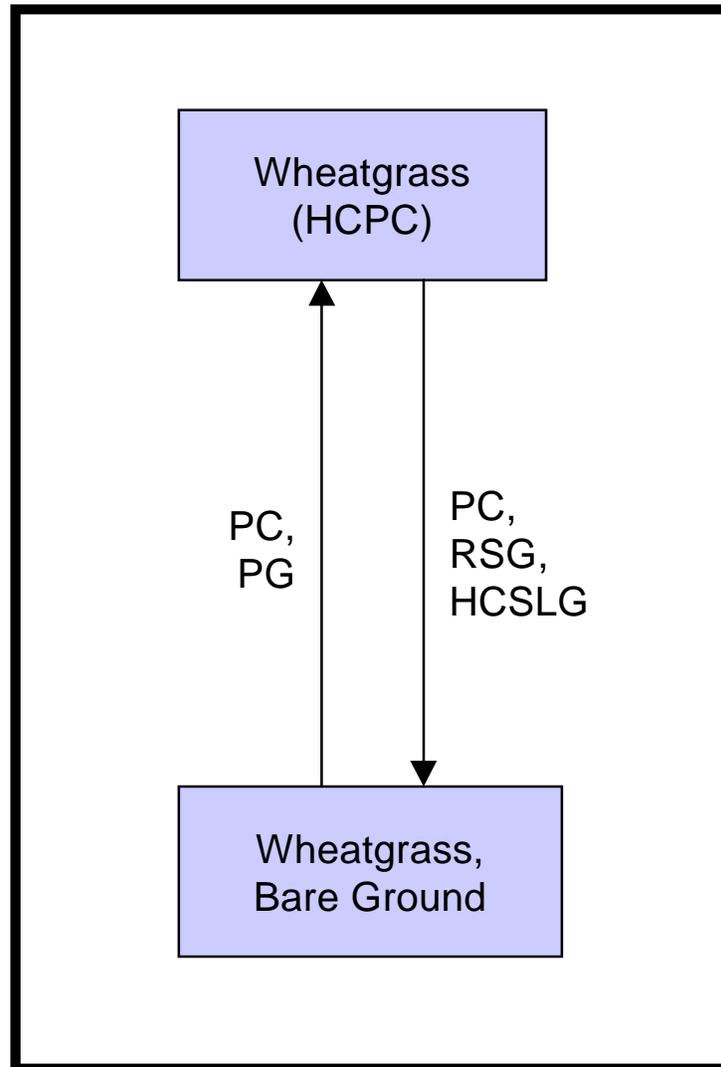
These soils are high in clay and have a low available water capacity. The shrink-swell potential is very high, resulting in cracks greater than two inches wide during dry periods. The native wheatgrasses, with their strong rhizomes and high drought tolerance, are able to thrive in these soils. Wheatgrasses dominate the site and production is closely related to the vigor of the native wheatgrass.

The plant community upon which interpretations are primarily based is the Historic Climax Plant Community (HCPC). The HCPC has been determined by studying 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 are discussed in more detail in the plant community descriptions following the diagram.

Plant Communities and Transitional Pathways



HCPC - Historic Climax Plant Community; **HCSLG** - Heavy, continuous season-long grazing; **PC** - Precipitation cycles; **PG** - Prescribed grazing; **RSG** - Repeated seasonal grazing.

Plant Community Composition and Group Annual Production

COMMON/GROUP NAME	SCIENTIFIC NAME	SYMBOL	Wheatgrass (HCPC)		
			Group	lbs./acre	% Comp
GRASSES & GRASS-LIKES				1040 - 1170	80 - 90
WHEATGRASSES			1	520 - 780	40 - 60
western wheatgrass	Pascopyrum smithii	PASM	1	390 - 780	30 - 60
Montana wheatgrass	Elymus albicans	ELAL7	1	390 - 780	30 - 60
thickspike wheatgrass	Elymus lanceolatus ssp. lanceolatus	ELLAL	1	390 - 780	30 - 60
WARM SEASON GRASSES			2	0 - 130	0 - 10
blue grama	Bouteloua gracilis	BOGR2	2	0 - 65	0 - 5
buffalograss	Buchloe dactyloides	BUDA	2	0 - 130	0 - 10
sideoats grama	Bouteloua curtipendula	BOCU	2	0 - 65	0 - 5
COOL-SEASON SHORT GRASSES & GRASS-LIKES			3	0 - 65	0 - 5
prairie junegrass	Koeleria macrantha	KOMA	3	0 - 39	0 - 3
Cusick's bluegrass	Poa cusickii	POCU3	3	0 - 65	0 - 5
Canby bluegrass	Poa canbyi	POCA	3	0 - 39	0 - 3
plains reedgrass	Calamagrostis montanensis	CAMO	3	0 - 39	0 - 3
Sandberg bluegrass	Poa secunda	POSE	3	0 - 26	0 - 2
bottlebrush squirreltail	Elymus elymoides	ELEL5	3	0 - 39	0 - 3
sedge	Carex spp.	CAREX	3	0 - 65	0 - 5
COOL-SEASON MID GRASSES			4	65 - 390	5 - 30
green needlegrass	Nassella viridula	NAVI4	4	65 - 390	5 - 30
FORBS			6	65 - 130	5 - 10
American vetch	Vicia americana	VIAM	6	0 - 65	0 - 5
bastard toadflax	Comandra spp.	COMAN	6	0 - 26	0 - 2
bladderpod	Lesquerella spp.	LESQU	6	0 - 26	0 - 2
bluebells	Mertensia spp.	MERTE	6	0 - 26	0 - 2
deervetch	Lotus unifoliolatus var. unifoliolatus	LOUNU	6	0 - 65	0 - 5
desert biscuitroot	Lomatium foeniculaceum	LOFO	6	0 - 65	0 - 5
gumbo lily	Oenothera caespitosa ssp. caespitosa	OECAC2	6	0 - 26	0 - 2
heath aster	Symphyotrichum ericoides	SYER	6	0 - 26	0 - 2
Lambert crazyweed	Oxytropis lambertii	OXLA3	6	0 - 26	0 - 2
milkvetch	Astragalus spp.	ASTRA	6	0 - 26	0 - 2
Missouri goldenrod	Solidago missouriensis	SOMI2	6	0 - 26	0 - 2
phlox	Phlox spp.	PHLOX	6	0 - 26	0 - 2
prairie coneflower	Ratibida columnifera	RACO3	6	0 - 26	0 - 2
pussytoes	Antennaria spp.	ANTEN	6	0 - 26	0 - 2
scarlet gaura	Gaura coccinea	GACO5	6	0 - 26	0 - 2
scarlet globemallow	Sphaeralcea coccinea	SPCO	6	0 - 65	0 - 5
wavyleaf thistle	Cirsium undulatum	CIUN	6	0 - 26	0 - 2
western wallflower	Erysimum capitatum var. capitatum	ERCAC	6	0 - 26	0 - 2
western yarrow	Achillea millefolium	ACMI2	6	0 - 39	0 - 3
wild onion	Allium spp.	ALLIU	6	0 - 39	0 - 3
wild parsley	Musineon divaricatum	MUDI	6	0 - 65	0 - 5
other perennial forbs		2FP	6	0 - 26	0 - 2
SHRUBS			7	65 - 130	5 - 10
big sagebrush	Artemisia tridentata	ARTR2	7	0 - 130	0 - 10
fourwing saltbush	Atriplex canescens	ATCA2	7	0 - 65	0 - 5
winterfat	Krascheninnikovia lanata	KRLA2	7	0 - 65	0 - 5
birdfoot sagebrush	Artemisia pedatifida	ARPE6	7	0 - 65	0 - 5
black greasewood	Sarcobatus vermiculatus	SAVE4	7	0 - 65	0 - 5
cactus	Opuntia spp.	OPUNT	7	0 - 130	0 - 10
other shrubs		2SHRUB	7	0 - 26	0 - 2

Annual Production lbs./acre	LOW	RV	HIGH
GRASSES & GRASS-LIKES	680	1105	1530
FORBS	60	98	135
SHRUBS	60	98	135
TOTAL	800	1300	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.

Plant Community Composition and Group Annual Production

COMMON/GROUP NAME	SYMBOL	Wheatgrass (HCPC)			Wheatgrass, Bare Ground		
		Group	lbs./acre	% Comp	Group	lbs./acre	% Comp
GRASSES & GRASS-LIKES			1040 - 1170	80 - 90		420 - 510	70 - 85
WHEATGRASSES		1	520 - 780	40 - 60	1	300 - 420	50 - 70
western wheatgrass	PASM	1	390 - 780	30 - 60	1	240 - 420	40 - 70
Montana wheatgrass	ELAL7	1	390 - 780	30 - 60	1	120 - 240	20 - 40
thickspike wheatgrass	ELLAL	1	390 - 780	30 - 60	1	240 - 360	40 - 60
WARM-SEASON GRASSES		2	0 - 130	0 - 10	2	0 - 30	0 - 5
blue grama	BOGR2	2	0 - 65	0 - 5	2	0 - 30	0 - 5
buffalograss	BUDA	2	0 - 130	0 - 10	2	0 - 30	0 - 5
sideoats grama	BOCU	2	0 - 65	0 - 5			
COOL-SEASON GRASS/GRASS-LIKE		3	0 - 65	0 - 5	3	0 - 30	0 - 5
prairie junegrass	KOMA	3	0 - 39	0 - 3	3	0 - 6	0 - 1
Cusick's bluegrass	POCU3	3	0 - 65	0 - 5			
Canby bluegrass	POCA	3	0 - 39	0 - 3	3	0 - 6	0 - 1
plains reedgrass	CAMO	3	0 - 39	0 - 3			
Sandberg bluegrass	POSE	3	0 - 26	0 - 2	3	0 - 6	0 - 1
bottlebrush squirreltail	ELEL5	3	0 - 39	0 - 3	3	0 - 18	0 - 3
sedge	CAREX	3	0 - 65	0 - 5	3	0 - 18	0 - 3
COOL-SEASON MID GRASSES		4	65 - 390	5 - 30	4		
green needlegrass	NAV14	4	65 - 390	5 - 30			
NON-NATIVE GRASSES		5			5	0 - 30	0 - 5
cheatgrass	BRTE				5	0 - 30	0 - 5
FORBS		6	65 - 130	5 - 10	6	60 - 120	10 - 20
American vetch	VIAM	6	0 - 65	0 - 5	6	0 - 18	0 - 3
bastard toadflax	COUM	6	0 - 26	0 - 2	6	0 - 6	0 - 1
bladderpod	LESQU	6	0 - 26	0 - 2	6	0 - 6	0 - 1
bluebells	MERTE	6	0 - 26	0 - 2			
curlycup gumweed	GRSQ				6	0 - 18	0 - 3
deervetch	LOUNU	6	0 - 65	0 - 5			
desert biscuitroot	LOFO	6	0 - 65	0 - 5	6	0 - 18	0 - 3
field pennycress	THAR5				6	0 - 18	0 - 3
gumbo lily	OECAC2	6	0 - 26	0 - 2			
heath aster	SYER	6	0 - 26	0 - 2	6	0 - 12	0 - 2
Lambert crazyweed	OXLA3	6	0 - 26	0 - 2	6	0 - 6	0 - 1
milkvetch	ASTRA	6	0 - 26	0 - 2	6	0 - 6	0 - 1
Missouri goldenrod	SOMI2	6	0 - 26	0 - 2	6	0 - 12	0 - 2
mustard	BRASS2				6	0 - 18	0 - 3
phlox	PHLOX	6	0 - 26	0 - 2	6	0 - 12	0 - 2
prairie coneflower	RACO3	6	0 - 26	0 - 2	6	0 - 12	0 - 2
pussytoes	ANTEN	6	0 - 26	0 - 2	6	0 - 12	0 - 2
scarlet gaura	GACO5	6	0 - 26	0 - 2			
scarlet globemallow	SPCO	6	0 - 65	0 - 5	6	0 - 18	0 - 3
sweetclover	MELIL				6	0 - 120	0 - 20
wavyleaf thistle	CIUN	6	0 - 26	0 - 2	6	0 - 12	0 - 2
western salsify	TRDU				6	0 - 18	0 - 3
western wallflower	ERCAC	6	0 - 26	0 - 2	6	0 - 12	0 - 2
western yarrow	ACMI2	6	0 - 39	0 - 3	6	0 - 18	0 - 3
wild onion	ALLIU	6	0 - 39	0 - 3	6	0 - 12	0 - 2
wild parsley	MUDI	6	0 - 65	0 - 5	6	0 - 18	0 - 3
other perennial forbs	2FP	6	0 - 26	0 - 2	6	0 - 12	0 - 2
SHRUBS		7	65 - 130	5 - 10	7	0 - 60	0 - 10
big sagebrush	ARTR2	7	0 - 130	0 - 10	7	0 - 30	0 - 5
birdfoot sagebrush	ARPE6	7	0 - 65	0 - 5	7	0 - 30	0 - 5
black greasewood	SAVE4	7	0 - 65	0 - 5	7	0 - 6	0 - 1
broom snakeweed	GUSA2				7	0 - 30	0 - 5
cactus	OPUNT	7	0 - 130	0 - 10	7	0 - 30	0 - 5
fourwing saltbush	ATCA2	7	0 - 65	0 - 5	7	0 - 6	0 - 1
winterfat	KRLA2	7	0 - 65	0 - 5			
other shrubs	2SHRUB	7	0 - 26	0 - 2	7	0 - 12	0 - 2
Annual Production lbs./acre			LOW RV HIGH		LOW RV HIGH		
GRASSES & GRASS-LIKES			680 - 1105 - 1530		345 - 480 - 610		
FORBS			60 - 98 - 135		55 - 90 - 125		
SHRUBS			60 - 98 - 135		0 - 30 - 65		
TOTAL			800 - 1300 - 1800		400 - 600 - 800		

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 repeatable plant communities. The plant composition tables shown above have been developed from the best available knowledge at the time of this revision. As more information is collected, some of these plant community descriptions may be revised or removed, and new ones added. None of these plant communities should necessarily be thought of as “Desired Plant Communities” (DPCs). According to the 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

The plant community upon which interpretations are primarily based is the Wheatgrass Plant Community. This is also considered the HCPC. This plant community can be maintained with prescribed grazing, prescribed burning, or areas receiving occasional short periods of deferment. The potential vegetation is about 80-90 percent grasses or grass-like plants, 5-10 percent forbs, and 5-10 percent shrubs. Cool-season grasses dominate the plant community. Major grasses include native wheatgrass such as western wheatgrass, Montana wheatgrass, and thickspike wheatgrass. The plant diversity is low, being dominated by the wheatgrasses. Other grasses and grass-like species occurring on the plant community may include native bluegrasses, buffalograss, blue grama, and sedge. The dominant forbs include biscuitroot, wild parsley, scarlet globemallow, and western yarrow. Shrubs that may occur on the plant community include big sagebrush, cactus, greasewood, saltbush, birdfoot sagebrush, and winterfat. In the central to eastern portions of the MLRA, greasewood will decrease with grazing pressure, while in the western portion greasewood encroaches from adjacent sites and will increase with grazing pressure.

This plant community is resilient and 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 wheatgrasses, increasing the percent bare ground and creating moderate to high soil erosion potential. The actual plant composition may not be greatly changed, however, the production and viability of the site has greatly changed. With a few years of average to above average precipitation, the plant community will make a fast recovery. If disturbed, dense clays are resilient. Mechanical practices, such as deep ripping and furrowing, improve the hydrology, which invigorates the plant community. The native wheatgrass plant species are strongly rhizomatous and adapted to droughty, saline soils. Transects done on sites with high vigor averaged a 10 percent basal cover. Water infiltration is low and runoff is moderate to high because of the high clay content in the soil. Plant litter is properly distributed with some movement offsite and natural plant mortality is low. As this plant community moves to the Wheatgrass, Bare Ground Plant Community, one to possibly several intermediate stages can occur. Drought and moderate to heavy spring use will lower basal density of green needlegrass and native wheatgrasses creating opportunities for invasive species such as sweet clover, annuals, and big sagebrush.

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: SD6001

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:

- Long-term heavy, continuous season-long grazing (overstocked situations) or repeated seasonal grazing (early season), along with below average precipitation, will move this plant community to the *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 70-85 percent grass, 10-20 percent forbs, and 0-10 percent shrubs. The grass component is almost entirely native wheatgrasses. Other perennial grasses are generally not found. Forbs found in this plant community include pennycress, annual mustards, curlycup gumweed, and sweet clover. Generally, the shrub component has dropped out.

When compared to the Wheatgrass Plant Community, annual and biennial forbs may occur. The vigor and basal density of the native wheatgrasses has been severely reduced. Often, the site will be bare ground with a few sprigs of wheatgrass and cheatgrass will likely invade this plant community. Production of cool-season grasses has been greatly reduced. Warm-season grasses, such as blue grama and buffalograss, comprised a very minor percentage of the Wheatgrass Plant Community and disappear along with green needlegrass and perennial forbs in this plant community. As this plant community deteriorates even further, it will be dominated by birdfoot sagebrush and cheatgrass. The plant diversity is extremely low. Due to the 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 disturbance 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: SD6001

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, above average precipitation or severe disturbance (such as mechanical ripping and chiseling), this plant community will move towards the *Wheatgrass Plant Community*.

Ecological Site Interpretations

Animal Community – Wildlife Interpretations

The MLRA 60A lies within the drier portion of the northern mixed-grass prairie ecosystem where sagebrush steppes to the west yield to grassland steppes to the east. Prior to European settlement, this area consisted of diverse grass/shrub land habitats interspersed with varying densities of depressional, in-stream wetlands, and woody riparian corridors. These habitats provided critical life cycle components for many of its users. Many species of grassland birds, small mammals, reptiles, amphibians, and herds of roaming bison, elk, and pronghorn were among the inhabitants adapted to

this semi-arid region. Roaming herbivores, as well as, several small mammal and insect species, were the primary consumers linking the grassland resources to predators such as the wolf, mountain lion, and grizzly bear, as well as, smaller carnivores such as the coyote, bobcat, fox, and raptors. The prairie dog was once abundant; however, the species remains a keystone species within its range. The black-footed ferret, burrowing owl, ferruginous hawk, mountain plover, and swift fox were associated with prairie dog complexes.

Historically, the northern mixed-grass prairie was a disturbance-driven ecosystem with fire, herbivory, and climate functioning as the primary disturbance factors either singly or in combination. Following European settlement, livestock grazing, cropland conversion, elimination of fire, energy development, and other anthropogenic factors influenced species composition and abundance. Introduced and invasive species further impacted plant and animal communities. Bison was a historical keystone species but have been extirpated as a free-ranging herbivore. The loss of the bison and prairie dog, and fire as ecological drivers greatly influenced the character of the remaining native plant communities and altered wildlife habitats. Human development has reduced habitat quality for area-sensitive species.

Within MLRA 60A the Dense Clay Ecological Site provides upland grassland cover with an associated forb and shrub component. It was typically part of an expansive grassland landscape that included combinations of Shallow Loamy, Claypan, Thin Loamy, Thin Claypan, Sandy, Sandy Claypan, Loamy, and Clayey Ecological Sites. This site provided habitat for species requiring unfragmented grassland. Important habitat features and components found commonly or exclusively on this site may include greater sage-grouse and sharp-tailed grouse leks; upland nesting habitat for grassland birds, forbs and insects for brood habitat; and a forage source for small and large herbivores. Many grassland and shrub steppe nesting bird populations are declining. Extirpated species include free-ranging American bison, grizzly bear, gray wolf, black-footed ferret, mountain plover, Rocky Mountain locust, and swift fox.

The majority of the Dense Clay Ecological Site remains intact and provides increasingly important habitat for grassland and shrub steppe nesting birds, small rodents, coyotes, and a variety of reptiles, amphibians, and insects. Invasive species such as annual bromegrasses and crested wheatgrass have impacted the biological integrity of the site for some grassland birds such as greater sage-grouse. Changes in historic fire regime and domestic grazing have impacted the forb/shrub/grass percentages. Greater sage-grouse and Brewer's sparrow benefit when big sagebrush increases.

Wheatgrass (HCPC): The predominance of grasses (mostly wheatgrasses) plus high diversity of forbs and shrubs in this community favors grazers and mixed-feeders, such as deer and pronghorn. Insects, such as pollinators, play a large role in maintaining the forb community and provide a forage base for grassland birds and other species. The complex plant structural diversity provides habitat for a wide array of migratory and resident birds. Brewer's and grasshopper sparrow, lark bunting, western meadowlark, greater sage-grouse, and sharp-tailed grouse are common and benefit from the structure and composition this plant community provides. This site provides limited breeding habitat for the loggerhead shrike. This site provides excellent nesting and brood rearing habitat for greater sage-grouse and sharp-tailed grouse. Diverse prey populations are available for grassland raptors such as northern harrier, ferruginous hawk, Swainson's hawk, golden eagle, and prairie falcon.

The diversity of forbs and shrubs provide high nutrition levels for small and large herbivores including voles, mice, thirteen-lined ground squirrels, white-tailed jackrabbit, and deer. This ecological site provides suitable wintering habitat for pronghorn. The moderate stature of this plant community provides suitable thermal, protective and escape cover for small herbivores and grassland birds. Predators utilizing this plant community including coyote, American badger, red fox, and long-tailed

weasel. This plant community provides habitat for spade foot toad, Great Plains toad, bull snake, and western rattlesnake.

Wheatgrass/Bare Ground: This plant community develops as a result of heavy, continuous season-long grazing, repeated seasonal grazing, and precipitation cycles. Forb abundance and diversity increases significantly while shrub abundance, particularly big sagebrush and cacti decline. The loss of taller grasses limits this vegetative community for big sage brush associated species such as greater sage-grouse, Brewer's sparrow, and desert cottontail. Species such as horned lark, long-billed curlew, upland sandpiper, and white-tailed jackrabbit will increase due to the loss of big sagebrush. Prey populations are limited reducing availability for grassland raptors such as golden eagle, ferruginous hawk, and Swainson's hawk.

Impairment of the ecological processes impacts offsite aquatic habitats through excessive runoff, nutrient, and sediment loads. Increased amount of bare ground causes elevated surface temperatures resulting from reduced cover and litter will greatly reduce habitat for most amphibian species, grassland birds and mammals.

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

Common Name	Cattle	Sheep	Horses	Deer	Antelope	Bison	Elk
Grasses & Grass-likes							
blue grama	U D P D	D P P D	U D P U	D P P D	D P P D	U D P U	U D P U
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 P D	U U P D	U U D U	N U D U	N U D U	U U D U	U U D U
Canby bluegrass	U D U D	N P U N	U D U D	N P U N	N P U N	U D U D	U D U D
Cusick's bluegrass	U P U D	D P U D	U P U D	U P N D	U P N D	U P U D	U P U D
green needlegrass	U P U D	N P N P	U P U D	N P N P	N P N P	U P U D	U P U D
Montana 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
plains reedgrass	U D U U	N D N N	U D U U	N D N N	N D N N	U D U U	U D U 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	U U U U	U D U U	N U N N	N D N N	N D N N	N U N N	N U N N
sedge	U P U D	U P U 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 D	U P D D	U D P U	U P D U	U P D U	U D P U	U D P U
thickspike wheatgrass	U D D U	U D U U	U D D U	N D N N	N D N N	U D D U	U D D U
western wheatgrass	U P D D	U D U U	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
bastard toadflax	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
bladderpod	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
bluebells	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
deervetch	U U U U	U D D U	U U U U	U D D U	U D D U	U U U U	U D 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
gumbo lily	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
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
Lambert crazyweed	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
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
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
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
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
wavyleaf thistle	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
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 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
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							
big sagebrush	U U 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
birdfoot sagebrush	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 N U
black greasewood	U D D U	T T T T	U D D U	D U U D	D U U D	U D D U	D U U U
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
fourwing saltbush	P D D P	P D D P	P D D P	P D D P	P D D P	P D D P	P D D P
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

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 (HCPC)	1,300	0.41
Wheatgrass, Bare Ground	600	0.19

*Based on 790 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

Precipitation is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group D. Infiltration is very slow and runoff potential for this site varies from negligible (in concave areas) to 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 exception would be where short grasses form a strong sod. Normally, 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 opportunities for upland game species. The wide varieties of plants which bloom from spring until fall have an esthetic value that appeals to visitors.

Wood Products

Other Products

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

Supporting Information

Associated Sites

(060AY011SD) – Clayey 13-16” P.Z.	(060AY040SD) – Clayey 16-18” P.Z.
(060AY007SD) – Saline Lowland	(060AY015SD) – Thin Claypan
(060AY026SD) – Saline Upland	(060AY021SD) – Clayey Overflow
(060AY025SD) – Shallow Dense Clay	(060AY042SD) – Lowland

Similar Sites

(060AY011SD & 060AY040SD) – Clayey 13-16” P.Z. and Clayey 16-18” P.Z. [higher production; more short grasses]
(060AY025SD) – Shallow Dense Clay [steeper slopes and higher on landscape; lower production]
(060AY015SD) – Thin Claypan [more big sagebrush; more plains pricklypear; contains slickspots]

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 description include: Everet Bainter, Range Management Specialist (RMS, NRCS; Stan Boltz, RMS, NRCS; Brandon Brazee, RMS, NRCS; Darrel DuVall, RMS, NRCS; Jill Epley, RMS, NRCS; Glen Mitchell, RMS, NRCS; Cheryl Nielsen, RMS, NRCS; Rick Peterson, RMS, NRCS; and Mike Stirling, RMS, NRCS.

<u>Data Source</u>	<u>Number of Records</u>	<u>Sample Period</u>	<u>State</u>	<u>County</u>
SCS-RANGE-417	1	1981	SD	Pennington
Ocular Estimates	6	1996 – 2001	SD	Butte, Pennington

State Correlation

This site has been correlated between Montana (MT), Nebraska (NE), SD, and WY in MLRA 60A.

Field Offices

Belle Fourche, SD	Custer, SD	Hot Springs, SD	Pine Ridge, SD	Sundance, WY
Broadus, MT	Ekalaka, MT	Lusk, WY	Rapid City, SD	Wall, SD
Buffalo, SD	Faith, SD	Martin, SD	Rushville, NE	
Chadron, NE	Gillette, WY	Newcastle, WY	Sturgis, SD	

Relationship to Other Established Classifications

Level IV Ecoregions of the Conterminous United States: 43e – Sagebrush Steppe, 43g – Semi-arid Pierre Shale Plains, and 43k – Dense Clay Prairie.

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://soils.usda.gov/technical/nasis>)

USDA, NRCS, 2002. National Soil Survey Handbook, Title 430-VI. (<http://soils.usda.gov/technical/handbook/>)

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

MT, State Range Management Specialist Date

NE, State Range Management Specialist Date

SD, State Range Management Specialist Date

WY, State Range Management Specialist Date